Lower Thames Crossing

7.7 Combined Modelling and Appraisal Report - Appendix C - Transport Forecasting Package

APFP Regulation 5(2)(q)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 7

DATE: October 2022

Planning Inspectorate Scheme Ref: TR010032
Application Document Ref: TR010032/APP/7.7

VERSION: 1.0

Lower Thames Crossing

7.7 Combined Modelling and Appraisal Report - Appendix C - Transport Forecasting Package

List of contents

Page number

1 Executive summary 1
2 Introduction 4
2.1 The purpose of the Transport Forecasting Package 4
2.2 The Project 4
2.3 Statement of Scheme Objectives 7
2.4 Structure of this report 7
3 Summary of previous work 9
3.1 The background to the Lower Thames Area Model 9
3.2 Overview of the modelling approach 10
3.3 Highway Assignment Model 12
3.4 Variable Demand Model 35
3.5 The LTAM Base Plus model 44
4 The Uncertainty Log and forecast years 51
4.1 The Uncertainty Log 51
4.2 Forecast years and scenarios in the LTAM 55
5 Forecast year demand 62
5.1 Overall approach 62
5.2 Forecast year highway demand matrices 65
5.3 Forecast year reference matrix totals 73
6 Forecast year supply 79
6.1 Do Minimum networks 79
6.2 Do Something networks 88
7 Equilibrium demand forecasts 96
7.1 Introduction 96
7.2 Model parameters 97
7.3 LTAM Base Plus model 104
7.4 LTAM 2030 core DM and DS forecasts 117
7.5 LTAM 2037 core DM and DS forecasts 133
7.6 LTAM 2045 core DM and DS forecasts 149

7.7 LTAM 2051 core DM and DS forecasts 165
8 Assignment results for economic assessment 181
8.1 Introduction 181
8.2 LTAM 2030 core – outputs to economic assessment 182
8.3 LTAM 2037 core – outputs to economic assessment 219
8.4 LTAM 2045 core – outputs to economic assessment 253
8.5 LTAM 2051 core – outputs to economic assessment 286
8.6 LTAM low and high growth scenarios 320
9 Assignment results for environmental assessment 321
9.1 Introduction 321
9.2 AADT and AAWT calculation methodology...321
9.3 LTAM 2030 core – outputs to environmental assessment 324
9.4 LTAM 2037 core – outputs to environmental assessment 326
9.5 LTAM 2045 core – outputs to environmental assessment 328
9.6 LTAM 2051 core – outputs to environmental assessment 330
9.7 DMRB speed banding exercise 332
10 Assignment results for operational performance assessment 341
10.1 Introduction 341
10.2 LTAM 2030 core – outputs to operational assessment................................341
10.3 LTAM 2037 core – outputs to operational assessment................................359
10.4 LTAM 2045 core – outputs to operational assessment................................377
10.5 LTAM 2051 core – outputs to operational assessment................................395
11 Overall conclusion 413
Glossary 417

Model Run IDs used in this report are:

Base	=	LR_N108
Base Plus	=	LR_BP09
Core Do Minimum	=	LR_CM49 (LR-CM45 is utilised in Chapter 9)
Core Do Something	=	LR_CS72 (LR_CS67 is utilised in Chapter 9)
Low Growth Do Minimum	=	LR_LM49
Low Growth Do Something	=	LR_LS72
High Growth Do Minimum	=	LR_HM49
High Growth Do Something	=	LR_HS72

List of plates

Plate 2.1 Lower Thames Crossing route 6
Plate 3.1 Transport modelling approach for Options Appraisal 9
Plate 3.2 LTAM overall model structure 10
Plate 3.3 LTAM Fully Modelled Area 13
Plate 3.4 LTAM Inner Model Area 14
Plate 3.5 All LTAM screenlines and cordons 21
Plate 3.6 Count sites used in model calibration 21
Plate 3.7 Count sites used in model validation 22
Plate 3.8 LTAM strategic journey time routes 23
Plate 3.9 LTAM zoning structure 24
Plate 3.10 LTAM zoning structure within the FMA 25
Plate 3.11 Overall LTAM network development process 26
Plate 3.12 LTAM highway network – zoomed in 27
Plate 3.13 LTAM highway network – Fully Modelled Area 27
Plate 3.14 LTAM highway network – full model coverage 28
Plate 3.15 The LTAM highway prior matrix development process 29
Plate 3.16 LTAM's Inner (red), Fully Modelled (blue) and External (yellow) Areas 38
Plate 3.17 Dartford Crossing TMC – monthly escorts by duration 47
Plate 4.1 LTAM study area for planned developments' data collection 53
Plate 4.2 Overall development locations in the LTAM study area 56
Plate 4.3 Development locations in Dartford, Gravesham and Thurrock 57
Plate 4.4 Development locations in Maidstone, Medway, Tonbridge and Malling 58
Plate 4.5 Transport schemes in core scenario (north) 59
Plate 4.6 Transport schemes in core scenario (south) 60
Plate 4.7 Transport schemes in core scenario (west) 61
Plate 6.1 Profile of car charge types from November 2014 to May 2019 83
Plate 6.2 Profile of two-axle charge types from November 2014 to May 2019 83
Plate 6.3 Profile of two+ axle charge types from November 2014 to May 2019 84
Plate 6.4 Lower Thames Crossing A2 junction representation in the LTAM 89
Plate 6.5 Lower Thames Crossing A13/A1089 junction representation in the LTAM 90
Plate 6.6 Lower Thames Crossing M25 junction representation in the LTAM 91
Plate 7.1 Assigned flow differences – actual base vs Base Plus (AM peak all vehicles (PCUs)) 113
Plate 7.2 Assigned flow differences – actual base vs Base Plus (inter-peak all vehicles (PCUs)) 114
Plate 7.3 Assigned flow differences – actual base vs Base Plus (PM peak all vehicles (PCUs)) 114
Plate 7.4 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DM AM peak) 125
Plate 7.5 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DM inter-peak) 126

Plate 7.6 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DM PM peak) 126
Plate 7.7 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DS AM peak) 127
Plate 7.8 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DS inter-peak) 127
Plate 7.9 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DS PM peak) 128
Plate 7.10 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DM AM peak) 141
Plate 7.11 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DM inter-peak) 142
Plate 7.12 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DM PM peak) 142
Plate 7.13 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DS AM peak) 143
Plate 7.14 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DS inter-peak) 143
Plate 7.15 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DS PM peak) 144
Plate 7.16 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DM AM peak) 157
Plate 7.17 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DM inter-peak) 158
Plate 7.18 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DM PM peak) 158
Plate 7.19 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DS AM peak) 159
Plate 7.20 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DS inter-peak) 159
Plate 7.21 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DS PM peak) 160
Plate 7.22 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DM AM peak) 173
Plate 7.23 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DM inter-peak) 174
Plate 7.24 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DM PM peak) 174
Plate 7.25 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DS AM peak) 175
Plate 7.26 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DS inter-peak) 175
Plate 7.27 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DS PM peak) 176

Plate 8.1 Select link analysis – Dartford Crossing DM 2030 core AM peak 184
Plate 8.2 Select link analysis – Dartford Crossing DS 2030 core AM peak.....................184
Plate 8.3 Select link analysis – Lower Thames Crossing DS 2030 core AM peak 185
Plate 8.4 Select link analysis – Dartford Crossing DM 2030 core inter-peak 186
Plate 8.5 Select link analysis – Dartford Crossing DS 2030 core inter-peak...................187
Plate 8.6 Select link analysis – Lower Thames Crossing DS 2030 core inter-peak 187
Plate 8.7 Select link analysis – Dartford Crossing DM 2030 core PM peak 189
Plate 8.8 Select link analysis – Dartford Crossing DS 2030 core PM peak.....................189
Plate 8.9 Select link analysis – Lower Thames Crossing DS 2030 core PM peak 190
Plate 8.10 Actual flow comparison plot – 2030 core DM vs DS AM peak 192
Plate 8.11 Actual flow comparison plot – 2030 core DM vs DS inter-peak 192
Plate 8.12 Actual flow comparison plot – 2030 core DM vs DS PM peak 193
Plate 8.13 Identification of key corridor locations 196
Plate 8.14 Link based journey time routes for comparison 199
Plate 8.15 Route based journey time comparison 203
Plate 8.16 Select link analysis – Dartford Crossing DM 2037 core AM peak 221
Plate 8.17 Select link analysis – Dartford Crossing DS 2037 core AM peak...................221
Plate 8.18 Select link analysis – Lower Thames Crossing DS 2037 core AM peak 222
Plate 8.19 Select link analysis – Dartford Crossing DM 2037 core inter-peak 223
Plate 8.20 Select link analysis – Dartford Crossing DS 2037 core inter-peak.................224
Plate 8.21 Select link analysis – Lower Thames Crossing DS 2037 core inter-peak 224
Plate 8.22 Select link analysis – Dartford Crossing DM 2037 core PM peak 226
Plate 8.23 Select link analysis – Dartford Crossing DS 2037 core PM peak...................226
Plate 8.24 Select link analysis – Lower Thames Crossing DS 2037 core PM peak 227
Plate 8.25 Actual flow comparison plot – 2037 core DM vs DS AM peak 229
Plate 8.26 Actual flow comparison plot – 2037 core DM vs DS inter-peak 229
Plate 8.27 Actual flow comparison plot – 2037 core DM vs DS PM peak 230
Plate 8.28 Select link analysis – Dartford Crossing DM 2045 core AM peak 255
Plate 8.29 Select link analysis – Dartford Crossing DS 2045 core AM peak...................255
Plate 8.30 Select link analysis – Lower Thames Crossing DS 2045 core AM peak 256
Plate 8.31 Select link analysis – Dartford Crossing DM 2045 core inter-peak 257
Plate 8.32 Select link analysis – Dartford Crossing DS 2045 core inter-peak.................258
Plate 8.33 Select link analysis – Lower Thames Crossing DS 2045 core inter-peak 258
Plate 8.34 Select link analysis – Dartford Crossing DM 2045 core PM peak 260
Plate 8.35 Select link analysis – Dartford Crossing DS 2045 core PM peak...................260
Plate 8.36 Select link analysis – Lower Thames Crossing DS 2045 core PM peak 261
Plate 8.37 Actual flow comparison plot – 2045 core DM vs DS AM peak 263
Plate 8.38 Actual flow comparison plot – 2045 core DM vs DS inter-peak 263
Plate 8.39 Actual flow comparison plot – 2045 core DM vs DS PM peak 264
Plate 8.40 Select link analysis – Dartford Crossing DM 2051 core AM peak 288
Plate 8.41 Select link analysis – Dartford Crossing DS 2051 core AM peak...................289
Plate 8.42 Select link analysis – Lower Thames Crossing DS 2051 core AM peak 289
Plate 8.43 Select link analysis – Dartford Crossing DM 2051 core inter-peak 291
Plate 8.44 Select link analysis – Dartford Crossing DS 2051 core inter-peak.................291

Plate 8.45 Select link analysis – Lower Thames Crossing DS 2051 core inter-peak 292
Plate 8.46 Select link analysis – Dartford Crossing DM 2051 core PM peak 293
Plate 8.47 Select link analysis – Dartford Crossing DS 2051 core PM peak....................294
Plate 8.48 Select link analysis – Lower Thames Crossing DS 2051 core PM peak.........294
Plate 8.49 Actual flow comparison plot – 2051 core DM vs DS AM peak 296
Plate 8.50 Actual flow comparison plot – 2051 core DM vs DS inter-peak 296
Plate 8.51 Actual flow comparison plot – 2051 core DM vs DS PM peak 297
Plate 9.1 TRIS sites used in environmental factor calculations.......................................323
Plate 9.2 AADT all vehicles flow difference plot – 2030 core DM vs DS 325
Plate 9.3 AADT non-HGV vehicles flow difference plot – 2030 core DM vs DS..............325
Plate 9.4 AADT HGV vehicles flow difference plot – 2030 core DM vs DS......................326
Plate 9.5 AADT all vehicles flow difference plot – 2037 core DM vs DS 327
Plate 9.6 AADT non-HGV vehicles flow difference plot – 2037 core DM vs DS..............327
Plate 9.7 AADT HGV vehicles flow difference plot – 2037 core DM vs DS......................328
Plate 9.8 AADT all vehicles flow difference plot – 2045 core DM vs DS 329
Plate 9.9 AADT non-HGV vehicles flow difference plot – 2045 core DM vs DS..............329
Plate 9.10 AADT HGV vehicles flow difference plot – 2045 core DM vs DS....................330
Plate 9.11 AADT all vehicles flow difference plot – 2051 core DM vs DS 331
Plate 9.12 AADT non-HGV vehicles flow difference plot – 2051 core DM vs DS............331
Plate 9.13 AADT HGV vehicles flow difference plot – 2051 core DM vs DS....................332
Plate 9.14 Distribution of pivot factors by environmental time period..............................334
Plate 9.15 Link speed band changes actual base vs 2030 core DM AADT24 336
Plate 9.16 Link speed band changes actual base vs 2030 core DM AM peak................336
Plate 9.17 Link speed band changes actual base vs 2030 core DM inter-peak..............337
Plate 9.18 Link speed band changes actual base vs 2030 core DM PM peak................337
Plate 9.19 Link speed band changes actual base vs 2030 core DM off peak 338
Plate 9.20 Link speed band changes 2030 core DM vs 2030 core DS AADT24.............338
Plate 9.21 Link speed band changes 2030 core DM vs 2030 core DS AM peak 339
Plate 9.22 Link speed band changes 2030 core DM vs 2030 core DS inter-peak 339
Plate 9.23 Link speed band changes 2030 core DM vs 2030 core DS PM peak 340
Plate 9.24 Link speed band changes 2030 core DM vs 2030 core DS off peak 340
Plate 10.1 The Project junction with A2/M2 – LTAM predicted traffic lows 2030 core AM peak all vehicles (PCUs)...347
Plate 10.2 The Project junction with A2/M2 – LTAM predicted traffic flows 2030 core AM peak HGV (PCUs) 348
Plate 10.3 The Project junction with A13 – LTAM predicted traffic flows 2030 core AM peak all vehicles (PCUs) 349
Plate 10.4 The Project junction with A13 – LTAM predicted traffic flows 2030 core AM peak HGV (PCUs) 350
Plate 10.5 The Project junction with M25 – LTAM predicted traffic flows 2030 core AM peak all vehicles (PCUs)...351
Plate 10.6 The Project junction with M25 – LTAM predicted traffic flows 2030 core AM peak HGV (PCUs) 352

Plate 10.7 The Project junction with A2/M2 – LTAM predicted traffic flows 2030 core PM peak all vehicles (PCUs)....353
Plate 10.8 The Project junction with A2/M2 – LTAM predicted traffic flows 2030 core PM peak HGV (PCUs) 354
Plate 10.9 The Project junction with A13 – LTAM predicted traffic flows 2030 core PM peak all vehicles (PCUs) 355
Plate 10.10 The Project junction with A13 – LTAM predicted traffic flows 2030 core PM peak HGV (PCUs) 356
Plate 10.11 The Project junction with M25 – LTAM predicted traffic flows 2030 core PM peak all vehicles (PCUs)....357
Plate 10.12 The Project junction with M25 – LTAM predicted traffic flows 2030 core PM peak HGV (PCUs) 358
Plate 10.13 The Project junction with A2/M2 – LTAM predicted traffic flows 2037 core AM peak all vehicles (PCUs)....365
Plate 10.14 The Project junction with A2/M2 – LTAM predicted traffic flows 2037 core AM peak HGV (PCUs) 366
Plate 10.15 The Project junction with A13 – LTAM predicted traffic flows 2037 core AM peak all vehicles (PCUs)....367
Plate 10.16 The Project junction with A13 – LTAM predicted traffic flows 2037 core AM peak HGV (PCUs) 368
Plate 10.17 The Project junction with M25 – LTAM predicted traffic flows 2037 core AM peak all vehicles (PCUs)....369
Plate 10.18 The Project junction with M25 – LTAM predicted traffic flows 2037 core AM peak HGV (PCUs) 370
Plate 10.19 The Project junction with A2/M2 – LTAM predicted traffic flows 2037 core PM peak all vehicles (PCUs)....371
Plate 10.20 The Project junction with A2/M2 – LTAM predicted traffic flows 2037 core PM peak HGV (PCUs) 372
Plate 10.21 The Project junction with A13 – LTAM predicted traffic flows 2037 core PM peak all vehicles (PCUs)....373
Plate 10.22 The Project junction with A13 – LTAM predicted traffic flows 2037 core PM peak HGV (PCUs) 374
Plate 10.23 The Project junction with M25 – LTAM predicted traffic flows 2037 core PM peak all vehicles (PCUs)....375
Plate 10.24 The Project junction with M25 – LTAM predicted traffic flows 2037 core PM peak HGV (PCUs) 376
Plate 10.25 The Project junction with A2/M2 – LTAM predicted traffic flows 2045 core AM peak all vehicles (PCUs)....383
Plate 10.26 The Project junction with A2/M2 – LTAM predicted traffic flows 2045 core AM peak HGV (PCUs) 384
Plate 10.27 The Project junction with A13 – LTAM predicted traffic flows 2045 core AM peak all vehicles (PCUs)....385
Plate 10.28 The Project junction with A13 – LTAM predicted traffic flows 2045 core AM peak HGV (PCUs) 386

Plate 10.29 The Project junction with M25 – LTAM predicted traffic flows 2045 core AM peak all vehicles (PCUs)....387
Plate 10.30 The Project junction with M25 – LTAM predicted traffic flows 2045 core AM peak HGV (PCUs) 388
Plate 10.31 The Project junction with A2/M2 – LTAM predicted traffic flows 2045 core PM peak all vehicles (PCUs)....389
Plate 10.32 The Project junction with A2/M2 – LTAM predicted traffic flows 2045 core PM peak HGV (PCUs) 390
Plate 10.33 The Project junction with A13 – LTAM predicted traffic flows 2045 core PM peak all vehicles (PCUs)....391
Plate 10.34 The Project junction with A13 – LTAM predicted traffic flows 2045 core PM peak HGV (PCUs) 392
Plate 10.35 The Project junction with M25 – LTAM predicted traffic flows 2045 core PM peak all vehicles (PCUs)....393
Plate 10.36 The Project junction with M25 – LTAM predicted traffic flows 2045 core PM peak HGV (PCUs) 394
Plate 10.37 The Project junction with A2/M2 – LTAM predicted traffic flows 2051 core AM peak all vehicles (PCUs)....401
Plate 10.38 The Project junction with A2/M2 – LTAM predicted traffic flows 2051 core AM peak HGV (PCUs) 402
Plate 10.39 The Project junction with A13 – LTAM predicted traffic flows 2051 core AM peak all vehicles (PCUs)....403
Plate 10.40 The Project junction with A13 – LTAM predicted traffic flows 2051 core AM peak HGV (PCUs) 404
Plate 10.41 The Project junction with M25 – LTAM predicted traffic flows 2051 core AM peak all vehicles (PCUs)....405
Plate 10.42 The Project junction with M25 – LTAM predicted traffic flows 2051 core AM peak HGV (PCUs) 406
Plate 10.43 The Project junction with A2/M2 – LTAM predicted traffic flows 2051 core PM peak all vehicles (PCUs)....407
Plate 10.44 The Project junction with A2/M2 – LTAM predicted traffic flows 2051 core PM peak HGV (PCUs) 408
Plate 10.45 The Project junction with A13 – LTAM predicted traffic flows 2051 core PM peak all vehicles (PCUs)....409
Plate 10.46 The Project junction with A13 – LTAM predicted traffic flows 2051 core PM peak HGV (PCUs) 410
Plate 10.47 The Project junction with M25 – LTAM predicted traffic flows 2051 core PM peak all vehicles (PCUs)....411
Plate 10.48 The Project junction with M25 – LTAM predicted traffic flows 2051 core PM peak HGV (PCUs) 412

List of tables

Page number

Table 1.1 Predicted peak and inter-peak two-way hourly flows at the Dartford Crossing and the Lower Thames Crossing (PCUs) 3
Table 2.1 Scheme Objectives 7
Table 3.1 Correspondence between highway assignment model and demand model time periods 16
Table 3.2 Minimum segmentation for a multi-stage demand model....16
Table 3.3 LTAM use of selected available model network data 19
Table 3.4 Origin-destination demand datasets – use in development of the LTAM 20
Table 3.5 Final LTAM post ME matrix totals (PCUs) 30
Table 3.6 Modelled vs observed individual count comparison calibration sites AM peak cars 30
Table 3.7 Modelled vs observed individual count comparison calibration sites AM peak all vehicles....31
Table 3.8 Modelled vs observed individual count comparison calibration sites inter-peak cars 31
Table 3.9 Modelled vs observed individual count comparison calibration sites inter-peak all vehicles....31
Table 3.10 Modelled vs observed individual count comparison calibration sites PM peak cars 31
Table 3.11 Modelled vs observed individual count comparison calibration sites PM peak all vehicles....32
Table 3.12 Modelled vs observed individual count comparison validation sites AM peak cars 32
Table 3.13 Modelled vs observed individual count comparison validation sites AM peak all vehicles....32
Table 3.14 Modelled vs observed individual count comparison validation sites inter-peak cars 33
Table 3.15 Modelled vs observed individual count comparison validation sites inter-peak all vehicles 33
Table 3.16 Modelled vs observed individual count comparison validation sites PM peak cars 33
Table 3.17 Modelled vs observed individual count comparison validation sites PM peak all vehicles....33
Table 3.18 Modelled vs observed journey time summary statistics AM peak 34
Table 3.19 Modelled vs observed journey time summary statistics inter-peak 34
Table 3.20 Modelled vs observed journey time summary statistics PM peak 34
Table 3.21 The hierarchical demand responses used with each of the LTAM's variable demand segments 36
Table 3.22 Elasticities for each individual user class 39
Table 3.23 Final matrix-based fuel price elasticities of PCU kilometres....39
Table 3.24 Final network-based fuel price elasticities of PCU kilometres....40

Table 3.25 Journey time elasticities and the data used in their calculation........................41
Table 3.26 Final PT fare elasticities – home-based purposes 43
Table 3.27 Final PT fare elasticities – non-home-based purposes 43
Table 3.28 The final distribution, mode and frequency response parameters used in the LTAM (time period θ = 1 for all segments)..44
Table 3.29 2017 monthly average hourly flow values (PCU) and average speed (M25 junction 1b to junction 31) (km/hr)..45
Table 3.30 Average rate of escorts per model period and associated level of delay (Base Plus)...47
Table 3.31 Overall Dartford Crossing capacity calculation (northbound) – actual base network (March 2016) 48
Table 3.32 Overall Dartford Crossing capacity calculation (northbound) – Base Plus network (May 2017) 49
Table 3.33 Dartford Crossing Base Plus traffic flow calibration statistics (veh/hr) (model run ref. – BP09)..50
Table 3.34 Dartford Crossing Base Plus average speed comparison statistics (M25 junction 1b – junction 31) (km/hr) (model run ref. – BP09)..50
Table 4.1 TAG classification of future inputs (TAG Unit M4, Table A2 (DfT, 2019)) 54
Table 4.2 Forecast scenarios..55
Table 5.1 New development to LTAM zone correspondence 63
Table 5.2 TRICS trip rates used in the LTAM for employment locations (all vehicles)......65
Table 5.3 TRICS trip rates used in the LTAM for employment locations (car and taxi)......66
Table 5.4 TRICS trip rates used in the LTAM for employment locations (LGVs) 67
Table 5.5 TRICS trip rates used in the LTAM for employment locations (HGVs)...............68
Table 5.6 TRICS trip rates used in the LTAM for residential locations (all vehicles)..........69
Table 5.7 TRICS trip rates used in the LTAM for residential locations (car and taxi).........69
Table 5.8 TRICS Trip rates used in the LTAM for residential locations (LGVs) 70
Table 5.9 TRICS trip rates used in the LTAM for residential locations (HGVs)..................70
Table 5.10 DP World forecast trips (hourly PCUs)...71
Table 5.11 Tilbury2 port forecast trips..71
Table 5.12 LTAM forecast port traffic growth assumptions 71
Table 5.13 LTAM reference matrix totals in DIADEM segmentation (core growth scenario highway trips in PCUs)..74
Table 5.14 LTAM reference matrix totals in SATURN segmentation (core growth scenario hourly PCUs) 77
Table 6.1 LTAM base year charges (2016 values in 2010 prices) 80
Table 6.2 LTAM modelled time periods and forecast year charging regime correspondence 80
Table 6.3 Forecast year central London congestion charges in the LTAM 81
Table 6.4 Dart Charge prices (September 2018 to current) 82
Table 6.5 Dartford Crossing assumed forecast year payment types by vehicle class 84
Table 6.6 LTAM user class charges (2018 values in 2018 prices).....................................85
Table 6.7 RPI growth and GDP deflator values (November 2021 TAG Databook (v1.17)) 85
Table 6.8 Forecast year Dartford Crossing charges in the LTAM (2010 prices) 85

Table 6.9 Blackwall and Silvertown modelled charges in LTAM time periods....................87
Table 6.10 Percentage of travellers using Dartford and the Project with trips originating or terminating in a resident's discount zone...93
Table 6.11 Estimated Lower Thames Crossing Resident's Discount percentage.............93
Table 6.12 Lower Thames Crossing assumed forecast year payment types by vehicle class...94
Table 6.13 LTAM User Class charges (2018 values in 2018 prices) 94
Table 6.14 Forecast year Lower Thames Crossing charges in the LTAM (2010 prices) ...95
Table 7.1 HAM VOT parameters actual base (highway users pence per minute) 97
Table 7.2 VDM VOT parameters actual base (pence per hour)..97
Table 7.3 HAM and VDM VOC parameters actual base (highway users pence per km)...98
Table 7.4 HAM VOT parameters Base Plus (highway users pence per minute)................98
Table 7.5 VDM VOT parameters Base Plus (pence per hour)..98
Table 7.6 HAM and VDM VOC parameters Base Plus (highway users pence per km) 99
Table 7.7 HAM VOT parameters 2030 (highway users pence per minute)........................99
Table 7.8 VDM VOT parameters 2030 (pence per hour)...99
Table 7.9 HAM and VDM VOC parameters 2030 (highway users pence per km) 100
Table 7.10 HAM VOT parameters 2037 (highway users pence per minute)....................100
Table 7.11 VDM VOT parameters 2037 (pence per hour) 100
Table 7.12 HAM and VDM VOC parameters 2037 (highway users pence per km) 101
Table 7.13 HAM VOT parameters 2045 (highway users pence per minute)....................101
Table 7.14 VDM VOT parameters 2045 (pence per hour) 101
Table 7.15 HAM and VDM VOC parameters 2045 (highway users pence per km) 102
Table 7.16 HAM VOT parameters 2051 (highway users pence per minute)....................102
Table 7.17 VDM VOT parameters 2051 (pence per hour) 102
Table 7.18 HAM and VDM VOC parameters 2051 (highway users pence per km) 103
Table 7.19 Convergence and stability statistics (Base Plus 2016)..................................105
Table 7.20 Relevant movement pattern..106
Table 7.21 Number of relevant movements by model area 107
Table 7.22 Percentage of relevant movements by model area.......................................107
Table 7.23 LTAM DIADEM matrix total comparison – actual base vs VDM output matrix (Base Plus highway trips in PCUs) 107
Table 7.24 LTAM SATURN matrix total comparison – actual base vs VDM output matrix (Base Plus hourly PCUs) 110
Table 7.25 Key network statistics – reference matrix vs VDM output matrix (Base Plus 2016)..116
Table 7.26 Convergence and stability statistics (core 2030 DM) 118
Table 7.27 Convergence and stability statistics (core 2030 DS).....................................119
Table 7.28 LTAM DIADEM matrix total comparison – reference matrix vs VDM output matrices (core 2030 reference DM and DS highway trips in PCUs) 120
Table 7.29 LTAM SATURN matrix total comparison – reference matrix vs VDM output matrices (core 2030 reference DM and DS hourly PCUs) 123
Table 7.30 Key network statistics – reference matrix vs VDM output matrix (core 2030) (Simulation area only)..129

Table 7.31 Convergence and stability statistics (core 2037 DM) 134
Table 7.32 Convergence and stability statistics (core 2037 DS).....................................135
Table 7.33 LTAM DIADEM matrix total comparison – reference matrix vs VDM output matrices (core 2037 reference DM and DS highway trips in PCUs) 136
Table 7.34 LTAM SATURN matrix total comparison – reference matrix vs VDM output matrices (core 2037 reference DM and DS hourly PCUs) 139
Table 7.35 Key network statistics – reference matrix vs VDM output matrix (core 2037) (Simulation area only)...145
Table 7.36 Convergence and stability statistics (core 2045 DM) 150
Table 7.37 Convergence and stability statistics (core 2045 DS).....................................151
Table 7.38 LTAM DIADEM Matrix total comparison – reference matrix vs VDM output matrices (core 2045 reference DM and DS highway trips in PCUs) 152
Table 7.39 LTAM SATURN matrix total comparison – reference matrix vs VDM output matrices (core 2045 reference DM and DS hourly PCUs) 155
Table 7.40 Key network statistics – reference matrix vs VDM output matrix (core 2045) (Simulation area only)...161
Table 7.41 Convergence and stability statistics (core 2051 DM) 166
Table 7.42 Convergence and stability statistics (core 2051 DS).....................................167
Table 7.43 LTAM DIADEM matrix total comparison – reference matrix vs VDM output matrices (core 2051 reference DM and DS highway trips in PCUs) 168
Table 7.44 LTAM SATURN matrix total comparison – reference matrix vs VDM output matrices (core 2051 reference DM and DS hourly PCUs) 171
Table 7.45 Key network statistics – reference matrix vs VDM output matrix (core 2051) (Simulation area only)...177
Table 8.1 TAG summary of convergence measures and acceptable values 182
Table 8.2 HAM convergence statistics – 2030 core DM AM peak 182
Table 8.3 HAM convergence statistics – 2030 core DM inter-peak 182
Table 8.4 HAM convergence statistics – 2030 core DM PM peak 182
Table 8.5 HAM convergence statistics – 2030 core DS AM peak....................................183
Table 8.6 HAM convergence statistics – 2030 core DS inter-peak..................................183
Table 8.7 HAM convergence statistics – 2030 core DS PM peak....................................183
Table 8.8 Select link analysis – summary of primary corridors of movement 2030 AM peak two-way flow 185
Table 8.9 Select link analysis – summary of primary corridors of movement 2030 inter-peak two-way flow 188
Table 8.10 Select link analysis – summary of primary corridors of movement 2030 PM peak two-way flow 190
Table 8.11 Cross-river traffic flows (NB flows approaching TMC) – 2030 core DM vs DS (hourly flows in PCUs) 194
Table 8.12 Cross-river traffic flows (NB flows after TMC) – 2030 core DM vs DS (hourly flows in PCUs) 195
Table 8.13 Key corridor traffic flows – 2030 core DM vs DS (hourly flows in PCUs) 197
Table 8.14 Link based journey time scenario comparison (2030 core DM vs DS) AM peak 200

Table 8.15 Link based journey time scenario comparison (2030 core DM vs DS) inter-peak 201
Table 8.16 Link based journey time scenario comparison (2030 core DM vs DS) PM peak 202
Table 8.17 Route based journey time comparison north to south movements (2030 core DM vs DS) AM peak 204
Table 8.18 Route based journey time comparison north to south movements (2030 core DM vs DS) inter-peak....................206
Table 8.19 Route based journey time comparison north to south movements (2030 core DM vs DS) PM peak 208
Table 8.20 Route based journey time comparison south to north movements (2030 core DM vs DS) AM peak 210
Table 8.21 Route based journey time comparison south to north movements (2030 core DM vs DS) inter-peak....................212
Table 8.22 Route based journey time comparison south to north movements (2030 core DM vs DS) PM peak 214
Table 8.23 HAM convergence statistics – 2037 core DM AM peak 219
Table 8.24 HAM convergence statistics – 2037 core DM inter-peak 219
Table 8.25 HAM convergence statistics – 2037 core DM PM peak 219
Table 8.26 HAM convergence statistics – 2037 core DS AM peak....................219
Table 8.27 HAM convergence statistics – 2037 core DS inter-peak 220
Table 8.28 HAM convergence statistics – 2037 core DS PM peak....................220
Table 8.29 Select link analysis – summary of primary corridors of movement 2037 AM peak two-way flow 222
Table 8.30 Select link analysis – summary of primary corridors of movement 2037 inter-peak two-way flow 225
Table 8.31 Select link analysis – summary of primary corridors of movement 2037 PM peak two-way flow 227
Table 8.32 Cross-river traffic flows (NB flows approaching TMC) – 2037 core DM vs DS (hourly flows in PCUs) 231
Table 8.33 Cross-river traffic flows (NB flows after TMC) – 2037 core DM vs DS (hourly flows in PCUs) 232
Table 8.34 Key corridor traffic flows – 2037 core DM vs DS (hourly flows in PCUs) 233
Table 8.35 Link based journey time scenario comparison (2037 core DM vs DS) AM peak 235
Table 8.36 Link based journey time scenario comparison (2037 core DM vs DS) inter-peak 236
Table 8.37 Link based journey time scenario comparison (2037 core DM vs DS) PM peak 237
Table 8.38 Route based journey time comparison north to south movements (2037 core DM vs DS) AM peak 238
Table 8.39 Route based journey time comparison north to south movements (2037 core DM vs DS) inter-peak....................240

Table 8.40 Route based journey time comparison north to south movements (2037 core DM vs DS) PM peak 242
Table 8.41 Route based journey time comparison south to north movements (2037 core DM vs DS) AM peak 244
Table 8.42 Route based journey time comparison south to north movements (2037 core DM vs DS) inter-peak....246
Table 8.43 Route based journey time comparison south to north movements (2037 core DM vs DS) PM peak 248
Table 8.44 HAM convergence statistics – 2045 core DM AM peak 253
Table 8.45 HAM convergence statistics – 2045 core DM inter-peak 253
Table 8.46 HAM convergence statistics – 2045 core DM PM peak 253
Table 8.47 HAM convergence statistics – 2045 core DS AM peak....253
Table 8.48 HAM convergence statistics – 2045 core DS inter-peak....254
Table 8.49 HAM convergence statistics – 2045 core DS PM peak....254
Table 8.50 Select link analysis – summary of primary corridors of movement 2045 AM peak two-way flow 256
Table 8.51 Select link analysis – summary of primary corridors of movement 2045 inter-peak two-way flow 259
Table 8.52 Select link analysis – summary of primary corridors of movement 2045 PM peak two-way flow 261
Table 8.53 Cross-river traffic flows (NB flows approaching TMC) – 2045 core DM vs DS (hourly flows in PCUs) 265
Table 8.54 Cross-river traffic flows (NB flows after TMC) – 2045 core DM vs DS (hourly flows in PCUs) 266
Table 8.55 Key corridor traffic flows – 2045 core DM vs DS (hourly flows in PCUs) 267
Table 8.56 Link based journey time scenario comparison (2045 core DM vs DS) AM peak 269
Table 8.57 Link based journey time scenario comparison (2045 core DM vs DS) inter-peak 270
Table 8.58 Link based journey time scenario comparison (2045 core DM vs DS) PM peak 271
Table 8.59 Route based journey time comparison north to south movements (2045 core DM vs DS) AM peak 272
Table 8.60 Route based journey time comparison north to south movements (2045 core DM vs DS) inter-peak....274
Table 8.61 Route based journey time comparison north to south movements (2045 core DM vs DS) PM peak 276
Table 8.62 Route based journey time comparison south to north movements (2045 core DM vs DS) AM peak 278
Table 8.63 Route based journey time comparison south to north movements (2045 core DM vs DS) inter-peak....280
Table 8.64 Route based journey time comparison south to north movements (2045 core DM vs DS) PM peak 282
Table 8.65 HAM convergence statistics – 2051 core DM AM peak 286

Table 8.66 HAM convergence statistics – 2051 core DM inter-peak 286
Table 8.67 HAM convergence statistics – 2051 core DM PM peak 287
Table 8.68 HAM convergence statistics – 2051 core DS AM peak....287
Table 8.69 HAM convergence statistics – 2051 core DS inter-peak 287
Table 8.70 HAM convergence statistics – 2051 core DS PM peak....287
Table 8.71 Select link analysis – summary of primary corridors of movement 2051 AM peak two-way flow 290
Table 8.72 Select link analysis – summary of primary corridors of movement 2051 inter-peak two-way flow 292
Table 8.73 Select link analysis – summary of primary corridors of movement 2051 PM peak two-way flow 295
Table 8.74 Cross-river traffic flows (NB flows approaching TMC) – 2051 core DM vs DS (hourly flows in PCUs) 298
Table 8.75 Cross-river traffic flows (NB flows after TMC) – 2051 core DM vs DS (hourly flows in PCUs) 299
Table 8.76 Key corridor traffic flows – 2051 core DM vs DS (hourly flows in PCUs) 300
Table 8.77 Link based journey time scenario comparison (2051 core DM vs DS) AM peak 302
Table 8.78 Link based journey time scenario comparison (2051 core DM vs DS) inter-peak 303
Table 8.79 Link based journey time scenario comparison (2051 core DM vs DS) PM peak 304
Table 8.80 Route based journey time comparison north to south movements (2051 core DM vs DS) AM peak 305
Table 8.81 Route based journey time comparison north to south movements (2051 core DM vs DS) inter-peak....307
Table 8.82 Route based journey time comparison north to south movements (2051 core DM vs DS) PM peak 309
Table 8.83 Route based journey time comparison south to north movements (2051 core DM vs DS) AM peak 311
Table 8.84 Route based journey time comparison south to north movements (2051 core DM vs DS) inter-peak....313
Table 8.85 Route based journey time comparison south to north movements (2051 core DM vs DS) PM peak 315
Table 9.1 Environmental assessment time period definitions 322
Table 9.2 Environmental assessment time period equations....323
Table 9.3 Environmental assessment time period factors....324
Table 9.4 Motorway speed bands....335
Table 9.5 Urban speed bands....335

1 Executive summary

1.1.1 The Lower Thames Area Model (LTAM) is designed for use in forecasting the impact of providing a new road crossing of the River Thames between Gravesend and Tilbury on the performance of the highway network. The LTAM is used to assess the changes in traffic flows, travel times, speeds and levels of congestion on the road network.

1.1.2 The methods used to build the LTAM model and the match between the model and the observed traffic flows and journey times are described in the Transport Model Package (Appendix B of the Combined Modelling and Appraisal Report (ComMA) (Application Document 7.7)). This Transport Forecasting Package (TFP) describes how the model has been used to forecast the number of vehicles using the road network in the future, where they are travelling to/from and the journey times on different parts of the road network.

1.1.3 The base year LTAM reflects travel patterns and conditions on the road network for an average weekday in March 2016. The modelled hours are:

a. AM peak hour (07:00–08:00)

b. Average inter-peak hour (09:00–15:00)

c. PM peak hour (17:00–18:00)

1.1.4 The proposed opening year of the A122 Lower Thames Crossing (the Project) is 2030 so this is the first forecast model year. Traffic forecasts were also prepared for 2045 as this is 15 years after opening. The forecasts for 2045 are known as the project design year forecasts and the engineers use these traffic forecasts when designing the Project. Forecasts were also produced for 2037 in order to provide more detailed information on the trajectory of traffic growth and the changes in the time and distance of trips on the network for use in the economic appraisal of the new crossing. A set of traffic forecasts were also produced for 2051 as this is the furthest date into the future for which traffic growth forecasts are published by the Department for Transport (DfT).

1.1.5 In each of the forecast years, the representation of the highway network in the model is updated to include all changes to the network that have funding or are more than likely to be built. This includes all schemes in National Highways' first two Road Investment Strategies (RIS1 and RIS2) (DfT, 2015 and 2020a) that have a Preferred Route Announcement and some local authority schemes. These committed future schemes are listed in this report.

1.1.6 The growth in the number of car trips in the area is obtained by using the detailed traffic growth forecasts produced by the DfT in their National Trip End Model and published as TEMPro 7.2 traffic growth forecasts (DfT, 2017). More detailed information on the location of new trips in the future is added into the model by explicitly including those major new developments in the study area that are near certain or more than likely to be built. The overall increase in the number of trips for each forecast year in the model matches the overall level of growth predicted by the DfT's National Trip End Model.

1.1.7 The percentage growth in light goods vehicles (LGVs) and heavy goods vehicles (HGVs) is taken from the DfT's Road Traffic Forecasts, published in 2018 (RTF18) (DfT, 2018). Again, explicit consideration is given to the amount of commercial vehicles from major new developments in the area that are more than likely to be built in the future. These sites are listed in this report.

1.1.8 The LTAM is a variable demand model. For each model year, the model is used to forecast how travellers will change their behaviour as a result of changes in the levels of congestion, the cost of fuel, the fuel efficiency of the fleet and change in incomes (which affects people's ability to afford the trips they wish to make).

1.1.9 The transport model is first used to forecast the change in the number of trips in the area by applying the traffic growth factors taken from the DfT's TEMPro software (DfT, 2017) and the DfT's RTF18 (DfT, 2018). These are called the reference case matrices in the TFP.

1.1.10 The model is then used to forecast the routes that drivers will take, given the higher levels of traffic on the network and their behavioural responses to the change in the time and cost of their planned trips. These forecasts are prepared using a road network which does not include the Project, but does include those other changes to the network which are more than likely to happen.

1.1.11 The modelled behavioural responses included in the LTAM are changes to the frequency with which people make the same trip, the possibility of switching to/from rail, changes in the time of day they travel (from say the middle of the day into a peak period) and changing where they travel to/from. In the TFP these forecasts are known as the 'Do Minimum' scenario.

1.1.12 The LTAM is then used to model what is likely to happen when the Project is operational. The proposed Project is included into the highway network and again travellers can respond by changing trip frequency, the mode of transport used, the time of day at which they travel and where they travel to/from. These forecasts are known as the 'Do Something' scenario.

1.1.13 The outputs from the transport model show how many vehicles are expected to use each part of the road network. This information is then used to predict the environmental impacts of traffic (for example on noise and air quality – for more information see ES Appendix 4.4 - Traffic and Transport (Application Document 6.3)). The speed on each section of the network and the length of journeys is calculated in the model. This is used to measure the performance of the road network and to provide details on the location and level of congestion.

1.1.14 The TFP provides information on the volume of traffic at key points on the transport network in the future, and journey times on the network. The LTAM predicts that when the Project is opened there will be a reduction in the number of vehicles using the Dartford Crossing and a rise in the overall number of vehicles crossing the Thames using either crossing. The traffic flows at the Dartford Crossing and the Lower Thames Crossing are presented in Table 1.1 using passenger car units (PCUs). A HGV has a PCU factor of 2.5 as it uses more road space than a car, which has a PCU factor of 1. For the purposes of producing the traffic forecasts it is assumed that charges will be applied at the Lower Thames Crossing and that these will be the same as those charged at the Dartford Crossing.

Table 1.1 Predicted peak and inter-peak two-way hourly flows at the Dartford Crossing and the Lower Thames Crossing (PCUs)

Period	Year	Without the Project	With the Project	
		Dartford Crossing*	Dartford Crossing*	Lower Thames Crossing
AM peak hour	2016	14,430	–	
	2030	16,020	13,280	8,040
	2045	16,260	14,870	8,940
Inter-peak hour	2016	11,790	–	
	2030	14,410	10,780	6,510
	2045	15,660	12,770	7,590
PM peak hour	2016	12,830	–	
	2030	15,310	12,020	7,990
	2045	16,280	13,540	8,830

** These flows are taken on the approach to the Traffic Management Cell (TMC) at the Dartford Crossing*

1.1.15 The TFP presents information on which trips will remain using the Dartford Crossing and which trips will use the Project in future. It also describes the changes in flows on other parts of the network, showing which areas experience a decrease in traffic volumes and reduced levels of congestion and those areas where the volume of traffic is likely to rise.

1.1.16 The LTAM has been checked by specialist staff within National Highways throughout its development to ensure that it was built following the appropriate technical guidelines and is suitable for use as a base for forecasting the changes in the performance of trips on the strategic highway network and major local roads in the area when a new river crossing is provided between Kent, Thurrock and Essex.

1.1.17 The forecasting work undertaken using the LTAM has been checked by specialist staff within National Highways while it was carried out to ensure that the work followed the DfT’s guidance on preparing traffic forecasts as set out in the Transport Analysis Guidance (TAG) (DfT, 2013a).

2 Introduction

2.1 The purpose of the Transport Forecasting Package

2.1.1 This report, the Transport Forecasting Package (TFP), describes the methodologies and tools adopted to generate the traffic forecasts used to support the Project development. It provides details of the assumptions used in the forecasting process and presents the traffic forecasts required for economic, environmental and operational assessments.

2.1.2 One of its key aims is to demonstrate that the procedures adopted in producing the forecasts are consistent with good practice and the advice given by the Department for Transport (DfT) in Transport Analysis Guidance (TAG) and within the Design Manual for Roads and Bridges (DMRB).

2.1.3 TAG provides guidance in the development of models such as the Lower Thames Area Model (LTAM). It provides indicative targets for some quantitative metrics developed when assessing the quality of a model. It stresses that there is an element of uncertainty in observed data and the focus should be to ensure that the model is suitable for its intended purpose within the critical area for the interventions that are to be tested, rather than overfitting the model to observed data. The TFP is presented as an appendix to the ComMA (Application Document 7.7). Along with the other appendices, the ComMA provides a comprehensive description of how data has been collected, how the model has been developed, how the forecasts have been produced and how model outputs have been used to support wider appraisal activities.

2.2 The Project

2.2.1 The A122 Lower Thames Crossing (the Project) would provide a connection between the A2 and M2 in Kent and the M25 south of junction 29, crossing under the River Thames through a tunnel. The Project route is presented in Plate 2.1.

2.2.2 The A122 would be approximately 23km long, 4.25km of which would be in tunnel. On the south side of the River Thames, the Project route would link the tunnel to the A2 and M2. On the north side, it would link to the A13, M25 junction 29 and the M25 south of junction 29. The tunnel portals would be located to the east of the village of Chalk on the south of the River Thames and to the west of East Tilbury on the north side.

2.2.3 Junctions are proposed at the following locations:

a. New junction with the A2 to the south-east of Gravesend

b. Modified junction with the A13/A1089 in Thurrock

c. New junction with the M25 between junctions 29 and 30

2.2.4 To align with National Policy Statement for National Networks (DfT, 2014) policy and to help the Project meet the Scheme Objectives, it is proposed that road user charges would be levied in line with the Dartford Crossing. Vehicles would be charged for using the new tunnel.

2.2.5 The Project route would be three lanes in both directions, except for:

a. link roads

b. stretches of the carriageway through junctions

c. the southbound carriageway from the M25 to the junction with the A13/A1089, which would be two lanes

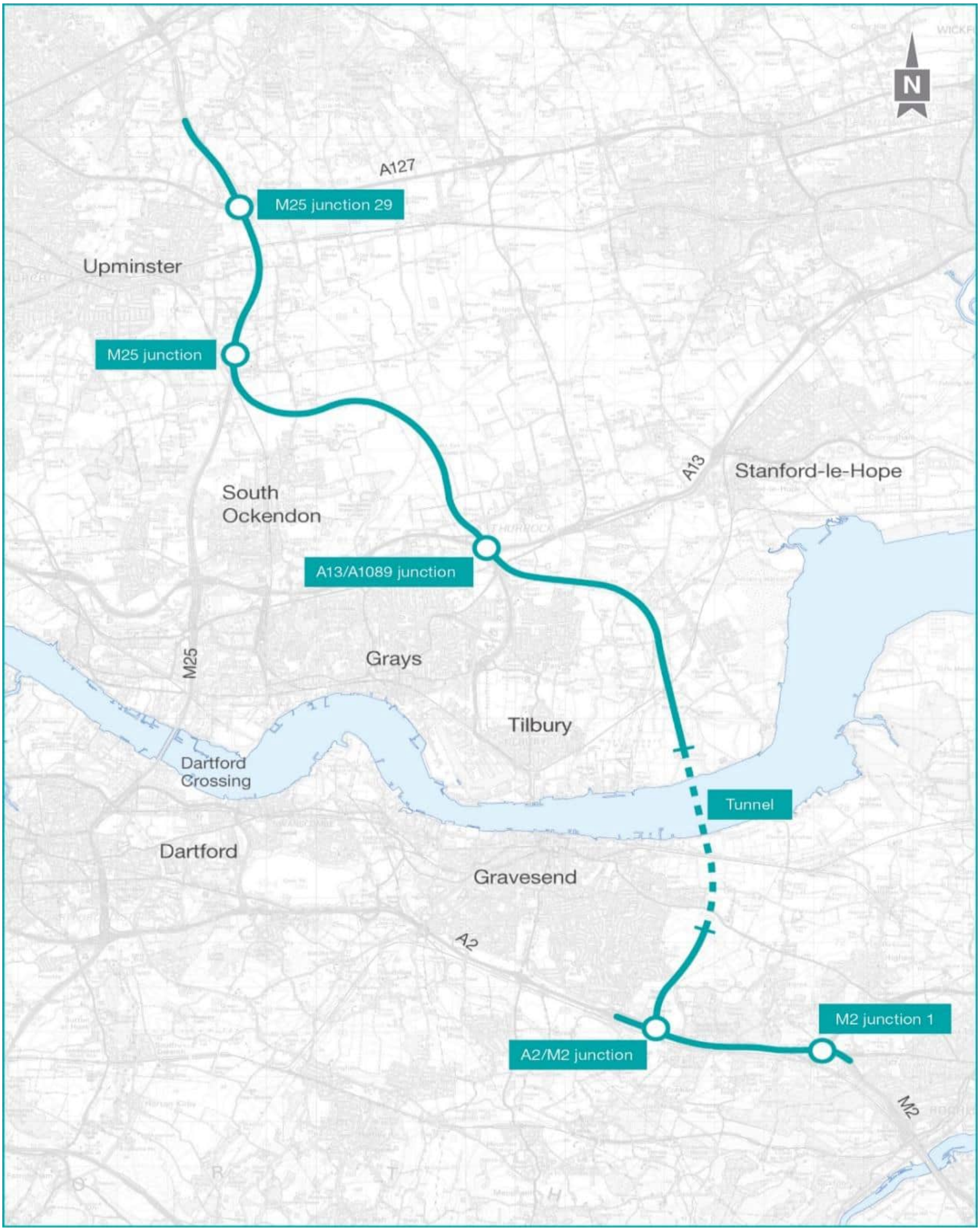
2.2.6 In common with most A-roads, the A122 would operate with no hard shoulder but would feature a 1m hard strip on either side of the carriageway. It would also feature technology including stopped vehicle and incident detection, lane control, variable speed limits and electronic signage and signalling. The A122 design outside the tunnel would include emergency areas. The tunnel would include a range of enhanced systems and response measures instead of emergency areas.

2.2.7 The A122 would be classified as an ‘all-purpose trunk road’ with green signs. For safety reasons, walkers, cyclists, horse riders and slow-moving vehicles would be prohibited from using it.

2.2.8 The Project would include adjustment to a number of local roads. There would also be changes to a number of Public Rights of Way, used by walkers, cyclists and horse riders. Construction of the Project would also require the installation and diversion of a number of utilities, including gas pipelines, overhead electricity powerlines and underground electricity cables, as well as water supplies and telecommunications assets and associated infrastructure.

2.2.9 The Project has been developed to avoid or minimise significant effects on the environment. The measures adopted include landscaping, noise mitigation, green bridges, floodplain compensation, new areas of ecological habitat and two new parks.

Plate 2.1 Lower Thames Crossing route



2.3 Statement of Scheme Objectives

2.3.1 National Highways and DfT have agreed Scheme Objectives for the Project and these are presented in Table 2.1.

Table 2.1 Scheme Objectives

Scheme Objectives	
Economic	• To support sustainable local development and regional economic growth in the medium to long term • To be affordable to government and users • To achieve value for money
Community & environment	• To minimise adverse impacts on health and the environment
Transport	• To relieve the congested Dartford Crossing and its approach roads and improve their performance by providing free-flowing north-south capacity • To improve the resilience of the Thames crossings and the major road network • To improve safety

2.4 Structure of this report

2.4.1 This TFP has been developed and structured in accordance with the requirements of National Highways Project Control Framework (PCF). Subsequent chapters of this document are structured as follows:

a. Chapter 3 provides a summary of the previous work undertaken.
b. Chapter 4 provides a description of the Uncertainty Log used and the forecast years adopted.
c. Chapter 5 describes the derivation of the forecast year demand.
d. Chapter 6 discusses how the forecast year networks have been constructed.
e. Chapter 7 provides an overview of the equilibrium demand forecasts.
f. Chapter 8 describes the data output to support economic appraisal activities.
g. Chapter 9 describes the data output to support environmental assessment activities.
h. Chapter 10 describes the data output to support operational assessment activities.
i. Chapter 11 provides an overall summary and conclusions on the work undertaken.

2.4.2 The associated executive summary and abbreviations are also included as supporting text.

2.4.3 Due to rounding, numbers presented throughout this document may not add up precisely to the totals provided.

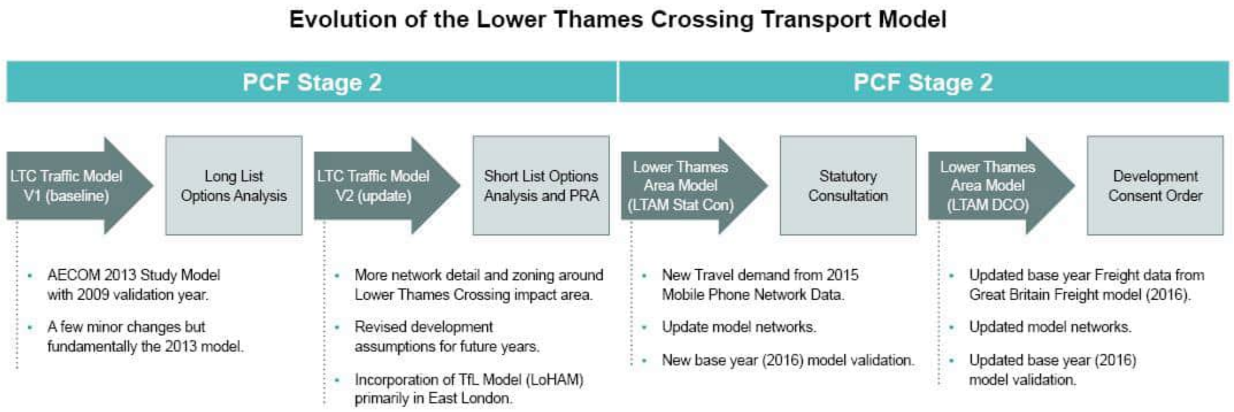
2.4.4 Annexes are referenced in this document. The annexes are provided in a separate report - Combined Modelling and Appraisal Report - Appendix C - Transport Forecasting Package Annexes (Application Reference 7.7).

3 Summary of previous work

3.1 The background to the Lower Thames Area Model

3.1.1 The traffic modelling approach adopted for the appraisal of the Lower Thames Crossing Options Phase of the National Highways PCF was determined by the project programme requirements, the level of detail required at each stage of the analysis and the availability of existing traffic models. The models developed at each stage were considered to be appropriate to inform the decisions being made at that stage. These three criteria led to a four-step modelling approach being adopted as illustrated in Plate 3.1.

Plate 3.1 Transport modelling approach for Options Appraisal



3.1.2 Versions 1 and 2 of the Lower Thames Crossing model (LTC V1 and LTC V2) are derived from the model developed by AECOM for the Review of Lower Thames Crossing Capacity Study in 2013 (DfT, 2013). These two versions of the LTC model have been used for the PCF Stage 2 Option Selection: LTC V1 for the long list appraisal and LTC V2 for the appraisal of the short-listed options. A modified version of the LTC V2 model (Version 2.1) was used to appraise the five Post-Consultation Appraisal Routes. The LTC Version 2.1 model included several network enhancements, incorporated new values of time based on DfT's October 2015 consultation and revisions to the methodology used for the production of future year trip ends.

3.1.3 For the Project Development Phase, to meet PCF Stage 3 and Development Consent Order (DCO) submission requirements, a further update of the model was undertaken.

3.1.4 The updated version of the model is called the Lower Thames Area Model (LTAM). The original version of the model was known as LTAM Stat Con. It was developed during 2016 and 2017 and was used extensively to support the evidence base for the Project's Statutory Consultation in late 2018.

3.1.5 Post statutory consultation the model has been further updated to incorporate updated freight data and more recently released economic parameters such as values of time (VOT) and vehicle operating costs (VOC). This updated model is known as LTAM DCO. The development of this model was documented in the Transport Model Package as Appendix B of the ComMA (Application Document

7.7). A summary of this is provided in the sections below. The updated LTAM DCO base year model (March 2016) provides a more robust basis from which to forecast future traffic flows.

3.1.6 The model has been developed to predict the impact of the Project, both in the immediate vicinity of the Project, and also on other potentially impacted routes. The forecasts produced by the model are then utilised to inform economic, operational and environmental appraisal activities which make up the core of the business case for implementing the Project.

3.2 Overview of the modelling approach

3.2.1 There are two primary modelling components required:

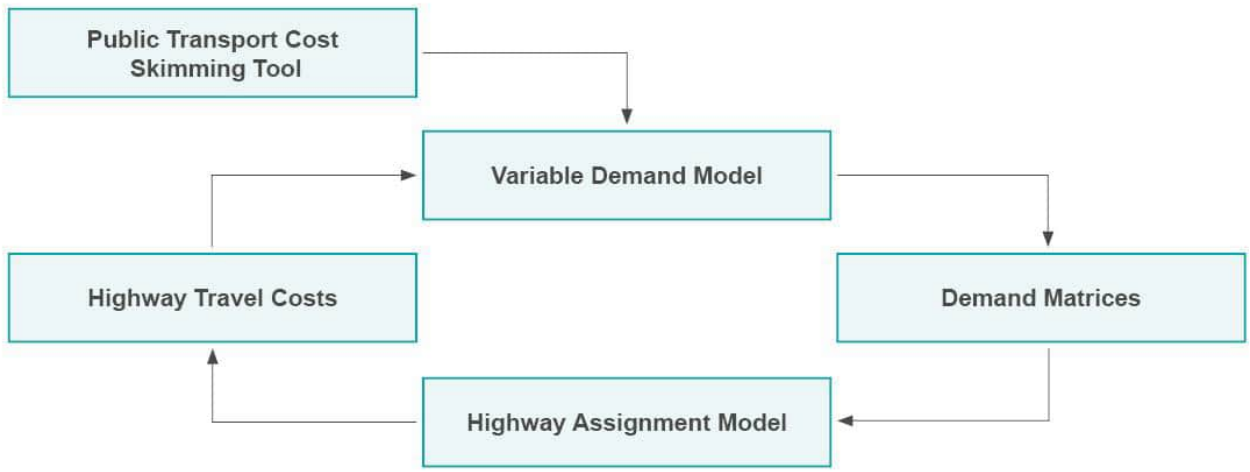
a. The **Variable Demand Model (VDM)** which is used to predict the future levels of demand for travel

b. The **Highway Assignment Model (HAM)** which is used to predict a variety of different characteristics of travelling on the highway network such as traffic flows, speeds, delays, routes and journey costs, etc.

3.2.2 Connecting these two modelling components enables the impact of proposed transport interventions and growth (or decline) in demand for travel to be combined to provide a forecast of future travel conditions. The main modelling connection involves the VDM predicting the amount and pattern of travel in the future and the HAM estimating the associated costs of this travel.

3.2.3 It is understood from generic economic theory of supply and demand that as costs increase demand decreases and vice versa. The outcome of this is an iterative process of the recalculation of supply and demand which needs to be run until an equilibrium point is identified to a defined level of convergence. This process is illustrated in Plate 3.2.

Plate 3.2 LTAM overall model structure



3.2.4 Dynamic Integrated Assignment and DEmand Model (DIADEM) software has been identified as the most appropriate tool for the VDM component. The aim of DIADEM is to provide a relatively simple mechanism for combining the complex procedures of a demand model with externally developed highway assignment models. DIADEM Software Version 6.3.4 has been used for this model.

3.2.5 The National Highways Integrated DIADEM Interface (HEIDI) has been used to develop reference matrices for use in DIADEM. HEIDI was originally developed for use with the National Highways Regional Traffic Models (RTMs). HEIDI Version 6.2 has been used for this model.

3.2.6 The VDM has been developed with five main mechanisms. These are Trip Generation (which is undertaken outside of DIADEM), Trip Frequency, Main Time Period Choice, Modal Choice and Trip Distribution. The model is applied as an incremental model and has been calibrated to expected elasticities using the TAG illustrative parameters.

3.2.7 Simulation and Assignment of Traffic to Urban Road Networks (SATURN) has been identified as the most appropriate tool for building the LTAM HAM. As a ‘conventional’ traffic assignment model it can deal with local, large conurbation, regional or even national models thus making it appropriate for the modelling of the Project. SATURN Software Version 11.4.07H has been used for this model.

3.2.8 The public transport cost skimming tool provides public transport costs for use in the demand model. The model used here was originally developed by Stantec for National Highways for use in the development of the RTM. This has been rezoned to the LTAM zone system. In DIADEM, public transport (PT) costs are assumed to be fixed, that is they are not modified after each iteration of the model. For this reason, they are not included within the supply demand equilibrium loop but are simply an exogenous data import to the VDM. The PT cost skimming tool is developed in PTV VISUM Version 17.

3.2.9 The supply demand model mechanism is an iterative process. The model needs to run until an equilibrium point has been reached to a desired level of convergence. The recommended criterion for measuring convergence between the supply and demand models is the demand/supply gap (%Relative GAP). This is defined in TAG Unit M2.1 Section 6.3.4 (DfT, 2020b) as:

$$\frac{\sum_a C(X_a^n) D\left|\left(C(X_a^n)\right) - X_a^n\right|}{\sum_a C(X_a^n) X_a^n} * 100$$

where:

X_a^n is cell *a* in the previous assignment matrix for iteration *n*;

$C(X_a^n)$ is cell *a* in the previous generalised costs resulting from assigning that matrix;

$D(C(X_a^n)$ is cell *a* in the matrix output by the demand model based on costs $C(X_a^n)$; and

$a$represents every combination of origin, destination, demand segment, time period and mode.

3.2.10 TAG suggests that many models should be able to achieve a %GAP of less than 0.1% although in more problematic cases values of 0.2% are also considered acceptable.

3.3 Highway Assignment Model

Model coverage – geographical

3.3.1 The method used to identify the LTAM coverage is summarised below.

3.3.2 When redefining the geographical coverage of the LTAM there were several key objectives:

a. To produce a model that can support economic, environmental and operational assessments in line with TAG requirements

b. To minimise modelling noise and improve convergence

c. To minimise model run time whilst ensuring compliance with the requirements of TAG

3.3.3 During model scoping, to identify whether these objectives have been met, there are two key considerations:

a. To identify the likely area of impact of the Project

b. TAG guidelines

Identifying the likely region of impact of the Project

3.3.4 To identify the likely region of impact of the Project, existing model forecasts using the LTC V2 model were used. Forecasts were provided for a With and Without Scheme scenario. To show the maximum possible impact of the Project, an assumption was made to use only the 2041 forecast year (central growth) which was the latest year for which DfT provided forecasts at that time. The comparisons were undertaken between the Do Minimum and Do Something model runs used to inform the Preferred Route Announcement (PRA).

3.3.5 A range of different criteria were used to identify the likely impacted links including DMRB Air Quality Screening and DMRB Traffic Screening criteria.

TAG guidelines

3.3.6 TAG defines the model coverage in the following terms:

a. The **Fully Modelled Area** (FMA) which consists of an area of detailed modelling where significant impacts of the intervention are certain, and the rest of the fully modelled area which covers the area where the impacts of the intervention are quite likely but relatively weak in magnitude.

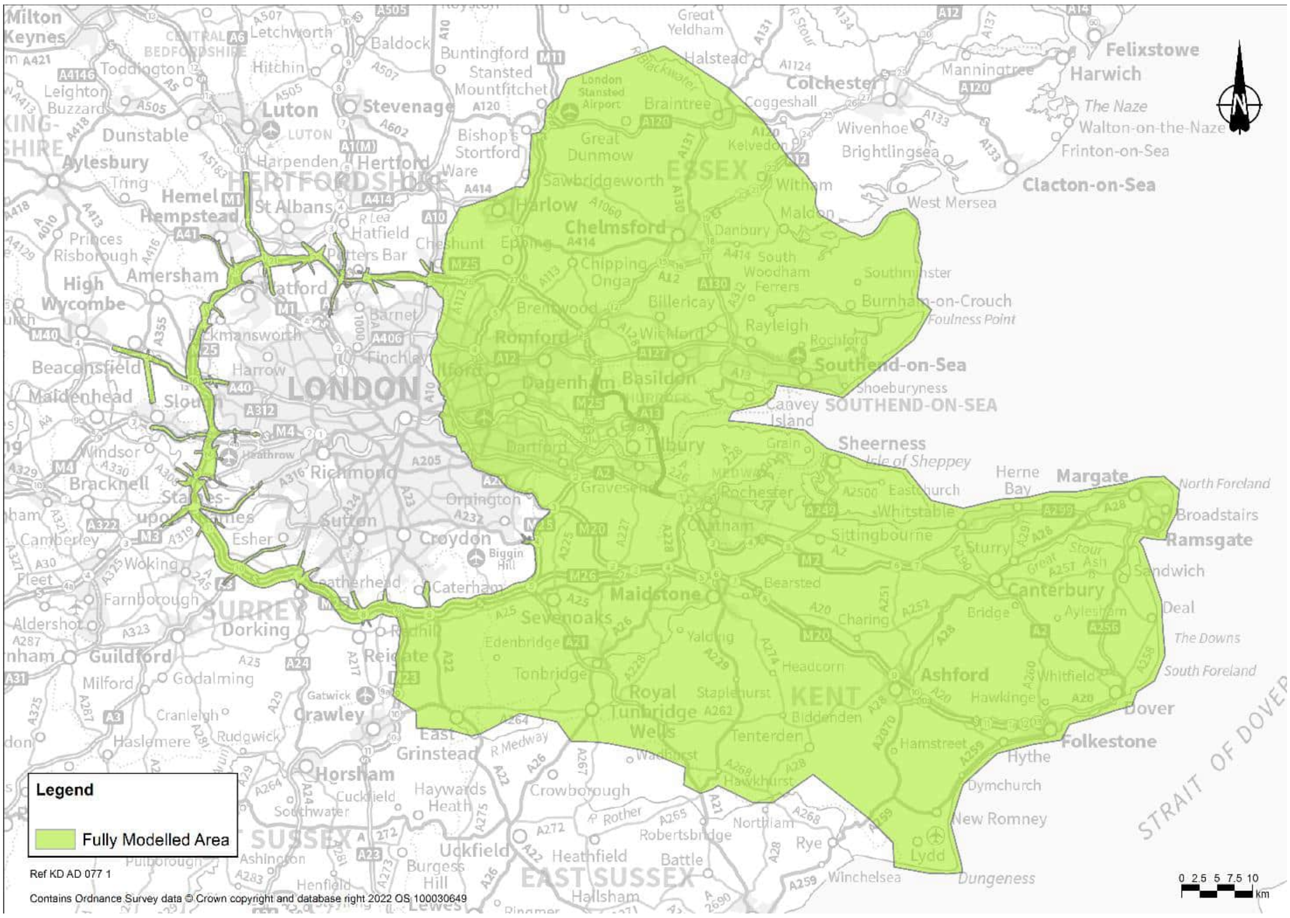
b. The **External Area** (EA) where the impacts are assumed to be so small as to be negligible.

3.3.7 The FMA is categorised by small zones, detailed networks and comprehensive representations of junction behaviour.

3.3.8 Due to the requirement for the HAM to connect to the demand model for forecasting purposes, and for the demand model to function appropriately, the full cost of travelling to the zones in the external area needs to be incorporated. It is generally accepted that this will be at a much lower level of detail than the FMA. The main requirement for the external network, in terms of network and zoning detail, is that routing into the fully modelled area needs to be realistic and to enable appropriate (re)routing outside of the modelled area. The external network is therefore required for potential alternative destinations to be represented and the full length of trips to be included for extracting costs. The external area covers the rest of the UK. It has been coded as buffer network with much larger zone sizes and fixed speeds.

3.3.9 Considering the impacted link analysis described above and the requirements of TAG, the FMA for the LTAM has been defined as shown in Plate 3.3.

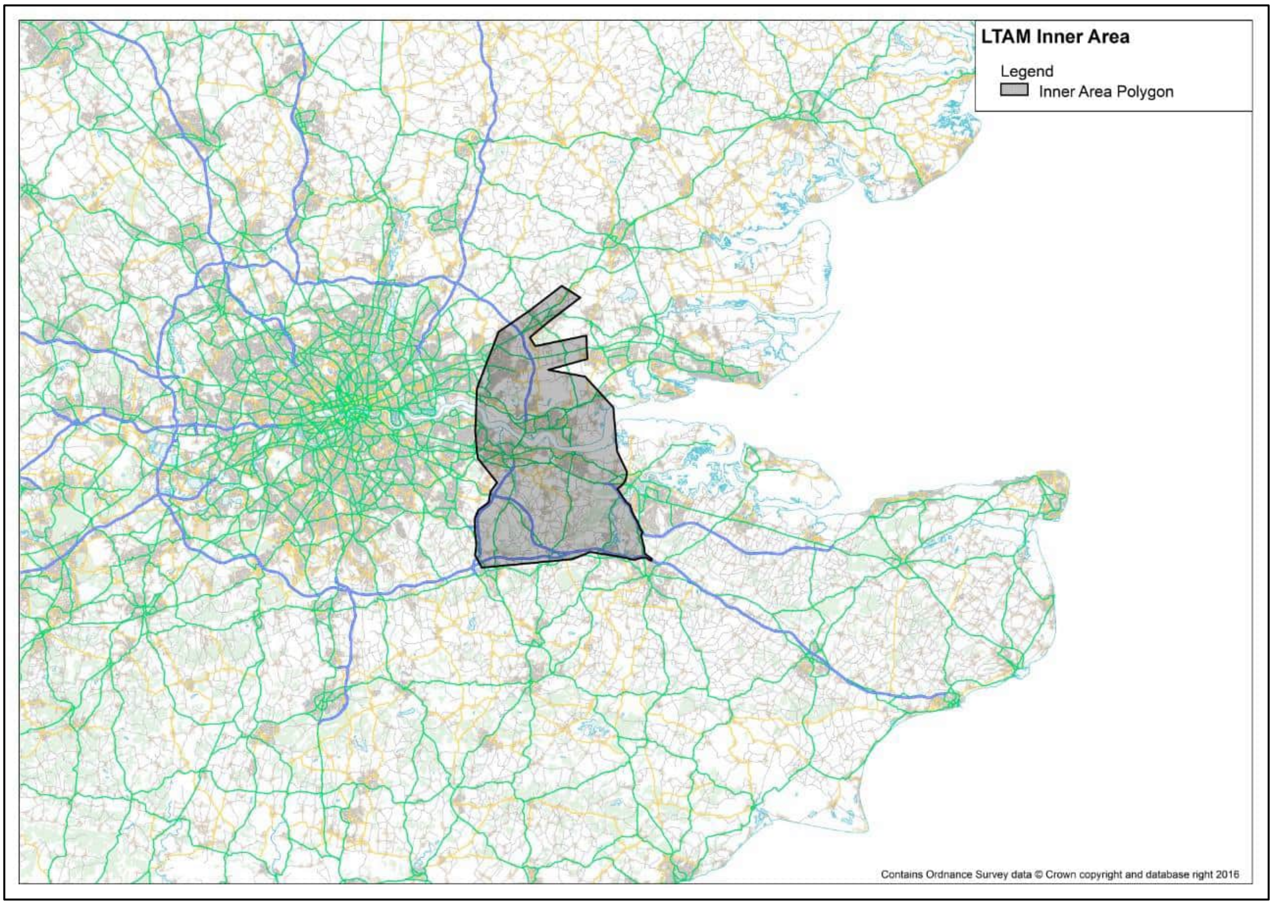
Plate 3.3 LTAM Fully Modelled Area



3.3.10 This area extends over the entire M25 orbital route together with its junctions with major roads such as the M3, M4, M1, M11, A1, and M40. It also extends to cover most of Essex, Kent and the eastern part of Greater London. This modelled area is considered appropriate for use with the LTAM. It covers the primary links predicted to be likely to be impacted by the Project.

3.3.11 The area outside of the FMA was determined as the EA. Within the FMA a smaller area, considered particularly important when assessing potential Project options, has been identified. This 'Inner Model Area' is shown in Plate 3.4.

Plate 3.4 LTAM Inner Model Area



3.3.12 Model calibration and validation statistics provided later in this section will be presented both from the entire model area and Inner Model Area perspective. The primary target is to achieve a high standard of model calibration and validation within the Inner Model Area.

Model coverage – temporal

3.3.13 In order to decide the temporal dimensions of the LTAM a series of detailed analyses were undertaken. The key decisions required were as follows:

a. Defining the model month and year

b. Defining the peak hours and peak periods

Defining the model month and year

3.3.14 This analysis focussed on three main aspects:

a. Definition of a neutral/representative month

b. Source of origin-destination demand data

c. Localised issues affecting network performance

3.3.15 The analysis undertaken shows that the most appropriate month to use for the LTAM is **March 2016**.

Defining the peak hours and peak periods

3.3.16 The analytical approach compared the peak hours and peak periods at the Dartford Crossing with the peak hours and periods in a wider model area. The key decisions required were to identify:

a. Whether a peak hour or average hour model would be most appropriate

b. Which hours each model peak hour and peak period should represent

3.3.17 For the first of these points, TAG suggests that where traffic patterns illustrate that there is a distinct peak hour within the peak period, a peak hour model should be developed. Furthermore, actual peak hour models are to be preferred in most circumstances. Peak hour models have the following advantages:

a. Traffic flows and congestion at peak times will be more robustly modelled, which will not be the case if average conditions are less congested.

b. A peak hour is more representative of a situation in reality. While traffic counts and journey times can, in principle, be averaged over the peak hours, it is hard to judge the plausibility of the routes modelled for a period which does not exist in reality.

3.3.18 There are very few specific circumstances where an average peak period model would be preferred over an actual peak hour model. These are:

a. Capacity on the network is more than adequate to cater for forecast demand in the base year and forecast years.

b. Traffic levels are approximately constant throughout the period.

c. A substantial proportion of the trips in the fully modelled area are longer than one hour (although this may be more appropriately handled through modelling longer time periods or through dynamic methods).

3.3.19 Analysis of available traffic count data is the best way to determine whether these peaks exist and also the hours which should be reflected in each modelled period.

3.3.20 The methodology undertaken followed a three-step process as follows:

a. Identify the peak hour

b. Identify the peak period

c. Calculate the difference between the actual peak hour and the average peak period to decide whether a peak or average peak model is necessary

3.3.21 This analysis showed that if an average hour rather than a peak hour assignment model was used this would underestimate congestion by between 3–9%. It is therefore necessary to develop peak hour assignment models for the morning and evening peaks as follows:

a. The morning (AM) peak hour is 07:00–08:00.

b. The inter-peak (IP) period is an average hour from 09:00–15:00.

c. The evening (PM) peak hour is 17:00–18:00.

3.3.22 For the demand model where it is necessary to represent the full 24 hours of a day the following time periods were identified:

a. The morning peak period is 06:00–09:00.

b. The inter-peak period is from 09:00–15:00.

c. The evening peak period is 15:00–18:00.

d. The off peak (OP) period is 18:00–06:00.

3.3.23 Table 3.1 shows the correspondence between the three highway assignment model periods and the four demand model periods.

Table 3.1 Correspondence between highway assignment model and demand model time periods

Demand model period	Highway assignment model period
AM peak (06:00–09:00)	AM peak hour (07:00–08:00)
Inter-peak (09:00–15:00)	Inter-peak average hour (09:00–15:00)
PM peak (15:00–18:00)	PM peak hour (17:00–18:00)
Off peak (18:00–06:00)	Factored version of the HAM peak hours*

** The AM, IP and PM matrices are combined using appropriate time period specific factors to produce a 12-hour matrix. The off peak employer's business and other traffic is derived by factoring this 12-hour matrix, while the off peak commuting and goods vehicle traffic is derived by factoring the IP average hour matrix. These are then used to obtain the final average off peak hour for assignment.*

Model coverage – segmentation

3.3.24 'Segmentation' is the division of travel, traveller and transport attributes into different categories so that all travellers in the same category can be treated in the same way. The segmentation used in the LTAM needs to be considered both with respect to the VDM and the HAM. As is often the case, the LTAM has different segmentation between these two components.

3.3.25 A detailed review of current guidance was undertaken in order to inform the segmentation used within the LTAM. From the VDM perspective, TAG (Unit M2.1, Table 2.1) (DfT, 2020b) sets out the minimum segmentation required for a multi-stage demand model. Table 3.2 provides these categories and a commentary on their applicability for the LTAM.

Table 3.2 Minimum segmentation for a multi-stage demand model

Attribute	Segmentation	Comments for the LTAM
Household type and traveller type	Two categories: travellers categorised into car-available/no-car-available or by household car ownership into car-owning/non-car-owning. Models that only need to deal with road traffic will include only	The model will only deal with trips that can choose to travel by road, therefore only

Attribute	Segmentation	Comments for the LTAM
	those travellers who have a car available. If a local trip generation model is being developed, a more detailed segmentation into household structure employed members, etc. is very desirable and used in the National Trip End Model (NTEM), but this finer level of segmentation need not be carried through to the subsequent stages.	travellers with a car available are included.
Value of time (VOT)	Variation of VOT across the population is important but can usually be addressed sufficiently through the trip purpose split. However, for schemes specifically involving charging, some additional segmentation by willingness-to-pay or income may be required. In this case three separate income ranges – high, medium and low (with different VOT) with demand distributed evenly across the groups – will be adequate. Where there is a large range of trip distance, it is desirable to allow VOT to vary with trip distance.	As the Project is a charging Project, three categories of income have been applied to non-work trip purposes. National Travel Survey (NTS) data is used to define these categories. VOT will not be varied with trip distance.
Trip Purpose	Three categories: Commuting/Employer's Business/Other: these categories are likely to have different elasticities and different distributions in both time and space, and substantially different values of time.	LTAM adopts the three categories. Employer's Business and Other are also segmented by Home-Based- and Non-Home-Based in the VDM.
Modes	Two categories: Car/Public Transport. It is usually necessary to have a base of trips that can transfer to and from car.	Car and public transport modes are included.
Road vehicle types	Two categories: Car/other, where 'other' may include freight and bus/coach as a fixed-flow matrix for assignment.	Car, LGV and HGV are included. Bus/Coach is included in the HGV segment.

3.3.26 Applying these principles leads to the LTAM VDM having the following demand segments:

a. Home-based Employer's Business

b. Home-based Commute Low income

c. Home-based Commute Medium income

d. Home-based Commute High income

e. Home-based Other Low income

f. Home-based Other Medium income

g. Home-based Other High income

h. Non-home-based Employer's Business

i. Non-home-based Other Low income

j. Non-home-based Other Medium income

k. Non-home-based Other High income

l. LGV

m. HGV

n. Port Trips (Sea and Air) Employer's Business

o. Port Trips (Sea and Air) Other Low income

p. Port Trips (Sea and Air) Other Medium income

q. Port Trips (Sea and Air) Other High income

3.3.27 This list of different demand segments is simplified somewhat in the LTAM HAM. TAG guidance (Unit M3.1) (DfT, 2020c) suggests that vehicle operating costs vary by vehicle type and values of time vary by the purpose of the trip being made. It also states that values of time may also vary by income group. It therefore suggests that cars on business, other cars, LGVs and HGVs should be treated as individual user classes and assigned separately. In this case, HGV movements have been further segmented to represent port and non-port trips separately. Port HGV trips are assumed to be all of other goods vehicle 2 (OGV2 – all rigid vehicles with four or more axles and all articulated vehicles) type which is reflected in the parameters used in the modelling process. Non-work car demand should also be split by income band where tolling and charging schemes are to be assessed. Taking these points into consideration the LTAM HAM has the following user classes/segments:

a. Cars – Employer's Business

b. Cars – Commute Low Income

c. Cars – Commute Medium Income

d. Cars – Commute High Income

e. Cars – Other Low Income

f. Cars – Other Medium Income

g. Cars – Other High Income

h. LGVs

i. HGVs – Non-Port

j. HGVs – Port

Summary of data collection

3.3.28 A series of existing transport models were identified and reviewed to ascertain their potential use in developing the networks for the LTAM. The associated strengths and weaknesses of each model were identified.

3.3.29 Given the strengths and weaknesses of each of the available source models, a plan was devised for which of the source models would be used for different areas in the LTAM network. This is provided in Table 3.3.

Table 3.3 LTAM use of selected available model network data

Data	Most appropriate model
Primary source of highway network data outside the M25.	LTC V2.1
Primary source of highway network data inside the M25.	River Crossings Highway Assignment Model (RXHAM)
Supplementary model highway network on strategic road network corridors	South East Regional Transport Model (SERTM)
Supplementary model highway network in Kent.	M20 Smart Motorway Transport Model (M20STM)
Primary source of public transport network data	SERTM

3.3.30 Additional network coding, where none of the source models was considered to have enough detail, was coded from scratch, following the principles of the National Highways RTM network coding manual.

3.3.31 The primary source of public transport network data came from the SERTM. A public transport cost skimming tool has been developed in PTV VISUM covering the entirety of England and connected to the combined, detailed RTM zoning systems. This tool was sourced from the SERTM developers and recoded to the LTAM zoning system.

3.3.32 A series of existing datasets were identified and reviewed to ascertain their potential use in developing the demand matrices for the LTAM. Again, the associated strengths and weaknesses of each of these datasets were identified.

3.3.33 Table 3.4 sets out how the different origin-destination datasets have been used in the development of the LTAM.

Table 3.4 Origin-destination demand datasets – use in development of the LTAM

Dataset	LTAM use
South East Regional Traffic Model (SERTM) Prior Matrices	These are the primary source of origin-destination data used in the development of the LTAM demand matrices.
Lower Thames Crossing Version 2.1 Model Matrices (LTC V2.1)	These matrices were developed based on data collected in 2001 and were therefore not used.
National Highways Trip Information System (TIS)	Extracts were requested from the TIS. Select link outputs were used for verification of Dartford Crossing movements. Matrices were used for deriving Origin Destination (OD)-Production Attraction (PA) factors for use in development of demand model matrices from calibrated highway assignment model matrices.
National Travel Survey (NTS) Data	This data was used as the primary source for identifying appropriate income segmentation bands and factors to apply to the SERTM demand matrices to produce the income segmented matrices for the LTAM.
Teletrac (formerly Trafficmaster) Origin-Destination Data	This data has already been used to develop the LGV component of the SERTM matrices. Further use during the development of the LTAM was not considered appropriate.
Census Journey to Work Data	This dataset has been used extensively during the development of the SERTM prior matrices. Further use during the development of the LTAM matrices was not considered as being required.
Great Britain Freight Model (GBFM)	This dataset has been used as the primary data source for the development of the LTAM DCO HGV matrices.
Dart Charge User Survey	This has been used as a verification dataset to compare the LTAM predicted distribution pattern of flows using the existing crossing with those observed in the survey.
South East Regional Traffic Model (SERTM) Public Transport (Rail) Matrices	These are the primary source of public transport origin destination data used in the development of the LTAM.

3.3.34 There were a range of different traffic count data sources identified and assessed for their potential use in the development of the LTAM. Any gaps in this dataset were identified and additional surveys commissioned. Some of the data was aggregated into a series of screenlines covering strategic movements throughout the model area. Some sites were nominated as non-screenline locations. Plate 3.5 provides a graphical representation of these screenlines. Plate 3.6 shows the count data used in calibration. Plate 3.7 shows the count data used in validation.

Plate 3.5 All LTAM screenlines and cordons

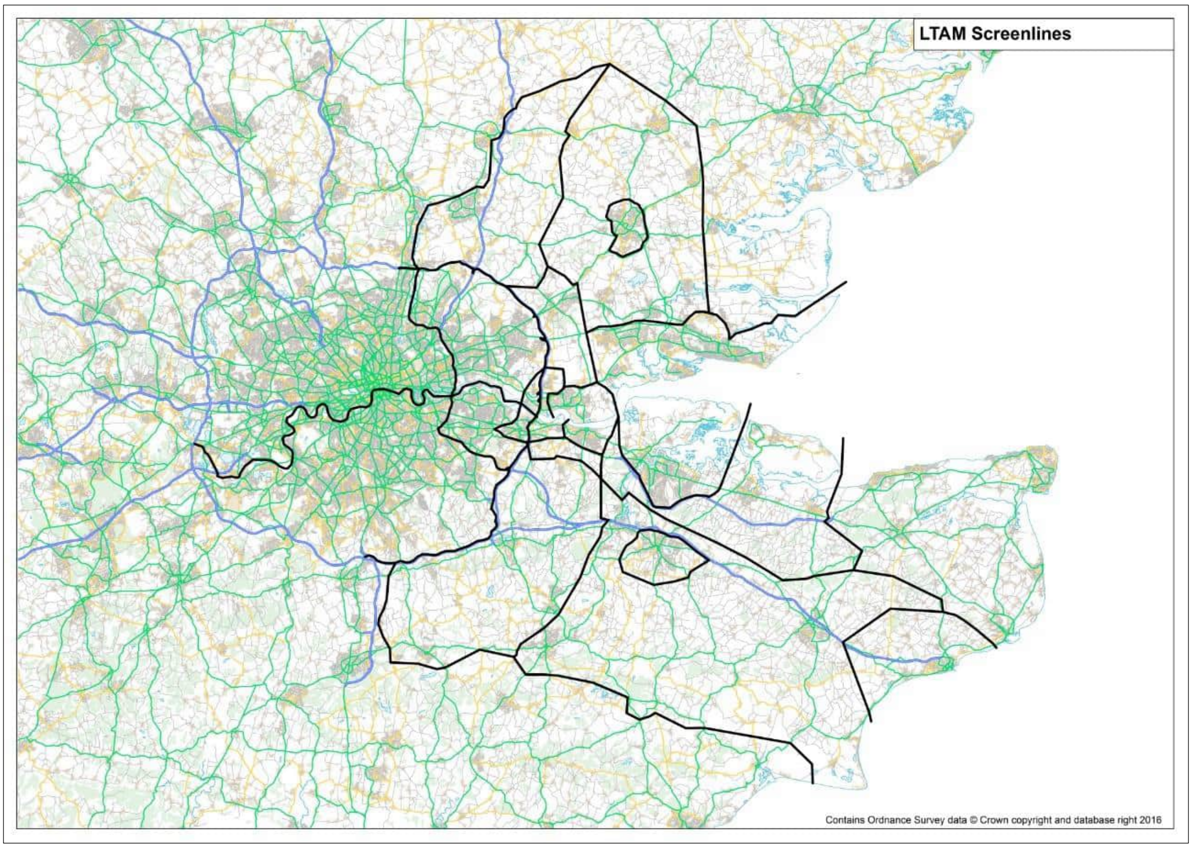


Plate 3.6 Count sites used in model calibration

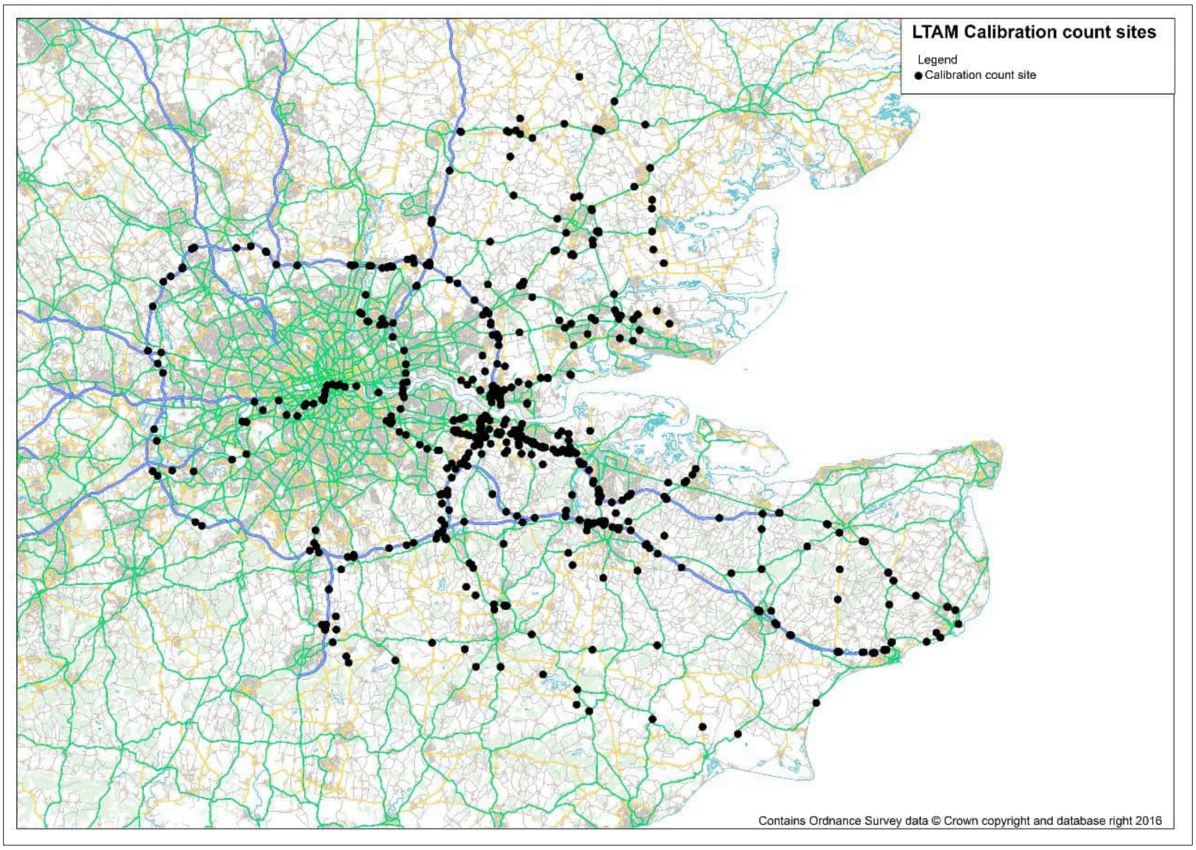
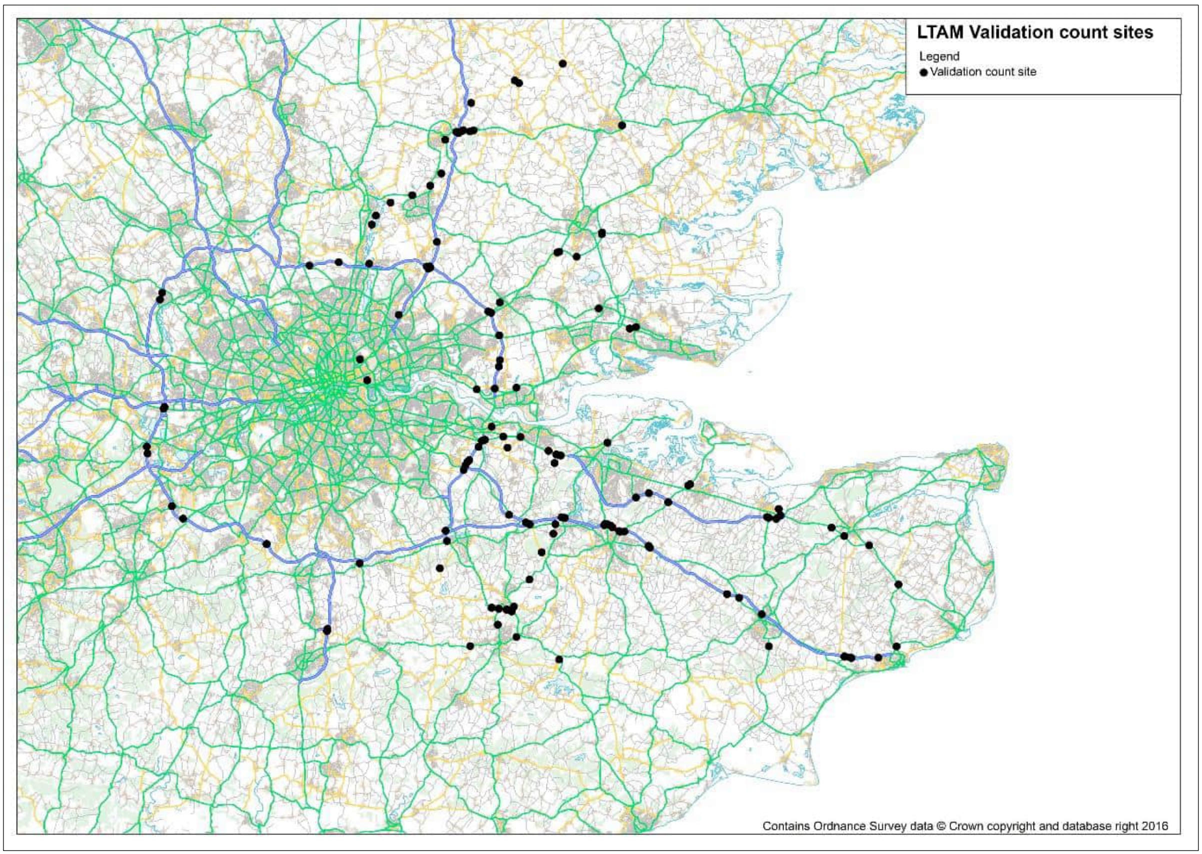


Plate 3.7 Count sites used in model validation



3.3.35 There were three different journey time datasets available for use in developing the LTAM:

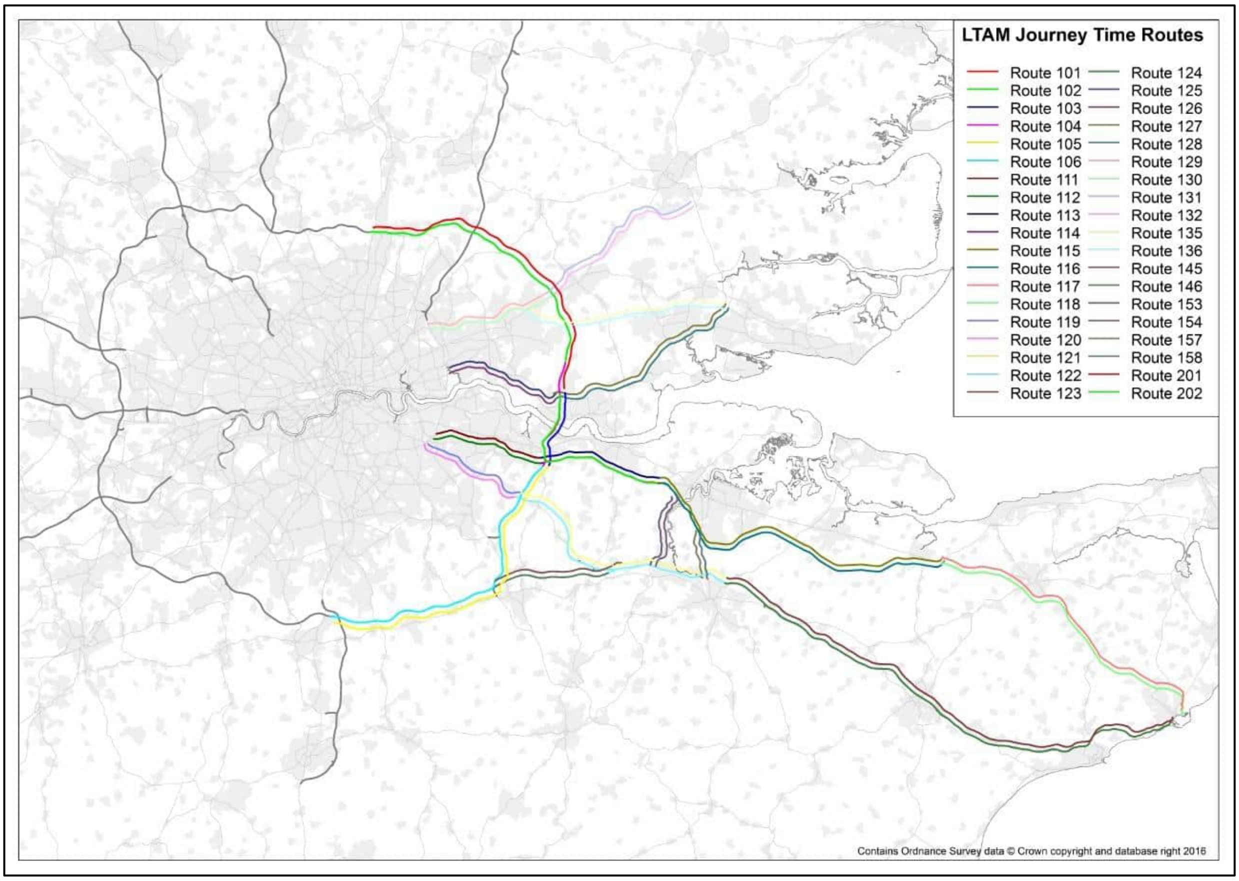
a. Teletrac Journey Time Database – this was used as the primary source of journey time data during the calibration of the LTAM.

b. TRIS Journey Time Database – this dataset has been used to supplement the Teletrac journey time data as a verification dataset.

c. Dartford Crossing Bluetooth Journey Time Surveys – this dataset has been used to supplement the Teletrac journey time data as a verification dataset specifically at the Dartford Crossing.

3.3.36 A series of journey time routes have been defined covering the primary corridors of interest. These are shown in Plate 3.8.

Plate 3.8 LTAM strategic journey time routes



Network development

3.3.37 The SERTM zoning structure (DF3 release) was taken as the starting point for developing the LTAM zoning system. The 2,306 zones in the SERTM were aggregated/disaggregated to form the 1,013 zones in the LTAM. Plate 3.9 shows the zones in the EA. Plate 3.10 shows the zones in the FMA.

Plate 3.9 LTAM zoning structure

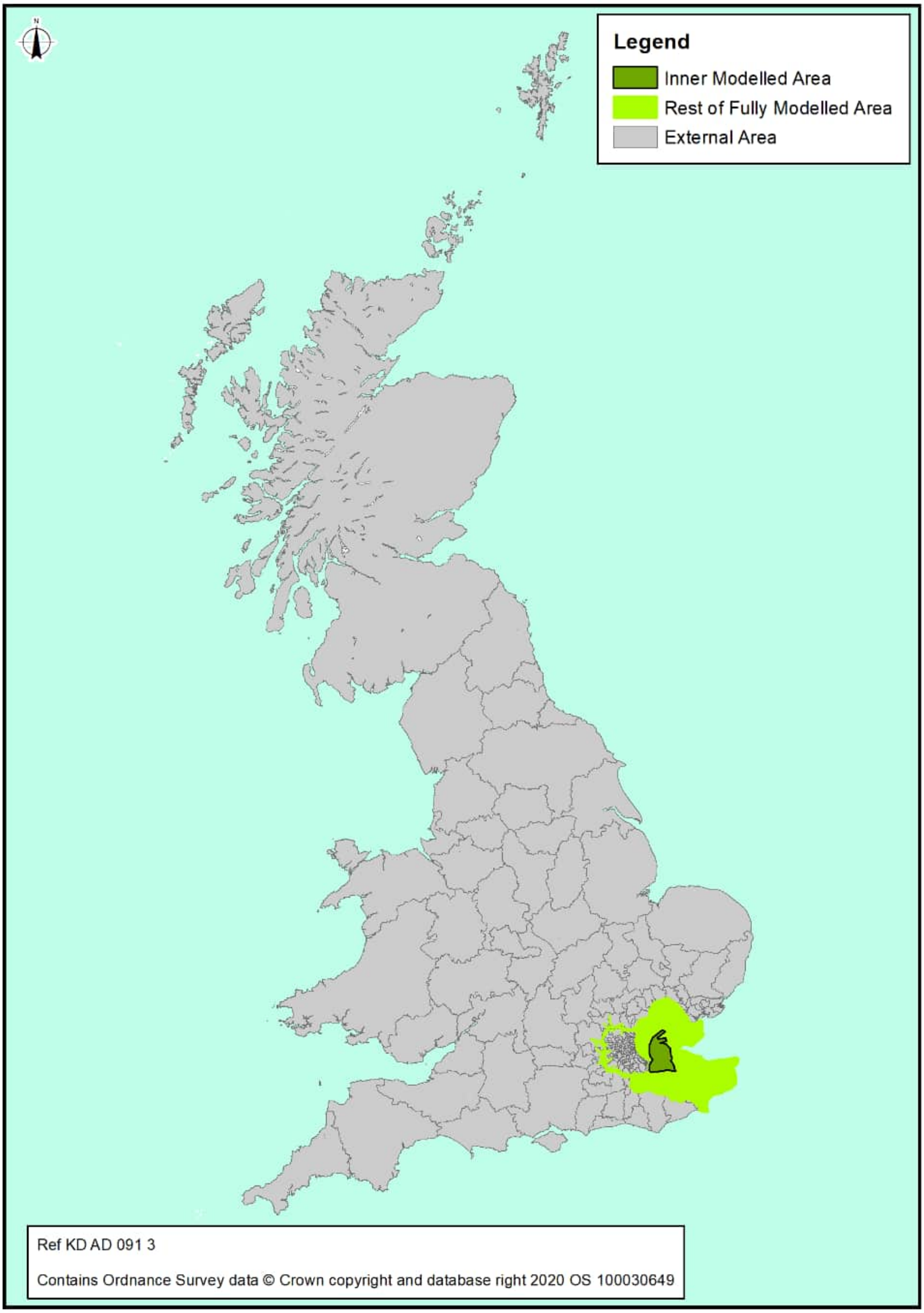
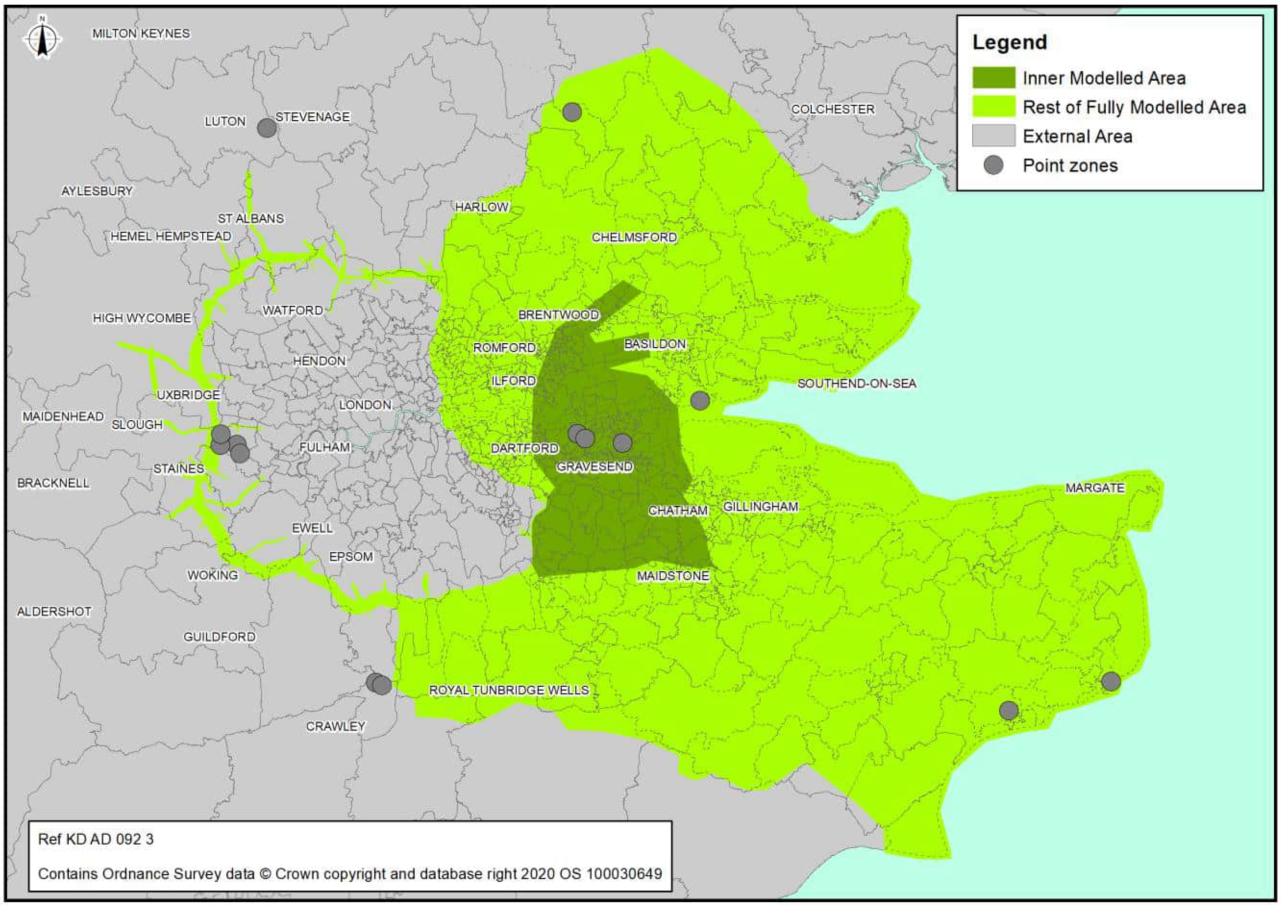


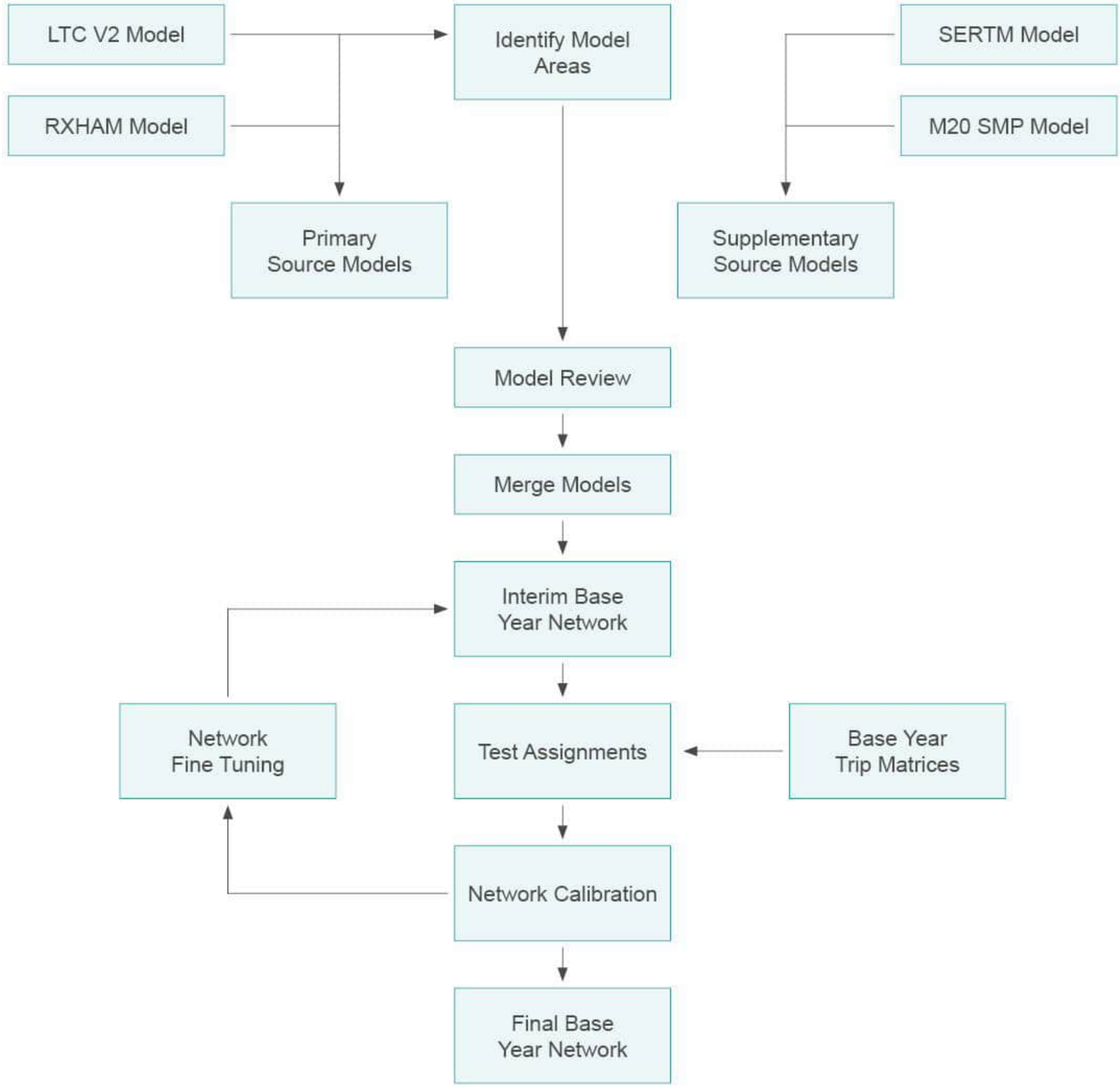
Plate 3.10 LTAM zoning structure within the FMA



3.3.38 Ports were allocated as point zones within the LTAM zoning structure (shown as grey circles in Plate 3.10).

3.3.39 Plate 3.11 shows the overall network development process referencing the available network datasets described above.

Plate 3.11 Overall LTAM network development process



3.3.40 Plate 3.12 to Plate 3.14 provide plots of the final LTAM network at different zoom levels.

Plate 3.12 LTAM highway network – zoomed in

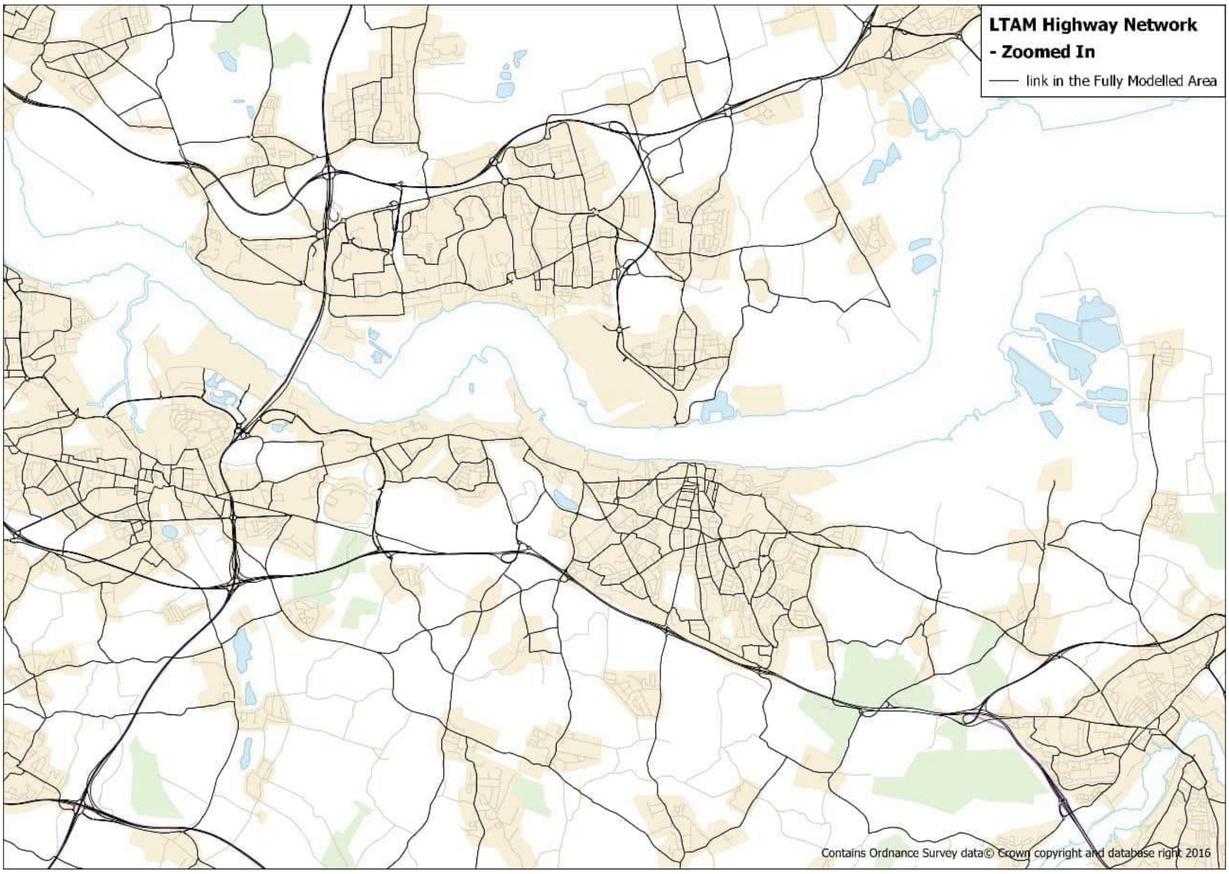


Plate 3.13 LTAM highway network – Fully Modelled Area

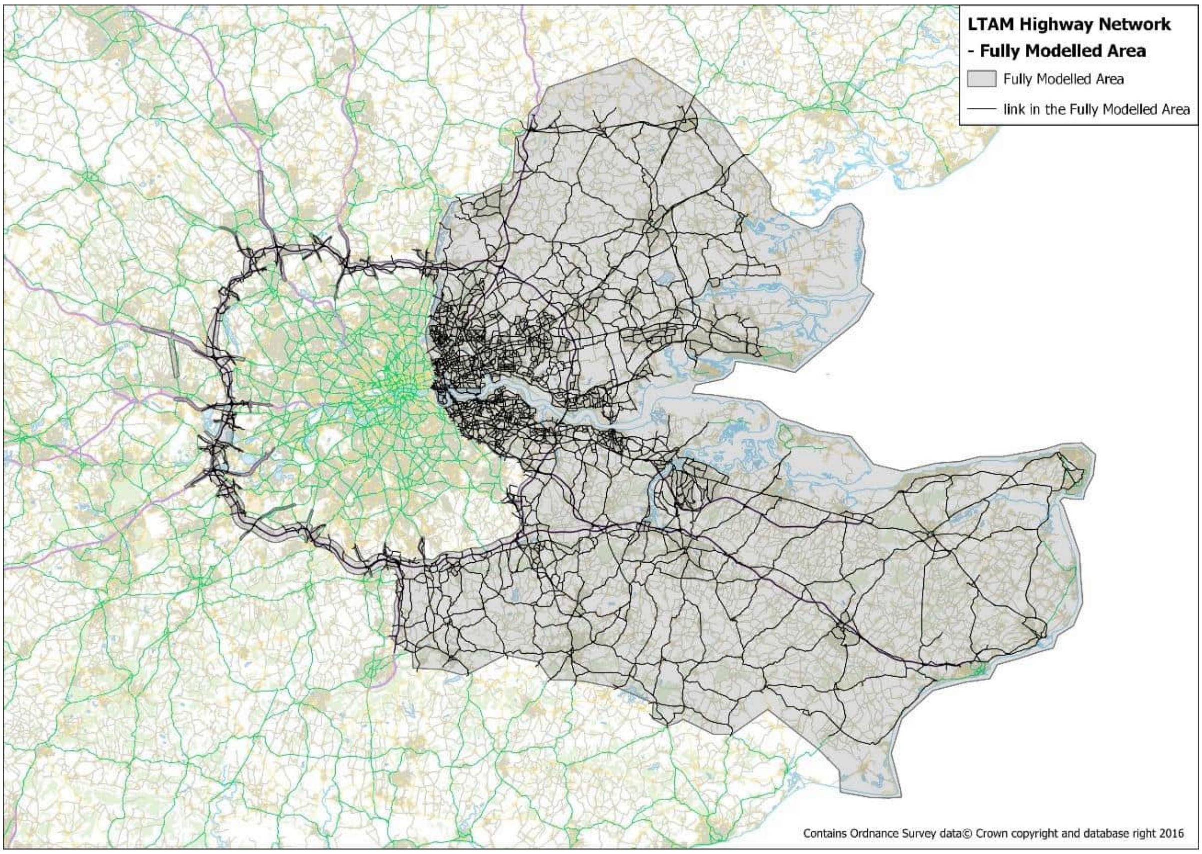
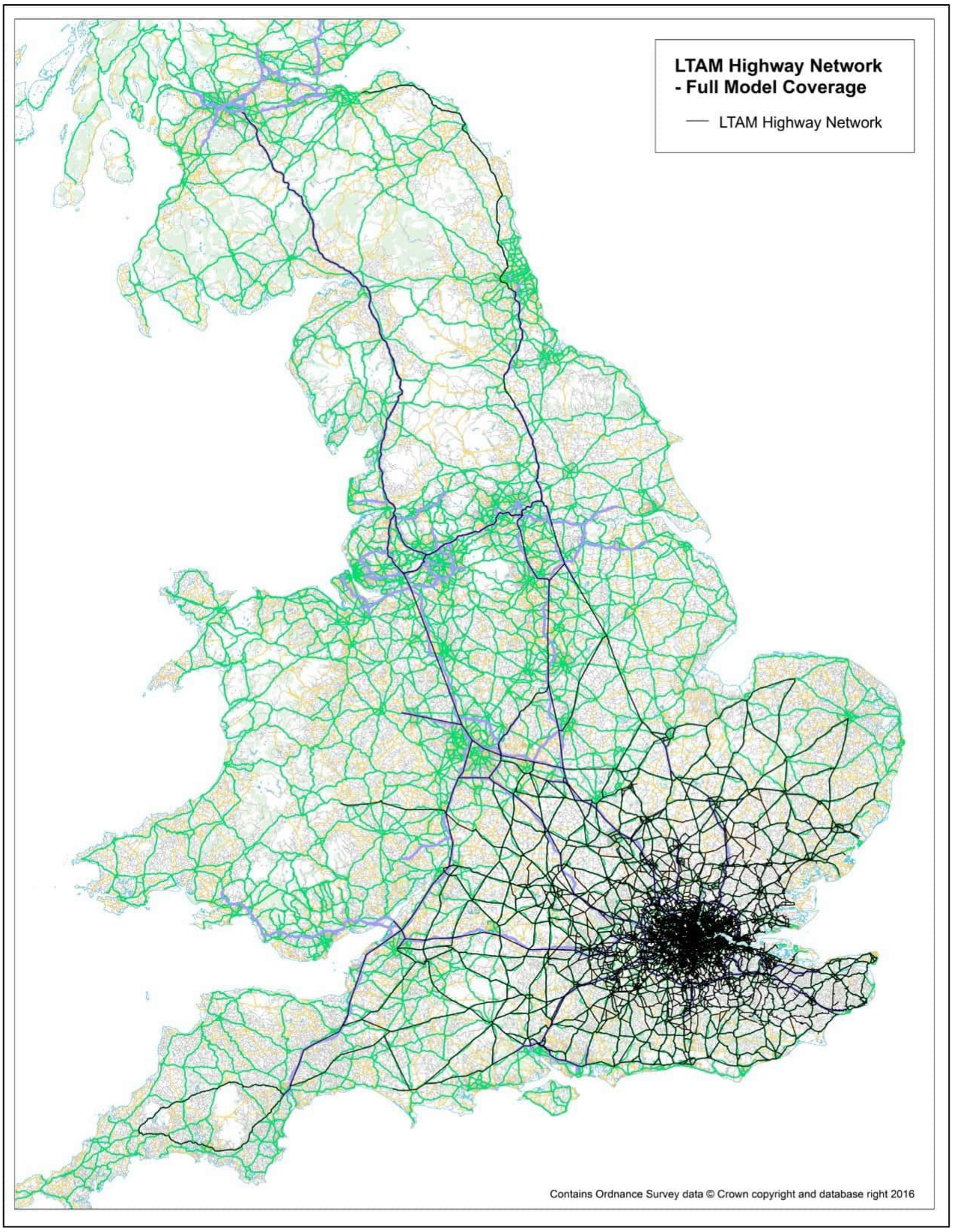


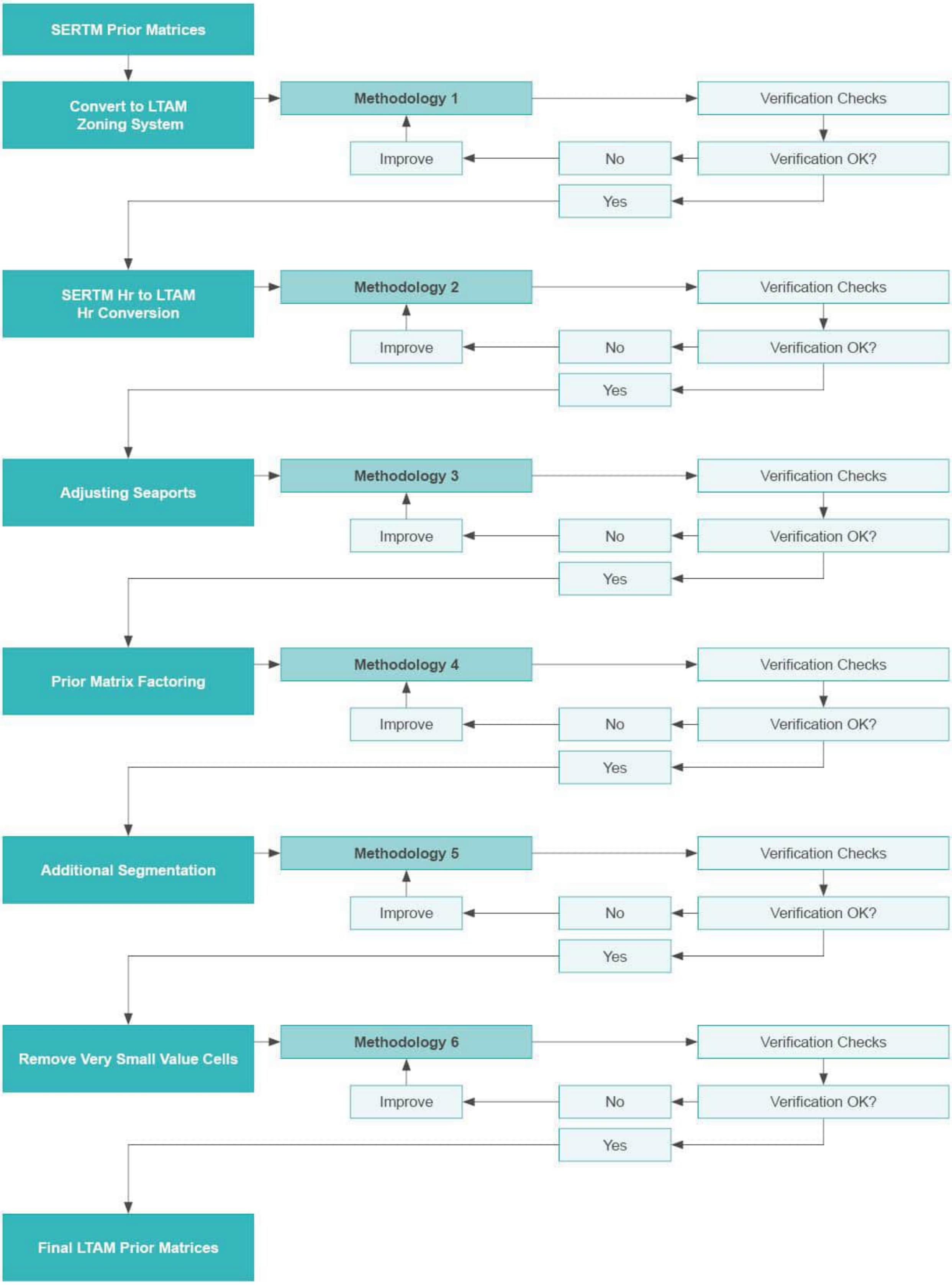
Plate 3.14 LTAM highway network – full model coverage



Matrix development

3.3.41 The primary source of data for developing the LTAM demand matrices was the SERTM prior matrices. Plate 3.15 shows the methodology used to convert the SERTM prior matrices into prior matrices suitable for use in the LTAM.

Plate 3.15 The LTAM highway prior matrix development process



3.3.42 The above procedure sets out the methodology used to develop the LTAM Stat Con demand matrices. In the LTAM DCO model the HGV data has been updated to use the Great Britain Freight Model matrices and the LGV demand matrices have been improved. These prior matrices were then further refined using matrix estimation (ME) techniques. The final post ME matrix totals are provided in Table 3.5.

Table 3.5 Final LTAM post ME matrix totals (PCUs)

Userclass	AM	IP	PM
Car employer's business	446,238	388,822	535,264
Car commute low income	416,937	189,525	476,874
Car commute medium income	844,010	291,124	915,198
Car commute high income	717,359	207,507	740,837
Car other low income	650,296	1,156,146	1,127,337
Car other medium income	693,521	923,590	1,135,034
Car other high income	554,821	620,234	860,322
Car total	4,323,182	3,776,948	5,790,865
LGV	730,141	630,596	527,223
HGV (port and non-port combined)	129,666	145,529	83,900

Model calibration and validation

3.3.43 The LTAM HAM has been calibrated according to TAG principles. The primary calibration and validation criteria involve comparisons of modelled traffic flows against observed flows and modelled travel times against observed journey times. Table 3.6 to Table 3.11 provide a summary of the individual count site observed vs modelled flows for cars and all vehicles combined for each time period for the calibration sites.

Table 3.6 Modelled vs observed individual count comparison calibration sites AM peak cars

	No. sites	Cars			
		No. sites GEH<5	No. sites DMRB pass	No. sites overall pass	% Sites overall pass
Screenline	475	405	423	426	90%
Non-screenline	371	327	340	341	92%
Total	846	732	763	767	91%
Inner model area	309	286	291	293	95%

Table 3.7 Modelled vs observed individual count comparison calibration sites AM peak all vehicles

	No. sites	All vehicles			
		No. sites GEH<5	No. sites DMRB pass	No. sites overall pass	% Sites overall pass
Screenline	475	401	414	416	88%
Non-screenline	371	327	332	335	90%
Total	846	728	746	751	89%
Inner model area	309	284	290	290	94%

Table 3.8 Modelled vs observed individual count comparison calibration sites inter-peak cars

	No. sites	Cars			
		No. sites GEH<5	No. sites DMRB pass	No. sites overall pass	% Sites overall pass
Screenline	475	425	445	446	94%
Non-screenline	371	341	349	350	94%
Total	846	766	794	796	94%
Inner model area	309	291	297	297	96%

Table 3.9 Modelled vs observed individual count comparison calibration sites inter-peak all vehicles

	No. sites	All vehicles			
		No. sites GEH<5	No. sites DMRB pass	No. sites overall pass	% Sites overall pass
Screenline	475	420	437	439	92%
Non-screenline	371	335	347	347	94%
Total	846	755	784	786	93%
Inner model area	309	286	296	296	96%

Table 3.10 Modelled vs observed individual count comparison calibration sites PM peak cars

	No. sites	Cars			
		No. sites GEH<5	No. sites DMRB pass	No. sites overall pass	% Sites overall pass
Screenline	475	410	422	422	89%
Non-screenline	371	323	330	333	90%
Total	846	733	752	755	89%
Inner model area	309	280	282	283	92%

Table 3.11 Modelled vs observed individual count comparison calibration sites PM peak all vehicles

	No. sites	All vehicles			
		No. sites GEH<5	No. sites DMRB pass	No. sites overall pass	% Sites overall pass
Screenline	475	408	419	422	89%
Non-screenline	371	322	328	329	89%
Total	846	730	747	751	89%
Inner model area	309	280	281	282	91%

3.3.44 These tables show that overall, the LTAM is able to predict levels of flow by cars and all vehicles combined which compare favourably with observed flow levels. This is the case on screenline sites, non-screenline sites and in total. In particular, in the inner model area the comparison is very close with between 91% and 96% of sites passing the TAG guidance.

3.3.45 Table 3.12 to Table 3.17 provide a summary of the individual count site observed vs modelled flows for cars and all vehicles combined for each time period for the validation sites.

Table 3.12 Modelled vs observed individual count comparison validation sites AM peak cars

	No. sites	Cars			
		No. sites GEH<5	No. sites DMRB pass	No. sites overall pass	% Sites overall pass
Screenline	60	25	34	35	58%
Non-screenline	130	83	89	93	72%
Total	190	108	123	128	67%
Inner model area	43	32	35	36	84%

Table 3.13 Modelled vs observed individual count comparison validation sites AM peak all vehicles

	No. sites	All vehicles			
		No. sites GEH<5	No. sites DMRB pass	No. sites overall pass	% Sites overall pass
Screenline	60	17	29	29	48%
Non-screenline	130	84	83	86	66%
Total	190	101	112	115	61%
Inner model area	43	35	36	36	84%

Table 3.14 Modelled vs observed individual count comparison validation sites inter-peak cars

	No. sites	Cars			
		No. sites GEH<5	**No. sites DMRB pass**	**No. sites overall pass**	**% Sites overall pass**
Screenline	60	22	30	32	53%
Non-screenline	130	95	100	102	78%
Total	190	117	130	134	71%
Inner model area	43	40	39	40	93%

Table 3.15 Modelled vs observed individual count comparison validation sites inter-peak all vehicles

	No. sites	All vehicles			
		No. sites GEH<5	**No. sites DMRB pass**	**No. sites overall pass**	**% Sites overall pass**
Screenline	60	19	26	26	43%
Non-screenline	130	87	93	94	72%
Total	190	106	119	120	63%
Inner model area	43	36	37	37	86%

Table 3.16 Modelled vs observed individual count comparison validation sites PM peak cars

	No. sites	Cars			
		No. sites GEH<5	**No. sites DMRB pass**	**No. sites overall pass**	**% Sites overall pass**
Screenline	60	23	28	28	47%
Non-screenline	130	80	86	87	67%
Total	190	103	114	115	61%
Inner model area	43	32	34	34	79%

Table 3.17 Modelled vs observed individual count comparison validation sites PM peak all vehicles

	No. sites	All vehicles			
		No. sites GEH<5	**No. sites DMRB pass**	**No. sites overall pass**	**% Sites overall pass**
Screenline	60	24	26	27	45%
Non-screenline	130	81	84	85	65%
Total	190	105	110	112	59%
Inner model area	43	31	31	31	72%

3.3.46 These tables show that the LTAM is predicting flows that accord well with observed values at the validation locations, in particular in the inner model area with between 72% and 93% of sites achieving the TAG guidance.

3.3.47 Table 3.18 to Table 3.20 provide overall summary statistics for the modelled vs observed journey times.

Table 3.18 Modelled vs observed journey time summary statistics AM peak

Difference	LGVs		HGVs	
	No. pass	% Pass	No. Pass	% Pass
<15% or less than 1 min diff.	35	90%	35	90%
<30%	4	10%	4	10%
>30%	0	0%	0	0%
Total	39		39	

Table 3.19 Modelled vs observed journey time summary statistics inter-peak

Difference	LGVs		HGVs	
	No. pass	% Pass	No. pass	% Pass
<15% or less than 1 min diff.	39	100%	39	100%
<30%	0	0%	0	0%
>30%	0	0%	0	0%
Total	39		39	

Table 3.20 Modelled vs observed journey time summary statistics PM peak

Difference	LGVs		HGVs	
	No. pass	% Pass	No. pass	% Pass
<15% or less than 1 min diff.	37	95%	35	90%
<30%	2	5%	4	10%
>30%	0	0%	0	0%
Total	39		39	

3.3.48 These tables demonstrate that overall the LTAM is predicting journey times on key routes that compare favourably with observations. This is the case for both light and heavy vehicles where the TAG guidance of 85% of routes is achieved in all time periods. The HGV percentage pass figure is lower. This is due to the inability of SATURN to capture the speed differential between LGVs and HGVs. In any case the journey time validation comparisons are considered to be acceptable in all time periods.

3.3.49 The analysis presented above demonstrates that the LTAM HAM predicts traffic flows and journey times across strategic routes to an appropriate level. The HAM is therefore considered to be appropriate for use in forecasting the potential impacts of the Project.

3.4 Variable Demand Model

Requirement for a VDM

3.4.1 The purpose of a variable demand model is to establish the extent of travel suppression in the 'Without Scheme' case and the extra traffic that is expected to be induced in the 'With Scheme' case.

3.4.2 As explained in TAG Unit M2.1 (DfT, 2020b), the benefit from schemes can be substantially altered by changes in demand that are caused by the scheme. Paragraph 2.2.4 of that guidance unit states that preliminary quantitative estimates of the potential effects of variable demand on both traffic levels and benefits should be made if it is thought that a fixed demand assessment will be appropriate.

3.4.3 As per paragraph 2.2.1 of TAG Unit M2.1 (DfT, 2020b), it may be acceptable to assess a scheme on the basis of fixed demand assignments if the following criteria are satisfied:

a. The scheme is quite modest either spatially or financially and is also quite modest in terms of its effect on travel costs (schemes with a capital cost of less than £5 million can generally be considered as modest) or meets the following two points:

   i. There is no congestion or crowding on the network in the forecast year (10 to 15 years after opening), in the absence of the scheme.

   ii. The scheme will have no appreciable effect on travel choices (for example mode choice or distribution) in the corridor(s) containing the scheme.

3.4.4 The Project does not satisfy any of the above criteria:

a. The Project involves making network changes over a wide area, not merely in the immediate vicinity of the crossing itself.

b. The Without Scheme situation is expected to be highly congested due to the fact that the Dartford Crossing is at capacity in the base year, and the introduction of the Project is expected to provide important congestion relief.

c. The amounts of re-routing caused by the introduction of the Project – as a result of the increase in cross-river capacity that is introduced by it – are expected to be large, with consequent large changes in travel costs relative to the Without Scheme situation.

d. The introduction of the new option for crossing the river can reasonably be predicted to have an appreciable effect on travellers' distribution choices.

3.4.5 In summary, the size, scope and predicted effect of the Project on travel costs and routing lead to the conclusion that an appropriate appraisal of its impacts can only be carried out through the use of a variable demand model.

Model structure

3.4.6 The different types of demand responses that are available in DIADEM for logit models are:

a. Trip frequency – that is how many trips are made, which therefore allows for demand suppression and generation

b. Macro time period – that is whether to travel in, say, the AM peak, inter-peak, PM peak or off peak periods

c. Mode – that is whether to travel by car or PT

d. Distribution (destination choice) – that is whether to travel to one destination or another

3.4.7 Two types of distribution model may be used:

a. Singly constrained – in which a segment's trip ends are fixed for one end of a trip

b. Doubly constrained – in which a segment's trip ends are fixed at both ends, that is for both total zonal origins (or productions) and total zonal destinations (or attractions)

3.4.8 In the LTAM, all of the available responses are included for at least some of the demand segments. Table 3.21 summarises the responses that are used with each of the demand segments.

Table 3.21 The hierarchical demand responses used with each of the LTAM's variable demand segments

Segment index	Abbreviation	DIADEM demand method	Response hierarchy
1	Home Based Employer's Business (HBEB)	Incremental PA	Time period Mode Singly (production) constrained distribution
2	Home Based Commuting (HBW) L		Time period Mode Doubly constrained distribution
3	HBW M		
4	HBW H		
5	Home Based Other (HBO) L		Frequency Time period Mode Singly (production) constrained distribution
6	HBO M		
7	HBO H		

Segment index	Abbreviation	DIADEM demand method	Response hierarchy
8	Non Home Based Employer's Business (NHBEB)	Incremental OD	Time period Mode Singly (origin) constrained distribution
9	Non Home Based Other (NHBO) L		Frequency Time period Mode Singly (origin) constrained distribution
10	NHBO M		
11	NHBO H		

Model calibration

3.4.9 The standard way to verify that a variable demand model's behaviour is realistic before using it to perform forecast year traffic predictions is to run a series of realism tests that involve changing the costs of using the two main modes, highway and PT, and to assess whether the responses are in accordance with expected values.

3.4.10 As discussed in Section 6.4 of TAG Unit M2.1 (DfT, 2020b), the method used to assess the acceptability of a model's responses is to calculate its demand elasticities and verify that they are within certain ranges. The elasticities are calculated by making a small proportional change to a relevant cost across the whole model and calculating the resulting proportional change in the amount of travel that is affected by that cost.

3.4.11 The realism tests that are required by TAG are the responses due to changes in highway fuel cost and public transport fares. Additionally, the elasticity of demand in response to car journey time changes is also required, but an approximation to this can be obtained from the car fuel price elasticity, which is the approach undertaken here.

3.4.12 Other requirements set out in TAG for the calculation of demand elasticities are:

a. They must be calculated using the base year model.

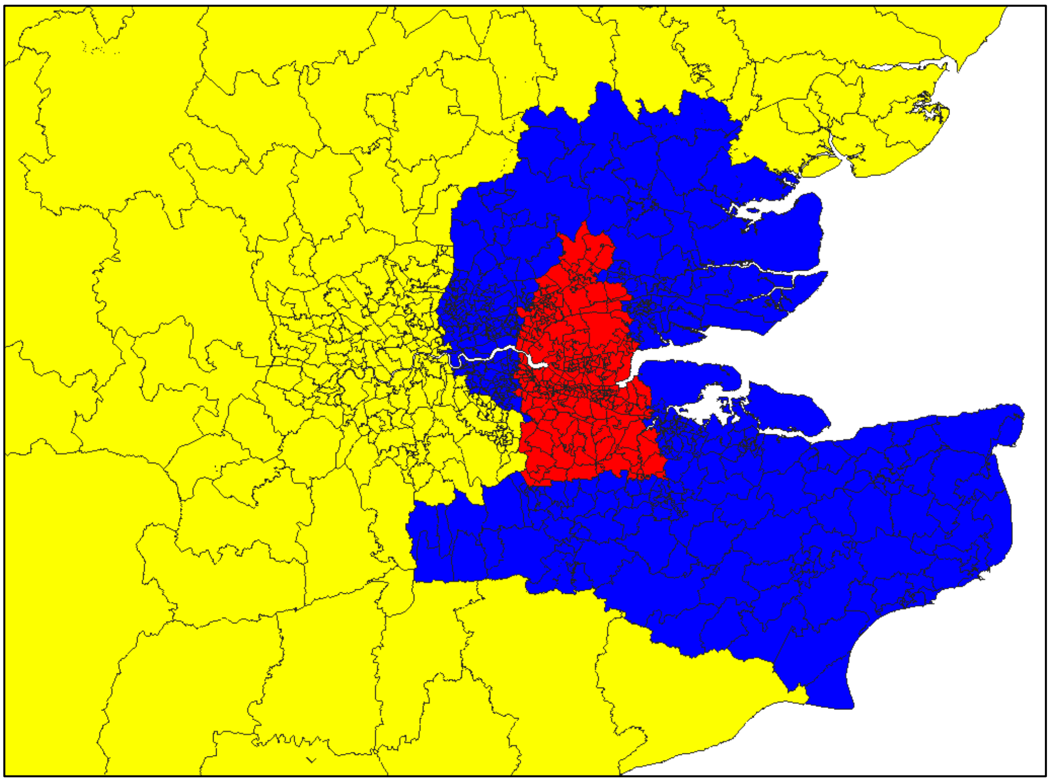
b. If distance-based cost damping is being used in the model, the realism tests must be performed with its effects included. A sensitivity test may be performed in which the cost damping is turned off, to be able to assess its impact.

c. The elasticities must be calculated from the outputs of a converged model.

d. A demand-weighted average of the elasticities calculated for individual time periods and journey purposes should be reported in addition to the individual values themselves.

3.4.13 In the calculation of both fuel price and PT fare elasticities, the matrix-based values have been obtained for movements from origins in the FMA to all destinations, including external zones. This classification of movements is the same as was used in SERTM for the calculation of the fuel price elasticities and it has been retained it for those calculations. The area classification used is illustrated in Plate 3.16.

Plate 3.16 LTAM's Inner (red), Fully Modelled (blue) and External (yellow) Areas



Fuel price realism test

3.4.14 The fuel price realism test was conducted by increasing the fuel components of the base year vehicle operating cost parameters by 10% by modifying the fuel costs in the TAG Databook V1.17 (DfT, 2021).

3.4.15 Fuel price elasticities must be calculated in two ways:

a. Based on the trip matrix and distance skims

b. Based on network link flows and distances

3.4.16 For the matrix-based elasticity, PCU-Kms for each OD pair were obtained separately for each time period and user class by multiplying the trip matrices by the average distances skimmed from the assignment outputs. These were then summed over all destination zones for origin zones in the FMA only to obtain the final PCU-Kms value used in the rest of the calculation.

3.4.17 For the network-based elasticity, the method used was to extract PCU-Kms by multiplying actual link flows for each user class in each time period by the link length, for links in the simulation network only. The total for each time period and user class was used in the rest of the calculation.

3.4.18 The realism test scenario was run to convergence with DIADEM's relative gap criteria set to 0.05% for the whole model and 0.15% for the chosen sub-area. Convergence was achieved after seven demand/supply loops.

3.4.19 Because the calculations make use of highway assignment model outputs, elasticities were obtained for each time period and each of the seven user classes that correspond to the 11 variable demand segments. The disaggregate data were also combined to obtain elasticities at the level of journey purpose without income segmentation, and further combined into values for each journey purpose over a whole day and for each time period over all purposes. These values are summarised in Table 3.22.

Table 3.22 Elasticities for each individual user class

Matrix-based elasticity	Business	Commute low	Commute medium	Commute high	Other low	Other medium	Other high
AM	-0.09	-0.26	-0.15	-0.07	-0.64	-0.35	-0.19
IP	-0.12	-0.29	-0.19	-0.11	-0.56	-0.34	-0.23
PM	-0.09	-0.28	-0.16	-0.08	-0.52	-0.28	-0.18
OP	-0.17	-0.30	-0.20	-0.13	-0.62	-0.39	-0.29
Network-based elasticity	**Business**	**Commute low**	**Commute medium**	**Commute high**	**Other low**	**Other medium**	**Other high**
AM	-0.05	-0.32	-0.18	-0.07	-0.76	-0.39	-0.20
IP	-0.11	-0.43	-0.27	-0.14	-0.75	-0.43	-0.26
PM	-0.06	-0.37	-0.19	-0.05	-0.69	-0.37	-0.18
OP	-0.21	-0.46	-0.31	-0.21	-0.87	-0.56	-0.40

3.4.20 The final matrix-based elasticities after aggregation over income segments are shown in Table 3.23, while the corresponding values from the network-based calculations are shown in Table 3.24. Because the OP period data are unvalidated and are an estimate based on factoring the matrices for the validated time periods, the elasticities have been reported in each table both with and without the inclusion of the OP's PCU-Kms.

Table 3.23 Final matrix-based fuel price elasticities of PCU kilometres

Internal zones to all destinations (OD, matrix calculation)				
Car elasticity	**Business**	**Commuting**	**Car other**	**Total**
AM	-0.09	-0.14	-0.38	-0.24
IP	-0.12	-0.19	-0.38	-0.31
PM	-0.09	-0.15	-0.32	-0.23
OP	-0.17	-0.20	-0.43	-0.34
All day	-0.12	-0.16	-0.38	-0.29
Excl. OP	-0.10	-0.16	-0.36	-0.27

Table 3.24 Final network-based fuel price elasticities of PCU kilometres

Simulation network (network calculation)				
Car elasticity	**Business**	**Commuting**	**Car other**	**Total**
AM	-0.05	-0.15	-0.41	-0.26
IP	-0.11	-0.25	-0.47	-0.39
PM	-0.06	-0.16	-0.38	-0.27
OP	-0.21	-0.30	-0.59	-0.48
All day	-0.11	-0.21	-0.48	-0.36
Excl. OP	-0.08	-0.18	-0.43	-0.32

3.4.21 Guidance states that the trip-km elasticities with respect to fuel price are expected to satisfy the following criteria:

a. The average elasticity of car use with respect to fuel cost should lie in the range -0.25 to -0.35.

b. The side of -0.30 on which the elasticity lies – that is, closer to -0.25 or -0.35 – should be appropriate for the area covered by the model, taking into account such attributes as levels of income and average trip lengths.

c. The pattern of elasticities calculated over all purposes is expected to show that peak period values are lower than inter-peak values, which are lower than off peak values.

d. Employer's Business (EB) trips are expected to have elasticities close to -0.1.

e. Trips for discretionary purposes, such as Other, are expected to have elasticities close to -0.4.

f. Commuting trips are expected to have elasticities that are near to the average.

3.4.22 By comparing the LTAM fuel price elasticities with the guidance, the following comments can be made:

a. The all-day elasticity over all purposes is -0.29 from the matrix calculation and -0.36 from the network calculation. Excluding the unvalidated OP period leads to a matrix-based value of -0.27 and a network-based value of -0.32. These elasticities are within or close to the expected range.

b. The all-purpose elasticities are lower in the peaks than in the inter-peak, which are in turn lower than the elasticities in the off peak. This is true of both the network- and matrix-based values.

c. The all-day elasticity for EB trips is -0.12 from the matrix based calculation and -0.11 from the network based calculations. These are close to the expected value. The variation of the EB elasticity across the time periods displays the expected behaviour.

d. The all-day elasticity for Other trips is -0.38 from the matrix calculation and -0.48 from the network calculation. The value from the network calculation is particularly high due to the contribution of the unvalidated off peak period. Excluding that period leads to values of -0.36 and -0.43, respectively, for matrix and network calculations. These are close to the expected value of -0.40.

e. The Commuting elasticities are -0.16 from the matrix calculation and -0.21 from the network calculation. These lie outside the range reported by TAG, though from the network calculation the IP and OP elasticities lie within or close to the expected range.

Journey time realism test

3.4.23 Journey time elasticities are difficult to obtain accurately, and so an approximate method is used, which relates them to the fuel price elasticities and the values of VOT and VOC.

3.4.24 TAG Unit M2.1, paragraph 6.4.28 states that the journey time elasticities should be checked '*to ensure that the model does not produce very high output elasticities (say stronger than -2.0)*'.

3.4.25 The final values calculated for each user class are shown in Table 3.25, together with the assignment hours and kilometres and other parameters used in their calculation. These have been calculated using the PCU-Kms extracted from the simulation network, and so they are consistent with the values shown earlier for the network-based fuel price elasticities.

Table 3.25 Journey time elasticities and the data used in their calculation

Period	User class	PCU-hrs	PCU-Kms	ppm	ppk	aT/bK	PCU-km elasticity	Journey time elasticity
AM	HBEB	17,815	975,847	30.11	12.81	2.575	-0.053	-0.14
AM	HBW L	8,807	413,801	9.29	6.38	1.859	-0.324	-0.60
AM	HBW M	20,105	996,880	15.61	6.38	2.961	-0.176	-0.52
AM	HBW H	21,831	1,156,520	27.22	6.38	4.832	-0.068	-0.33
AM	HBO L	17,566	844,130	7.59	6.38	1.485	-0.760	-1.13
AM	HBO M	21,082	1,078,477	13.07	6.38	2.403	-0.393	-0.95
AM	HBO H	24,212	1,331,912	20.82	6.38	3.559	-0.196	-0.70
IP	HBEB	8,889	529,560	30.85	12.42	2.501	-0.113	-0.28
IP	HBW L	4,803	238,056	9.44	6.2	1.843	-0.427	-0.79
IP	HBW M	7,812	419,652	15.87	6.2	2.859	-0.267	-0.76
IP	HBW H	7,767	445,045	27.66	6.2	4.671	-0.139	-0.65
IP	HBO L	20,396	1,044,479	8.09	6.2	1.529	-0.755	-1.15

Period	User class	PCU-hrs	PCU-Kms	ppm	ppk	aT/bK	PCU-km elasticity	Journey time elasticity
IP	HBO M	20,780	1,163,481	13.93	6.2	2.408	-0.430	-1.04
IP	HBO H	20,761	1,236,061	22.18	6.2	3.605	-0.263	-0.95
PM	HBEB	15,138	834,318	30.54	12.81	2.595	-0.062	-0.16
PM	HBW L	10,572	512,736	9.32	6.38	1.807	-0.372	-0.67
PM	HBW M	21,435	1,127,160	15.67	6.38	2.803	-0.187	-0.52
PM	HBW H	24,230	1,375,704	27.31	6.38	4.524	-0.049	-0.22
PM	HBO L	24,485	1,112,723	7.95	6.38	1.645	-0.687	-1.13
PM	HBO M	28,772	1,423,692	13.69	6.38	2.602	-0.373	-0.97
PM	HBO H	31,073	1,662,996	21.8	6.38	3.831	-0.184	-0.71
OP	HBEB	3,743	252,500	31.12	12.11	2.286	-0.212	-0.48
OP	HBW L	1,751	96,216	9.46	6.07	1.701	-0.457	-0.78
OP	HBW M	2,893	171,609	15.9	6.07	2.649	-0.307	-0.81
OP	HBW H	2,849	179,868	27.71	6.07	4.338	-0.205	-0.89
OP	HBO L	6,204	356,469	7.92	6.07	1.362	-0.870	-1.19
OP	HBO M	6,878	426,793	13.64	6.07	2.173	-0.564	-1.23
OP	HBO H	7,338	483,769	21.72	6.07	3.256	-0.403	-1.31

3.4.26 All of the values calculated for the journey time elasticity are negative, so that increasing journey time leads to fewer trips, as expected, and are all weaker than -2.0.

Public transport fare realism test

3.4.27 The public transport fare elasticity is calculated from the proportional change in public transport trips as a result of an increase in public transport fares, in contrast to the PCU-Km-based highway elasticity. These PT fare elasticities must be calculated from the demand matrices and reported by time period and journey purpose.

3.4.28 The method used to calculate these elasticities was to increase the values of the fares inputted to DIADEM by 10% for all OD pairs and to examine the resulting changes in the numbers of PT trips for each demand segment. All other inputs to the model, such as the PT travel times, values of time and vehicle operating costs were unchanged from their base model values.

3.4.29 The scenario was run to convergence with DIADEM's relative gap criteria set to 0.05% for the whole model and 0.15% for the chosen sub-area. Convergence was achieved after five demand/supply loops.

3.4.30 In accordance with TAG, the PT fare elasticities were calculated using trips for all zone pairs except external-to-external movements. The final PT fare elasticities are shown in Table 3.26 for home-based purposes and Table 3.27 for non-home-based purposes.

Table 3.26 Final PT fare elasticities – home-based purposes

Purpose	Ref. trips (24 hrs)	VDM trips (24 hrs)	Elasticity
HBEB	27,441	27,076	-0.14
HBW	366,069	362,265	-0.11
HBO	43,857	41,079	-0.69

Table 3.27 Final PT fare elasticities – non-home-based purposes

Purpose	Time period	Ref. trips (period)	VDM trips (period)	Elasticity
NHBEB	AM	7,270	7,127	-0.21
	IP	9,841	9,659	-0.20
	PM	5,181	5,098	-0.17
	OP	4,438	4,361	-0.18
	All day	26,731	26,245	-0.19
NHBO	AM	1,701	1,554	-0.95
	IP	5,612	5,114	-0.97
	PM	6,603	6,048	-0.92
	OP	2,536	2,329	-0.89
	All day	16,452	15,045	-0.94

3.4.31 Paragraph 6.4.21 of TAG Unit M2.1 (DfT, 2020b) suggests a range of -0.2 to -0.9 within which the PT fare elasticities are expected to lie. It is stated that the pattern of elasticities across purposes and time periods will show the same general features as expected of the fuel price elasticities, though it is recognised that there is little empirical evidence on which the patterns are based.

3.4.32 The PT fare elasticities obtained from the LTAM realism test shows that EB and Commuting values are lower than those for Other, which is in line with expectation. The Commuting elasticity is quite low and lies outside of the range suggested by the guidance, nonetheless, it is plausible for rail travel to work in the south-east of England to be fairly inelastic with respect to cost. For the NHB purposes, for which the elasticities are calculated for each time period, there is not much evidence of the peak elasticities being generally lower than those in the non-peak periods, but the values are fairly constant between periods. The NHBO all-day elasticity is seen to be slightly above the expected range.

Final demand model parameters

3.4.33 The final parameters used in the LTAM are shown in Table 3.28 for all demand responses with the exception of time period choice. Note that the distribution model parameters are shown with negative signs, as this is the form in which their values need to be entered into DIADEM.

3.4.34 All of the distribution and mode choice parameters are the ‘median’ values in Tables 5.1 and 5.2 of TAG Unit M2.1 (DfT, 2020b), which are intended to be used as a starting point for calibration, and which are also the final values used in SERTM.

3.4.35 As suggested by paragraph 5.6.17 of TAG Unit M2.1 (DfT, 2020b), macro time period choice has been set for all variable demand segments to have the same sensitivity to costs as mode choice. As time period choice is immediately above mode choice in the nested logit tree, this is achieved by setting the value of θ for the time period response to 1.0 for all demand segments.

3.4.36 TAG does not contain any recommended values for the frequency response, and so the values used in the LTAM were taken from the Design Freeze 2 version of SERTM. Note that the Design Freeze 3 version of SERTM removed all frequency responses but they have been retained for the LTAM.

Table 3.28 The final distribution, mode and frequency response parameters used in the LTAM (time period θ = 1 for all segments)

Segment	Distribution		Other responses (mode-independent)	
	Car	PT	Mode	Frequency
HBEB	-0.067	-0.036	0.45	–
HBW (L, M, H)	-0.065	-0.033	0.68	–
HBO (L, M, H)	-0.090	-0.036	0.53	0.087
NHBEB	-0.081	-0.042	0.73	–
NHBO (L, M, H)	-0.077	-0.033	0.81	0.066

3.5 The LTAM Base Plus model

3.5.1 A primary objective of the Project is to reduce congestion at the Dartford Crossing. In order for the LTAM to predict this impact in as robust a way as possible it is necessary to pay careful consideration to how the Dartford Crossing is represented in the base year, and subsequently in forecast years. Key to this method is the representation of the Dartford Traffic Management Cell (TMC) which is used to manage traffic flow at the existing crossing. The method adopted is summarised below.

3.5.2 A TMC is in operation at the entrance to the northbound tunnels at the Dartford Crossing. It enables the operators to monitor vehicles and traffic conditions and ‘intervene’ in order to ensure safe operation. There are generally three types of TMC intervention:

a. **Extractions** – this is where a vehicle approaches the tunnels in the wrong lane. One example of this is Dangerous Goods Vehicles (DGVs) which are only allowed through the western tunnel. Therefore, if one approaches the tunnels in lanes 3 or 4, which means it could only use the eastern tunnel, the TMC is used to extract the DGV from the regular flow and enable it to switch into the western tunnel approach. Similarly, vehicles over 4.8m high cannot use the western tunnel so if they approach in lanes 1 and 2 they also need to be extracted.

b. **Escorts** – DGVs are not allowed through the tunnels alongside the general traffic flow. DGVs are held in a queuing station adjacent to the tunnels and at regular intervals are escorted through the western tunnel in convoy. The

TMC is used to hold the regular flow of vehicles until the DGVs have cleared the tunnel.

c. **Flow Metering** – this is used when significant queuing occurs. If these queues start to block back towards the exit of the tunnels at the north side of the River Thames, the TMC is used to regulate the flow of vehicles entering the tunnel at the south side of the River Thames so that queueing does not occur in the tunnel.

3.5.3 It is clear from analysis of the available journey time and traffic flow data that northbound demand over the crossing is heavily constrained by the reduced capacity in the tunnels. Analysis of the TMC operation data shows that TMC operation for flow metering was substantial during the base model month of March 2016 leading to further reductions in capacity. Much of this flow metering was associated with roadworks at M25 junction 30 (with the A13) which were in place throughout the model month but were removed in December 2016.

3.5.4 The LTAM is an incremental model which means that it 'pivots' from a fixed baseline condition. If the actual base of March 2016 is used as this fixed point for pivoting then, because of the capacity issues at the Dartford Crossing in the model month, when the forecast models are run it could lead to underestimates of the flow at the Dartford Crossing and therefore substantially underestimate the benefits of introducing a new Lower Thames Crossing. It is therefore important to remedy this problem in the model.

3.5.5 The adopted method to deal with this was to create a 'Base Plus' network where the roadworks at M25 junction 30 (with the A13) are removed and the TMC flow metering is reduced to present day levels. The calibrated VDM was then run using the Base Plus network conditions. Theory suggests that the VDM will increase the demand in the matrices, due to the increase in capacity at the crossing. These output matrices and associated travel costs are then used as the fixed point that the forecast scenarios are 'pivoted' from. This approach is similar to that adopted when the National Highways Regional Traffic Models are used for forecasting to take account of the effect of the roadworks that were in place when data was collected.Table 3.29 shows the average hourly flow values in PCUs and the average speed from January 2017 to June 2017 for each time period in each direction. The values for March 2016 are also included for comparison purposes.

Table 3.29 2017 monthly average hourly flow values (PCU) and average speed (M25 junction 1b to junction 31) (km/hr)

Direction	Month	Flow in PCU/hr			Speed in km/hr		
		AM (07:00–08:00)	IP (Avg. 09:00–15:00)	PM (17:00–18:00)	AM (07:00–08:00)	IP (Avg. 09:00–15:00)	PM (17:00–18:00)
Southbound (SB)	Mar-16	7,633	5,531	6,777	72.0	77.9	70.2
	–						
	Jan-17	7,086	5,246	6,269	73.2	77.8	64.1
	Feb-17	7,343	5,730	6,635	70.2	76.8	63.4

Direction	Month	Flow in PCU/hr			Speed in km/hr		
		AM (07:00–08:00)	IP (Avg. 09:00–15:00)	PM (17:00–18:00)	AM (07:00–08:00)	IP (Avg. 09:00–15:00)	PM (17:00–18:00)
	Mar-17	7,624	5,796	6,801	72.3	79.8	70.7
	Apr-17	7,873	6,127	6,973	71.9	79.4	71.8
	May-17	7,813	5,900	6,798	73.0	78.1	70.8
Northbound (NB)	Mar-16	6,760	6,103	6,251	60.1	62.3	47.9
	–						
	Jan-17	6,359	5,839	5,684	57.1	61.6	57.6
	Feb-17	6,682	6,182	6,160	55.7	57.5	54.0
	Mar-17	6,887	6,330	6,329	54.6	61.0	55.2
	Apr-17	6,875	6,529	6,723	57.4	53.1	48.0
	May-17	6,743	6,400	6,308	54.9	58.3	55.4

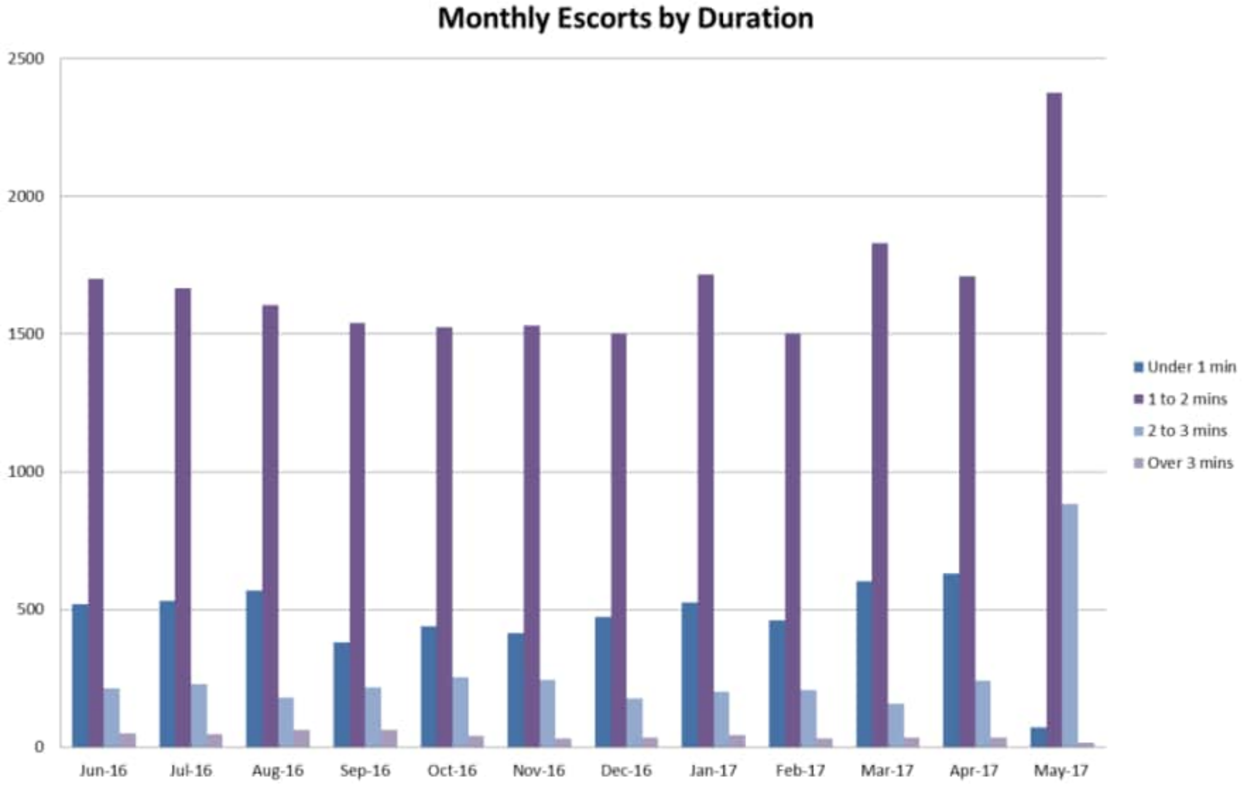
3.5.6 Although the roadworks at M25 junction 30 (with the A13) were removed in December 2016 there was an active speed restriction of 50mph in place until March 2017. Easter fell in April in 2017. It was therefore decided to use May 2017 as the representative month for the Base Plus model.

3.5.7 The analysis presented in Table 3.29 shows that in May 2017 flow values northbound at the crossing have increased substantially over March 2016 in the inter-peak with flows in the AM and PM being similar to those in March 2016. In the AM and inter-peak the average speed has decreased. In the PM the average speed has increased.

3.5.8 In the southbound direction flows have increased slightly in the AM and inter-peak direction, potentially due to the removal of the A13 roadworks. Speeds are relatively similar to those in March 2016.

3.5.9 Plate 3.17 shows the distribution of escort durations as extracted from the Dartford Crossing TMC Dashboard.

Plate 3.17 Dartford Crossing TMC – monthly escorts by duration



3.5.10 As can be seen, May 2017 escorts are slightly higher in number than previous months, and with a higher proportion of durations between one and three minutes and a much lower proportion of durations under one minute. It is therefore necessary to increase the average duration of an escort from 90 seconds in the actual base to 120 seconds in the Base Plus. The rate of escorts should be left constant.

3.5.11 Table 3.30 shows the average rate of escorts and the level of delay associated with them, assuming a 120 second duration for each occurrence. The percentage of red time is shown along with the length of red time assuming a 120 second signal cycle time.

Table 3.30 Average rate of escorts per model period and associated level of delay (Base Plus)

Time period	Rate per hour	Duration (secs)	% Red	Red time (secs)
AM	4	120	13%	16
IP	4.75	120	16%	19
PM	3.5	120	12%	14

3.5.12 Table 3.31 shows the actual base Dartford Crossing capacity calculations for comparison purposes. Table 3.32 shows the updated Dartford Crossing capacity calculations assuming extractions remain the same, the escort duration has been increased and flow metering substantially reduced.

Table 3.31 Overall Dartford Crossing capacity calculation (northbound) – actual base network (March 2016)

Time period	Tunnel	Maximum capacity (PCU/hr)	TMC Signal Times (Based on 120 second cycle time)						Effective capacity (PCU/hr)	Base year obs. flow (PCU/hr)	Base year V/C ratio
			Extractions red	Escorts red	Flow metering red	Total red	Total green	Green factor			
AM	Western	3,650	0	12	3	15	105	0.88	3,194	–	–
	Eastern	3,850	0	0	3	3	117	0.98	3,754	–	–
	Total	7,500	–	–	–	–	–	–	6,948	6,760	0.97
IP	Western	3,650	0	14	3	17	103	0.86	3,125	–	–
	Eastern	3,850	0	0	3	3	117	0.98	3,754	–	–
	Total	7,500	–	–	–	–	–	–	6,879	6,102	0.89
PM	Western	3,650	0	11	17	28	93	0.77	2,814	–	–
	Eastern	3,850	0	0	17	17	103	0.86	3,305	–	–
	Total	7,500	–	–	–	–	–	–	6,118	6,250	1.02

Table 3.32 Overall Dartford Crossing capacity calculation (northbound) – Base Plus network (May 2017)

Time period	Tunnel	Maximum capacity (PCU/hr)	TMC signal times (based on 120 second cycle time)						Effective capacity (PCU/hr)	May 2017 flow	May 2017 V/C ratio
			Extractions red	Escorts red	Flow metering red	Total red	Total green	Green factor			
AM	Western	3,650	0	16	0.5	17	104	0.86	3,148	–	–
	Eastern	3,850	0	0	0.5	1	119	1.00	3,834	–	–
	Total	7,500	–	–	–	–	–	–	6,982	6,743	0.97
IP	Western	3,650	0	19	0	19	101	0.84	3,072	–	–
	Eastern	3,850	0	0	0	1	119	0.99	3,818	–	–
	Total	7,500	–	–	–	–	–	–	6,890	6,400	0.93
PM	Western	3,650	0	14	5	19	101	0.84	3,072	–	–
	Eastern	3,850	0	0	5	5	115	0.96	3,690	–	–
	Total	7,500	–	–	–	–	–	–	6,762	6,308	0.93

3.5.13 It is important to ensure that the Base Plus model still replicates observed conditions at the crossing after the capacity constraint has been lifted. Table 3.33 shows the flow comparison between the May 2017 observed flows and the Base Plus modelled flows at the Dartford Crossing in the AM and PM peak hours.

Table 3.33 Dartford Crossing Base Plus traffic flow calibration statistics (veh/hr) (model run ref. – BP09)

Direction	Time period	Observed	Modelled	Difference	Difference %
Southbound	AM	6,003	6,023	20	0.33%
	PM	5,740	5,856	116	2.02%
Northbound	AM	5,322	5,515	193	3.63%
	PM	5,176	5,178	2	0.04%

3.5.14 Table 3.34 shows the average speed comparison between the May 2017 Bluetooth journey time data and the Base Plus modelled speed in the AM and PM Peak hours.

Table 3.34 Dartford Crossing Base Plus average speed comparison statistics (M25 junction 1b – junction 31) (km/hr) (model run ref. – BP09)

Direction	Time period	Observed	Modelled	Difference	Difference %
Southbound	AM	73.0	67.8	-5.2	-7.1%
	PM	70.8	70.8	0.0	0.0%
Northbound	AM	54.9	52.8	-2.1	-3.8%
	PM	55.4	57.6	2.2	3.9%

3.5.15 Table 3.33 and Table 3.34 show that the Base Plus model reproduces vehicular flows and speeds in line with those observed in May 2017. It is therefore considered that the Base Plus model is a robust base upon which to produce the forecasts for the LTAM.

3.5.16 As the forecast year models pivot from the Base Plus model, it is also necessary to relocate the 'spare' zones allocated in the actual base models, which have been given a notional location, into the real locations where they will be used in the forecast year models to represent the new development traffic. Once allocated, these locations are then held fixed in all of the forecast year Do Minimum and Do Something networks.

4 The Uncertainty Log and forecast years

4.1 The Uncertainty Log

4.1.1 The Uncertainty Log, supplied in Annex A, provides information on the latest assumptions regarding planned developments and transport schemes in the vicinity of the Project. The assumptions are based on information provided by National Highways, local authorities and London boroughs. The process adopted is summarised below.

4.1.2 The development assumptions have been used to explicitly model development trips included in the future year matrices within the LTAM forecast model. The transport schemes' assumptions have been used to code forecast networks as appropriate.

4.1.3 The Uncertainty Log has been prepared in accordance with TAG Unit M4 (DfT, 2019). The primary purpose for developing the Uncertainty Log is to provide the spatial distribution of planned developments and transport schemes by using local authority planning data for developments and transport schemes, and National Highways data for transport schemes on the strategic road network.

Area covered by the Uncertainty Log

4.1.4 TAG Unit M4 (DfT, 2019) requires that uncertainty should be assessed in relation to developments located in the '*vicinity of the scheme being appraised*'.

4.1.5 The area considered within the Uncertainty Log includes local authorities which meet the following criteria:

a. All district/unitary councils through which the Project passes, either in whole or in part.

b. Any adjacent district/unitary councils where different development scenarios are likely to affect the results of our appraisal and design.

Developments and highway schemes included in the Uncertainty Log

4.1.6 The Uncertainty Log developed for the version of the LTAM used at Statutory Consultation has been used as the starting point for this version of the Uncertainty Log, which supports the version of the LTAM used to assess the Project submitted with our DCO. Land use development data has been updated based on revised information provided by local authorities in 2021. The final date for the receipt of information was 30 September 2021 in order for the LTAM forecasts, dependent assessments and DCO application documents to be produced.

4.1.7 The phasing of the planned developments has been either based on the phasing information provided by the local authorities or, where this information was not available, it was assumed that all developments would be in place by the Opening Year.

4.1.8 Highway schemes on the strategic road network have been obtained from National Highways and specific schemes included comprise those identified in the Road Investment Strategies (RIS1 (DfT, 2015) and RIS2 (DfT, 2020a)) and the Junction Improvement Programme (JIP) (National Highways, 2022).

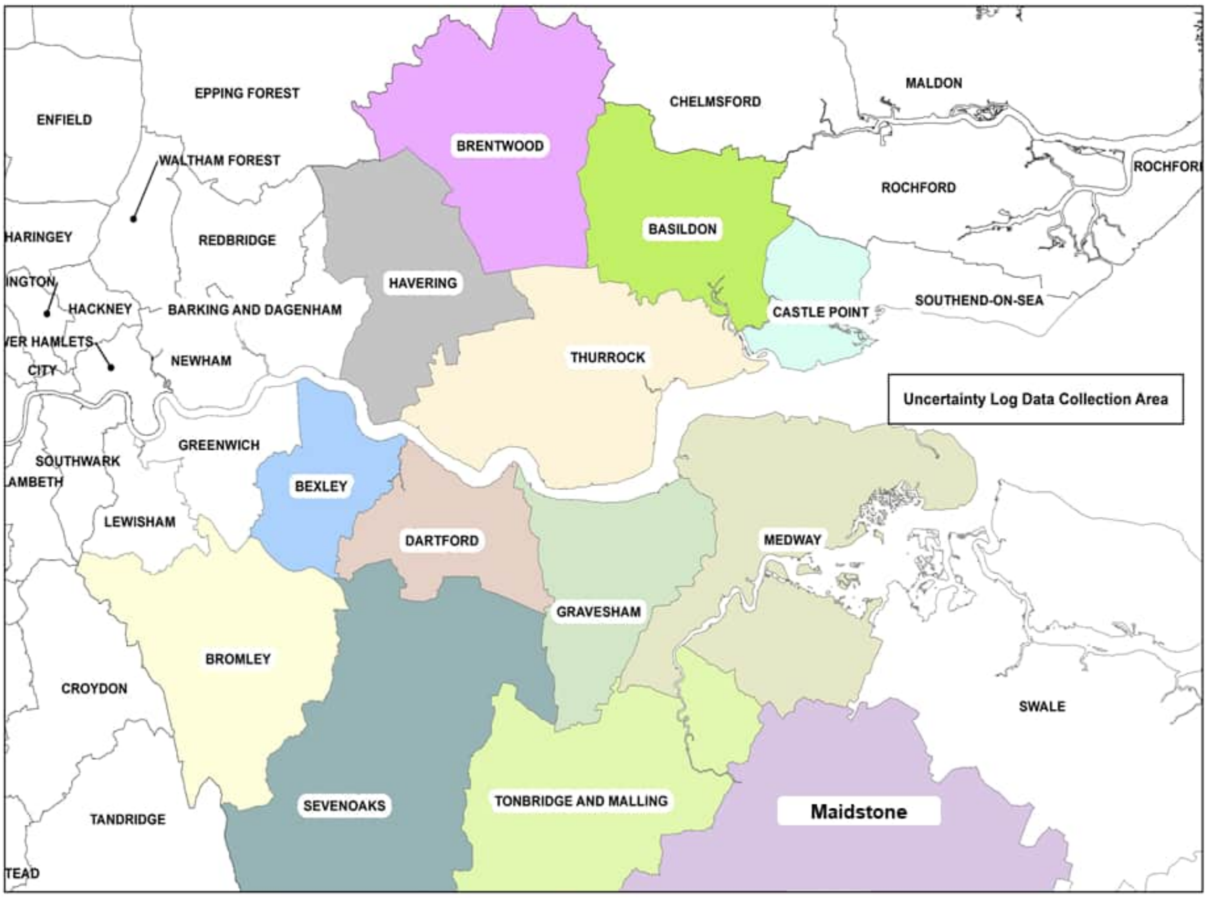
4.1.9 Highway schemes on the local highway network have been obtained from local highway authorities, and their inclusion within the Uncertainty Log has been based on whether they are likely to have an impact on the operation of the highway network within the host and neighbouring authorities as listed below.

4.1.10 Based on the criteria mentioned above, the following local authorities have been consulted for their planned developments and/or highway schemes:

a. Essex
    i. Basildon Borough Council
    ii. Brentwood Borough Council
    iii. Castle Point Borough Council
    iv. Thurrock Council
b. Kent
    i. Dartford Borough Council
    ii. Gravesham Borough Council
    iii. Maidstone Borough Council
    iv. Medway Council
    v. Sevenoaks District Council
    vi. Tonbridge and Malling Borough Council
c. Greater London
    i. London Borough of Bexley
    ii. London Borough of Bromley
    iii. London Borough of Havering

4.1.11 This area is shown in Plate 4.1.

Plate 4.1 LTAM study area for planned developments' data collection



Justification for the developments/schemes included

4.1.12 Data received from many authorities was extensive, with many development sites included. Many of these are too minor to have any impact on the forecasts and judgement is required to select the developments to be included. As such, in order to provide a framework for this decision-making process, inclusion in the Uncertainty Log necessitated meeting the following minimum size criteria:

a. Residential: 200 dwellings

b. B1 'Office' – 10,000m² gross floor area

c. B2 'Industrial' – 1,500m² gross floor area

d. B8 'Warehousing' – 5,000m² gross floor area

e. All other land use classes – 1,500m² gross floor area

4.1.13 In addition, two proposed developments that met the above criteria for inclusion have not been added to the Uncertainty Log. They have been excluded on the basis that the development proposals do not include necessary highway interventions that would maintain the integrity of the road network. The developments are:

a. Highsted Park (21/503906/EIOUT and 21/503914/EIOUT)

b. MedwayOne (MC/21/0979)

4.1.14 National Highways is working with the promotors of these developments to agree appropriate mitigation for the road network.

4.1.15 The status of all the schemes (both developments and highway schemes) has been classified according to a classification set out in TAG Unit M4 (DfT, 2019), as shown in Table 4.1.

Table 4.1 TAG classification of future inputs (TAG Unit M4, Table A2 (DfT, 2019))

Probability of the input	Status	Core scenario assumption
Near certain: The outcome will happen or there is a high probability that it will happen.	Intent announced by proponent to regulatory agencies.	This should form part of the core scenario.
	Approved development proposals.	
	Projects under construction.	
More than likely: The outcome is likely to happen but there is some uncertainty.	Submission of planning or consent application imminent.	This could form part of the core scenario.
	Development application within the consent process.	
Reasonably foreseeable: The outcome may happen, but there is significant uncertainty.	Identified within a development plan.	These should be excluded from the core scenario but may form part of the alternative scenarios.
	Not directly associated with the transport strategy/scheme, but may occur if the strategy/scheme is implemented.	
	Development conditional upon the transport strategy/scheme proceeding.	
	Or, a committed policy goal, subject to tests (for example of deliverability) whose outcomes are subject to significant uncertainty.	
Hypothetical: There is considerable uncertainty whether the outcome will ever happen.	Conjecture based upon currently available information.	These should be excluded from the core scenario but may form part of the alternative scenarios.
	Discussed on a conceptual basis.	
	One of a number of possible inputs in an initial consultation process.	
	Or, a policy aspiration.	

4.1.16 For National Highways schemes, advice provided by the National Highways TPG Business Partner suggested that all schemes included within a published RIS and with a Preferred Route or Scheme announcement should be considered as being ‘more than likely’ and should therefore be included within the core scenario.

4.2 Forecast years and scenarios in the LTAM

Forecast years in the LTAM

4.2.1 The forecast years for the LTAM have been defined to fit in with the scheduled opening year of the Project as follows:

a. Opening year – 2030

b. Intermediate year – 2037

c. Design year – 2045

d. Horizon year – 2051

Scenarios to be modelled in the LTAM

4.2.2 The core scenario, as described in TAG Unit M4 (DfT, 2019), forms the primary evidence for the Project appraisal. In addition to the core scenario, alternative scenarios have been considered. These consist of low and high growth scenarios which are defined so as to represent national uncertainty.

4.2.3 The alternative scenarios are required to inform the appraisal as to whether, under high demand assumptions, the Project is still effective or, under low demand assumptions, the Project is still economically viable.

4.2.4 Local uncertainty generally relates to uncertainty around whether proposed land use developments or infrastructure schemes will go ahead. Local uncertainty is not currently modelled using the LTAM for the appraisal of the Project.

4.2.5 The schemes which are included in each scenario depends on their status in the planning stage based on the TAG guidance as shown in Table 4.2.

Table 4.2 Forecast scenarios

Scenario	Supply (network schemes)	Demand	
		Developments	**NTEM constraint**
Core	Near certain and More than likely schemes	Near certain and More than likely developments	Standard NTEM
High growth	Near certain and More than likely schemes	Near certain and More than likely developments	NTEM plus TAG High Growth Increment
Low growth	Near certain and More than likely schemes	Near certain and More than likely developments	NTEM minus TAG Low Growth Increment

4.2.6 The methodology used to apply the TAG high and low growth increment is discussed in Section 8.6.

4.2.7 The developments and schemes included in the Uncertainty Log are provided in Annex A.

4.2.8 An overall plot showing all developments in the LTAM study area is provided in Plate 4.2. A zoomed in version for Dartford, Gravesham and Thurrock is provided in Plate 4.3. A zoomed in version showing the developments in Maidstone, Medway, Tonbridge and Malling is provided in Plate 4.4. Transport schemes are shown in Plate 4.5 to Plate 4.7.

Plate 4.2 Overall development locations in the LTAM study area

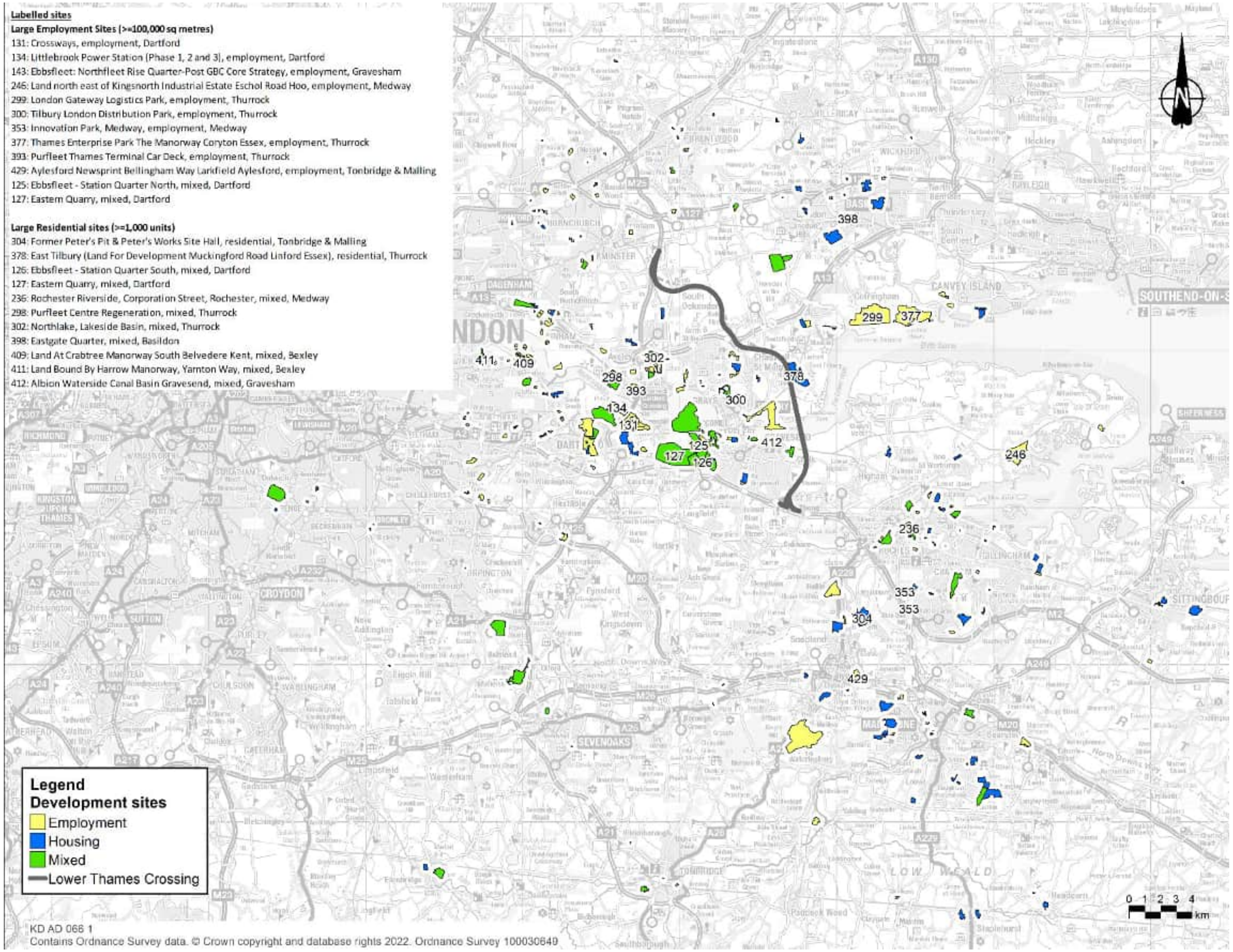


Plate 4.3 Development locations in Dartford, Gravesham and Thurrock

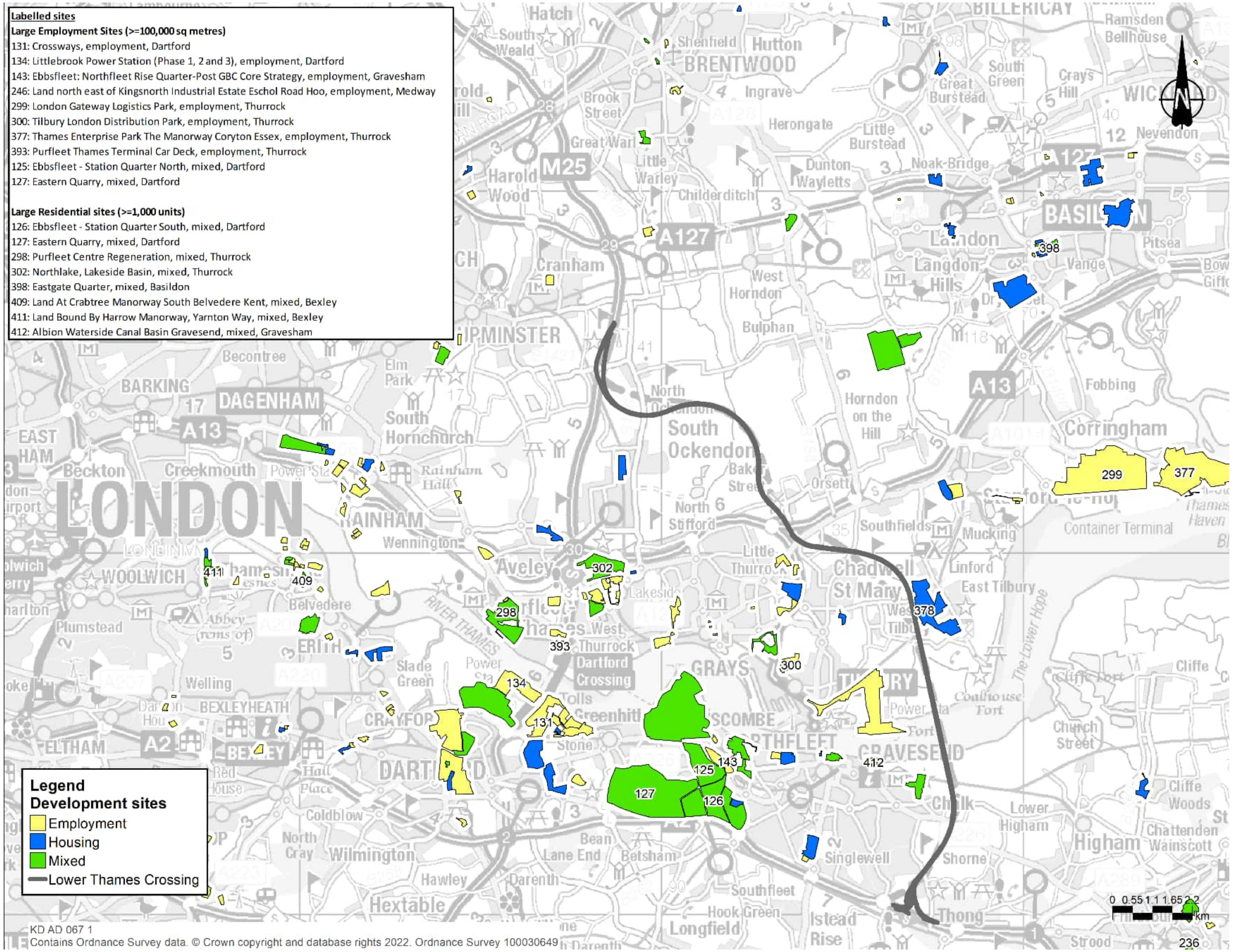


Plate 4.4 Development locations in Maidstone, Medway, Tonbridge and Malling

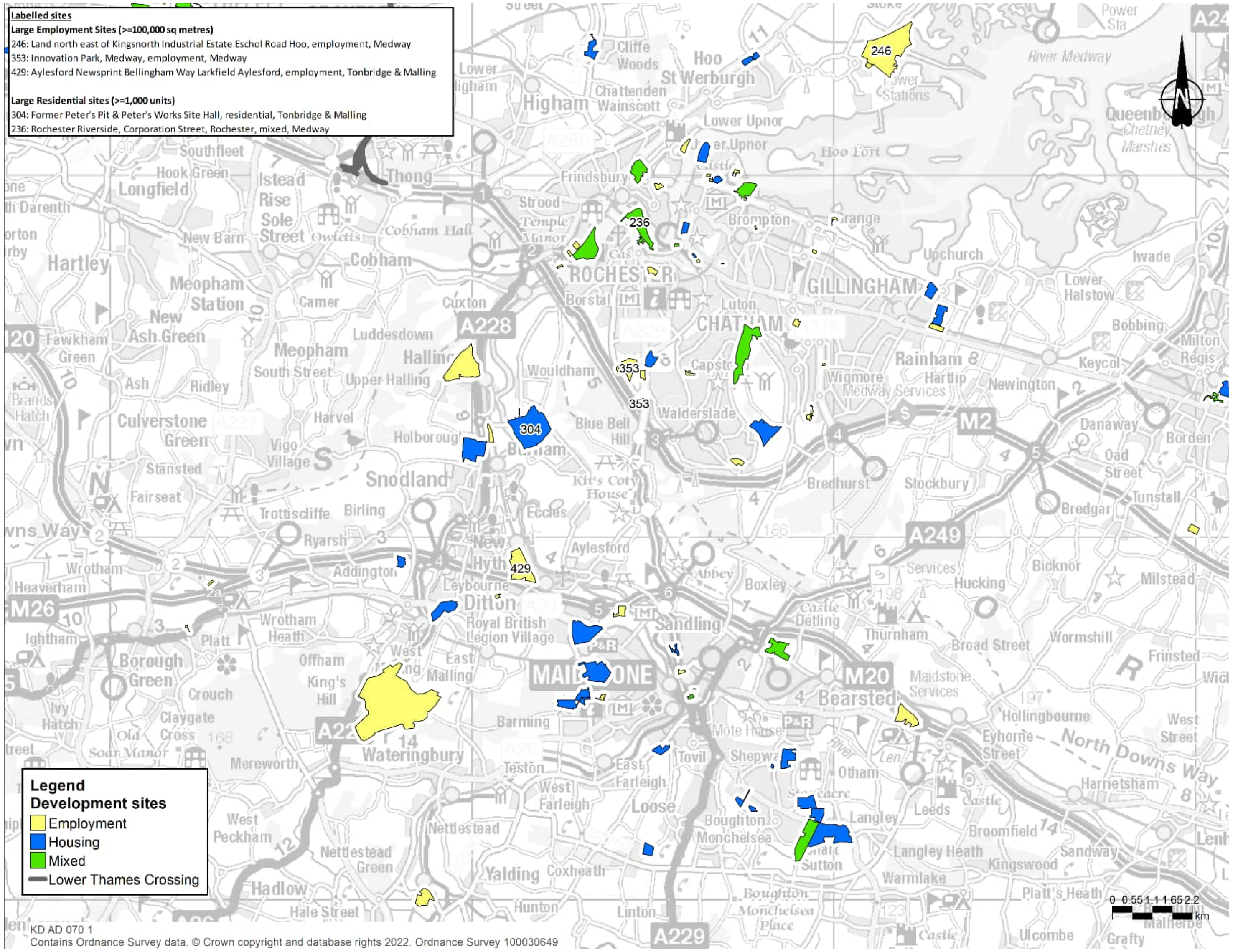


Plate 4.5 Transport schemes in core scenario (south)

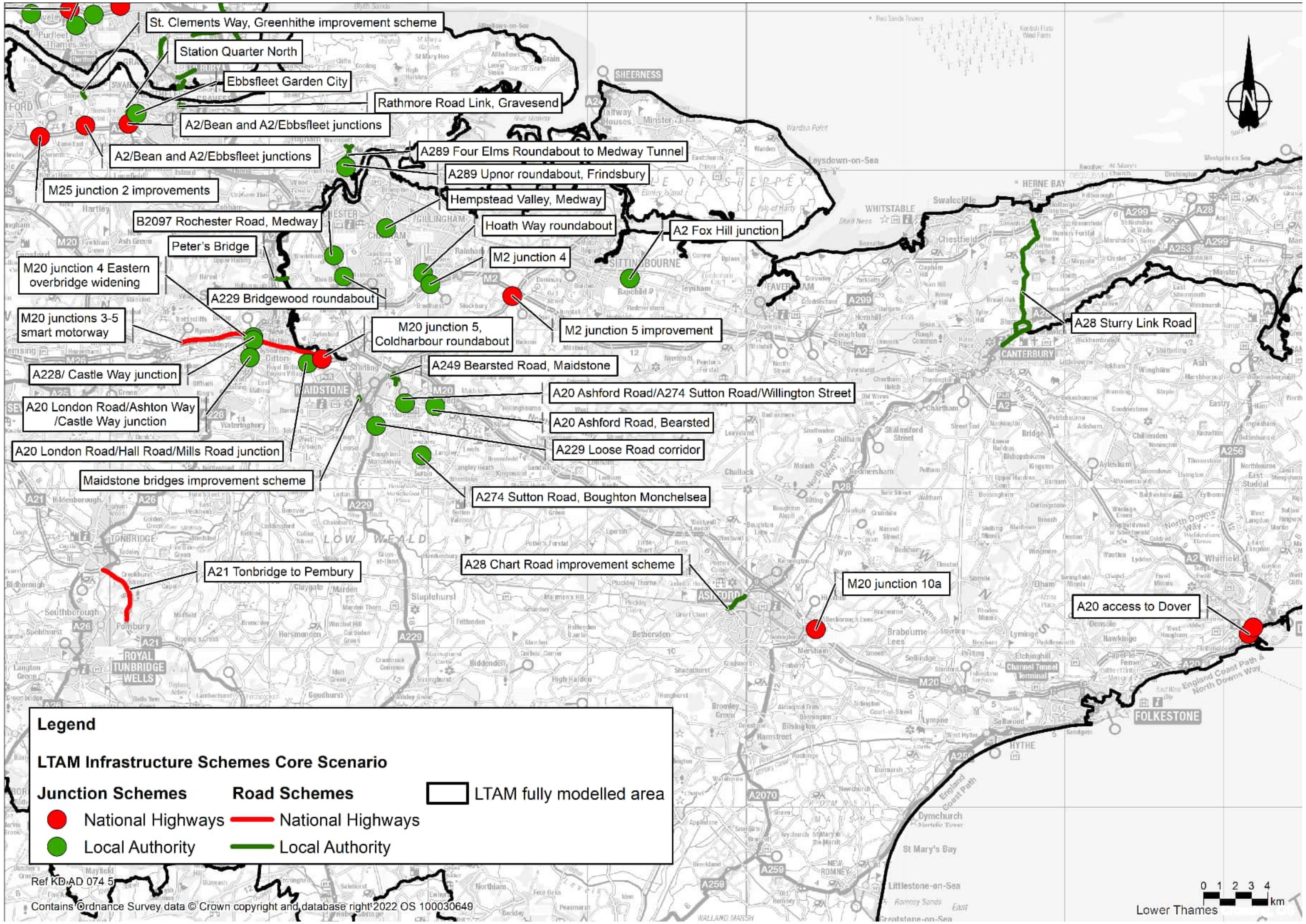


Plate 4.6 Transport schemes in core scenario (west)

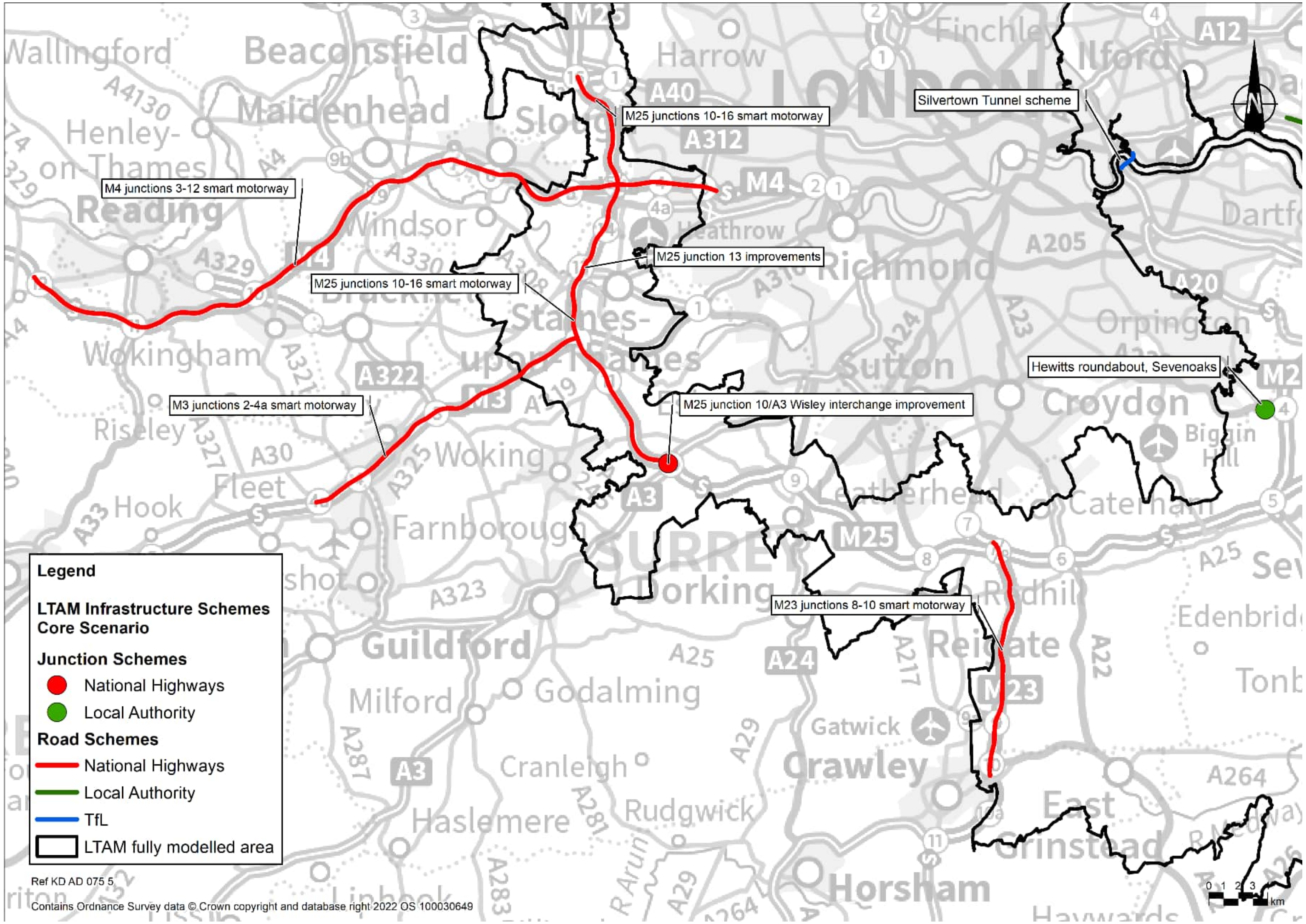
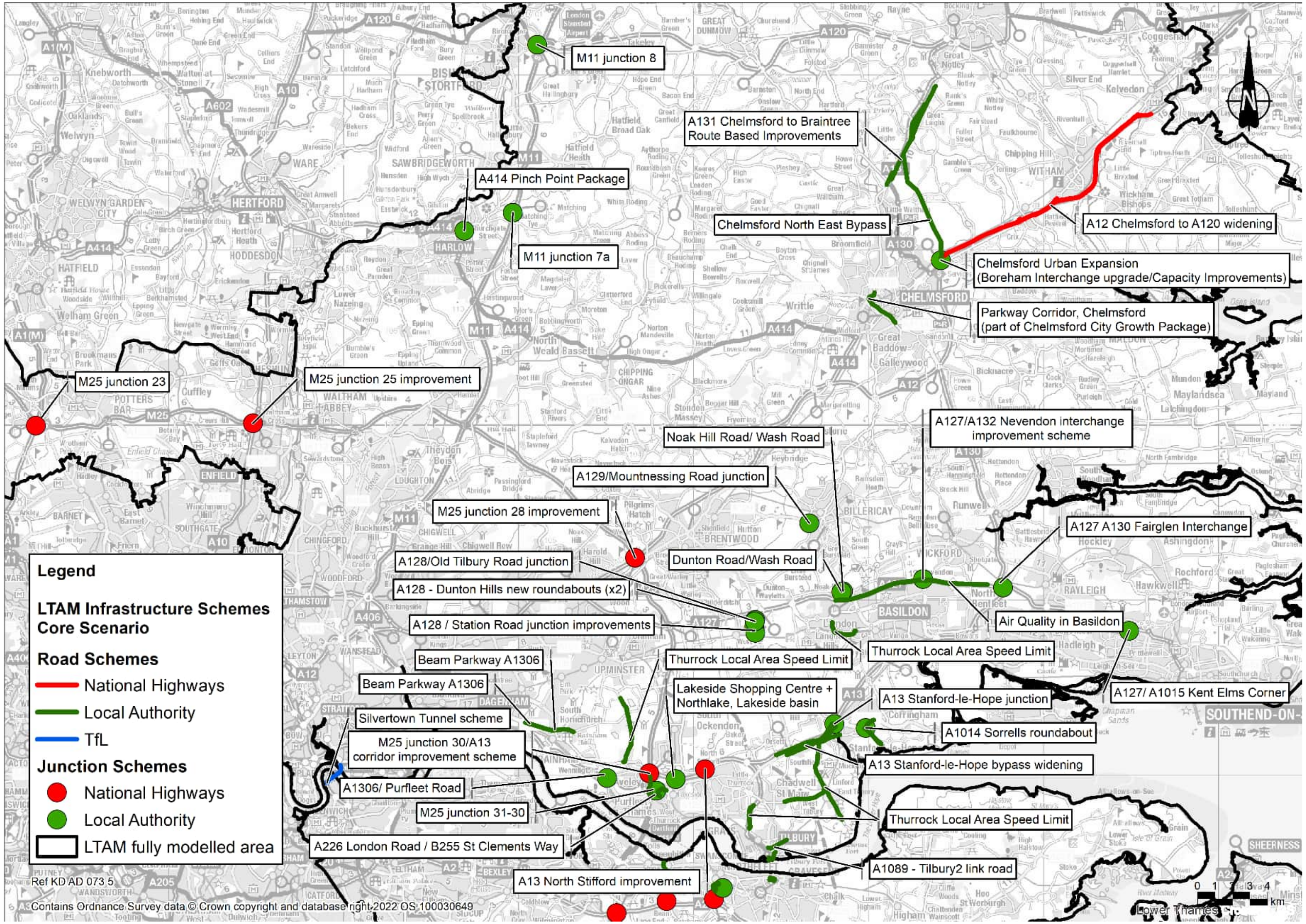


Plate 4.7 Transport schemes in core scenario (north)



5 Forecast year demand

5.1 Overall approach

Statement on dependent development

5.1.1 As defined in TAG Unit A2.2 (DfT, 2020d), a dependent development is a very particular case of induced investment. Its key features are:

a. There is a clear intention to develop a specific site.

b. The existing transport network cannot reasonably accommodate the additional traffic associated with the development, hence the need for a transport investment.

5.1.2 TAG Unit A2.2 also states that '*it is not appropriate to use the dependent development method outlined below for very large individual and programmatic schemes that aim to have significant structural impacts on multiple, geographically dispersed, unidentified sites. An assessment of induced investment impacts for these schemes would require supplementary economic modelling.*' The Project certainly falls within the category of '*very large individual schemes*' and it would certainly have '*significant structural impacts on multiple, geographically dispersed, unidentified sites*'.

5.1.3 The requirement for the Project is substantial, given the existing levels of demand. The provision of the Project will, therefore, enable growth in the surrounding area. However, none of this growth is defined as being specifically dependent on the delivery of the Project for the purposes of the guidance in TAG Unit A2.2 (DfT 2020d).

New development locations allocated to the LTAM zones

5.1.4 When incorporating new development sites into the forecast model there are generally two options available to the modeller to represent the development spatially:

a. Incorporate the development within an existing model zone

b. Represent the new development as a new independent zone

5.1.5 The first option essentially means that trips from the new development would be treated in the same way as the trips within the existing zone. This is usually appropriate for smaller developments where the land use mix is similar to that within the existing zone.

5.1.6 The primary benefit of representing a new development location as a separate zone is that it enables trips from the new development to be modelled differently from the existing locations. This could be, for example, the access and egress to/from the new development or the distribution pattern of trips. This approach is usually adopted for very large developments, or for developments where trip behaviour is considered to be substantially different from that in the existing land use.

5.1.7 During the development of the base year model a series of zones were set aside to enable specific new development locations to be incorporated into the forecasts. As stated above it is not necessary for all developments to be represented as an independent zone. In some cases, developments were grouped together and then represented as a single zone. The developments allocated to new independent zones are shown in Table 5.1.

Table 5.1 New development to LTAM zone correspondence

New development name	LTAM zone number
Tilbury London Distribution Park	8001
London Gateway Logistics Park Plot 1020 1070 1080 3010 4010 & 4020a	8002
Tilbury 2	8003
Newnham Park Bearsted Road Maidstone	8004
Eastern Quarry	8005
Rochester Riverside Corporation Street Rochester	8006
Purfleet Centre Regeneration	8007
Ebbsfleet Valley (Northfleet Rise Quarter)	8008
Ebbsfleet: Northfleet Rise Quarter-Post GBC Core Strategy	
Ebbsfleet Valley (excluding NRQ)	8009
Ebbsfleet Valley (Springhead Quarter)	
Northlake Lakeside Basin	8010
Former Somerfield Depot	8011
Dovers Corner	
Plot 6 Beam Reach 5 Business Park Consul Avenue	
Plot 10 & 11 Beam Reach 5 Business Park Consul Avenue	
Plot 12 Beam Reach 5 Rainham	
Havering College of Further And Higher Education	
Creek Way Rainham	
Nos. 35–87 (inclusive) New Road Rainham	
49–87 New Road & Able House Askwith Road Rainham	
Beam Park Former Ford Assembly Plant Site New Road (A1306) Rainham	
Ebbsfleet – Station Quarter North	8012
Sittingbourne Town Centre Regeneration	8013
Northfleet Embankment West: Former Cement Works	8014
Northfleet Embankment East (Residential Site) Crete Hall Road Northfleet Gravesend Kent	8015
Gravesend Town Centre: Heritage Quarter	8016
Land at Chatham Docks Pier Road Gillingham	8017
Langley Park Sutton Road Boughton Monchelsea	8018
Fort Halstead (GEA) Crow Drive Halstead Sevenoaks KENT TN14 7BU	8019

New development name	LTAM zone number
Stonehouse Park Sevenoaks	
Land at St Mary's Island Maritime Way Chatham Maritime	8020
Colonial Mutual House Quayside Chatham Maritime	
Royal Sovereign House Quayside Chatham Maritime	
Machine Shop 8 Chatham Maritime	
Training Centre Chatham Freight Station Chatham Docks	
The Bridge	8021
Northern Gateway	8022
Northern Gateway East and Mill Pond	
Northern Gateway – GSK North Site	
South of Ratcliffe Highway Former Sports Ground Bells Lane Hoo	8023
Land north east of Kingsnorth Industrial Estate Eschol Road Hoo	
Buildings 208 & 209 Kingsnorth Industrial Estate Eschol Road Kingsnorth	
Phase 1 Zone D National Grid Land Grain Road Grain	
Former Military Site Upnor Road Lower Upnor	
Land west of Town Road Cliffe Woods Medway	
Woodcut Farm Bearsted Road Bearsted	8024
Land to East of Euclid Way and South of West Thurrock Way (West Thurrock Green)	8026
Unit A2C Lakeside Retail Park	
Unit A Lakeside Retail Park Thurrock	
Sports Direct Thurrock Shopping Park	
Gilbarco Veeder Root site Compton Close	8027
Westgate Dartford	8028
Innovation Park Medway	8029
Thames Enterprise Park The Manorway Coryton Essex	8030
Len House (Rootes Maidstone) Mill Street	8031

5.2 Forecast year highway demand matrices

5.2.1 Chapter 4 and Annex A provide details of the different new development locations incorporated within the LTAM forecast year highway demand matrices. This section describes how the forecast number of trips for each development were estimated and how overall growth levels were constrained to the values set out in the NTEM V7.2 (DfT, 2017) for car trips and Road Traffic Forecasts (RTF) 2018 (DfT, 2018) for goods vehicle trips.

Trip generation and distribution process

5.2.2 As shown in Annex A, the data collected from the local authorities relating to proposed development locations includes the type and size of the development. Where a specific development had published information with robust estimates on the quantum of traffic generated by the development these figures were used in the LTAM. In the absence of such information the TRICS database was used to derive trip rates for the different types of development, which were then applied in order to generate the numbers of trips to and from each of these locations.

5.2.3 Table 5.2 to Table 5.5 provide the trip rates used for the employment locations for all vehicles combined and for the different vehicle types separately. Employment trip rates are presented as the hourly vehicle trip rate per 100m^2 gross floor area. For some development types the trip rates were calculated based upon a combination of different land use types due to there being a low sample in the TRICS database.

5.2.4 Table 5.6 to Table 5.9 provide the trip rates used for the residential locations for all vehicles combined and for the different vehicle types separately. Residential trip rates are presented as the hourly vehicle trip rate per dwelling unit. TRICS Version 7.4.3 was used for these calculations.

Table 5.2 TRICS trip rates used in the LTAM for employment locations (all vehicles)

TRICS land use type	All vehicles					
	AM (07:00 – 08:00)		IP (Avg. 09:00– 15:00)		PM (17:00– 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
01-Retail A-Food Superstore_Sub	1.069	1.685	4.376	4.608	4.708	4.591
01-Retail I-Shopping Centre – Local Shops_Sub	3.561	3.981	5.851	6.061	6.197	5.552
01-Retail J-Retail Park – Including Food	2.315	2.833	5.113	5.334	5.453	5.072
02-Employment A-Office_TC	0.040	0.566	0.250	0.402	1.140	0.108
02-Employment A-Office_Sub	0.053	0.635	0.176	0.281	1.191	0.081
02-Employment B-Business Park_Sub	0.061	0.480	0.271	0.339	0.986	0.110
02-Employment D-Industrial Estate_Sub	0.140	0.383	0.341	0.359	0.414	0.123
02-Employment F-Warehouse (Commercial)_Sub	0.041	0.116	0.070	0.081	0.172	0.054

TRICS land use type	All vehicles					
	AM (07:00 – 08:00)		IP (Avg. 09:00– 15:00)		PM (17:00– 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
04-Education A-Primary_Sub	0.045	0.643	0.229	0.297	0.380	0.145
04-Education C-College/University_Sub	0.043	0.216	0.254	0.317	0.539	0.218
05-Health A-General Hospital – With Casualty_Sub	0.287	0.822	0.464	0.537	0.819	0.336
05-Health G-GP Surgeries_Sub	0.113	1.346	3.602	3.592	3.184	2.232
06-Hotel, Food and Drink A-Hotels_Sub	0.362	0.150	0.200	0.198	0.184	0.315
06-Hotel, Food&Drink C-Pub/Restaurant_Sub	0.118	0.471	0.953	1.205	1.582	2.150
07-Leisure C-Leisure Centre	0.386	0.455	0.559	0.594	1.215	1.322
07-Leisure Q-Community Centre_Sub	0.386	0.455	0.559	0.594	1.215	1.322
14-Car Show Rooms A-Car Show Rooms_Sub	0.056	0.337	0.545	0.572	0.486	0.296
15-Vehicle Services B-Motorist Centre (Fast Fit)_Sub	0.043	0.301	1.042	1.116	0.731	0.467
A1-Retail-Shopping Mall	0.000	0.048	0.193	0.239	0.235	0.106
Community centres	0.190	0.190	0.400	0.400	0.430	0.430

Table 5.3 TRICS trip rates used in the LTAM for employment locations (car and taxi)

TRICS land use type	Car and taxi					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
01-Retail A-Food Superstore_Sub	0.994	1.564	4.204	4.437	4.587	4.432
01-Retail I-Shopping Centre – Local Shops_Sub	2.503	2.799	5.046	5.207	5.214	4.652
01-Retail J-Retail Park – Including Food	1.748	2.182	4.625	4.822	4.900	4.542
02-Employment A-Office_TC	0.032	0.532	0.220	0.368	1.140	0.108
02-Employment A-Office_Sub	0.049	0.627	0.158	0.259	1.188	0.079
02-Employment B-Business Park_Sub	0.028	0.428	0.186	0.251	0.930	0.086
02-Employment D-Industrial Estate_Sub	0.031	0.223	0.170	0.180	0.323	0.081
02-Employment F-Warehouse (Commercial)_Sub	0.011	0.091	0.032	0.038	0.147	0.035
04-Education A-Primary_Sub	0.036	0.623	0.210	0.280	0.372	0.135
04-Education C-College/University_Sub	0.035	0.201	0.233	0.296	0.529	0.209

TRICS land use type	Car and taxi					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
05-Health A-General Hospital – With Casualty_Sub	0.259	0.779	0.411	0.483	0.781	0.305
05-Health G-GP Surgeries_Sub	0.113	1.243	3.227	3.220	3.116	2.173
06-Hotel, Food and Drink A-Hotels_Sub	0.325	0.136	0.177	0.175	0.167	0.285
06-Hotel, Food&Drink C-Pub/Restaurant_Sub	0.000	0.118	0.853	1.114	1.475	2.036
07-Leisure C-Leisure Centre	0.374	0.444	0.538	0.571	1.208	1.306
07-Leisure Q-Community Centre_Sub	0.374	0.444	0.538	0.571	1.208	1.306
14-Car Show Rooms A-Car Show Rooms_Sub	0.056	0.289	0.464	0.500	0.445	0.245
15-Vehicle Services B-Motorist Centre (Fast Fit)_Sub	0.043	0.258	0.886	0.974	0.670	0.386
A1-Retail-Shopping Mall	0.000	0.045	0.176	0.223	0.231	0.102
Community centres	0.184	0.185	0.384	0.384	0.427	0.425

Table 5.4 TRICS trip rates used in the LTAM for employment locations (LGVs)

TRICS land use type	LGVs					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
01-Retail A-Food Superstore_Sub	0.064	0.100	0.159	0.158	0.116	0.154
01-Retail I-Shopping Centre – Local Shops_Sub	1.006	1.130	0.712	0.770	0.951	0.840
01-Retail J-Retail Park – Including Food	0.535	0.615	0.435	0.464	0.534	0.497
02-Employment A-Office_TC	0.008	0.034	0.029	0.034	0.000	0.000
02-Employment A-Office_Sub	0.004	0.008	0.015	0.020	0.003	0.002
02-Employment B-Business Park_Sub	0.031	0.048	0.076	0.079	0.053	0.020
02-Employment D-Industrial Estate_Sub	0.097	0.147	0.148	0.152	0.085	0.034
02-Employment F-Warehouse (Commercial)_Sub	0.001	0.004	0.017	0.016	0.009	0.008
04-Education A-Primary_Sub	0.009	0.014	0.017	0.014	0.008	0.010
04-Education C-College/University_Sub	0.007	0.011	0.017	0.016	0.009	0.005
05-Health A-General Hospital – With Casualty_Sub	0.022	0.037	0.044	0.044	0.035	0.027
05-Health G-GP Surgeries_Sub	0.000	0.103	0.375	0.372	0.068	0.059

TRICS land use type	LGVs					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
06-Hotel, Food and Drink A-Hotels_Sub	0.037	0.007	0.015	0.016	0.017	0.030
06-Hotel, Food&Drink C-Pub/Restaurant_Sub	0.000	0.118	0.075	0.068	0.107	0.114
07-Leisure C-Leisure Centre	0.012	0.011	0.021	0.023	0.007	0.016
07-Leisure Q-Community Centre_Sub	0.012	0.011	0.021	0.023	0.007	0.016
14-Car Show Rooms A-Car Show Rooms_Sub	0.000	0.048	0.078	0.069	0.041	0.051
15-Vehicle Services B-Motorist Centre (Fast Fit)_Sub	0.000	0.043	0.149	0.135	0.061	0.081
A1-Retail-Shopping Mall	0.000	0.002	0.012	0.012	0.004	0.003
Community centres	0.006	0.005	0.015	0.016	0.003	0.005

Table 5.5 TRICS trip rates used in the LTAM for employment locations (HGVs)

TRICS land use type	HGVs					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
01-Retail A-Food Superstore_Sub	0.011	0.021	0.013	0.013	0.005	0.005
01-Retail I-Shopping Centre – Local Shops_Sub	0.052	0.051	0.093	0.083	0.033	0.060
01-Retail J-Retail Park – Including Food	0.031	0.036	0.053	0.048	0.019	0.033
02-Employment A-Office_TC	0.000	0.000	0.000	0.000	0.000	0.000
02-Employment A-Office_Sub	0.000	0.000	0.002	0.002	0.000	0.000
02-Employment B-Business Park_Sub	0.003	0.005	0.009	0.009	0.003	0.003
02-Employment D-Industrial Estate_Sub	0.012	0.013	0.023	0.026	0.006	0.008
02-Employment F-Warehouse (Commercial)_Sub	0.028	0.021	0.020	0.028	0.016	0.011
04-Education A-Primary_Sub	0.000	0.007	0.002	0.003	0.000	0.000
04-Education C-College/University_Sub	0.001	0.004	0.005	0.005	0.001	0.004
05-Health A-General Hospital – With Casualty_Sub	0.006	0.006	0.009	0.009	0.003	0.004
05-Health G-GP Surgeries_Sub	0.000	0.000	0.000	0.000	0.000	0.000
06-Hotel, Food and Drink A-Hotels_Sub	0.000	0.007	0.009	0.007	0.000	0.000

TRICS land use type	HGVs					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
06-Hotel, Food&Drink C-Pub/Restaurant_Sub	0.118	0.235	0.024	0.023	0.000	0.000
07-Leisure C-Leisure Centre	0.000	0.000	0.001	0.000	0.000	0.000
07-Leisure Q-Community Centre_Sub	0.000	0.000	0.001	0.000	0.000	0.000
14-Car Show Rooms A-Car Show Rooms_Sub	0.000	0.000	0.003	0.003	0.000	0.000
15-Vehicle Services B-Motorist Centre (Fast Fit)_Sub	0.000	0.000	0.007	0.007	0.000	0.000
A1-Retail-Shopping Mall	0.000	0.001	0.004	0.003	0.000	0.002
Community centres	0.000	0.000	0.000	0.000	0.000	0.000

Table 5.6 TRICS trip rates used in the LTAM for residential locations (all vehicles)

TRICS land use type	All vehicles					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
03-Residential M-Mixed Private/Affordable Housing_Sub K&E All vehicles	0.248	0.062	0.132	0.115	0.129	0.291
03-Residential M-Mixed Private/Affordable Housing_Sub GLA All Vehicles/Split	0.136	0.044	0.092	0.081	0.089	0.128
03-Residential C-Flats Privately Owned_TC K&E All vehicles	0.102	0.052	0.109	0.107	0.114	0.163
03-Residential C-Flats Privately Owned_TC GLA All vehicles	0.101	0.026	0.054	0.049	0.082	0.119

Table 5.7 TRICS trip rates used in the LTAM for residential locations (car and taxi)

TRICS land use type	Car and taxi					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
03-Residential M-Mixed Private/Affordable Housing_Sub K&E All vehicles	0.225	0.051	0.114	0.097	0.116	0.269
03-Residential M-Mixed Private/Affordable Housing_Sub GLA All Vehicles/Split	0.120	0.036	0.076	0.065	0.080	0.118
03-Residential C-Flats Privately Owned_TC K&E All vehicles	0.094	0.048	0.082	0.079	0.109	0.159

TRICS land use type	Car and taxi					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
03-Residential C-Flats Privately Owned_TC GLA All vehicles	0.097	0.023	0.041	0.034	0.063	0.101

Table 5.8 TRICS Trip rates used in the LTAM for residential locations (LGVs)

TRICS land use type	LGVs					
	AM (07:00 – 08:00)		IP (Avg. 09:00 – 15:00)		PM (17:00 – 18:00)	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
03-Residential M-Mixed Private/Affordable Housing_Sub K&E All vehicles	0.022	0.010	0.017	0.017	0.013	0.022
03-Residential M-Mixed Private/Affordable Housing_Sub GLA All Vehicles/Split	0.010	0.004	0.014	0.014	0.007	0.010
03-Residential C-Flats Privately Owned_TC K&E All vehicles	0.008	0.004	0.024	0.027	0.005	0.004
03-Residential C-Flats Privately Owned_TC GLA All vehicles	0.000	0.000	0.010	0.010	0.015	0.014

Table 5.9 TRICS trip rates used in the LTAM for residential locations (HGVs)

TRICS Land Use Type	HGVs					
	AM (07:00-08:00)		IP (Avg. 09:00-15:00)		PM (17:00-18:00)	
	Origin	Dest	Origin	Dest	Origin	Dest
03-Residential M-Mixed Private/Affordable Housing_Sub K&E All vehicles	0.001	0.001	0.001	0.001	0.000	0.000
03-Residential M-Mixed Private/Affordable Housing_Sub GLA All Vehicles/Split	0.002	0.002	0.001	0.001	0.000	0.000
03-Residential C-Flats Privately Owned_TC K&E All vehicles	0.000	0.000	0.002	0.002	0.000	0.000
03-Residential C-Flats Privately Owned_TC GLA All vehicles	0.004	0.003	0.003	0.004	0.004	0.004

5.2.5 In respect of London Gateway, DP World were contacted, and they provided up-to-date estimates of traffic forecast to be generated from the London Gateway Seaport and the London Gateway Logistics Park. Tilbury2 have published figures stating the number of trips forecast to be produced. These values were used to generate forecasts in the required format for use in the LTAM.

5.2.6 Table 5.10 provides the trips identified for DP World. Table 5.11 provides the trips identified for Tilbury2.

Table 5.10 DP World forecast trips (hourly PCUs)

Time period	Location	Car – commute		Car – other		Car – business		LGV		HGV	
		Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.
AM peak	London Gateway Seaport	9	46	8	20	44	165	0	0	340	329
	London Gateway Logistics Park	5	70	5	30	25	252	12	124	168	179
Inter-peak	London Gateway Seaport	38	34	46	36	38	32	0	0	664	586
	London Gateway Logistics Park	76	81	92	86	76	75	85	85	189	312
PM peak	London Gateway Seaport	27	4	16	4	109	22	0	0	427	459
	London Gateway Logistics Park	74	8	43	8	294	42	145	20	180	154

Source: Provided by DP World

Table 5.11 Tilbury2 port forecast trips

Time period	Car – commute		Car – other		Car – business		LGV		HGV	
	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.
AM peak	1	15	1	8	0	2	2	36	267.5	150
Inter-peak	8	4	6	4	2	1	10	24	193	202.5
PM peak	30	1	18	1	5	0	10	5	112.5	130

Source: PoTLL ES APPENDIX 13.A: TRANSPORT ASSESSMENT DOCUMENT REF: 6.2 13.A (PoTTL, 2017)

5.2.7 Table 5.12 provides the overall assumptions used to apply growth for all major ports and distribution centres within the LTAM forecasts.

Table 5.12 LTAM forecast port traffic growth assumptions

LTAM zone	Location	Car – commute		Car – other		Car – business		LGV		HGV	
		Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.
5154	Tilbury Seaport	No growth beyond base year levels assumed. All growth would be incorporated within the Tilbury2 forecasts.									
8001	Tilbury Distribution Park	Uncertainty Log/TRICS trip rates									
8003	Tilbury2	As per Table 5.11 (above) in 2030 then zero additional growth									
5158	Purfleet Seaport	NTEM growth						RTF growth			
5159	London Gateway Seaport	As per Table 5.10 (above) in 2030 then zero additional growth									

LTAM zone	Location	Car – commute		Car – other		Car – business		LGV		HGV	
		Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.	Orig.	Dest.
8002	London Gateway Logistics Park	As per Table 5.10 (above) in 2030 then zero additional growth									
5160	Thurrock Seaport	NTEM growth						RTF growth			
7319	Dover Seaport	NTEM growth						RTF growth			
7321	Channel Tunnel	NTEM growth						RTF growth			

5.2.8 Each new development location was allocated a ‘donor zone’ from the base year model. These were generally either adjacent zones or zones which were considered to be ‘similar’ to the new development. For most new developments this donor zone was used to provide the spatial distribution of trips and the journey purpose split for car trips. Some larger new developments used a gravity model approach to define the spatial distribution. Bespoke gravity models were calibrated for each of these zones. A separate donor zone could also be defined from which user class proportions were derived, as appropriate, to split total car origin or destination trip ends into EB, Commute and Other purposes. As in the case of the distribution donor zones, special zones could be defined with bespoke user class splits for those developments for which specific values had been supplied, such as in the case of DP World.

5.2.9 The trip ends defined in the tables above represent peak hour OD travel. In order to input these trips into the demand model it was necessary to convert the home based non port trips into 24-hour Production Attraction format. This was achieved using the factors and transposition rules already applied in the base year LTAM.

5.2.10 It was also necessary to identify appropriate ‘fitting on factors’. For new development locations included within existing zones, the existing zone fitting on factors were applied. For new development locations allocated to new zones, fitting on factors were derived in order to reproduce the required origin and destination trip ends as defined above.

5.2.11 Growth in public transport trips was simply applied using factors derived from NTEM (DfT, 2017).

Constraining demand matrices to national growth

5.2.12 As per current guidance it is necessary to constrain overall growth to nationally approved forecasts. For car trips this is NTEM (DfT, 2017). For goods vehicle trips this is RTF (DfT, 2018). For the LTAM forecasts the constraints were applied at regional level.

5.2.13 The National Highways Interactive DIADEM Interface (HEIDI) was used to apply these constraints and produce the final reference case matrices for use in the core LTAM growth forecasts. The matrix totals derived from these processes are presented in the next section.

5.3 Forecast year reference matrix totals

5.3.1 Reference matrices for the core growth scenario for each of the forecast years were developed in line with the above approach.

5.3.2 Due to the nature of how matrices are input to DIADEM it is necessary to report the matrix totals in two ways, firstly using the 17 demand segments used in DIADEM and secondly using the 10 demand segments used in the highway assignment model. For presentation purposes HGV Port and HGV Non-Port trips were summed together providing total values for HGV movements.

5.3.3 The HAM matrices reported below are produced by DIADEM as part of the first loop of the VDM. They do not include any demand model responses and are simply a function of applying fitting on factors, person to vehicle/PCU factors and peak hour conversion factors to the input 17 demand segment reference matrices.

5.3.4 Table 5.13 presents the input reference matrix totals in the DIADEM segmentation. Table 5.14 presents the input reference matrix totals in the SATURN segmentation.

5.3.5 Matrix totals output from the fully converged VDM runs are presented in Chapter 6.

Table 5.13 LTAM reference matrix totals in DIADEM segmentation (core growth scenario highway trips in PCUs)

Segment	Matrix type	Time period	Actual base (2016)	Core growth (2030)			Core growth (2037)			Core growth (2045)			Core growth (2051)		
			Matrix total	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %
HBEB	24hr PA	N/A	2,554,589	2,857,146	302,557	11.8%	2,981,613	427,024	16.7%	3,147,878	593,289	23.2%	3,268,348	713,759	27.9%
HBW L	24hr PA	N/A	2,255,274	2,487,651	232,377	10.3%	2,582,934	327,661	14.5%	2,706,323	451,050	20.0%	2,793,968	538,694	23.9%
HBW M	24hr PA	N/A	3,993,999	4,397,540	403,541	10.1%	4,562,789	568,789	14.2%	4,778,135	784,135	19.6%	4,931,050	937,051	23.5%
HBW H	24hr PA	N/A	3,125,908	3,441,642	315,734	10.1%	3,569,700	443,791	14.2%	3,737,121	611,212	19.6%	3,856,176	730,268	23.4%
HBO L	24hr PA	N/A	6,076,175	7,107,779	1,031,604	17.0%	7,520,197	1,444,022	23.8%	7,981,403	1,905,229	31.4%	8,317,083	2,240,908	36.9%
HBO M	24hr PA	N/A	5,445,416	6,378,205	932,789	17.1%	6,751,940	1,306,523	24.0%	7,164,782	1,719,366	31.6%	7,465,286	2,019,870	37.1%
HBO H	24hr PA	N/A	3,896,462	4,585,658	689,196	17.7%	4,863,528	967,066	24.8%	5,160,986	1,264,524	32.5%	5,377,704	1,481,242	38.0%
NHBEB	By time period OD	AM	87,644	96,941	9,297	10.6%	100,756	13,112	15.0%	105,699	18,055	20.6%	109,243	21,599	24.6%
		IP	113,550	125,537	11,987	10.6%	130,494	16,944	14.9%	136,905	23,355	20.6%	141,496	27,946	24.6%
		PM	126,583	139,952	13,370	10.6%	145,489	18,906	14.9%	152,639	26,056	20.6%	157,763	31,180	24.6%
		OP	31,974	35,357	3,382	10.6%	36,751	4,777	14.9%	38,555	6,581	20.6%	39,848	7,873	24.6%
NHBO L	By time period OD	AM	123,476	140,883	17,407	14.1%	147,881	24,405	19.8%	156,073	32,597	26.4%	161,986	38,510	31.2%
		IP	327,526	373,905	46,379	14.2%	392,492	64,966	19.8%	414,052	86,526	26.4%	429,606	102,080	31.2%
		PM	258,558	295,323	36,766	14.2%	310,040	51,483	19.9%	327,017	68,460	26.5%	339,264	80,706	31.2%
		OP	72,110	82,331	10,221	14.2%	86,403	14,293	19.8%	91,094	18,984	26.3%	94,477	22,367	31.0%

Segment	Matrix type	Time period	Actual base (2016)	Core growth (2030)			Core growth (2037)			Core growth (2045)			Core growth (2051)		
			Matrix total	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %
NHBO M	By time period OD	AM	131,250	149,859	18,609	14.2%	157,343	26,093	19.9%	166,044	34,794	26.5%	172,328	41,078	31.3%
		IP	261,640	298,973	37,333	14.3%	313,942	52,302	20.0%	331,160	69,520	26.6%	343,587	81,947	31.3%
		PM	259,775	296,872	37,098	14.3%	311,739	51,965	20.0%	328,802	69,028	26.6%	341,118	81,344	31.3%
		OP	64,438	73,624	9,186	14.3%	77,289	12,850	19.9%	81,480	17,041	26.4%	84,503	20,065	31.1%
NHBO H	By time period OD	AM	105,420	120,686	15,267	14.5%	126,819	21,399	20.3%	133,793	28,373	26.9%	138,830	33,410	31.7%
		IP	178,457	204,576	26,119	14.6%	215,053	36,596	20.5%	226,808	48,351	27.1%	235,297	56,840	31.9%
		PM	200,519	229,923	29,404	14.7%	241,698	41,179	20.5%	254,872	54,353	27.1%	264,385	63,865	31.8%
		OP	47,153	54,044	6,891	14.6%	56,792	9,638	20.4%	59,856	12,702	26.9%	62,067	14,913	31.6%
LGV	By time period OD	AM	730,141	878,459	148,318	20.3%	963,813	233,672	32.0%	1,051,706	321,565	44.0%	1,100,079	369,938	50.7%
		IP	630,596	758,707	128,111	20.3%	832,304	201,708	32.0%	908,220	277,624	44.0%	950,137	319,541	50.7%
		PM	527,223	634,122	106,899	20.3%	695,606	168,383	31.9%	759,043	231,820	44.0%	794,072	266,849	50.6%
		OP	254,232	305,868	51,636	20.3%	335,540	81,308	32.0%	366,148	111,916	44.0%	383,049	128,816	50.7%
HGV	By time period OD	AM	129,666	133,441	3,775	2.9%	137,733	8,067	6.2%	142,904	13,238	10.2%	146,659	16,993	13.1%
		IP	145,529	149,941	4,412	3.0%	154,727	9,198	6.3%	160,495	14,966	10.3%	164,686	19,157	13.2%
		PM	83,900	86,491	2,591	3.1%	89,261	5,361	6.4%	92,599	8,698	10.4%	95,021	11,121	13.3%
		OP	58,012	59,477	1,465	2.5%	61,369	3,357	5.8%	63,652	5,640	9.7%	65,312	7,301	12.6%
Port trips EB	By time period OD	AM	4,704	4,925	221	4.7%	4,926	223	4.7%	4,926	222	4.7%	4,926	222	4.7%
		IP	3,340	3,427	87	2.6%	3,428	87	2.6%	3,428	87	2.6%	3,428	87	2.6%
		PM	4,153	4,295	143	3.4%	4,296	144	3.5%	4,296	144	3.5%	4,296	144	3.5%
		OP	1,329	1,326	-4	-0.3%	1,326	-4	-0.3%	1,326	-4	-0.3%	1,326	-4	-0.3%

Segment	Matrix type	Time period	Actual base (2016)	Core growth (2030)			Core growth (2037)			Core growth (2045)			Core growth (2051)		
			Matrix total	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %
Port trips O LI	By time period OD	AM	2,833	2,858	25	0.9%	2,859	26	0.9%	2,859	26	0.9%	2,859	26	0.9%
		IP	3,475	3,516	41	1.2%	3,517	41	1.2%	3,517	41	1.2%	3,517	41	1.2%
		PM	3,472	3,494	22	0.6%	3,495	22	0.6%	3,495	22	0.6%	3,495	22	0.6%
		OP	1,145	1,141	-4	-0.3%	1,141	-4	-0.3%	1,141	-4	-0.3%	1,141	-4	-0.3%
Port trips O MI	By time period OD	AM	3,307	3,333	25	0.8%	3,333	26	0.8%	3,333	26	0.8%	3,333	26	0.8%
		IP	3,670	3,713	43	1.2%	3,713	44	1.2%	3,713	44	1.2%	3,713	44	1.2%
		PM	4,074	4,097	24	0.6%	4,098	24	0.6%	4,098	24	0.6%	4,098	24	0.6%
		OP	1,269	1,265	-4	-0.3%	1,265	-4	-0.3%	1,265	-4	-0.3%	1,265	-4	-0.3%
Port trips O HI	By time period OD	AM	4,700	4,727	27	0.6%	4,728	28	0.6%	4,728	28	0.6%	4,728	28	0.6%
		IP	3,908	3,950	42	1.1%	3,951	43	1.1%	3,951	43	1.1%	3,951	43	1.1%
		PM	5,207	5,233	26	0.5%	5,234	27	0.5%	5,234	27	0.5%	5,234	27	0.5%
		OP	1,516	1,513	-3	-0.2%	1,513	-3	-0.2%	1,513	-3	-0.2%	1,513	-3	-0.2%

Table 5.14 LTAM reference matrix totals in SATURN segmentation (core growth scenario hourly PCUs)

Userclass	Time period	Actual base (2016)	Core growth (2030)			Core growth (2037)			Core growth (2045)			Core growth (2051)		
		Matrix total	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff to actual base	Diff. %
Car employer's business	AM	446,238	497,581	51,343	11.51%	518,401	72,163	16.17%	546,177	99,938	22.40%	566,311	120,073	26.91%
	IP	388,822	433,689	44,867	11.54%	451,981	63,158	16.24%	476,086	87,263	22.44%	493,481	104,659	26.92%
	PM	535,264	597,758	62,494	11.68%	623,134	87,870	16.42%	656,487	121,223	22.65%	680,581	145,317	27.15%
	OP	153,738	170,973	17,235	11.21%	178,202	24,464	15.91%	187,851	34,113	22.19%	194,827	41,089	26.73%
Car commute low income	AM	416,936	460,314	43,378	10.40%	477,838	60,901	14.61%	500,525	83,589	20.05%	516,624	99,687	23.91%
	IP	189,525	209,646	20,121	10.62%	217,741	28,216	14.89%	228,146	38,621	20.38%	235,544	46,019	24.28%
	PM	476,873	526,690	49,817	10.45%	546,984	70,111	14.70%	573,085	96,212	20.18%	591,621	114,748	24.06%
	OP	76,399	83,913	7,514	9.84%	87,098	10,699	14.00%	91,274	14,876	19.47%	94,242	17,843	23.36%
Car commute medium income	AM	844,009	928,691	84,682	10.03%	963,326	119,316	14.14%	1,008,539	164,530	19.49%	1,040,633	196,624	23.30%
	IP	291,124	321,837	30,714	10.55%	334,114	42,991	14.77%	349,919	58,796	20.20%	361,151	70,028	24.05%
	PM	915,198	1,009,361	94,163	10.29%	1,047,473	132,276	14.45%	1,096,844	181,647	19.85%	1,131,894	216,697	23.68%
	OP	117,377	128,762	11,384	9.70%	133,552	16,175	13.78%	139,876	22,498	19.17%	144,367	26,989	22.99%
Car commute high income	AM	717,359	789,352	71,993	10.04%	818,531	101,173	14.10%	856,849	139,490	19.44%	883,920	166,561	23.22%
	IP	207,506	229,446	21,940	10.57%	238,097	30,591	14.74%	249,260	41,753	20.12%	257,277	49,771	23.99%
	PM	740,837	817,154	76,318	10.30%	847,680	106,843	14.42%	887,323	146,487	19.77%	915,402	174,565	23.56%
	OP	83,604	91,716	8,112	9.70%	95,107	11,503	13.76%	99,576	15,972	19.10%	102,781	19,177	22.94%
Car other low income	AM	650,296	757,062	106,766	16.42%	799,761	149,464	22.98%	847,582	197,286	30.34%	882,349	232,053	35.68%
	IP	1,156,147	1,343,157	187,011	16.18%	1,417,605	261,458	22.61%	1,501,655	345,509	29.88%	1,562,672	406,525	35.16%
	PM	1,127,337	1,313,838	186,500	16.54%	1,387,430	260,093	23.07%	1,469,935	342,598	30.39%	1,529,874	402,537	35.71%
	OP	361,439	419,796	58,357	16.15%	443,332	81,893	22.66%	469,893	108,454	30.01%	489,193	127,754	35.35%

Userclass	Time period	Actual base (2016)	Core growth (2030)			Core growth (2037)			Core growth (2045)			Core growth (2051)		
		Matrix total	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff. to actual base	Diff. %	Matrix total	Diff to actual base	Diff. %
Car other medium income	AM	693,521	808,188	114,667	16.53%	854,074	160,553	23.15%	904,929	211,408	30.48%	941,899	248,378	35.81%
	IP	923,590	1,074,461	150,871	16.34%	1,134,561	210,971	22.84%	1,201,577	277,987	30.10%	1,250,235	326,645	35.37%
	PM	1,135,035	1,324,190	189,155	16.67%	1,398,891	263,856	23.25%	1,481,861	346,827	30.56%	1,542,148	407,113	35.87%
	OP	323,221	375,715	52,494	16.24%	396,955	73,734	22.81%	420,669	97,448	30.15%	437,903	114,682	35.48%
Car other high income	AM	554,821	648,600	93,780	16.90%	686,200	131,379	23.68%	726,782	171,961	30.99%	756,268	201,447	36.31%
	IP	620,234	724,363	104,128	16.79%	765,994	145,759	23.50%	811,125	190,891	30.78%	843,911	223,676	36.06%
	PM	860,322	1,007,860	147,538	17.15%	1,066,394	206,072	23.95%	1,129,402	269,079	31.28%	1,175,227	314,905	36.60%
	OP	232,764	271,625	38,860	16.70%	287,438	54,673	23.49%	304,564	71,800	30.85%	317,022	84,257	36.20%
Car total	AM	4,323,181	4,889,790	566,608	13.11%	5,118,131	794,949	18.39%	5,391,383	1,068,202	24.71%	5,588,004	1,264,823	29.26%
	IP	3,776,948	4,336,600	559,651	14.82%	4,560,093	783,145	20.73%	4,817,768	1,040,820	27.56%	5,004,271	1,227,322	32.50%
	PM	5,790,866	6,596,850	805,984	13.92%	6,917,986	1,127,120	19.46%	7,294,937	1,504,072	25.97%	7,566,746	1,775,881	30.67%
	OP	1,348,542	1,542,499	193,957	14.38%	1,621,683	273,141	20.25%	1,713,703	365,161	27.08%	1,780,335	431,793	32.02%
LGV	AM	730,141	878,459	148,318	20.31%	963,813	233,672	32.00%	1,051,706	321,565	44.04%	1,100,079	369,938	50.67%
	IP	630,596	758,707	128,111	20.32%	832,304	201,708	31.99%	908,220	277,624	44.03%	950,137	319,541	50.67%
	PM	527,223	634,122	106,899	20.28%	695,606	168,383	31.94%	759,043	231,820	43.97%	794,072	266,849	50.61%
	OP	254,232	305,868	51,636	20.31%	335,540	81,308	31.98%	366,148	111,916	44.02%	383,049	128,817	50.67%
HGV	AM	129,666	133,441	3,775	2.91%	137,734	8,067	6.22%	142,904	13,238	10.21%	146,659	16,993	13.10%
	IP	145,529	149,941	4,412	3.03%	154,727	9,198	6.32%	160,495	14,966	10.28%	164,686	19,157	13.16%
	PM	83,900	86,491	2,591	3.09%	89,261	5,361	6.39%	92,599	8,698	10.37%	95,021	11,121	13.25%
	OP	58,012	59,477	1,465	2.52%	61,369	3,357	5.79%	63,652	5,640	9.72%	65,312	7,301	12.58%

6 Forecast year supply

6.1 Do Minimum networks

Schemes included

6.1.1 Do Minimum networks are required to represent the highway network in the 'without the Project' scenario. The methodology used to identify the different infrastructure schemes to be included within the Without Scheme (Do Minimum) scenario is provided in Chapter 3. The schemes included are provided in Annex A and are shown graphically in Plate 4.5 to Plate 4.7. No schemes are considered to be dependent on the delivery of the Project.

6.1.2 As defined in Table 4.2, all schemes considered to be either near certain or more than likely are included within the core scenario. All of the schemes are scheduled to be completed before the proposed opening year of 2030. All of the near certain and more than likely schemes shown in the Uncertainty Log are therefore included in the 2030 core scenario networks. The 2037, 2045 and 2051 networks do not have any additional schemes. Low and high growth scenario networks are the same as the core scenario.

Other forecast year network changes

6.1.3 Forecast year model parameters such as the VOT and VOC are presented in Chapter 6.

6.1.4 Buffer link speeds have been modified in the forecast years to take account of speed reductions associated with increases in congestion in forecast years. The speeds have either been taken from the source models, which is primarily RXHAM in London, or by using speed reduction factors as provided in the Road Traffic Forecasts.

6.1.5 The TMC at the Dartford Crossing is assumed to remain constant in all forecast years. The Base Plus values presented in Table 3.32 are therefore maintained in each forecast year.

Charges

6.1.6 The methodology used for the derivation of tolls and charges for use in the base year is described in the Transport Model Package as Appendix B of the ComMA (Application Document 7.7).

6.1.7 In the base year there are two charging regimes that need to be included in the LTAM. These are the Dartford Crossing and the London congestion charge. The final base year values are provided in Table 6.1.

Table 6.1 LTAM base year charges (2016 values in 2010 prices)

Location	Vehicle type	Time period			
		AM	IP	PM	OP
London congestion charge	Car (all purposes)	£1.35	£1.35	£1.35	£0.00
	LGV	£2.03	£2.03	£2.03	£0.00
	HGV (port and non-port)	£2.14	£2.14	£2.14	£0.00
Dartford Crossing	Car (all purposes)	£1.42	£1.42	£1.42	£0.78
	LGV	£2.18	£2.18	£2.18	£1.20
	HGV non-port	£3.86	£3.86	£3.86	£2.12
	HGV port	£4.32	£4.32	£4.32	£2.37

6.1.8 The derivation of tolls and charges for use in the forecast year networks is summarised below.

Charge locations

6.1.9 In the base year, Blackwall Tunnel in London is free to use. However, as part of the consented TfL scheme for a new Silvertown River Crossing it is proposed to introduce new charges at Blackwall and for Blackwall and Silvertown to be equally charged. The proposed charging regime at Silvertown and Blackwall is to adopt directional charging based on the peak traffic flows.

6.1.10 Charges are included at the following locations in the forecast year LTAM Do Minimum networks:

a. Central London congestion charge

b. Dartford Crossing

c. Blackwall/Silvertown Tunnels

Charging regime correspondence to LTAM time periods

6.1.11 How these different charging regimes at each location relate to the different LTAM time periods is provided in Table 6.2.

Table 6.2 LTAM modelled time periods and forecast year charging regime correspondence

Hour	LTAM time periods	Dartford Charge	TfL congestion charge	TfL Silvertown and Blackwall SB	TfL Silvertown and Blackwall NB
00:00–01:00	OP	No charge	No charge	No charge	No charge
01:00–02:00	OP	No charge	No charge	No charge	No charge
02:00–03:00	OP	No charge	No charge	No charge	No charge
03:00–04:00	OP	No charge	No charge	No charge	No charge
04:00–05:00	OP	No charge	No charge	No charge	No charge
05:00–06:00	OP	No charge	No charge	No charge	No charge

Hour	LTAM time periods	Dartford Charge	TfL congestion charge	TfL Silvertown and Blackwall SB	TfL Silvertown and Blackwall NB
06:00–07:00	AM	Charge	No charge	Off peak	Peak
07:00–08:00	AM	Charge	Charge	Off peak	Peak
08:00–09:00	AM	Charge	Charge	Off peak	Peak
09:00–10:00	IP	Charge	Charge	Off peak	Peak
10:00–11:00	IP	Charge	Charge	Off peak	Off peak
11:00–12:00	IP	Charge	Charge	Off peak	Off peak
12:00–13:00	IP	Charge	Charge	Off peak	Off peak
13:00–14:00	IP	Charge	Charge	Off peak	Off peak
14:00–15:00	IP	Charge	Charge	Off peak	Off peak
15:00–16:00	PM	Charge	Charge	Off peak	Off peak
16:00–17:00	PM	Charge	Charge	Peak	Off peak
17:00–18:00	PM	Charge	Charge	Peak	Off peak
18:00–19:00	OP	Charge	No charge	Peak	Off peak
19:00–20:00	OP	Charge	No charge	Off peak	Off peak
20:00–21:00	OP	Charge	No charge	Off peak	Off peak
21:00–22:00	OP	Charge	No charge	Off peak	Off peak
22:00–23:00	OP	No charge	No charge	No charge	No charge
23:00–00:00	OP	No charge	No charge	No charge	No charge

6.1.12 How the charges are derived is covered in the following sections.

Central London congestion charge

6.1.13 As with the base year values, the congestion charge level applied in the forecast models is taken from the RXHAM model coding as provided by TfL. The RXHAM model does not have 2030 or 2051 forecast years therefore the charges applied for these years were interpolated and extrapolated from the available model years. The average values, which take into account exempt vehicles, are shown in Table 6.3.

Table 6.3 Forecast year central London congestion charges in the LTAM

Year	Car employer's business	Car commute	Car other	LGV	HGV
2030	£1.88	£1.88	£1.88	£2.81	£2.97
2037	£2.16	£2.16	£2.16	£3.24	£3.42
2045	£2.49	£2.49	£2.49	£3.76	£3.96
2051	£2.75	£2.75	£2.75	£4.14	£4.36

6.1.14 The charges shown are applied in the AM, IP and PM peaks with no charge levied in the off peak as per the pattern depicted in Table 6.2.

Dartford Crossing charges

6.1.15 The procedure used to define the Dartford Crossing average charges (as paid by motorists through the Dart Charge) for the forecast years was very similar to the one adopted for the base year. This is described in the section below.

6.1.16 In September 2018 the discount available to pre-pay account holders was reduced. The charge paid by these users was increased from £1.67 per crossing to £2.00 per crossing. This increase in charge is reflected in Table 6.4.

Table 6.4 Dart Charge prices (September 2018 to current)

Vehicle class	Vehicle type	One-off payment	Pre-pay account
A	Motorcycles, mopeds and quad bikes	Free	Free
B	Cars (including trailers), motorhomes and minibuses (with less than nine seats including the driver's seat)	£2.50	£2.00
C	Vehicles with two axles	£3.00	£2.63
D	Vehicles with more than two axles	£6.00	£5.19

6.1.17 The proportion of each of the paid user classes has been analysed from the Dart Charge data. Plate 6.1 to Plate 6.3 show how the proportions have changed over time. These figures show that, although there are fluctuations in the different charge types across different months, on average there has been little overall change.

6.1.18 It has therefore been considered appropriate to assume that the proportions of different charge types should be kept constant from those observed in the base year when calculating the average charges for use in the forecast year models.

Plate 6.1 Profile of car charge types from November 2014 to May 2019

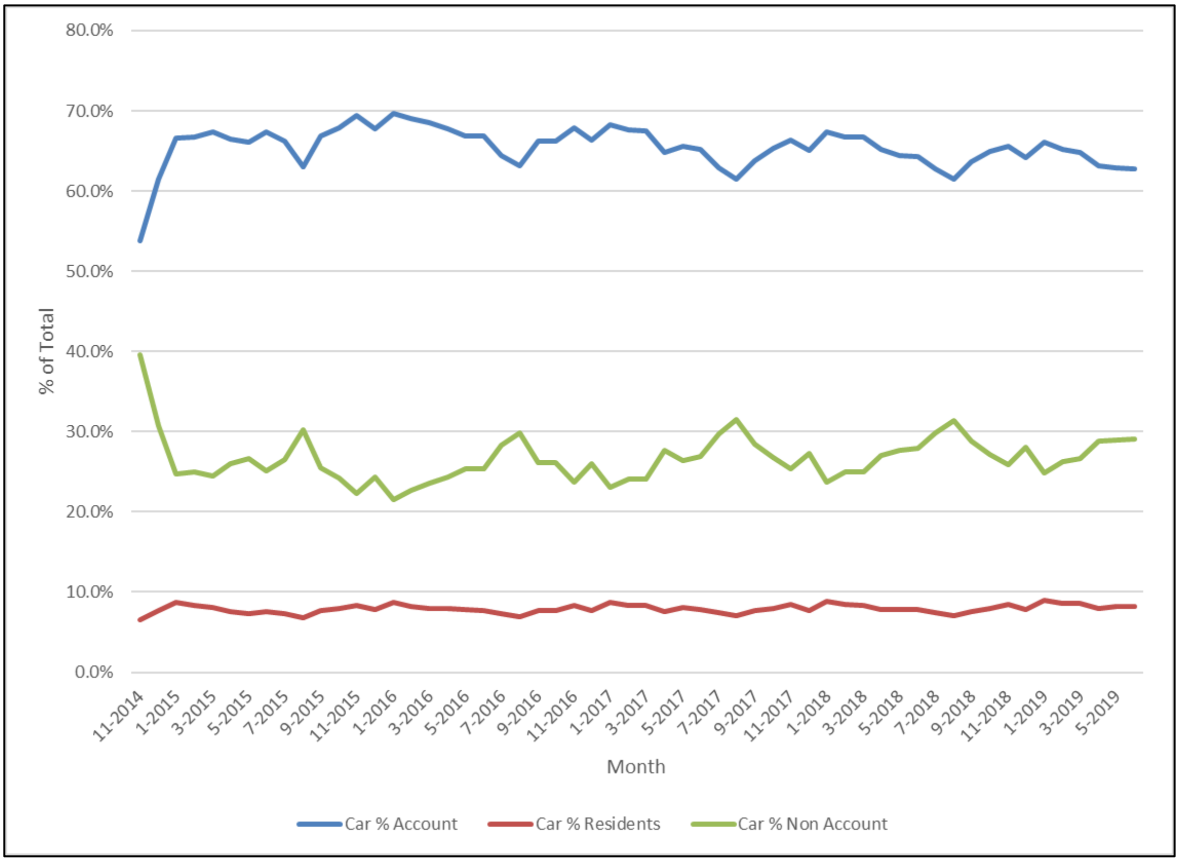


Plate 6.2 Profile of two-axle charge types from November 2014 to May 2019

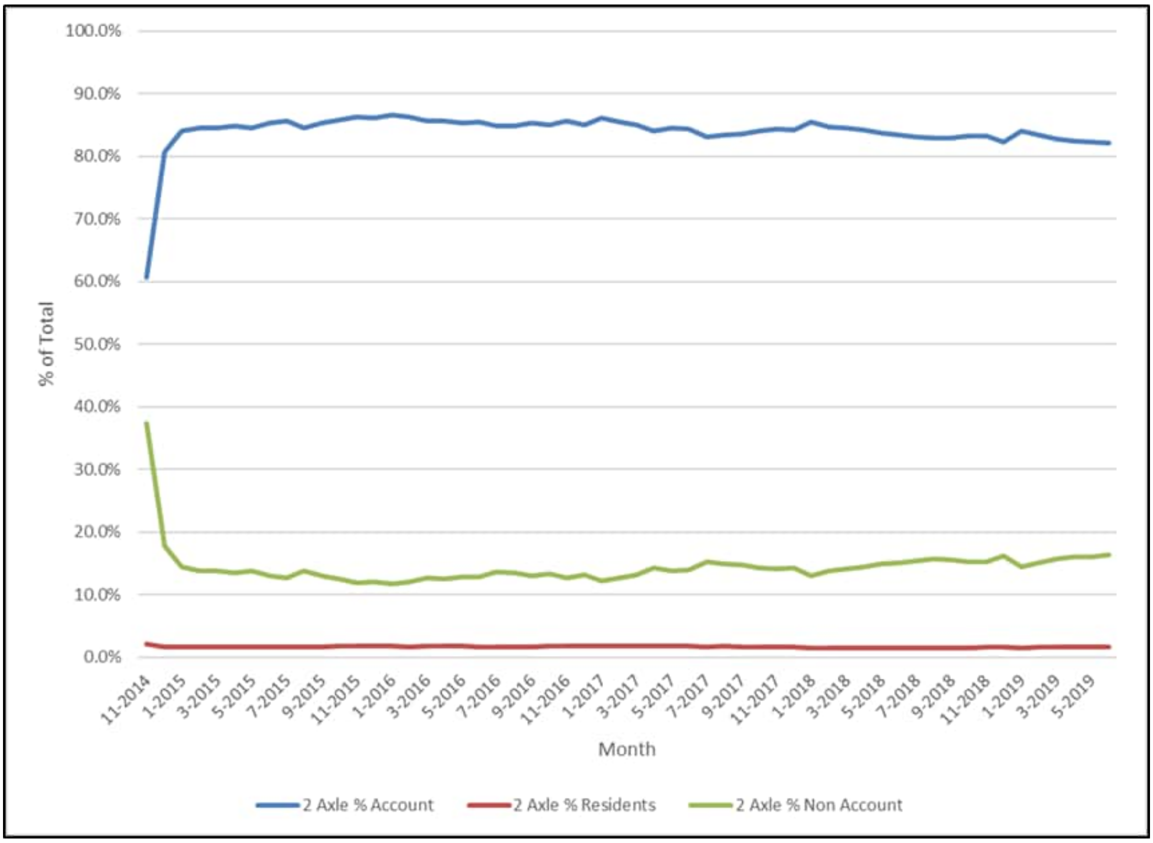
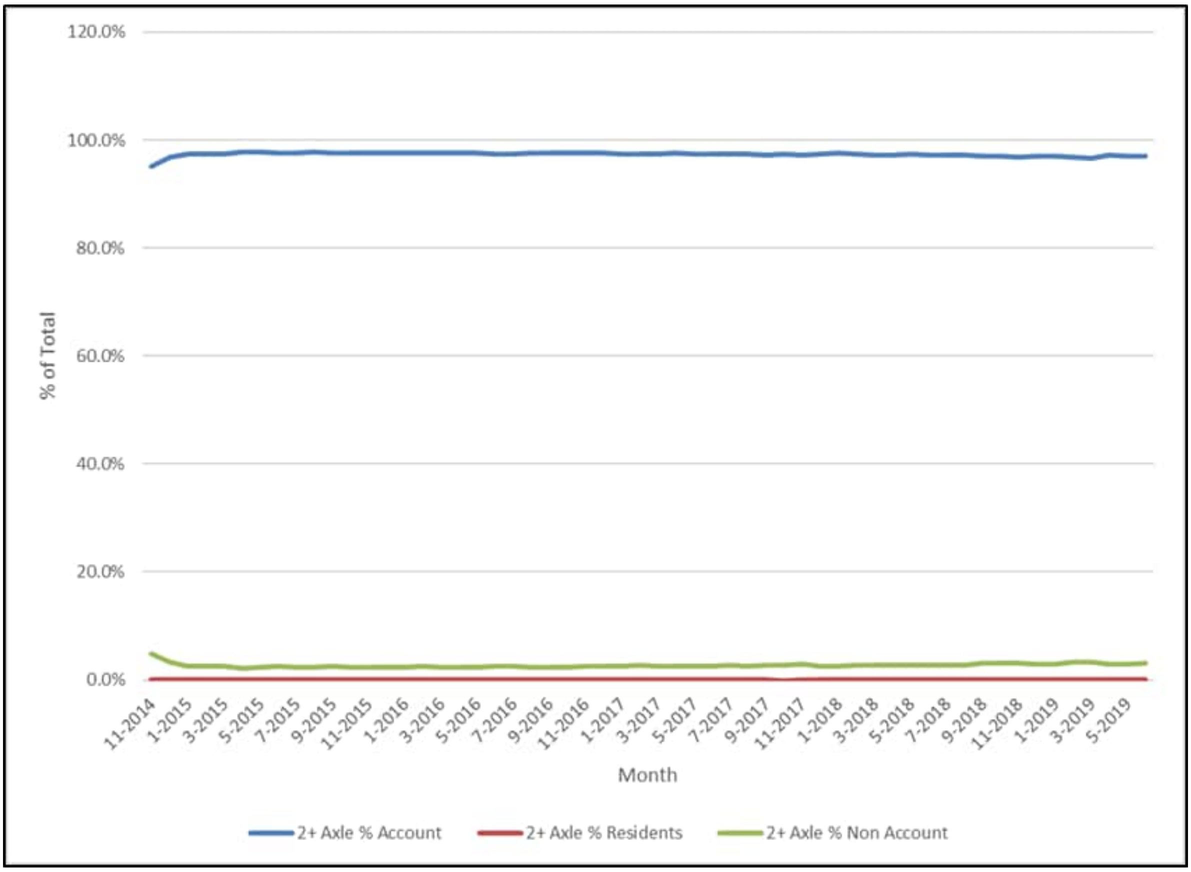


Plate 6.3 Profile of two+ axle charge types from November 2014 to May 2019



6.1.19 The charge type split values applied in the base year model are therefore used when calculating the average charge for the different forecast years. These values are presented in Table 6.5.

Table 6.5 Dartford Crossing assumed forecast year payment types by vehicle class

Vehicle class	Account (i.e. discounted)	Pay-as-you go/ non-account	Local resident account	Non-paying
A	0.0%	0.0%	0.0%	100.0%
B	65.1%	18.4%	8.0%	8.5%
C	79.8%	10.2%	1.5%	8.5%
D	89.3%	2.2%	0.0%	8.5%

6.1.20 There is a discrepancy between how Dart Charge considers HGVs and how the LTAM reflects them. The HGV model user class will consist of some vehicles in Dart Charge Class C and some in Dart Charge Class D. The weighted average HGV charge needs to reflect this.

6.1.21 Analysis conducted using base year traffic data suggested that 21% of the LTAM HGV class is Dart Charge Class C and 79% of the LTAM HGV class is Dart Charge Class D. These proportions are applied to the HGV Non-Port user class in the LTAM DCO model. Vehicles in the LTAM HGV Port userclass are assumed to be 100% Dart Charge Class D, leading to a different average charge applied in the model.

6.1.22 Applying these values and taking into account the reduction in the discount available to account holders leads to the average charges at the Dartford Crossing in 2018 as presented in Table 6.6.

Table 6.6 LTAM user class charges (2018 values in 2018 prices)

Vehicle class	Average charge
Car	£1.78
LGV	£2.41
HGV non-port	£4.26
HGV port	£4.77

6.1.23 National Highways has statutory powers to increase the charges at the Dartford Crossing in line with the Retail Price Index (RPI). Therefore, and in agreement with DfT RPI-based inflation has been applied to the charges for each of the forecast years.

6.1.24 As with all monetary values in the LTAM these are then converted back into 2010 prices using the Gross Domestic Product (GDP) deflator. The last RPI based charge increase at the Dartford Crossing was in 2014. The RPI inflationary increase is therefore calculated from a 2014 base.

6.1.25 The RPI and GDP deflator indices as provided in the November 2021 TAG data book (v1.17) for relevant years are shown in Table 6.7. RPI values are derived from Table A5.3.1. GDP values come from the Annual Parameters sheet.

Table 6.7 RPI growth and GDP deflator values (November 2021 TAG Databook (v1.17))

Year	RPI growth	GDP deflator
2010	–	100
2014	1	107.43
2018	1.092	115.14
2030	1.567	151.62
2037	1.922	177.78
2045	2.418	213.25
2051	2.871	244.43

6.1.26 Applying the factors presented in Table 6.7 to the 2018 charges presented in Table 6.6 leads to the charges presented in Table 6.8 for each of the model forecast years. The off peak charge factor is kept constant at 0.55 for each of the forecast years.

Table 6.8 Forecast year Dartford Crossing charges in the LTAM (2010 prices)

Year	Time period	Car employer's business	Car commute	Car other	LGV	HGV non-port	HGV port
2030	AM	£1.84	£1.84	£1.84	£2.49	£4.41	£4.93
	IP	£1.84	£1.84	£1.84	£2.49	£4.41	£4.93

Year	Time period	Car employer's business	Car commute	Car other	LGV	HGV non-port	HGV port
	PM	£1.84	£1.84	£1.84	£2.49	£4.41	£4.93
	OP	£1.01	£1.01	£1.01	£1.37	£2.42	£2.71
2037	AM	£1.92	£1.92	£1.92	£2.60	£4.61	£5.15
	IP	£1.92	£1.92	£1.92	£2.60	£4.61	£5.15
	PM	£1.92	£1.92	£1.92	£2.60	£4.61	£5.15
	OP	£1.06	£1.06	£1.06	£1.43	£2.53	£2.83
2045	AM	£2.02	£2.02	£2.02	£2.73	£4.84	£5.41
	IP	£2.02	£2.02	£2.02	£2.73	£4.84	£5.41
	PM	£2.02	£2.02	£2.02	£2.73	£4.84	£5.41
	OP	£1.11	£1.11	£1.11	£1.50	£2.66	£2.97
2051	AM	£2.09	£2.09	£2.09	£2.83	£5.01	£5.60
	IP	£2.09	£2.09	£2.09	£2.83	£5.01	£5.60
	PM	£2.09	£2.09	£2.09	£2.83	£5.01	£5.60
	OP	£1.15	£1.15	£1.15	£1.56	£2.75	£3.08

Blackwall/Silvertown Tunnels charge

6.1.27 The Silvertown Tunnel proposal underwent a DCO examination during 2017 with the Secretary of State granting consent on May 10 2018. The charges assessed (known as the Assessed Case) were determined and reported on in the Silvertown Tunnel Charging Statement (TfL, 2016).

6.1.28 The primary source of the charges to apply at Blackwall and Silvertown for the LTAM was the TfL RXHAM model. These charges had been adjusted from the advertised user charges for use in the model to represent exemptions, discounts, local residents, etc. It is important to note that the proposed charging regime uses different charges in different directions in the peak hours.

6.1.29 The RXHAM model does not have 2029 or 2051 forecast years therefore the charges applied for these years were interpolated and extrapolated from the available model years. The resultant figures were then adjusted according to the charging time periods and the LTAM modelled time periods based on the proportion of time a charge in place was in either a peak or off peak period.

6.1.30 As an example, to illustrate this, and referring to the charging regime set out in Table 6.2, the inter-peak charge in the SB direction is made up of 6 hours of the off peak charge so the average charge is £0.90. In the NB direction the inter-peak charge is made up of five hours of the off peak charge and one hour of the peak charge, so the average charge is £1.20.

6.1.31 The resultant modelled charges are shown in Table 6.9.

Table 6.9 Blackwall and Silvertown modelled charges in LTAM time periods

Direction	Year	Time period	Car employer's business	Car commute	Car other	LGV	HGV port and non-port
SB	2030	AM	£0.90	£0.90	£0.90	£1.49	£3.60
		IP	£0.90	£0.90	£0.90	£1.49	£3.60
		PM	£2.70	£2.70	£2.70	£4.50	£6.76
		OP	£0.45	£0.45	£0.45	£0.75	£1.46
	2037	AM	£0.90	£0.90	£0.90	£1.49	£3.60
		IP	£0.90	£0.90	£0.90	£1.49	£3.60
		PM	£2.70	£2.70	£2.70	£4.50	£6.76
		OP	£0.45	£0.45	£0.45	£0.75	£1.46
	2045	AM	£0.90	£0.90	£0.90	£1.49	£3.60
		IP	£0.90	£0.90	£0.90	£1.49	£3.60
		PM	£2.70	£2.70	£2.70	£4.50	£6.76
		OP	£0.45	£0.45	£0.45	£0.75	£1.46
	2051	AM	£0.90	£0.90	£0.90	£1.49	£3.60
		IP	£0.90	£0.90	£0.90	£1.49	£3.60
		PM	£2.70	£2.70	£2.70	£4.50	£6.76
		OP	£0.45	£0.45	£0.45	£0.75	£1.46
NB	2030	AM	£2.70	£2.70	£2.70	£4.50	£6.76
		IP	£1.20	£1.20	£1.20	£1.99	£4.13
		PM	£0.90	£0.90	£0.90	£1.49	£3.60
		OP	£0.30	£0.30	£0.30	£0.50	£1.20
	2037	AM	£2.70	£2.70	£2.70	£4.50	£6.76
		IP	£1.20	£1.20	£1.20	£1.99	£4.13
		PM	£0.90	£0.90	£0.90	£1.49	£3.60
		OP	£0.30	£0.30	£0.30	£0.50	£1.20
	2045	AM	£2.70	£2.70	£2.70	£4.50	£6.76
		IP	£1.20	£1.20	£1.20	£1.99	£4.13
		PM	£0.90	£0.90	£0.90	£1.49	£3.60
		OP	£0.30	£0.30	£0.30	£0.50	£1.20
	2051	AM	£2.70	£2.70	£2.70	£4.50	£6.76
		IP	£1.20	£1.20	£1.20	£1.99	£4.13
		PM	£0.90	£0.90	£0.90	£1.49	£3.60
		OP	£0.30	£0.30	£0.30	£0.50	£1.20

London Ultra Low Emission Zone (ULEZ) charge

6.1.32 The ULEZ charge is not included in the LTAM as there is currently very high compliance with the requirements of the scheme. As such it is considered that it does not alter traffic patterns to an extent that would affect the appraisal of the Project on the road network.

6.2 Do Something networks

Description of the Project

6.2.1 The Project is described in Section 2.2.

6.2.2 Plate 6.4 to Plate 6.6 present schematic representations of the Project's junctions as they have been depicted in the LTAM. The LTAM coding reflects the scheme drawings as contained within the General Arrangement drawings (Application Document 2.5).

Plate 6.4 Lower Thames Crossing A2 junction representation in the LTAM

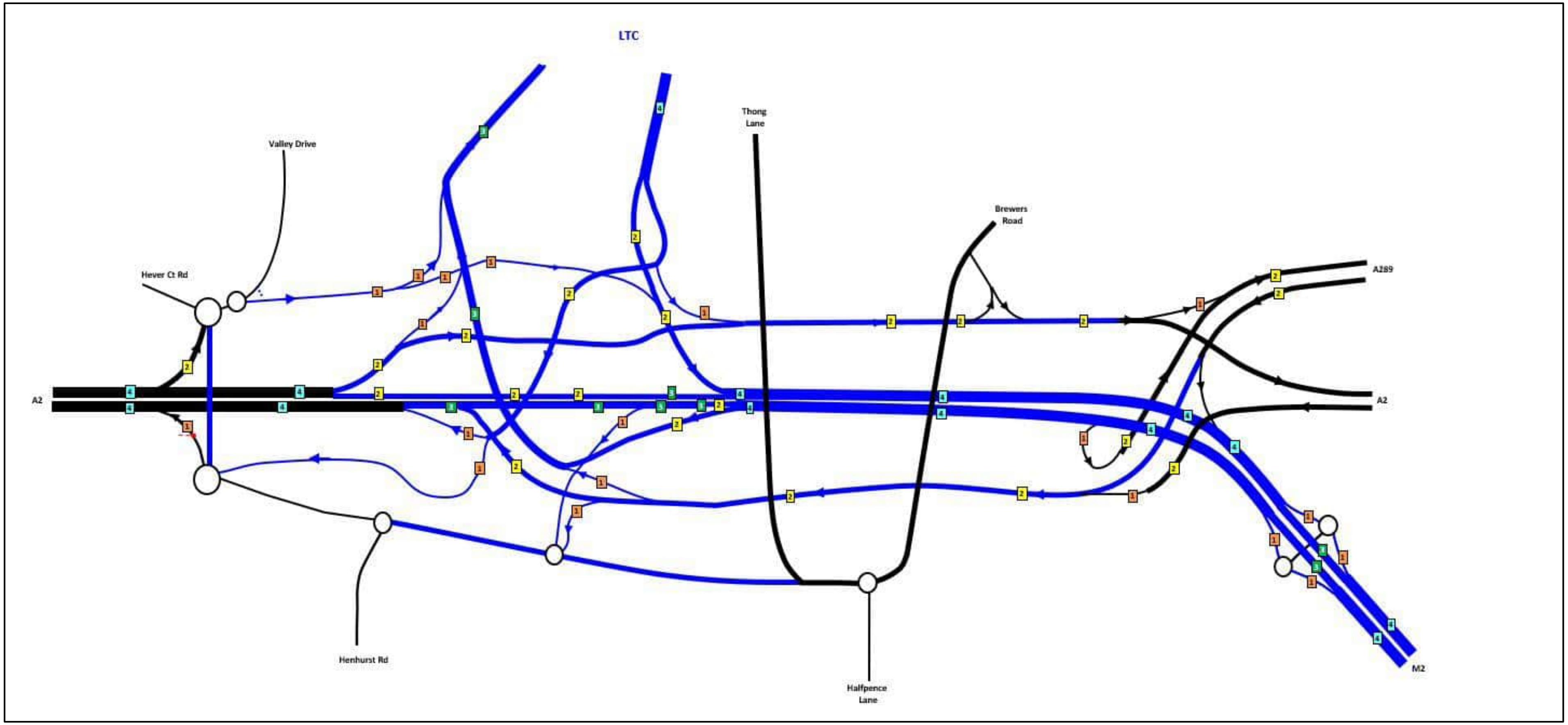


Plate 6.5 Lower Thames Crossing A13/A1089 junction representation in the LTAM

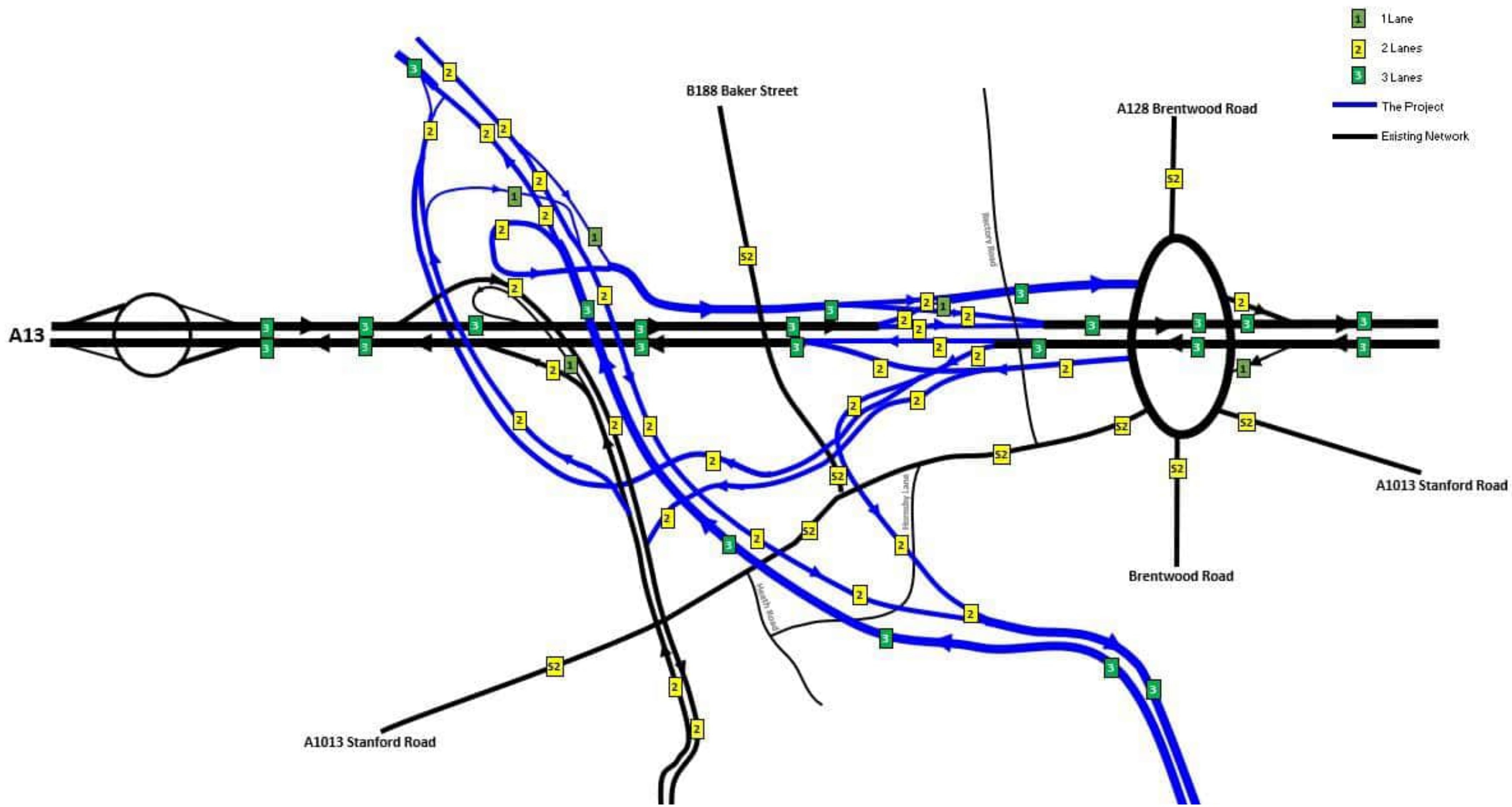
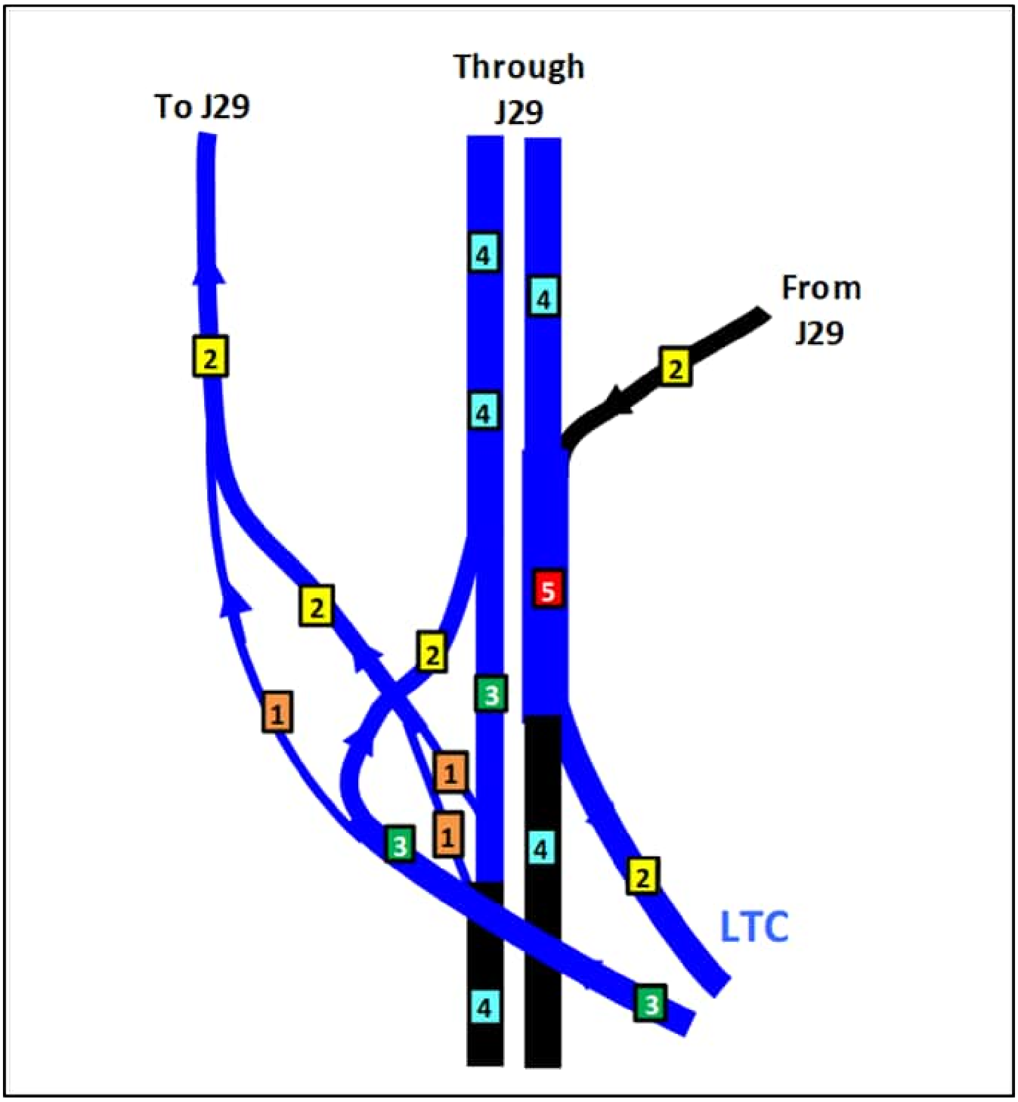


Plate 6.6 Lower Thames Crossing M25 junction representation in the LTAM



Network coding

6.2.3 Notwithstanding that the Project is to be designated as an all-purpose trunk road (APTR), the mainline is coded as a three-lane motorway (except for the northern section between the M25 and A13 where the southbound direction has two lanes). This is because an APTR with the same restrictions as a motorway means that this is considered the most appropriate coding. Generally, the capacity has been defined at 2,330 PCU/hr per lane. The lowest capacity section of the Project is the section with the incline coming out of the Lower Thames Crossing tunnel in each direction. The incline at these locations is 4% in the southbound direction and 3% in the northbound direction. As per the network coding manual, a reduced capacity of 2,120 PCU/hr per lane has been coded for these inclining sections. Merges and diverges are coded as per the SERTM Network Coding Manual so as to be consistent with the rest of the model.

6.2.4 The TMC is assumed to be unchanged between the Do Minimum (DM) and Do Something (DS) scenarios.

6.2.5 Guidance received from National Highways stipulated that the posted charges at the Lower Thames Crossing would be exactly the same as the posted charges at the Dartford Crossing. These are shown in Table 6.4. A similar method is therefore required, to that applied for the Dartford Crossing, in order to obtain the average charges for use in the model.

6.2.6 As the Lower Thames Crossing does not exist in the base year it is not possible to observe the proportions of different users in order to estimate the average charge. It is therefore necessary to use some assumptions and model forecasts in order to approximate these values. The sections below explain these assumptions and the way the model forecasts have been used to derive the values.

6.2.7 It is considered a reasonable approximation that the proportions of account holders, non-account holders and non-payers will be the same as at the Dartford Crossing. It is not valid to make the same assumption for the resident’s discount as the areas considered for resident’s discount for the Project are different to those at the Dartford Crossing. A methodology is therefore required to estimate the proportion of travellers who would qualify for a resident’s discount for the Project.

6.2.8 The analysis undertaken has investigated the movements using both of the crossings in previous forecast outputs produced from earlier versions of the model. The forecasts used are those used to support the 2018 Statutory Consultation exercise (Base = Actual Base 100; DM = CM6; DS = C8E). The forecast scenarios were analysed for the Project opening year (which was predicted to be 2026 prior to Statutory Consultation). Select link assignment procedures were used to identify the origins and destinations of trips using both the Dartford Crossing and the Project in the relevant scenarios.

6.2.9 Residents of Gravesham and Thurrock would qualify for a resident’s discount for the Project. Table 6.10 shows the percentage of trips using the Dartford Crossing in the base and the Project in 2026 that either originate or terminate in these areas. This analysis has been undertaken for the entire charge period at the Dartford Crossing (06:00–22:00). The percentage of HGVs using the Dartford Crossing and qualifying for a resident’s discount is observed to be almost 0%. The calculation has therefore only been performed for car and LGV trips.

Table 6.10 Percentage of travellers using Dartford and the Project with trips originating or terminating in a resident's discount zone

Vehicle class	Areas qualifying for resident's discount	2016 base	2026 DS
		Dartford Crossing	Lower Thames Crossing
Car	Dartford and Thurrock	36.78%	–
	Gravesham and Thurrock	–	35.75%
LGV	Dartford and Thurrock	29.26%	–
	Gravesham and Thurrock	–	19.91%

6.2.10 The analysis identifies the percentage of movements that either originate or terminate in a zone that would qualify for a resident's discount. It has been observed that in the base year 7.96% of current Dartford Crossing car users are residents. As expected, the model predicts that more than this percentage of trips start or end in that zone (reflecting that not all trips to and from these zones are made by residents). The method therefore pivots from this observed value to identify the percentage of people who would get a resident's discount at the Lower Thames Crossing in the Project opening year. So, for example, when estimating the percentage of car users with a resident's discount at the Lower Thames Crossing in 2030 the calculation is as follows:

a. Car base year observed resident's discount (all day average) = 7.96%

b. Car base year modelled trips originating or terminating in Dartford or Thurrock (all day average) = 36.78%

c. Car 2026 DS Lower Thames Crossing modelled trips originating or terminating in Thurrock or Gravesham (all day average) = 35.75%

d. Therefore, the percentage of people getting a resident's discount in 2030 DS at the Lower Thames Crossing would be = 7.96 x 35.75/36.78 = 7.73%

6.2.11 Table 6.11 provides the estimated percentage of resident's discount output from this process.

Table 6.11 Estimated Lower Thames Crossing Resident's Discount percentage

Vehicle class	Areas qualifying for Resident's Discount	Resident's Discount %
Car	Gravesham and Thurrock	7.73%
LGV	Gravesham and Thurrock	2.35%

6.2.12 Taking these estimates into account and normalizing the other charge type values, so that the total adds up to 100%, leads to the overall proportions of charge types for each user class as presented in Table 6.12.

Table 6.12 Lower Thames Crossing assumed forecast year payment types by vehicle class

Vehicle class	Account (i.e. discounted)	Pay-as-you go/ non-account	Local resident account	Non-paying
A	0.0%	0.0%	0.0%	100.0%
B	65.32%	18.46%	7.73%	8.49%
C	80.19%	10.29%	1.02%	8.49%
D	89.29%	2.22%	0.00%	8.49%

6.2.13 Applying the proportions of different charge types to the posted charges shown in Table 6.4 leads to the average charges for the Project as shown in Table 6.13.

Table 6.13 LTAM User Class charges (2018 values in 2018 prices)

Vehicle class	Average charge
Car	£1.78
LGV	£2.42
HGV non-port	£4.27
HGV port	£4.77

6.2.14 These values need to be converted into yearly values in 2010 prices by applying the same RPI inflation and GDP deflator values as were used earlier. This uses the same factors as set out in Table 6.7. Applying the factors presented in Table 6.7 to the 2018 charges presented in Table 6.13 leads to the charges presented in Table 6.14 for each of the model forecast years. The off peak charge factor is kept constant at 0.55 for each of the forecast years. As can be seen, these charges are very similar to the charges applied in the model for the Dartford Crossing. The largest difference is 1p.

Table 6.14 Forecast year Lower Thames Crossing charges in the LTAM (2010 prices)

Year	Time period	Car employer's business	Car commute	Car other	LGV	HGV non-port	HGV port
2030	AM	£1.84	£1.84	£1.84	£2.50	£4.41	£4.93
	IP	£1.84	£1.84	£1.84	£2.50	£4.41	£4.93
	PM	£1.84	£1.84	£1.84	£2.50	£4.41	£4.93
	OP	£1.01	£1.01	£1.01	£1.38	£2.42	£2.71
2037	AM	£1.93	£1.93	£1.93	£2.62	£4.61	£5.15
	IP	£1.93	£1.93	£1.93	£2.62	£4.61	£5.15
	PM	£1.93	£1.93	£1.93	£2.62	£4.61	£5.15
	OP	£1.06	£1.06	£1.06	£1.44	£2.54	£2.83
2045	AM	£2.02	£2.02	£2.02	£2.74	£4.84	£5.41
	IP	£2.02	£2.02	£2.02	£2.74	£4.84	£5.41
	PM	£2.02	£2.02	£2.02	£2.74	£4.84	£5.41
	OP	£1.11	£1.11	£1.11	£1.51	£2.66	£2.97
2051	AM	£2.09	£2.09	£2.09	£2.84	£5.01	£5.60
	IP	£2.09	£2.09	£2.09	£2.84	£5.01	£5.60
	PM	£2.09	£2.09	£2.09	£2.84	£5.01	£5.60
	OP	£1.15	£1.15	£1.15	£1.56	£2.76	£3.08

7 Equilibrium demand forecasts

7.1 Introduction

7.1.1 This section of the report provides information on the impact of the VDM on the forecasts. It provides details of the model parameters used for each of the forecast years and scenarios. It then provides statistics comparing the reference case, which is the input to the VDM, and the post-VDM outputs. The reference case reflects the levels of growth in demand if the costs of travel remain constant over time. Statistics are provided on the convergence of the VDM, the impacts on matrices, traffic flows on the networks and some key network statistics. Outputs are provided for the following forecasts:

a. Base Plus

b. 2030 DM and DS versus Reference

c. 2037 DM and DS versus Reference

d. 2045 DM and DS versus Reference

e. 2051 DM and DS versus Reference

7.2 Model parameters

7.2.1 Table 7.1 to Table 7.18 provide the model VOT and VOC for each of the forecast years for highway and public transport users. These values are derived from the TAG Databook (DfT, v1.17 November 2021).

Table 7.1 HAM VOT parameters actual base (highway users pence per minute)

User class	AM	IP	PM
Business	30.11	30.85	30.54
Commute low	9.29	9.44	9.32
Commute med.	15.61	15.87	15.67
Commute high	27.22	27.66	27.31
Other low	7.59	8.09	7.95
Other med.	13.07	13.93	13.69
Other high	20.82	22.18	21.80
LGV	20.87	20.87	20.87
HGV non-port	43.46	43.46	43.46
HGV port	43.46	43.46	43.46

Table 7.2 VDM VOT parameters actual base (pence per hour)

User class	Highway users all day	PT users all day
Business	1,835.74	2,635.38
Commute low	561.03	492.05
Commute med.	943.30	827.33
Commute high	1,644.44	1,442.25
Other low	476.55	266.15
Other med.	820.57	458.27
Other high	1,306.63	729.73

Table 7.3 HAM and VDM VOC parameters actul base (highway users pence per km)

User class	AM	IP	PM	All day
Business	12.33	11.95	12.33	12.01
Commute low	5.80	5.63	5.80	5.66
Commute med.	5.80	5.63	5.80	5.66
Commute high	5.80	5.63	5.80	5.66
Other low	5.80	5.63	5.80	5.66
Other med.	5.80	5.63	5.80	5.66
Other high	5.80	5.63	5.80	5.66
LGV	13.34	13.15	13.34	–
HGV non-port	26.18	25.42	26.18	–
HGV port	49.62	47.62	49.62	–

Table 7.4 HAM VOT parameters Base Plus (highway users pence per minute)

User class	AM	IP	PM	OP	Weekend
Business	30.11	30.85	30.54	31.12	34.97
Commute low	9.29	9.44	9.32	9.46	9.90
Commute med.	15.61	15.87	15.67	15.90	16.65
Commute high	27.22	27.66	27.31	27.71	29.02
Other low	7.59	8.09	7.95	7.92	9.40
Other med.	13.07	13.93	13.69	13.64	16.19
Other high	20.82	22.18	21.80	21.72	25.78
LGV	20.87	20.87	20.87	20.87	22.24
HGV non-port	43.46	43.46	43.46	43.46	43.46
HGV port	43.46	43.46	43.46	43.46	43.46

Table 7.5 VDM VOT parameters Base Plus (pence per hour)

User class	Highway users all day	PT users all day
Business	1,835.74	2,635.38
Commute low	561.03	492.05
Commute med.	943.30	827.33
Commute high	1,644.44	1,442.25
Other low	476.55	266.15
Other med.	820.57	458.27
Other high	1,306.63	729.73

Table 7.6 HAM and VDM VOC parameters Base Plus (highway users pence per km)

User class	AM	IP	PM	OP	Weekend	All day
Business	12.33	11.95	12.33	11.65	11.95	12.01
Commute low	5.80	5.63	5.80	5.52	5.63	5.66
Commute med.	5.80	5.63	5.80	5.52	5.63	5.66
Commute high	5.80	5.63	5.80	5.52	5.63	5.66
Other low	5.80	5.63	5.80	5.52	5.63	5.66
Other med	5.80	5.63	5.80	5.52	5.63	5.66
Other high	5.80	5.63	5.80	5.52	5.63	5.66
LGV	13.34	13.15	13.34	13.07	13.15	–
HGV non-port	26.18	25.42	26.18	24.88	25.42	–
HGV port	49.62	47.62	49.62	45.98	47.62	–

Table 7.7 HAM VOT parameters 2030 (highway users pence per minute)

User class	AM	IP	PM	OP	Weekend
Business	34.84	35.70	35.34	36.01	40.46
Commute low	10.75	10.92	10.78	10.94	11.46
Commute med.	18.07	18.36	18.13	18.40	19.26
Commute high	31.50	32.01	31.61	32.07	33.58
Other low	8.79	9.36	9.20	9.17	10.88
Other med.	15.13	16.12	15.84	15.79	18.74
Other high	24.09	25.66	25.23	25.14	29.84
LGV	24.15	24.15	24.15	24.15	25.74
HGV non-port	50.29	50.29	50.29	50.29	50.29
HGV port	50.29	50.29	50.29	50.29	50.29

Table 7.8 VDM VOT parameters 2030 (pence per hour)

User class	Highway users all day	PT users all day
Business	2,124.24	3,049.54
Commute low	649.20	569.38
Commute med.	1,091.55	957.34
Commute high	1,902.86	1,668.91
Other low	551.44	307.97
Other med.	949.52	530.29
Other high	1,511.96	844.41

Table 7.9 HAM and VDM VOC parameters 2030 (highway users pence per km)

User class	AM	IP	PM	OP	Weekend	All day
Business	10.63	10.28	10.63	10.00	10.28	10.33
Commute low	5.00	4.86	5.00	4.76	4.86	4.88
Commute med.	5.00	4.86	5.00	4.76	4.86	4.88
Commute high	5.00	4.86	5.00	4.76	4.86	4.88
Other low	5.00	4.86	5.00	4.76	4.86	4.88
Other med.	5.00	4.86	5.00	4.76	4.86	4.88
Other high	5.00	4.86	5.00	4.76	4.86	4.88
LGV	12.73	12.56	12.73	12.47	12.56	–
HGV non-port	26.98	26.21	26.98	25.65	26.21	–
HGV port	48.85	46.89	48.85	45.27	46.89	–

Table 7.10 HAM VOT parameters 2037 (highway users pence per minute)

User class	AM	IP	PM	OP	Weekend
Business	38.42	39.37	38.98	39.71	44.62
Commute low	11.85	12.04	11.89	12.07	12.63
Commute med.	19.93	20.25	20.00	20.29	21.24
Commute high	34.74	35.30	34.86	35.37	37.03
Other low	9.69	10.32	10.15	10.11	12.00
Other med.	16.68	17.77	17.47	17.41	20.66
Other high	26.57	28.30	27.82	27.72	32.91
LGV	26.63	26.63	26.63	26.63	28.38
HGV non-port	55.46	55.46	55.46	55.46	55.46
HGV port	55.46	55.46	55.46	55.46	55.46

Table 7.11 VDM VOT parameters 2037 (pence per hour)

User class	Highway users all day	PT users all day
Business	2,342.72	3,363.19
Commute low	715.97	627.94
Commute med.	1,203.82	1,055.81
Commute high	2,098.58	1,840.56
Other low	608.16	339.65
Other med.	1,047.19	584.84
Other high	1,667.48	931.26

Table 7.12 HAM and VDM VOC parameters 2037 (highway users pence per km)

User class	AM	IP	PM	OP	Weekend	All day
Business	9.30	8.97	9.30	8.71	8.97	9.02
Commute low	4.29	4.18	4.29	4.10	4.18	4.20
Commute med.	4.29	4.18	4.29	4.10	4.18	4.20
Commute high	4.29	4.18	4.29	4.10	4.18	4.20
Other low	4.29	4.18	4.29	4.10	4.18	4.20
Other med.	4.29	4.18	4.29	4.10	4.18	4.20
Other high	4.29	4.18	4.29	4.10	4.18	4.20
LGV	11.98	11.81	11.98	11.72	11.81	–
HGV non-port	26.63	25.87	26.63	25.32	25.87	–
HGV port	46.21	44.35	46.21	42.82	44.35	–

Table 7.13 HAM VOT parameters 2045 (highway users pence per minute)

User class	AM	IP	PM	OP	Weekend
Business	42.90	43.96	43.52	44.34	49.82
Commute low	13.23	13.45	13.28	13.47	14.11
Commute med.	22.25	22.61	22.33	22.65	23.72
Commute high	38.79	39.42	38.92	39.49	41.35
Other low	10.82	11.52	11.33	11.29	13.40
Other med.	18.63	19.84	19.51	19.44	23.07
Other high	29.66	31.60	31.06	30.95	36.74
LGV	29.74	29.74	29.74	29.74	31.69
HGV non-port	61.92	61.92	61.92	61.92	61.92
HGV port	61.92	61.92	61.92	61.92	61.92

Table 7.14 VDM VOT parameters 2045 (pence per hour)

User class	Highway users all day	PT users all day
Business	2,615.76	3,755.16
Commute low	799.41	701.13
Commute med.	1,344.11	1,178.86
Commute high	2,343.16	2,055.07
Other low	679.03	379.23
Other med.	1,169.23	653.00
Other high	1,861.81	1,039.79

Table 7.15 HAM and VDM VOC parameters 2045 (highway users pence per km)

User class	AM	IP	PM	OP	Weekend	All day
Business	8.42	8.11	8.42	7.86	8.11	8.16
Commute low	3.84	3.75	3.84	3.69	3.75	3.76
Commute med.	3.84	3.75	3.84	3.69	3.75	3.76
Commute high	3.84	3.75	3.84	3.69	3.75	3.76
Other low	3.84	3.75	3.84	3.69	3.75	3.76
Other med	3.84	3.75	3.84	3.69	3.75	3.76
Other high	3.84	3.75	3.84	3.69	3.75	3.76
LGV	11.37	11.21	11.37	11.12	11.21	–
HGV non-port	26.35	25.59	26.35	25.04	25.59	–
HGV port	45.93	44.09	45.93	42.57	44.09	–

Table 7.16 HAM VOT parameters 2051 (highway users pence per minute)

User class	AM	IP	PM	OP	Weekend
Business	46.34	47.48	47.01	47.90	53.82
Commute low	14.29	14.53	14.34	14.55	15.24
Commute med.	24.03	24.42	24.12	24.47	25.62
Commute high	41.90	42.58	42.04	42.66	44.66
Other low	11.69	12.45	12.24	12.19	14.47
Other med.	20.12	21.44	21.07	21.00	24.92
Other high	32.04	34.13	33.55	33.44	39.69
LGV	32.12	32.12	32.12	32.12	34.23
HGV non-port	66.89	66.89	66.89	66.89	66.89
HGV port	66.89	66.89	66.89	66.89	66.89

Table 7.17 VDM VOT parameters 2051 (pence per hour)

User class	Highway users all day	PT users all day
Business	2,825.48	4,056.23
Commute low	863.51	757.34
Commute med.	1,451.88	1,273.37
Commute high	2,531.03	2,219.84
Other low	733.48	409.64
Other med.	1,262.97	705.35
Other high	2,011.09	1,123.16

Table 7.18 HAM and VDM VOC parameters 2051 (highway users pence per km)

User class	AM	IP	PM	OP	Weekend	All day
Business	8.23	7.92	8.23	7.67	7.92	7.97
Commute low	3.73	3.65	3.73	3.59	3.65	3.66
Commute med.	3.73	3.65	3.73	3.59	3.65	3.66
Commute high	3.73	3.65	3.73	3.59	3.65	3.66
Other low	3.73	3.65	3.73	3.59	3.65	3.66
Other med.	3.73	3.65	3.73	3.59	3.65	3.66
Other high	3.73	3.65	3.73	3.59	3.65	3.66
LGV	11.12	10.96	11.12	10.88	10.96	–
HGV non-port	26.41	25.66	26.41	25.11	25.66	–
HGV port	46.29	44.43	46.29	42.90	44.43	–

7.3 LTAM Base Plus model

7.3.1 The specification for the Base Plus model is described in Section 3.5. The tables below present the impact of the VDM on the Base Plus reference matrices and assignments.

VDM convergence statistics

7.3.2 The LTAM convergence statistics are provided in Table 7.19 for the Base Plus VDM run.

Table 7.19 Convergence and stability statistics (Base Plus 2016)

Iteration	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	0.06%	0.72%	0.000	0.000	0.000	0%	0.000	0.000	0.000	0%	69,420,935
2	0.03%	0.30%	0.001	0.044	0.110	100.00%	0.014	0.000	0.008	91.29%	69,421,292
3	0.02%	0.16%	0.000	0.014	0.036	100.00%	0.005	0.000	0.004	97.91%	69,421,381
4	0.01%	0.10%	0.000	0.009	0.033	100.00%	0.002	0.000	0.003	99.84%	69,421,426

** The values in the Trips column only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Note: RAAD is Relative Average Absolute Difference. AAD is Average Absolute Difference

Matrix totals – actual base vs Base Plus

7.3.3 As described in Section 5.3, it is necessary to report the matrix totals in two ways, firstly using the 17 demand segments used in DIADEM and secondly using the 10 user classes used in the highway assignment model. For presentation purposes, HGV Port and HGV Non-Port trips were summed together providing total values for HGV movements.

7.3.4 The matrices used in the LTAM include all trips in the country, except for HGV trips, which cover only the south-east of England. A large majority of these trips are outside of the study area and will not impact the assessment of the Project. It is therefore important, when looking at the impacts that the VDM has made, to isolate those movements that are considered relevant to the Project appraisal.

7.3.5 During the development of the base model, a series of origin-to-destination movements were defined as being relevant to the Project appraisal. The identification of many of the irrelevant movements is relatively straightforward. For example, trips between Liverpool and Manchester can easily be considered as irrelevant. For some movements the identification is more difficult such as trips from the Midlands to the south coast. Some of these may use the M25, which would bring them within the region of influence of the Project. Some will simply use the M5 or other routes and should therefore also be considered as irrelevant.

7.3.6 The final designation of relevant movements was determined as follows. Initially, all movements which started or finished within the FMA (as defined in Plate 3.3) were considered to be relevant. Also, all external-to-external movements which crossed the FMA boundary were also considered relevant. This pattern was developed using a select link procedure in SATURN. Intrazonal movements within the FMA have been considered as being relevant.

7.3.7 Table 7.20 explains the pattern adopted. Table 7.21 shows the number of OD pairs in each model area considered to be relevant, in comparison to all movements and Table 7.22 shows the percentage of relevant movements by modelled area. The relevant movement pattern has only been applied to the SATURN matrix analysis in the subsequent tables below.

Table 7.20 Relevant movement pattern

Movement		All movements	Relevant movements inc. internal intrazonals
From	To		
Internal	Internal	Relevant	Relevant
Internal	External	Relevant	Relevant
External	Internal	Relevant	Relevant
External	External	Relevant	Only trips entering FMA

Table 7.21 Number of relevant movements by model area

Movement		All movements	Relevant movements inc. internal intrazonals
From	To		
Internal	Internal	556,516	556,516
Internal	External	199,182	199,182
External	Internal	199,182	199,182
External	External	71,289	31,909
Total		1,026,169	986,789

Table 7.22 Percentage of relevant movements by model area

Movement		All movements	Relevant movements inc. internal intrazonals
From	To		
Internal	Internal	100%	100%
Internal	External	100%	100%
External	Internal	100%	100%
External	External	100%	44.8%
Total		100%	96.2%

7.3.8 Table 7.23 presents a comparison of the actual base and Base Plus matrices for the DIADEM 17 demand segment pattern. Table 7.24 presents a comparison between the actual base and Base Plus matrices for the SATURN 10 userclass pattern. For presentation purposes HGV Port and HGV Non-Port trips were summed together providing total values for HGV movements. Only the SATURN matrices have the 'all movement' and 'relevant movements' analysis presented as this is more applicable to OD matrices as they are used in the assignment model.

Table 7.23 LTAM DIADEM matrix total comparison – actual base vs VDM output matrix (Base Plus highway trips in PCUs)

Segment	Matrix type	Time period	Actual base (2016)	VDM output Base Plus (2016)		
			Matrix total	Matrix total	Diff. to actual base	Diff. %
HBEB	24hr PA	N/A	2,554,589	2,554,609	20	0.0%
HBW L	24hr PA	N/A	2,255,274	2,255,294	20	0.0%
HBW M	24hr PA	N/A	3,993,999	3,994,074	74	0.0%
HBW H	24hr PA	N/A	3,125,908	3,125,986	78	0.0%
HBO L	24hr PA	N/A	6,076,175	6,076,242	68	0.0%
HBO M	24hr PA	N/A	5,445,416	5,445,483	67	0.0%
HBO H	24hr PA	N/A	3,896,462	3,896,520	58	0.0%

Segment	Matrix type	Time period	Actual base (2016)	VDM output Base Plus (2016)		
			Matrix total	Matrix total	Diff. to actual base	Diff. %
NHBEB	By time period OD	AM	87,644	87,661	17	0.0%
		IP	113,550	113,544	-5	0.0%
		PM	126,583	126,585	2	0.0%
		OP	31,974	31,975	1	0.0%
NHBO L	By time period OD	AM	123,476	123,480	4	0.0%
		IP	327,526	327,503	-23	0.0%
		PM	258,558	258,549	-8	0.0%
		OP	72,110	72,127	18	0.0%
NHBO M	By time period OD	AM	131,250	131,254	4	0.0%
		IP	261,640	261,629	-11	0.0%
		PM	259,775	259,768	-7	0.0%
		OP	64,438	64,450	11	0.0%
NHBO H	By time period OD	AM	105,420	105,425	5	0.0%
		IP	178,457	178,449	-8	0.0%
		PM	200,519	200,519	0	0.0%
		OP	47,153	47,160	7	0.0%
LGV	By time period OD	AM	730,141	730,141	0	0.0%
		IP	630,596	630,596	0	0.0%
		PM	527,223	527,223	0	0.0%
		OP	254,232	254,232	0	0.0%
HGV	By time period OD	AM	129,666	129,666	0	0.0%
		IP	145,529	145,529	0	0.0%
		PM	83,900	83,900	0	0.0%
		OP	58,012	58,012	0	0.0%
Port trips EB	By time period OD	AM	4,704	4,704	0	0.0%
		IP	3,340	3,340	0	0.0%
		PM	4,153	4,153	0	0.0%
		OP	1,329	1,329	0	0.0%
Port trips O LI	By time period OD	AM	2,833	2,833	0	0.0%
		IP	3,475	3,475	0	0.0%
		PM	3,472	3,472	0	0.0%
		OP	1,145	1,145	0	0.0%

Segment	Matrix type	Time period	Actual base (2016)	VDM output Base Plus (2016)		
			Matrix total	Matrix total	Diff. to actual base	Diff. %
Port trips O MI	By time period OD	AM	3,307	3,307	0	0.0%
		IP	3,670	3,670	0	0.0%
		PM	4,074	4,074	0	0.0%
		OP	1,269	1,269	0	0.0%
Port trips O HI	By time period OD	AM	4,700	4,700	0	0.0%
		IP	3,908	3,908	0	0.0%
		PM	5,207	5,207	0	0.0%
		OP	1,516	1,516	0	0.0%

Note: numbers in red signify a negative value

Table 7.24 LTAM SATURN matrix total comparison – actual base vs VDM output matrix (Base Plus hourly PCUs)

Userclass	Time period	All movements				Relevant movements			
		Actual base (2016)	VDM output Base Plus (2016)			Actual base (2016)	VDM output Base Plus (2016)		
		Matrix total	Matrix total	Diff. to actual base	Diff. %	Matrix total	Matrix total	Diff. to actual base	Diff. %
Car employer's business	AM	446,238	446,279	41	0.01%	37,271	37,311	40	0.11%
	IP	388,822	388,810	-12	0.00%	25,479	25,470	-8	-0.03%
	PM	535,264	535,276	12	0.00%	36,927	36,944	17	0.05%
	OP	153,738	153,740	2	0.00%	10,675	10,679	4	0.04%
Car commute low income	AM	416,936	416,936	0	0.00%	30,329	30,332	3	0.01%
	IP	189,525	189,523	-2	0.00%	16,864	16,862	-1	-0.01%
	PM	476,873	476,885	12	0.00%	31,593	31,608	15	0.05%
	OP	76,399	76,401	2	0.00%	6,716	6,719	3	0.05%
Car commute medium income	AM	844,009	844,028	19	0.00%	65,517	65,538	22	0.03%
	IP	291,124	291,123	0	0.00%	25,613	25,614	2	0.01%
	PM	915,198	915,230	32	0.00%	63,059	63,093	35	0.05%
	OP	117,377	117,379	2	0.00%	10,250	10,252	2	0.02%
Car commute high income	AM	717,359	717,363	4	0.00%	62,485	62,490	6	0.01%
	IP	207,506	207,506	-1	0.00%	21,824	21,826	1	0.01%
	PM	740,837	740,889	53	0.01%	61,372	61,428	57	0.09%
	OP	83,604	83,605	1	0.00%	8,722	8,724	2	0.02%

Userclass	Time period	All movements				Relevant movements			
		Actual base (2016)	VDM output Base Plus (2016)			Actual base (2016)	VDM output Base Plus (2016)		
		Matrix total	Matrix total	Diff. to actual base	Diff. %	Matrix total	Matrix total	Diff. to actual base	Diff. %
Car other low income	AM	650,296	650,297	1	0.00%	66,061	66,071	10	0.02%
	IP	1,156,147	1,156,090	-57	0.00%	91,354	91,313	-42	-0.05%
	PM	1,127,337	1,127,326	-11	0.00%	96,514	96,523	8	0.01%
	OP	361,439	361,483	44	0.01%	30,011	30,066	54	0.18%
Car other medium income	AM	693,521	693,525	3	0.00%	73,111	73,128	17	0.02%
	IP	923,590	923,561	-29	0.00%	85,024	85,013	-11	-0.01%
	PM	1,135,035	1,135,027	-8	0.00%	107,692	107,707	15	0.01%
	OP	323,221	323,251	30	0.01%	30,381	30,418	36	0.12%
Car other high income	AM	554,821	554,825	4	0.00%	69,393	69,410	17	0.02%
	IP	620,234	620,214	-20	0.00%	69,436	69,429	-6	-0.01%
	PM	860,322	860,335	13	0.00%	96,585	96,623	39	0.04%
	OP	232,764	232,784	19	0.01%	26,405	26,430	25	0.09%
Car total	AM	4,323,181	4,323,252	71	0.00%	404,167	404,281	115	0.03%
	IP	3,776,948	3,776,827	-121	0.00%	335,594	335,528	-66	-0.02%
	PM	5,790,866	5,790,968	103	0.00%	493,741	493,926	186	0.04%
	OP	1,348,542	1,348,643	100	0.01%	123,161	123,288	127	0.10%
LGV	AM	730,141	730,141	0	0.00%	90,011	90,011	0	0.00%
	IP	630,596	630,596	0	0.00%	67,707	67,707	0	0.00%
	PM	527,223	527,223	0	0.00%	69,510	69,510	0	0.00%
	OP	254,232	254,232	0	0.00%	27,140	27,140	0	0.00%
HGV	AM	129,666	129,666	0	0.00%	53,127	53,127	0	0.00%
	IP	145,529	145,529	0	0.00%	58,256	58,256	0	0.00%
	PM	83,900	83,900	0	0.00%	33,278	33,278	0	0.00%
	OP	58,012	58,012	0	0.00%	22,965	22,965	0	0.00%

Note: numbers in red signify a negative value

Assignments – actual base vs VDM output (Base Plus)

7.3.9 Plate 7.1 to Plate 7.3 provide a flow difference comparison between the actual base assignment and the VDM output assignment for the Base Plus for each time period. The plots are zoomed in to show the differences between the actual base and the Base Plus. Blue colours show reductions in traffic in the Base Plus, green colours show increases in traffic.

Plate 7.1 Assigned flow differences – actual base vs Base Plus (AM peak all vehicles (PCUs))

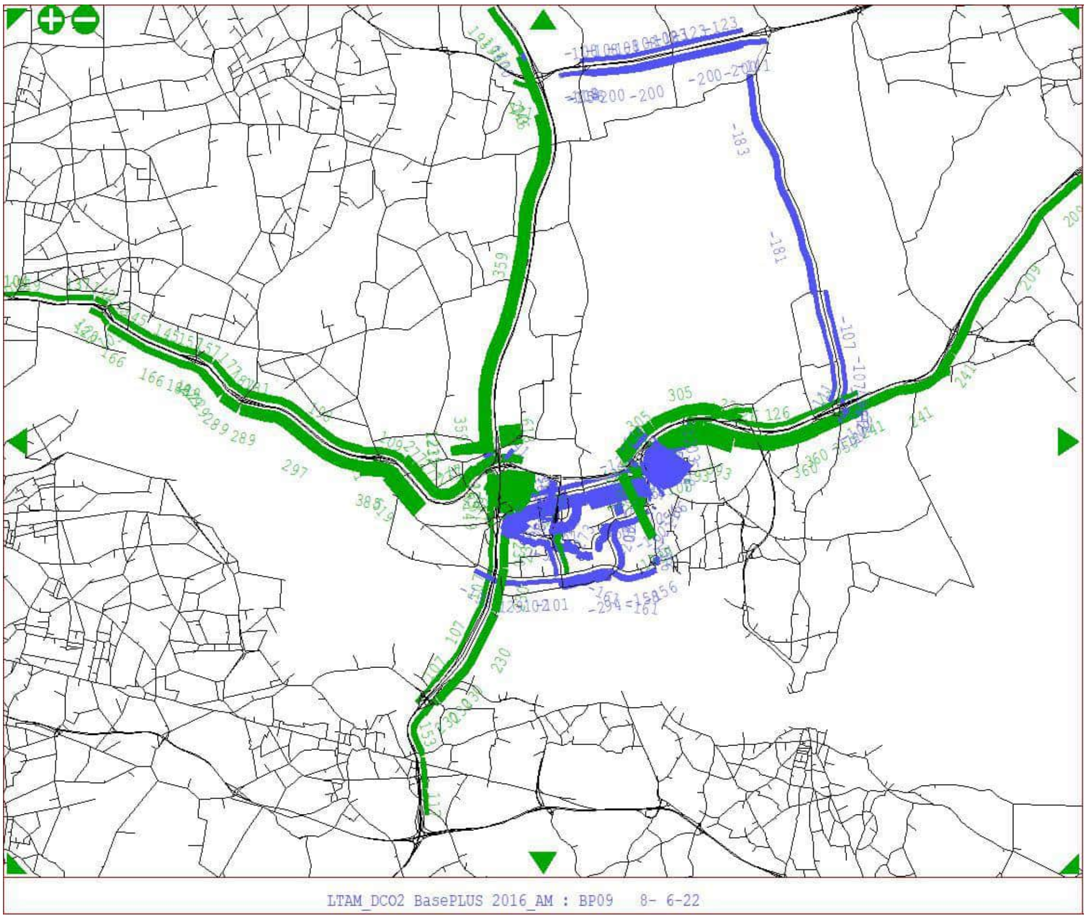


Plate 7.2 Assigned flow differences – actual base vs Base Plus (inter-peak all vehicles (PCUs))

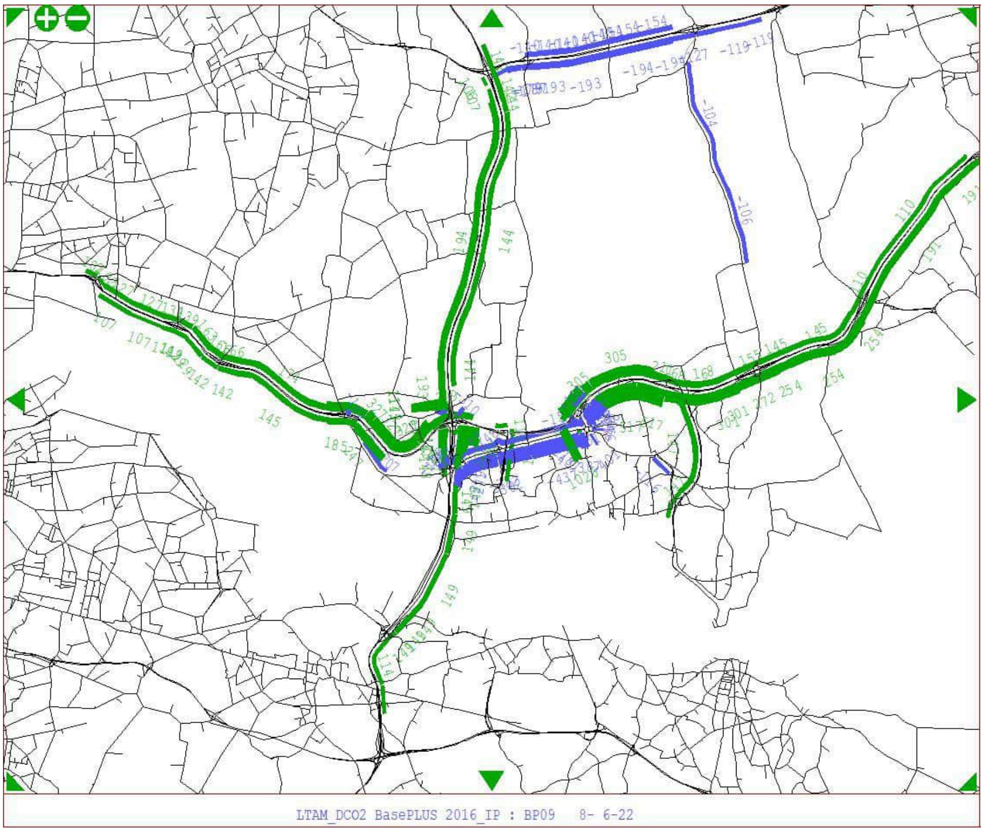
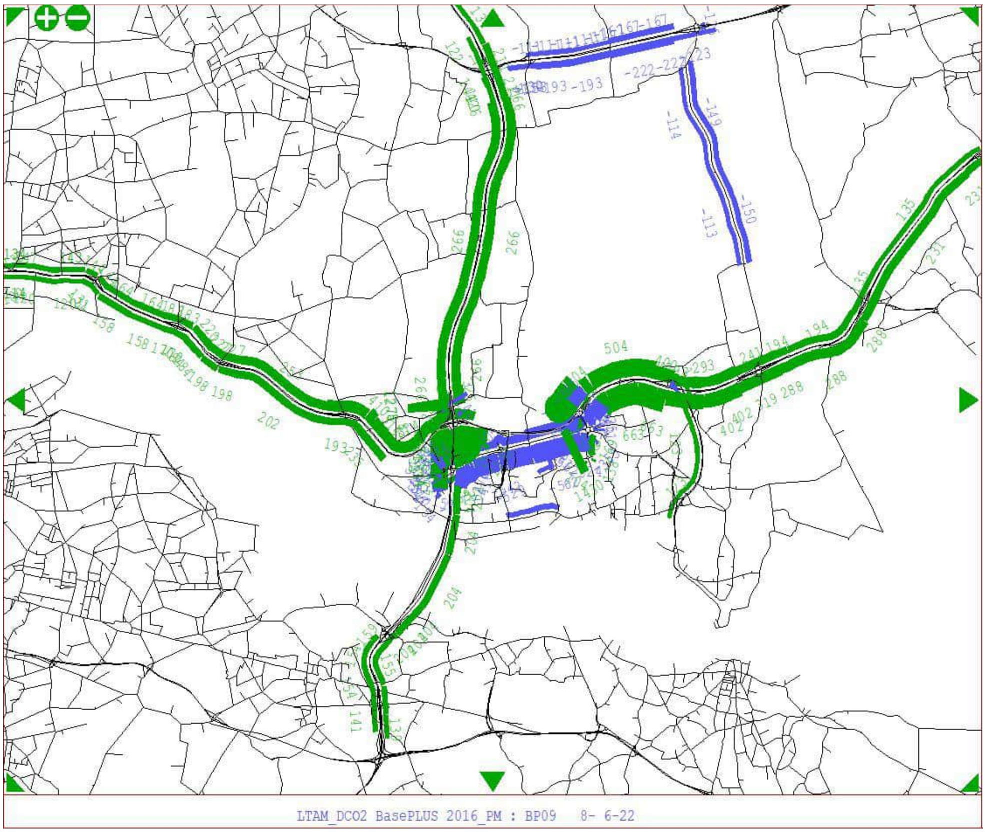


Plate 7.3 Assigned flow differences – actual base vs Base Plus (PM peak all vehicles (PCUs))



Key statistics – actual base vs Base Plus

7.3.10 Table 7.25 provides some key network statistics from the actual base and Base Plus.

Commentary on results

7.3.11 Table 7.19 demonstrates that the Base Plus VDM has converged to the required level within four iterations. There is a very small increase in the total number of variable demand trips reported by DIADEM. This is due to the action of the frequency response as a reaction to the small overall decrease in congestion across the model that is brought about by the removal of the roadworks and reduction in flow metering at the Dartford Crossing.

7.3.12 The Base Plus model is used to represent the conditions of the network after the roadworks at M25 junction 30 have been removed and the associated flow metering at the Dartford Crossing TMC has been reduced. Generally, the matrix totals in the peaks have increased very slightly as would be expected with the increases in capacity associated with the network improvements. This is especially the case when looking at the relevant movements.

7.3.13 The impact of the Base Plus is contained to flows around the existing crossing. Flows along the M25 and the A13 increase with similar reductions along the alternative routes.

7.3.14 As seen from Table 7.25, in the absence of the VDM, the impact of the removal of the roadworks would be a reduction in total time and a very small increase in distance travelled, when compared with the actual base. When the VDM is used, the level of journey time saving is reduced, taking total network time almost back to the totals seen in the actual base, and the increase in distance travelled increases. These increases lead to total network distances that are larger than in the actual base. This is due to the VDM allowing trips to redistribute to take account of the increases in capacity, thereby leading to slightly longer journeys.

Table 7.25 Key network statistics – reference matrix vs VDM output matrix (Base Plus 2016)

(Simulation area only)

Metric	Time period	Actual base (2016)				VDM output matrix (Base Plus 2016)			
		Actual base*	Base Plus**	Diff.	Diff. %	Actual base***	Base Plus****	Diff.	Diff. %
Time (PCU hours)	AM	218,677	217,723	-954	-0.44%	218,677	218,610	-67	-0.03%
	IP	157,429	156,924	-505	-0.32%	157,429	157,221	-208	-0.13%
	PM	215,612	214,779	-833	-0.39%	215,612	215,601	-12	-0.01%
	OP	56,729	56,621	-109	-0.19%	56,729	56,816	87	0.15%
Distance (PCU km)	AM	11,585,380	11,588,302	2,922	0.03%	11,585,380	11,613,250	27,870	0.24%
	IP	9,257,916	9,259,075	1,159	0.01%	9,257,916	9,274,653	16,737	0.18%
	PM	11,463,627	11,466,886	3,259	0.03%	11,463,627	11,496,926	33,299	0.29%
	OP	3,664,520	3,666,348	1,828	0.05%	3,664,520	3,683,626	19,107	0.52%
Average speed (km/hr)	AM	52.98	53.22	0.25	0.46%	52.98	53.12	0.14	0.27%
	IP	58.81	59.00	0.20	0.33%	58.81	58.99	0.18	0.31%
	PM	53.17	53.39	0.22	0.41%	53.17	53.33	0.16	0.30%
	OP	64.60	64.75	0.16	0.24%	64.60	64.83	0.24	0.37%

** These statistics are generated by assigning the actual base matrix to the actual base network.*

*** These statistics are generated by assigning the actual base matrix to the Base Plus network.*

**** The VDM is not run for the actual base. These values are the same as the reference matrix.*

***** These statistics are generated from the final VDM loop for the Base Plus.*

Note: numbers in red signify a negative value.

7.4 LTAM 2030 core DM and DS forecasts

7.4.1 Section 5.2 describes how the reference matrices have been developed. Section 6.1 describes how the Do Minimum networks have been developed. Section 6.2 describes how the Do Something networks have been developed. The analysis presented below describes the impact that the VDM has on the reference matrices and assigned networks, and provides some key network statistics.

VDM convergence statistics

7.4.2 Convergence statistics for the core 2030 forecasts are provided in Table 7.26 for the Do Minimum and in Table 7.27 for the Do Something.

Matrix totals – reference matrix vs VDM output matrix

7.4.3 As described in Section 5.3, it is necessary to report the matrix totals in two ways, firstly using the 17 demand segments used in DIADEM and secondly using the 10 user classes used in the highway assignment model. For presentation purposes HGV Port and HGV Non-Port trips were summed together providing total values for HGV movements.

7.4.4 Table 7.28 presents a comparison of the core 2030 reference matrices and VDM output matrices using the DIADEM 17 demand segment pattern. Table 7.29 presents a comparison between the core 2030 reference matrices and VDM output matrices using the SATURN 9 userclass pattern. In the case of the SATURN matrices, comparisons are shown at the level of all movements and for just relevant movements, as defined earlier in Section 7.3.

Table 7.26 Convergence and stability statistics (core 2030 DM)

Iteration	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	7.23%	12.80%	0	0	0	0%	0	0	0	0%	79,257,875
2	3.48%	5.59%	0.008	0.424	0.836	98.23%	0.086	0.017	2.152	42.84%	79,473,072
3	1.71%	2.68%	0.001	0.074	0.138	100.00%	0.035	0.008	1.074	77.31%	79,581,368
4	0.85%	1.31%	0.000	0.025	0.058	100.00%	0.017	0.004	0.537	95.60%	79,635,515
5	0.43%	0.67%	0.000	0.014	0.049	99.99%	0.008	0.002	0.268	98.97%	79,662,588
6	0.22%	0.34%	0.000	0.010	0.041	99.99%	0.004	0.001	0.134	99.70%	79,676,108
7	0.11%	0.20%	0.000	0.012	0.049	100.00%	0.002	0.001	0.071	99.92%	79,682,790
8	0.06%	0.12%	0.000	0.012	0.046	100.00%	0.001	0.000	0.034	99.98%	79,686,159
9	0.03%	0.08%	0.000	0.008	0.030	100.00%	0.001	0.000	0.023	100.00%	79,687,880

** The values in the Trips column only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Table 7.27 Convergence and stability statistics (core 2030 DS)

Iteration	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	7.25%	13.10%	0	0	0	0%	0	0	0	0%	79,257,875
2	3.50%	5.83%	0.004	0.215	0.434	99.76%	0.102	0.017	2.152	44.06%	79,474,375
3	1.72%	2.79%	0.001	0.062	0.121	99.98%	0.039	0.008	1.075	74.77%	79,582,858
4	0.85%	1.36%	0.000	0.021	0.049	100.00%	0.019	0.004	0.537	93.10%	79,637,081
5	0.43%	0.68%	0.000	0.011	0.031	100.00%	0.009	0.002	0.268	98.99%	79,664,170
6	0.22%	0.35%	0.000	0.009	0.037	100.00%	0.005	0.001	0.134	99.72%	79,677,678
7	0.11%	0.19%	0.000	0.007	0.029	100.00%	0.002	0.001	0.068	99.92%	79,684,409
8	0.06%	0.12%	0.000	0.007	0.031	100.00%	0.001	0.000	0.040	99.99%	79,687,843
9	0.03%	0.08%	0.000	0.007	0.026	100.00%	0.001	0.000	0.021	100.00%	79,689,513

** The values in the Trips column only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Table 7.28 LTAM DIADEM matrix total comparison – reference matrix vs VDM output matrices (core 2030 reference DM and DS highway trips in PCUs)

Segment	Matrix type	Time period	Reference matrix (core 2030)	VDM output matrix (core 2030 DM)			VDM output matrix (core 2030 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
HBEB	24hr PA	N/A	2,857,146	2,858,252	1,106	0.0%	2,858,298	1,152	0.0%
HBW L	24hr PA	N/A	2,487,651	2,487,508	-143	0.0%	2,487,533	-118	0.0%
HBW M	24hr PA	N/A	4,397,540	4,395,852	-1,688	0.0%	4,395,937	-1,603	0.0%
HBW H	24hr PA	N/A	3,441,642	3,436,210	-5,432	-0.2%	3,436,321	-5,321	-0.2%
HBO L	24hr PA	N/A	7,107,779	7,203,423	95,645	1.3%	7,203,636	95,857	1.3%
HBO M	24hr PA	N/A	6,378,205	6,424,270	46,065	0.7%	6,424,476	46,271	0.7%
HBO H	24hr PA	N/A	4,585,658	4,601,895	16,236	0.4%	4,602,104	16,445	0.4%
NHBEB	By time period OD	AM	96,941	96,935	-5	0.0%	96,990	49	0.1%
		IP	125,537	125,478	-59	0.0%	125,477	-59	0.0%
		PM	139,952	138,527	-1,426	-1.0%	138,537	-1,416	-1.0%
		OP	35,357	35,611	255	0.7%	35,602	245	0.7%
NHBO L	By time period OD	AM	140,883	142,928	2,046	1.5%	143,013	2,130	1.5%
		IP	373,905	378,726	4,821	1.3%	378,718	4,813	1.3%
		PM	295,323	297,050	1,726	0.6%	297,089	1,766	0.6%
		OP	82,331	84,009	1,678	2.0%	83,997	1,666	2.0%
NHBO M	By time period OD	AM	149,859	150,714	855	0.6%	150,793	934	0.6%
		IP	298,973	301,371	2,398	0.8%	301,394	2,421	0.8%
		PM	296,872	296,624	-248	-0.1%	296,637	-236	-0.1%
		OP	73,624	74,682	1,058	1.4%	74,663	1,039	1.4%

Segment	Matrix type	Time period	Reference matrix (core 2030)	VDM output matrix (core 2030 DM)			VDM output matrix (core 2030 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
NHBO H	By time period OD	AM	120,686	120,774	88	0.1%	120,824	137	0.1%
		IP	204,576	205,459	884	0.4%	205,468	892	0.4%
		PM	229,923	228,701	-1,222	-0.5%	228,776	-1,148	-0.5%
		OP	54,044	54,709	665	1.2%	54,689	645	1.2%
LGV	By time period OD	AM	878,459	878,459	0	0.0%	878,459	0	0.0%
		IP	758,707	758,707	0	0.0%	758,707	0	0.0%
		PM	634,122	634,122	0	0.0%	634,122	0	0.0%
		OP	305,868	305,868	0	0.0%	305,868	0	0.0%
HGV	By time period OD	AM	133,441	133,441	0	0.0%	133,441	0	0.0%
		IP	149,941	149,941	0	0.0%	149,941	0	0.0%
		PM	86,491	86,491	0	0.0%	86,491	0	0.0%
		OP	59,477	59,477	0	0.0%	59,477	0	0.0%
Port trips EB	By time period OD	AM	4,925	4,925	0	0.0%	4,925	0	0.0%
		IP	3,427	3,427	0	0.0%	3,427	0	0.0%
		PM	4,295	4,295	0	0.0%	4,295	0	0.0%
		OP	1,326	1,326	0	0.0%	1,326	0	0.0%
Port trips O LI	By time period OD	AM	2,858	2,858	0	0.0%	2,858	0	0.0%
		IP	3,516	3,516	0	0.0%	3,516	0	0.0%
		PM	3,494	3,494	0	0.0%	3,494	0	0.0%
		OP	1,141	1,141	0	0.0%	1,141	0	0.0%

Segment	Matrix type	Time period	Reference matrix (core 2030)	VDM output matrix (core 2030 DM)			VDM output matrix (core 2030 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Port trips O MI	By time period OD	AM	3,333	3,333	0	0.0%	3,333	0	0.0%
		IP	3,713	3,713	0	0.0%	3,713	0	0.0%
		PM	4,097	4,097	0	0.0%	4,097	0	0.0%
		OP	1,265	1,265	0	0.0%	1,265	0	0.0%
Port trips O HI	By time period OD	AM	4,727	4,727	0	0.0%	4,727	0	0.0%
		IP	3,950	3,950	0	0.0%	3,950	0	0.0%
		PM	5,233	5,233	0	0.0%	5,233	0	0.0%
		OP	1,513	1,513	0	0.0%	1,513	0	0.0%

Note: numbers in red signify a negative value

Table 7.29 LTAM SATURN matrix total comparison – reference matrix vs VDM output matrices (core 2030 reference DM and DS hourly PCUs)

Userclass	Time period	All movements							Relevant movements						
		Reference matrix (core 2030)	VDM output matrix (core 2030 DM)			VDM output matrix (core 2030 DS)			Reference matrix (core 2030)	VDM output matrix (core 2030 DM)			VDM output matrix (core 2030 DS)		
		Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %	Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Car employer's business	AM	497,581	497,999	418	0.08%	498,110	529	0.11%	41,822	41,826	5	0.01%	41,947	125	0.30%
	IP	433,689	433,663	-25	-0.01%	433,658	-30	-0.01%	28,965	28,888	-77	-0.27%	28,896	-70	-0.24%
	PM	597,758	595,169	-2,589	-0.43%	595,215	-2,544	-0.43%	42,366	41,775	-591	-1.40%	41,834	-533	-1.26%
	OP	170,973	171,473	500	0.29%	171,455	482	0.28%	11,555	11,917	362	3.13%	11,903	347	3.01%
Car commute low income	AM	460,314	458,419	-1,896	-0.41%	458,401	-1,914	-0.42%	34,079	34,265	186	0.54%	34,243	164	0.48%
	IP	209,646	210,219	573	0.27%	210,235	588	0.28%	19,200	19,361	160	0.84%	19,378	177	0.92%
	PM	526,690	525,761	-928	-0.18%	525,772	-918	-0.17%	35,686	35,850	165	0.46%	35,861	175	0.49%
	OP	83,913	84,214	301	0.36%	84,214	301	0.36%	7,122	7,250	129	1.80%	7,251	129	1.81%
Car commute medium income	AM	928,691	926,154	-2,537	-0.27%	926,243	-2,449	-0.26%	71,900	71,828	-72	-0.10%	71,919	19	0.03%
	IP	321,837	322,302	465	0.14%	322,298	461	0.14%	29,430	29,503	73	0.25%	29,501	71	0.24%
	PM	1,009,361	1,008,061	-1,300	-0.13%	1,008,100	-1,260	-0.12%	71,022	70,868	-153	-0.22%	70,911	-111	-0.16%
	OP	128,762	129,073	311	0.24%	129,063	301	0.23%	10,926	11,067	141	1.29%	11,057	131	1.20%
Car commute high income	AM	789,352	787,398	-1,954	-0.25%	787,353	-1,999	-0.25%	68,677	68,202	-476	-0.69%	68,165	-512	-0.75%
	IP	229,446	229,244	-202	-0.09%	229,250	-196	-0.09%	25,018	24,941	-77	-0.31%	24,951	-67	-0.27%
	PM	817,154	815,253	-1,901	-0.23%	815,411	-1,744	-0.21%	69,444	68,678	-766	-1.10%	68,844	-600	-0.86%
	OP	91,716	91,745	29	0.03%	91,740	24	0.03%	9,385	9,450	65	0.69%	9,444	59	0.63%
Car other low income	AM	757,062	767,946	10,884	1.44%	768,172	11,110	1.47%	80,030	80,697	668	0.83%	80,968	939	1.17%
	IP	1,343,157	1,360,071	16,914	1.26%	1,360,038	16,881	1.26%	111,322	112,905	1,583	1.42%	112,930	1,608	1.44%
	PM	1,313,838	1,326,205	12,367	0.94%	1,326,333	12,496	0.95%	119,464	119,013	-450	-0.38%	119,194	-269	-0.23%
	OP	419,796	426,906	7,109	1.69%	426,869	7,073	1.68%	35,633	37,213	1,580	4.43%	37,184	1,551	4.35%
Car other medium income	AM	808,188	813,229	5,040	0.62%	813,409	5,220	0.65%	88,523	88,079	-444	-0.50%	88,311	-212	-0.24%
	IP	1,074,461	1,082,271	7,810	0.73%	1,082,323	7,862	0.73%	103,495	104,022	527	0.51%	104,134	639	0.62%
	PM	1,324,190	1,327,841	3,652	0.28%	1,327,895	3,706	0.28%	133,048	131,270	-1,778	-1.34%	131,388	-1,660	-1.25%
	OP	375,715	379,858	4,143	1.10%	379,813	4,098	1.09%	35,998	37,170	1,172	3.25%	37,134	1,135	3.15%
Car other high income	AM	648,600	649,699	1,098	0.17%	649,819	1,219	0.19%	83,922	82,760	-1,162	-1.38%	82,951	-971	-1.16%
	IP	724,363	727,031	2,668	0.37%	727,033	2,671	0.37%	84,416	84,311	-106	-0.13%	84,370	-46	-0.05%
	PM	1,007,860	1,006,463	-1,397	-0.14%	1,006,700	-1,161	-0.12%	119,147	116,577	-2,570	-2.16%	116,894	-2,253	-1.89%
	OP	271,625	273,869	2,244	0.83%	273,820	2,195	0.81%	31,387	32,268	881	2.81%	32,229	842	2.68%
Car total	AM	4,889,790	4,900,843	11,053	0.23%	4,901,507	11,717	0.24%	468,953	467,657	-1,296	-0.28%	468,504	-448	-0.10%
	IP	4,336,600	4,364,801	28,201	0.65%	4,364,835	28,235	0.65%	401,846	403,929	2,083	0.52%	404,159	2,313	0.58%
	PM	6,596,850	6,604,754	7,904	0.12%	6,605,425	8,575	0.13%	590,176	584,032	-6,145	-1.04%	584,925	-5,251	-0.89%
	OP	1,542,499	1,557,137	14,638	0.95%	1,556,973	14,473	0.94%	142,006	146,335	4,329	3.05%	146,202	4,195	2.95%

Userclass	Time period	All movements							Relevant movements						
		Reference matrix (core 2030)	VDM output matrix (core 2030 DM)			VDM output matrix (core 2030 DS)			Reference matrix (core 2030)	VDM output matrix (core 2030 DM)			VDM output matrix (core 2030 DS)		
		Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %	Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
LGV	AM	878,459	878,459	0	0.00%	878,459	0	0.00%	109,297	109,297	0	0.00%	109,297	0	0.00%
	IP	758,707	758,707	0	0.00%	758,707	0	0.00%	82,700	82,700	0	0.00%	82,700	0	0.00%
	PM	634,122	634,122	0	0.00%	634,122	0	0.00%	84,406	84,406	0	0.00%	84,406	0	0.00%
	OP	305,868	305,868	0	0.00%	305,868	0	0.00%	32,824	32,824	0	0.00%	32,824	0	0.00%
HGV	AM	133,441	133,441	0	0.00%	133,441	0	0.00%	54,520	54,520	0	0.00%	54,520	0	0.00%
	IP	149,941	149,941	0	0.00%	149,941	0	0.00%	60,013	60,013	0	0.00%	60,013	0	0.00%
	PM	86,491	86,491	0	0.00%	86,491	0	0.00%	34,388	34,388	0	0.00%	34,388	0	0.00%
	OP	59,477	59,477	0	0.00%	59,477	0	0.00%	23,515	23,515	0	0.00%	23,515	0	0.00%

Note: numbers in red signify a negative value

Assignments – reference matrix vs VDM output matrix

7.4.5 Plate 7.4 to Plate 7.6 provide a flow difference comparison between the reference matrix assignment and the VDM output assignment for the DM scenario for each time period. Plate 7.7 to Plate 7.9 provide a flow difference comparison between the reference matrix assignment and the VDM output assignment for the DS scenario for each time period. Blue colours show reductions in traffic, green colours show increases in traffic.

Plate 7.4 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DM AM peak)

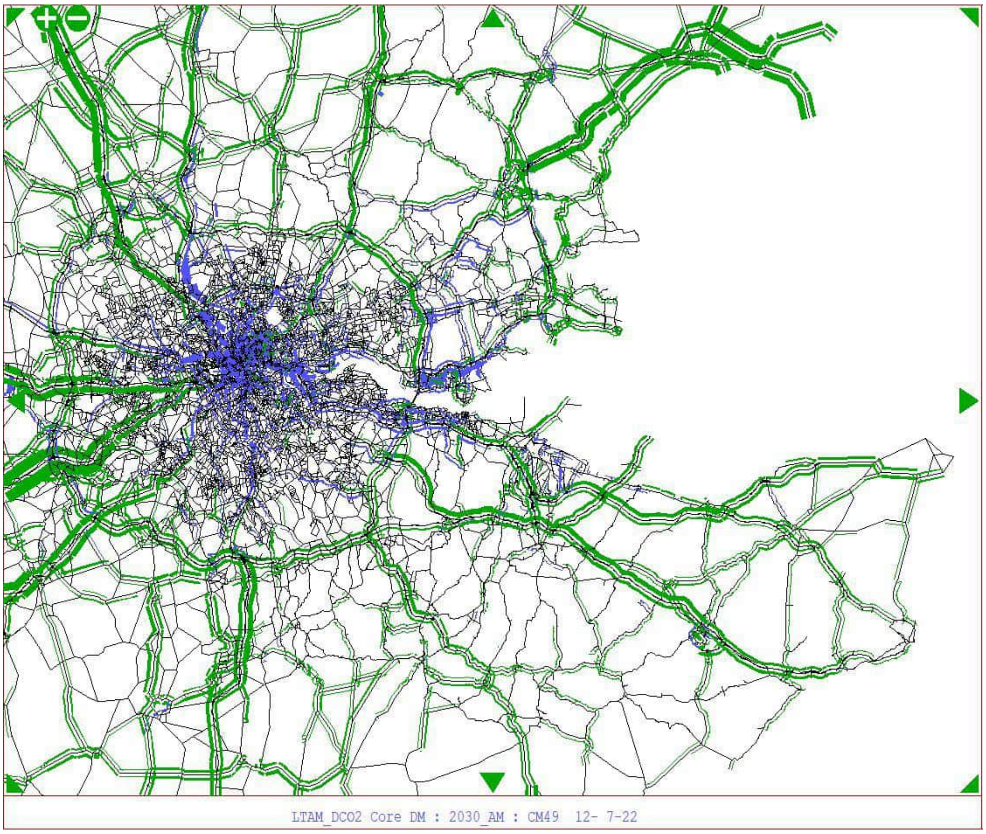


Plate 7.5 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DM inter-peak)

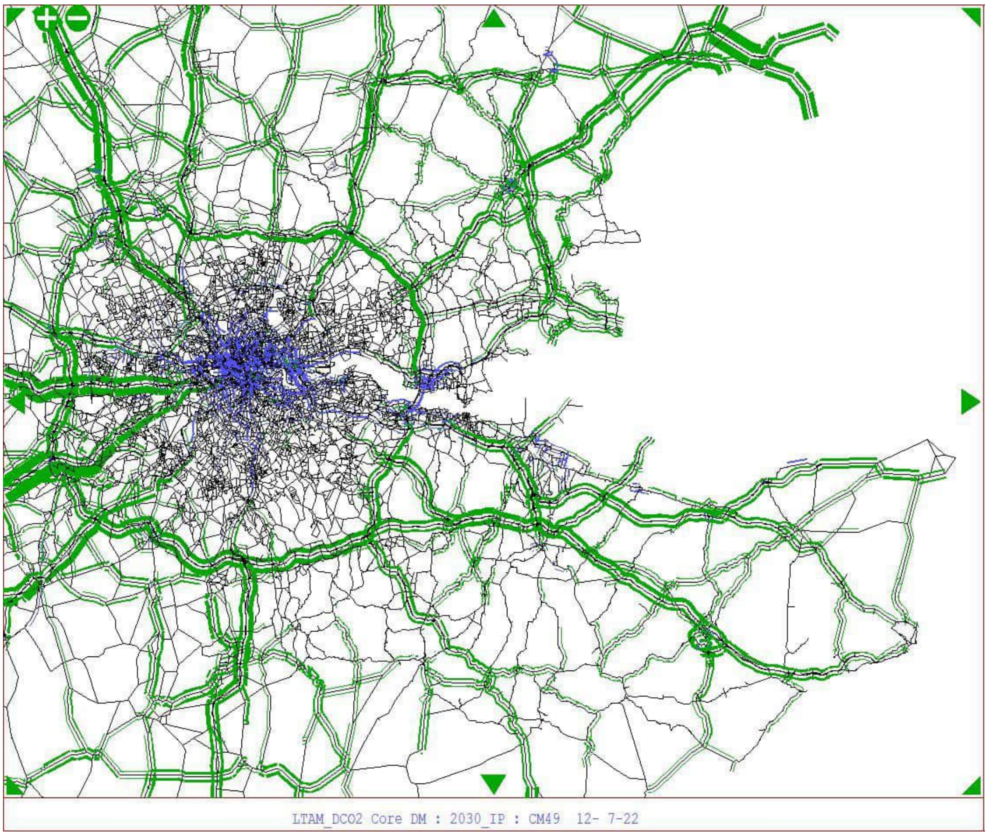


Plate 7.6 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DM PM peak)

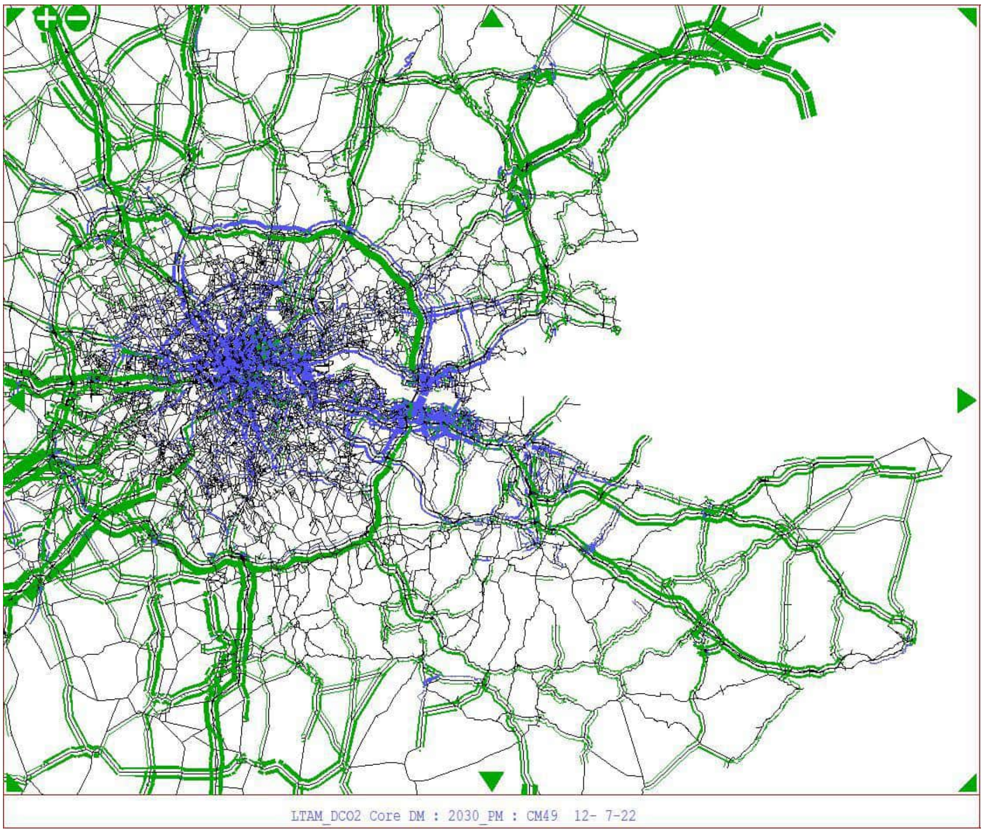


Plate 7.7 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DS AM peak)

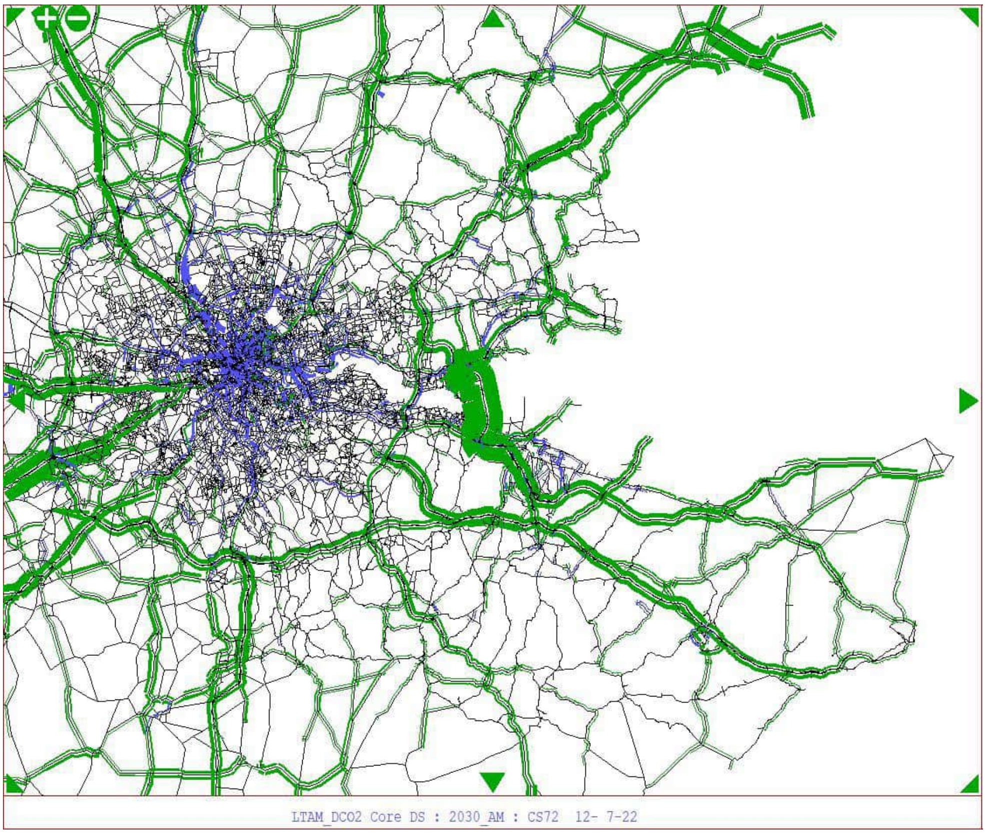
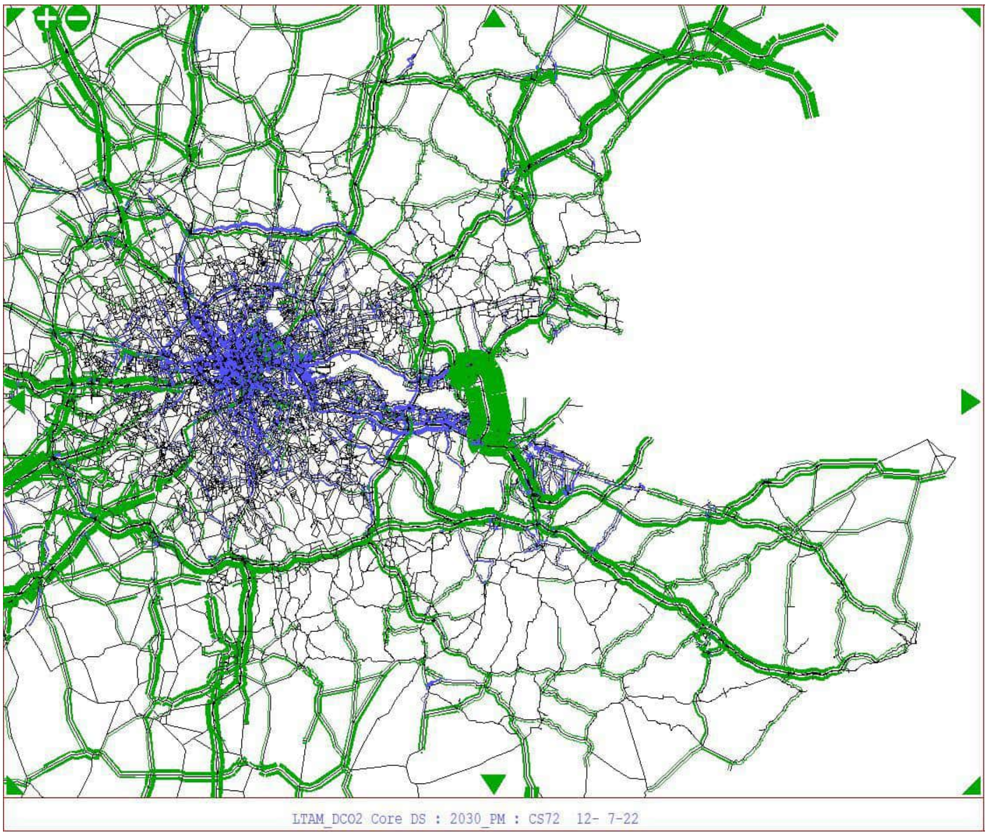


Plate 7.8 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DS inter-peak)

Plate 7.9 Assigned flow differences – reference matrix vs VDM output matrix (core 2030 reference vs 2030 DS PM peak)



Key statistics – reference matrix vs VDM output matrix

7.4.6 Table 7.30 provides some key network statistics from the reference matrix assignments and the VDM output matrix assignments.

Table 7.30 Key network statistics – reference matrix vs VDM output matrix (core 2030) (Simulation area only)

Metric	Time period	Reference matrix (core 2030)				VDM output matrix (core 2030)			
		DM*	DS**	Diff.	Diff. %	DM***	DS****	Diff.	Diff. %
Time (PCU hours)	AM	268,512	263,954	-4,558	-1.73%	265,795	265,874	79	0.03%
	IP	193,008	190,899	-2,109	-1.10%	195,849	195,633	-216	-0.11%
	PM	279,697	274,607	-5,090	-1.85%	271,540	271,965	426	0.16%
	OP	64,608	64,449	-159	-0.25%	68,390	68,410	19	0.03%
Distance (PCU km)	AM	13,364,218	13,327,033	-37,185	-0.28%	13,486,434	13,624,895	138,461	1.02%
	IP	10,852,288	10,831,109	-21,179	-0.20%	11,119,632	11,202,414	82,782	0.74%
	PM	13,531,053	13,498,262	-32,791	-0.24%	13,565,661	13,714,291	148,630	1.08%
	OP	4,222,445	4,212,864	-9,581	-0.23%	4,528,455	4,538,841	10,386	0.23%
Average speed (km/hr)	AM	49.77	50.49	0.72	1.42%	50.74	51.25	0.51	0.99%
	IP	56.23	56.74	0.51	0.90%	56.78	57.26	0.49	0.85%
	PM	48.38	49.15	0.78	1.58%	49.96	50.43	0.47	0.93%
	OP	65.35	65.37	0.01	0.02%	66.21	66.35	0.13	0.20%

** These statistics are generated by assigning the reference matrix to the DM network.*

*** These statistics are generated by assigning the reference matrix to the DS network.*

**** These statistics are generated from the final VDM loop for the DM.*

***** These statistics are generated from the final VDM loop for the DS.*

Note: numbers in red signify a negative value.

Commentary on results

7.4.7 Table 7.26 and Table 7.27 show that the VDM runs for the Do Minimum (DM) and Do Something (DS) scenarios converged to within the desired criteria, requiring nine demand/supply loops in each case.

7.4.8 At the level of the whole model, the total variable demand over all modes, purposes and time periods increases slightly during the iterations. The increases are small, being approximately 0.5% for each scenario – the DM variable demand increases by 430,005 while the DS variable demand increases by 431,638. This increase in trips is predominantly in the external area and is likely due to increases in values of time in forecast years which are reflected in the model as a real term's decrease in travel cost.

7.4.9 These totals are calculated over all variable trips; therefore, the changes are caused solely by LTAM's frequency response. This allows trips to be induced when overall costs decrease and deterred when overall costs increase. The increase over the loops in the DS scenario is very slightly greater than in the DM scenario; this is small enough to be caused by model noise but is as expected as the DS scenario provides more congestion relief than the DM, leading to lower travel costs overall.

7.4.10 Considering Table 7.28, which shows the highway trips produced by DIADEM at the level of all movements, the VDM is seen to generate a small increase in the numbers of home-based employer's business (HBEB) and small decreases in the numbers of home-based commuting (HBW) trips. By contrast, there are larger, but still relatively small, increases in home-based other (HBO) trips. The magnitudes of the changes in the DM and DS are similar, though in general the changes from the reference matrices in the DS are less negative or more positive than in the DM.

7.4.11 HBO trips have a larger elasticity than HBW and HBEB trips, so their response to changes in cost are likely to be larger than the random effects of model noise and hence the increases in HBO trips are likely to be a real effect.

7.4.12 The numbers of trips in the LGV, HGV and port trip demand segments are unchanged from the reference matrices in both the DM and the DS because their OD trips are fixed in the demand model and do not respond to cost changes other than through re-routing between fixed origins and destinations.

7.4.13 Considering Table 7.29, which shows the highway trips produced by the LTAM for SATURN assignment, it is seen that, at the level of all movements, the employer's business and commuting trips each show some small decreases and some small increases in both the DM and DS scenarios. The proportional changes caused by the VDM for these purposes are small. When the irrelevant movements are removed from the analysis, the majority of the purposes show increases.

7.4.14 Looked at over all car user classes, there are increases in highway trips forecast for relevant movements in all periods with the exception of the PM peak period. However, this decrease is proportionally so small as to be consistent with being caused by model noise.

7.4.15 The reference highway matrices are what are expected to apply in the future scenario if the utilities of different options (derived from generalised costs) are unchanged. However, it is expected that, even with the introduction of committed road schemes in the DM and the addition of the Project in the DS, congestion will increase in some parts of the road network relative to the base year situation as a result of increased travel demand.

7.4.16 Hence, reductions in the numbers of trips relative to the reference matrix for some assignment purposes in the DM and DS scenarios are not entirely unexpected. Table 7.29 shows that for relevant movements these occur for the high-income commuting purpose and in the peaks for the high-income other purpose. That the reductions in trips at the all-movement level are not, in the main, seen for the relevant movements implies that trip deterrence is occurring in those parts of the model further away from the fully modelled area. In these areas there are very large numbers of trips whose network costs are less accurately modelled than in the FMA.

7.4.17 Where there are reductions in the assigned trips, these are often seen to be less negative in the DS than in the DM scenario. This is due to the increased capacity of the network in the Do Something, in particular, the Lower Thames Crossing providing more capacity across the River Thames than in the DM scenario.

7.4.18 These changes in the matrices are supported by the flow difference analysis. As can be seen in the D M scenario, there is a general decrease in flow along the M25 on the approaches to the Dartford Crossing when compared to the reference matrix assignments. This is consistent across the time periods. In the DS scenario there is generally an increase in flow along this corridor as a result of redistribution which allows more trips to cross the River Thames in the Do Something due to the introduction of the Project.

7.4.19 The reference matrix assignments do not include this redistribution, which leads to lower flow over the Dartford Crossing (as the reference demand has the choice of using either the Dartford Crossing or the Project). Therefore, in the with-Scheme scenario there is spare capacity to cross the River Thames. The VDM will redistribute some trips that currently do not cross the River Thames into crossing the river in order to take advantage of this spare capacity. Much of this cross-river demand is suppressed in the reference case due to the lack of available capacity. There is a general reduction in flow throughout London which is due to the lack of spare capacity in the highway network to accommodate the levels of growth in travel demand.

7.4.20 The comparison of overall network statistics in Table 7.30 shows that in the reference case assignments there are large reductions in both journey time and distance travelled between the DM and DS scenarios. These reductions in time and distance are expected, since the Do Something introduces the Project, which allows existing destinations to be reached by some travellers more quickly via shorter routes than are available in the Do Minimum.

7.4.21 The post-VDM statistics show that both the DM and DS scenarios have increases in travel times relative to their respective reference matrix assignments except in the PM peak period. Due to the decreased total travel time in the reference DS assignment, this means that the increase in total travel time in the DS post-VDM case is larger than in the DM case. However, both scenarios converge to a situation in which total network time is approximately the same. By contrast, the final total network distance in the DS is noticeably larger than in the DM scenario, leading to the conclusion that the VDM has redistributed trips to take advantage of the travel time savings, resulting in longer distance journeys.

7.4.22 The average speeds over the entire network increase between the DM and DS scenarios in both the reference matrix assignment and post-VDM assignment. The speeds are higher in all periods in the post-VDM case for both scenarios than in the reference assignment case.

7.4.23 As expected, average speeds increase between the DM and DS due to the additional capacity and congestion relief introduced by the Project. Average speeds increase between the reference assignment and the post-VDM assignment as a result of trip redistribution, which allows trips to avoid existing congestion by changing their chosen destination. Average speeds in the OP period are almost unchanged relative to the reference matrix assignments.

7.5 LTAM 2037 core DM and DS forecasts

7.5.1 Section 5.2 describes how the reference matrices have been developed. Section 6.1 describes how the D M networks have been developed. Section 6.2 describes how the DS networks have been developed. The analysis presented below describes the impact that the VDM has on the reference matrices, assigned networks and some key network statistics.

VDM convergence statistics

7.5.2 Convergence statistics for the core 2037 forecasts are provided in Table 7.31 for the Do Minimum and in Table 7.32 for the Do Something.

Matrix totals – reference matrix vs VDM output matrix

7.5.3 As described in Section 5.3 it is necessary to report the matrix totals in two ways, firstly using the 17 demand segments used in DIADEM and secondly using the 10 user classes used in the highway assignment model. For presentation purposes HGV Port and HGV Non-Port trips were summed together providing total values for HGV movements.

7.5.4 Table 7.33 presents a comparison of the core 2037 reference matrices and VDM output matrices using the DIADEM 17 demand segment pattern. Table 7.34 presents a comparison between the core 2037 reference matrices and VDM output matrices using the SATURN 9 userclass pattern. In the case of the SATURN matrices, comparisons are shown at the level of all movements and for just relevant movements, as defined earlier in Section 7.3.

Table 7.31 Convergence and stability statistics (core 2037 DM)

Iteration	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	10.50%	16.14%	0	0	0	0%	0	0	0	0%	83,201,596
2	5.02%	6.94%	0.009	0.477	0.952	97.11%	0.109	0.027	3.642	34.62%	83,561,978
3	2.47%	3.30%	0.002	0.097	0.190	99.97%	0.045	0.013	1.819	66.14%	83,742,829
4	1.22%	1.61%	0.001	0.028	0.070	99.98%	0.021	0.006	0.909	92.15%	83,833,168
5	0.61%	0.81%	0.000	0.015	0.055	99.99%	0.011	0.003	0.454	98.75%	83,878,273
6	0.31%	0.41%	0.000	0.010	0.030	100.00%	0.005	0.002	0.227	99.70%	83,900,794
7	0.16%	0.23%	0.000	0.012	0.055	99.99%	0.003	0.001	0.115	99.92%	83,912,118
8	0.08%	0.14%	0.000	0.011	0.057	99.99%	0.001	0.000	0.059	99.97%	83,917,680
9	0.05%	0.10%	0.000	0.011	0.050	99.99%	0.001	0.000	0.029	99.99%	83,920,530

** The values in the Trips column numbers only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Table 7.32 Convergence and stability statistics (core 2037 DS)

Iteration	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	10.54%	16.57%	0	0	0	0%	0	0	0	0%	83,201,596
2	5.04%	7.18%	0.006	0.304	0.565	99.45%	0.134	0.027	3.643	34.20%	83,563,573
3	2.47%	3.40%	0.002	0.082	0.144	99.98%	0.049	0.013	1.819	63.80%	83,744,669
4	1.23%	1.65%	0.001	0.027	0.055	99.99%	0.023	0.006	0.909	89.74%	83,835,064
5	0.61%	0.83%	0.000	0.014	0.038	100.00%	0.011	0.003	0.454	98.75%	83,880,178
6	0.31%	0.42%	0.000	0.010	0.037	100.00%	0.006	0.002	0.229	99.72%	83,902,634
7	0.16%	0.24%	0.000	0.010	0.057	99.99%	0.003	0.001	0.119	99.92%	83,914,030
8	0.08%	0.15%	0.000	0.011	0.069	99.98%	0.002	0.000	0.059	99.97%	83,919,597
9	0.04%	0.10%	0.000	0.009	0.039	99.99%	0.001	0.000	0.033	99.96%	83,922,365

** The values in the Trips column numbers only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Table 7.33 LTAM DIADEM matrix total comparison – reference matrix vs VDM output matrices (core 2037 reference DM and DS highway trips in PCUs)

Segment	Matrix type	Time period	Reference matrix (core 2037)	VDM output matrix (core 2037 DM)			VDM output matrix (core 2037 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
HBEB	24hr PA	N/A	2,981,613	2,983,615	2,002	0.1%	2,983,663	2,050	0.1%
HBW L	24hr PA	N/A	2,582,934	2,584,605	1,671	0.1%	2,584,628	1,693	0.1%
HBW M	24hr PA	N/A	4,562,789	4,562,211	-578	0.0%	4,562,295	-494	0.0%
HBW H	24hr PA	N/A	3,569,700	3,563,319	-6,381	-0.2%	3,563,439	-6,261	-0.2%
HBO L	24hr PA	N/A	7,520,197	7,686,215	166,018	2.2%	7,686,467	166,271	2.2%
HBO M	24hr PA	N/A	6,751,940	6,829,149	77,209	1.1%	6,829,374	77,434	1.1%
HBO H	24hr PA	N/A	4,863,528	4,889,843	26,315	0.5%	4,890,060	26,532	0.5%
NHBEB	By time period OD	AM	100,756	100,668	-88	-0.1%	100,725	-30	0.0%
		IP	130,494	130,331	-163	-0.1%	130,338	-156	-0.1%
		PM	145,489	143,823	-1,666	-1.1%	143,832	-1,657	-1.1%
		OP	36,751	37,150	399	1.1%	37,137	385	1.0%
NHBO L	By time period OD	AM	147,881	151,281	3,400	2.3%	151,377	3,496	2.4%
		IP	392,492	400,576	8,084	2.1%	400,579	8,087	2.1%
		PM	310,040	314,138	4,098	1.3%	314,189	4,148	1.3%
		OP	86,403	89,204	2,801	3.2%	89,184	2,781	3.2%
NHBO M	By time period OD	AM	157,343	158,708	1,365	0.9%	158,793	1,450	0.9%
		IP	313,942	317,575	3,634	1.2%	317,616	3,674	1.2%
		PM	311,739	312,498	759	0.2%	312,518	778	0.2%
		OP	77,289	78,941	1,653	2.1%	78,912	1,623	2.1%

Segment	Matrix type	Time period	Reference matrix (core 2037)	VDM output matrix (core 2037 DM)			VDM output matrix (core 2037 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
NHBO H	By time period OD	AM	126,819	126,873	54	0.0%	126,929	111	0.1%
		IP	215,053	216,265	1,212	0.6%	216,283	1,230	0.6%
		PM	241,698	240,390	-1,308	-0.5%	240,474	-1,224	-0.5%
		OP	56,792	57,811	1,019	1.8%	57,782	991	1.7%
LGV	By time period OD	AM	963,813	963,813	0	0.0%	963,813	0	0.0%
		IP	832,304	832,304	0	0.0%	832,304	0	0.0%
		PM	695,606	695,606	0	0.0%	695,606	0	0.0%
		OP	335,540	335,540	0	0.0%	335,540	0	0.0%
HGV	By time period OD	AM	137,733	137,733	0	0.0%	137,733	0	0.0%
		IP	154,727	154,727	0	0.0%	154,727	0	0.0%
		PM	89,261	89,261	0	0.0%	89,261	0	0.0%
		OP	61,369	61,369	0	0.0%	61,369	0	0.0%
Port trips EB	By time period OD	AM	4,926	4,926	0	0.0%	4,926	0	0.0%
		IP	3,428	3,428	0	0.0%	3,428	0	0.0%
		PM	4,296	4,296	0	0.0%	4,296	0	0.0%
		OP	1,326	1,326	0	0.0%	1,326	0	0.0%
Port trips O LI	By time period OD	AM	2,859	2,859	0	0.0%	2,859	0	0.0%
		IP	3,517	3,517	0	0.0%	3,517	0	0.0%
		PM	3,495	3,495	0	0.0%	3,495	0	0.0%
		OP	1,141	1,141	0	0.0%	1,141	0	0.0%
Port trips O MI	By time period OD	AM	3,333	3,333	0	0.0%	3,333	0	0.0%
		IP	3,713	3,713	0	0.0%	3,713	0	0.0%

Segment	Matrix type	Time period	Reference matrix (core 2037)	VDM output matrix (core 2037 DM)			VDM output matrix (core 2037 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
		PM	4,098	4,098	0	0.0%	4,098	0	0.0%
		OP	1,265	1,265	0	0.0%	1,265	0	0.0%
Port trips O HI	By time period OD	AM	4,728	4,728	0	0.0%	4,728	0	0.0%
		IP	3,951	3,951	0	0.0%	3,951	0	0.0%
		PM	5,234	5,234	0	0.0%	5,234	0	0.0%
		OP	1,513	1,513	0	0.0%	1,513	0	0.0%

Note: numbers in red signify a negative value

Table 7.34 LTAM SATURN matrix total comparison – reference matrix vs VDM output matrices (core 2037 reference DM and DS hourly PCUs)

Userclass	Time period	All movements							Relevant movements						
		Reference matrix (core 2037)	VDM output matrix (core 2037 DM)			VDM output matrix (core 2037 DS)			Reference matrix (core 2037)	VDM output matrix (core 2037 DM)			VDM output matrix (core 2037 DS)		
		Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %	Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Car employer's business	AM	518,401	518,944	543	0.10%	519,059	658	0.13%	43,424	43,499	75	0.17%	43,623	199	0.46%
	IP	451,981	451,791	-190	-0.04%	451,798	-182	-0.04%	30,122	30,120	-2	-0.01%	30,135	12	0.04%
	PM	623,134	620,074	-3,060	-0.49%	620,125	-3,009	-0.48%	44,052	43,288	-764	-1.74%	43,351	-702	-1.59%
	OP	178,202	178,974	773	0.43%	178,950	749	0.42%	11,987	12,657	670	5.59%	12,642	654	5.46%
Car commute low income	AM	477,838	474,925	-2,912	-0.61%	474,901	-2,936	-0.61%	35,226	35,524	298	0.85%	35,495	269	0.76%
	IP	217,741	218,837	1,096	0.50%	218,856	1,115	0.51%	19,922	20,237	315	1.58%	20,256	334	1.67%
	PM	546,984	546,078	-906	-0.17%	546,091	-893	-0.16%	36,994	37,318	324	0.88%	37,332	338	0.91%
	OP	87,098	87,648	550	0.63%	87,648	550	0.63%	7,343	7,573	231	3.14%	7,574	231	3.15%
Car commute medium income	AM	963,326	959,657	-3,669	-0.38%	959,756	-3,570	-0.37%	74,196	74,077	-119	-0.16%	74,177	-19	-0.03%
	IP	334,114	334,962	848	0.25%	334,958	844	0.25%	30,569	30,750	181	0.59%	30,747	178	0.58%
	PM	1,047,473	1,046,182	-1,291	-0.12%	1,046,227	-1,246	-0.12%	73,448	73,218	-230	-0.31%	73,263	-184	-0.25%
	OP	133,552	134,083	531	0.40%	134,071	519	0.39%	11,254	11,505	251	2.23%	11,494	240	2.13%
Car commute high income	AM	818,531	815,996	-2,535	-0.31%	815,947	-2,584	-0.32%	71,149	70,404	-745	-1.05%	70,355	-794	-1.12%
	IP	238,097	237,870	-227	-0.10%	237,878	-220	-0.09%	26,068	25,982	-86	-0.33%	25,993	-76	-0.29%
	PM	847,680	845,376	-2,304	-0.27%	845,555	-2,125	-0.25%	72,157	70,973	-1,184	-1.64%	71,156	-1,001	-1.39%
	OP	95,107	95,191	84	0.09%	95,184	77	0.08%	9,733	9,857	124	1.27%	9,851	118	1.21%
Car other low income	AM	799,761	818,316	18,555	2.32%	818,579	18,818	2.35%	85,465	86,837	1,372	1.61%	87,143	1,679	1.96%
	IP	1,417,605	1,446,317	28,712	2.03%	1,446,305	28,700	2.02%	118,800	121,807	3,007	2.53%	121,847	3,047	2.56%
	PM	1,387,430	1,411,436	24,006	1.73%	1,411,607	24,177	1.74%	127,606	127,398	-208	-0.16%	127,625	20	0.02%
	OP	443,332	455,421	12,089	2.73%	455,356	12,024	2.71%	38,039	40,977	2,938	7.72%	40,940	2,900	7.62%
Car other medium income	AM	854,074	862,401	8,327	0.98%	862,599	8,525	1.00%	94,582	93,841	-742	-0.78%	94,077	-505	-0.53%
	IP	1,134,561	1,146,913	12,352	1.09%	1,147,007	12,446	1.10%	110,477	111,424	948	0.86%	111,562	1,085	0.98%
	PM	1,398,891	1,407,748	8,857	0.63%	1,407,831	8,940	0.64%	142,160	139,502	-2,658	-1.87%	139,646	-2,514	-1.77%
	OP	396,955	403,597	6,642	1.67%	403,522	6,567	1.65%	38,445	40,519	2,073	5.39%	40,477	2,031	5.28%
Car other high income	AM	686,200	687,723	1,523	0.22%	687,862	1,662	0.24%	89,932	87,905	-2,027	-2.25%	88,091	-1,841	-2.05%
	IP	765,994	769,893	3,900	0.51%	769,918	3,924	0.51%	90,387	90,153	-235	-0.26%	90,219	-169	-0.19%
	PM	1,066,394	1,065,645	-749	-0.07%	1,065,925	-470	-0.04%	127,756	123,726	-4,030	-3.15%	124,081	-3,675	-2.88%
	OP	287,438	290,956	3,518	1.22%	290,881	3,443	1.20%	33,662	35,168	1,505	4.47%	35,125	1,463	4.34%

Userclass	Time period	All movements							Relevant movements						
		Reference matrix (core 2037)	VDM output matrix (core 2037 DM)			VDM output matrix (core 2037 DS)			Reference matrix (core 2037)	VDM output matrix (core 2037 DM)			VDM output matrix (core 2037 DS)		
		Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %	Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Car total	AM	5,118,131	5,137,963	19,832	0.39%	5,138,703	20,572	0.40%	493,974	492,085	-1,889	-0.38%	492,962	-1,012	-0.20%
	IP	4,560,093	4,606,584	46,491	1.02%	4,606,719	46,627	1.02%	426,347	430,473	4,127	0.97%	430,759	4,413	1.03%
	PM	6,917,986	6,942,539	24,553	0.35%	6,943,360	25,374	0.37%	624,173	615,423	-8,750	-1.40%	616,454	-7,718	-1.24%
	OP	1,621,683	1,645,869	24,186	1.49%	1,645,612	23,929	1.48%	150,465	158,257	7,792	5.18%	158,102	7,637	5.08%
LGV	AM	963,813	963,813	0	0.00%	963,813	0	0.00%	120,000	120,000	0	0.00%	120,000	0	0.00%
	IP	832,304	832,304	0	0.00%	832,304	0	0.00%	90,661	90,661	0	0.00%	90,661	0	0.00%
	PM	695,606	695,606	0	0.00%	695,606	0	0.00%	92,494	92,494	0	0.00%	92,494	0	0.00%
	OP	335,540	335,540	0	0.00%	335,540	0	0.00%	35,980	35,980	0	0.00%	35,980	0	0.00%
HGV	AM	137,734	137,734	0	0.00%	137,734	0	0.00%	56,336	56,336	0	0.00%	56,336	0	0.00%
	IP	154,727	154,727	0	0.00%	154,727	0	0.00%	61,968	61,968	0	0.00%	61,968	0	0.00%
	PM	89,261	89,261	0	0.00%	89,261	0	0.00%	35,549	35,549	0	0.00%	35,549	0	0.00%
	OP	61,369	61,369	0	0.00%	61,369	0	0.00%	24,289	24,289	0	0.00%	24,289	0	0.00%

Note: numbers in red signify a negative value

Assignments – reference matrix vs VDM output matrix

7.5.5 Plate 7.10 to Plate 7.12 provide a flow difference comparison between the reference matrix assignment and the VDM output assignment for the DM scenario for each time period. Plate 7.13 to Plate 7.15 provide a flow difference comparison between the reference matrix assignment and the VDM output assignment for the DS scenario for each time period. Blue colours show reductions in traffic, green colours show increases in traffic.

Plate 7.10 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DM AM peak)

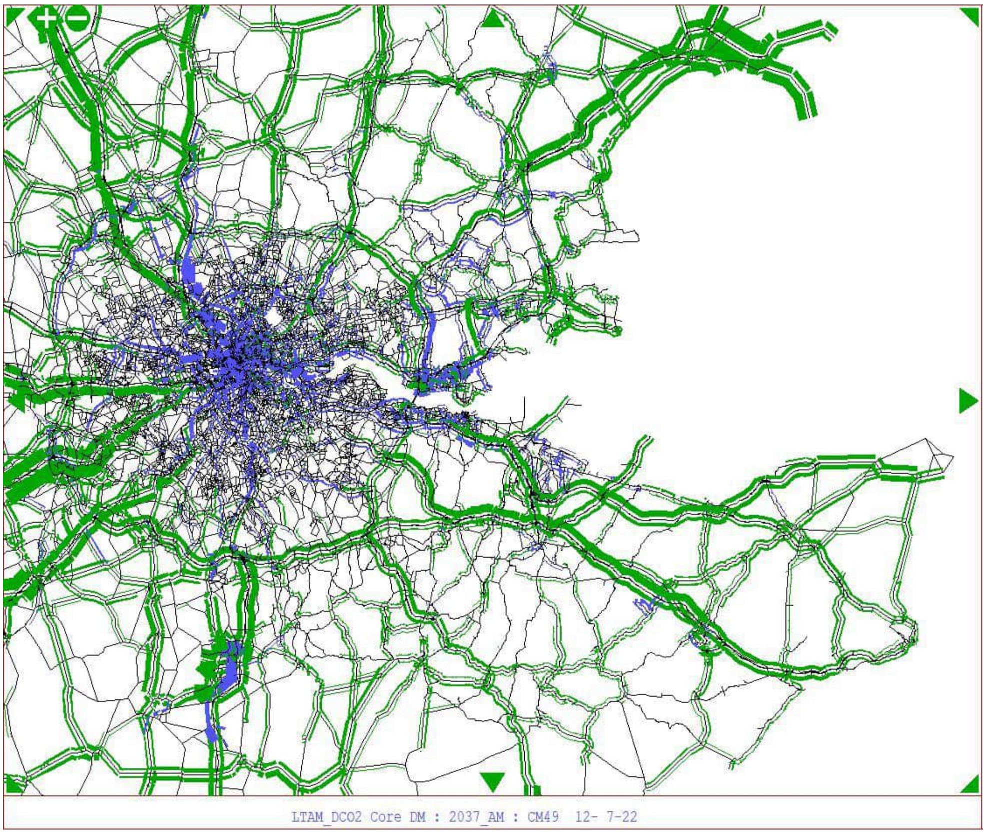


Plate 7.11 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DM inter-peak)

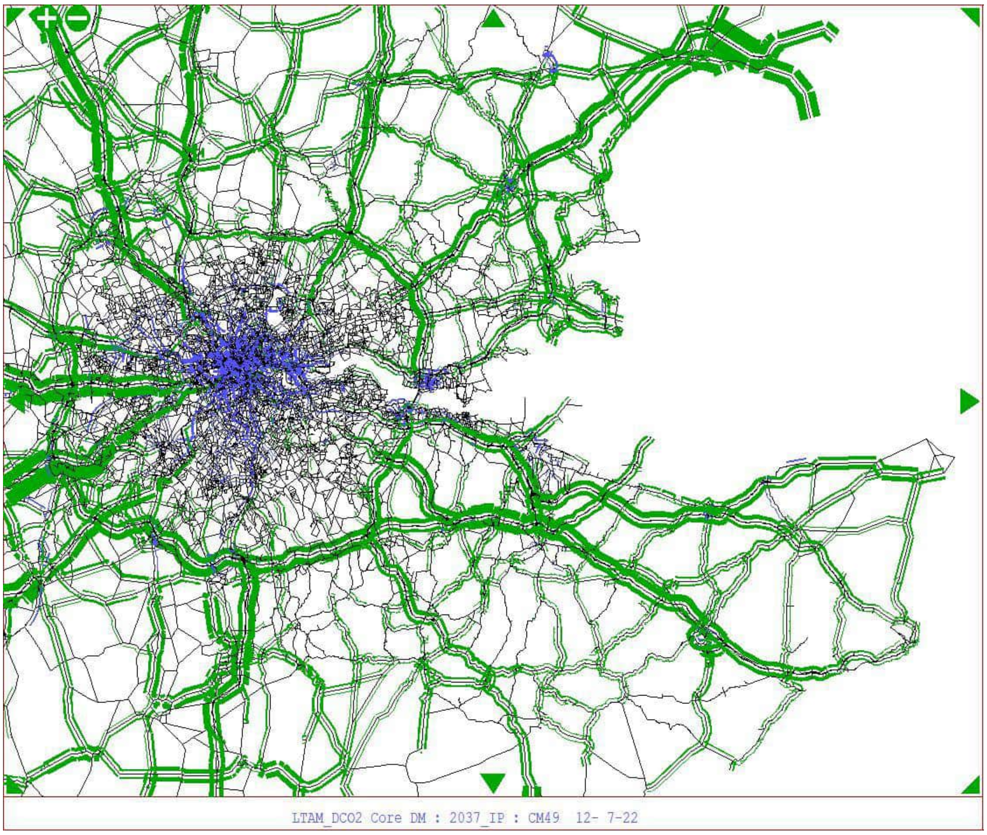


Plate 7.12 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DM PM peak)

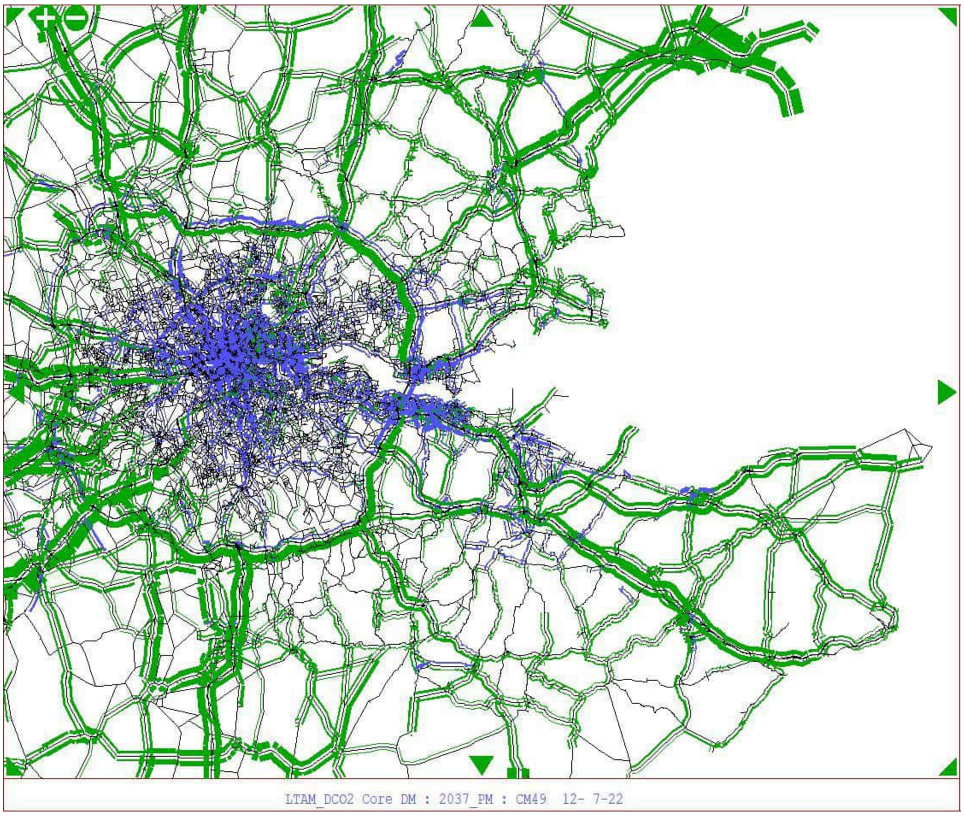


Plate 7.13 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DS AM peak)

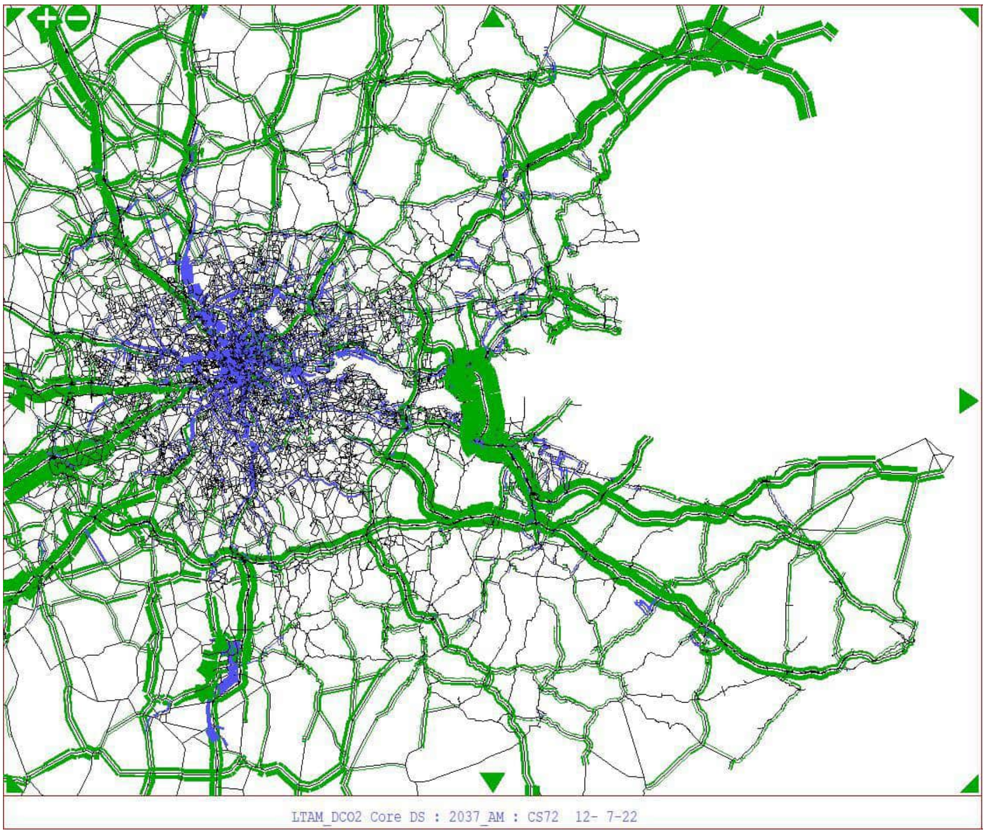


Plate 7.14 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DS inter-peak)

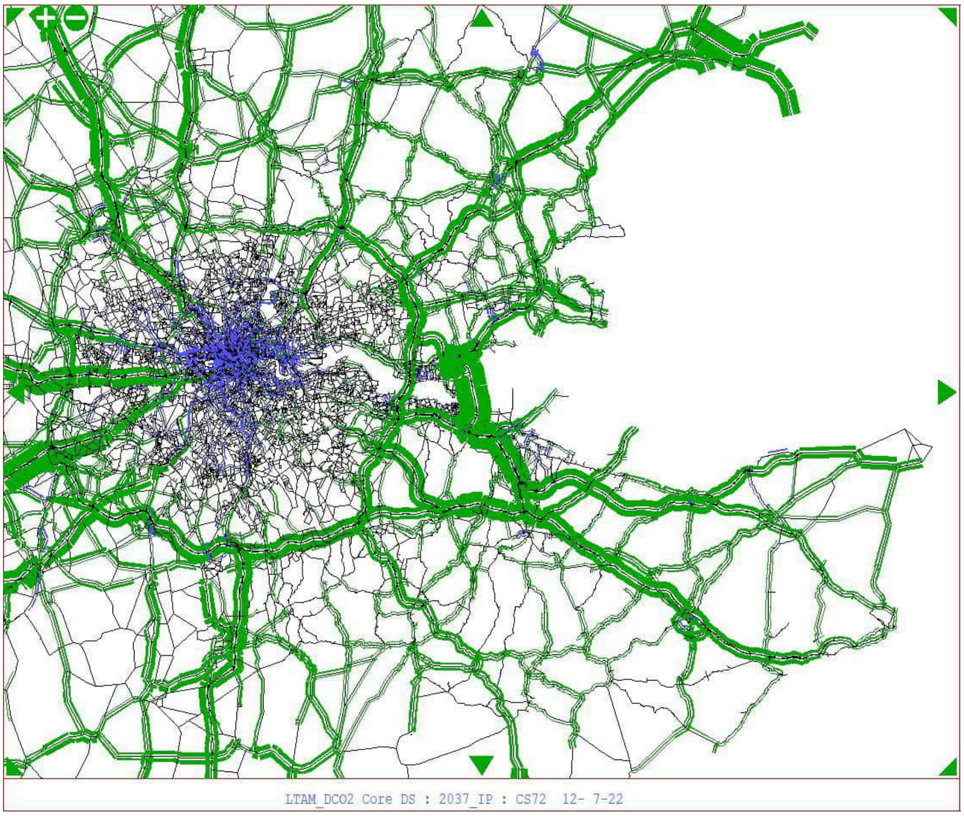
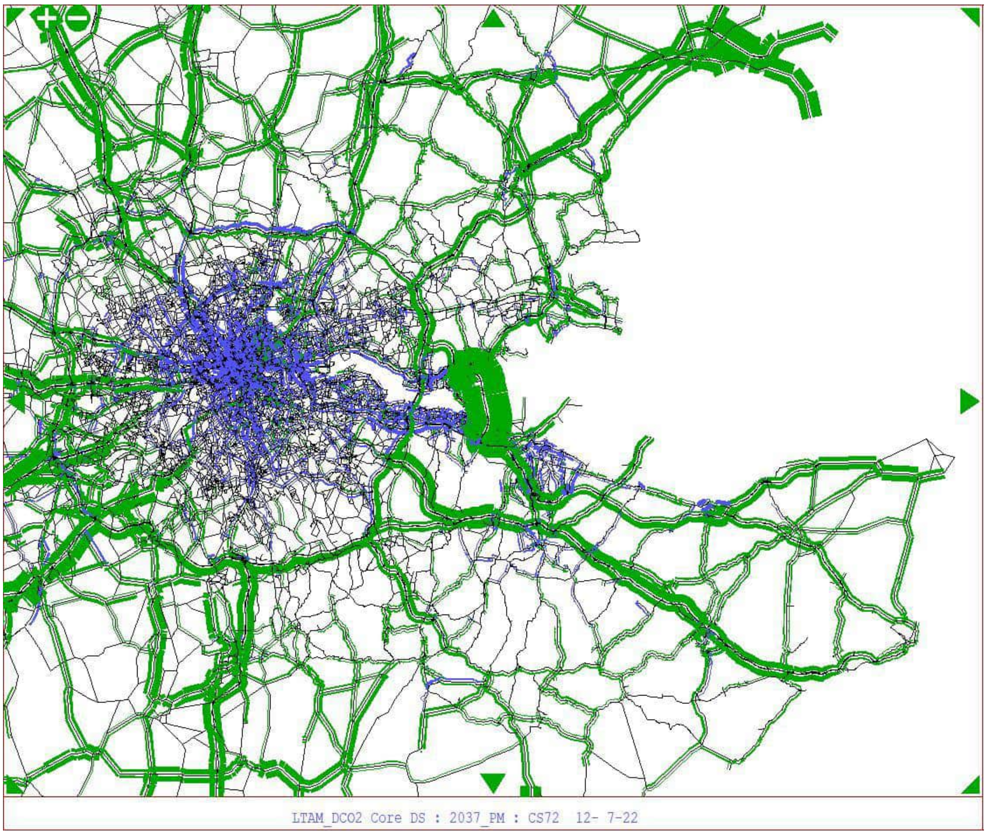


Plate 7.15 Assigned flow differences – reference matrix vs VDM output matrix (core 2037 reference vs 2037 DS PM peak)



Key statistics – reference matrix vs VDM output matrix

7.5.6 Table 7.35 provides some key network statistics from the reference matrix assignments and the VDM output matrix assignments.

Table 7.35 Key network statistics – reference matrix vs VDM output matrix (core 2037) (Simulation area only)

Metric	Time period	Reference matrix (core 2037)				VDM output matrix (core 2037)			
		DM*	DS**	Diff.	Diff. %	DM***	DS****	Diff.	Diff. %
Time (PCU hours)	AM	294,811	289,359	-5,452	-1.88%	291,738	291,860	121	0.04%
	IP	210,391	207,887	-2,504	-1.20%	216,365	216,037	-328	-0.15%
	PM	310,262	304,099	-6,163	-2.03%	299,650	300,230	580	0.19%
	OP	69,110	68,946	-165	-0.24%	76,044	76,089	45	0.06%
Distance (PCU km)	AM	14,120,236	14,072,756	-47,480	-0.34%	14,316,905	14,469,968	153,063	1.06%
	IP	11,516,979	11,491,373	-25,606	-0.22%	11,955,974	12,048,783	92,809	0.77%
	PM	14,304,179	14,266,922	-37,257	-0.26%	14,398,261	14,564,773	166,512	1.14%
	OP	4,530,566	4,520,292	-10,275	-0.23%	5,076,211	5,088,337	12,126	0.24%
Average speed (km/hr)	AM	47.90	48.63	0.74	1.52%	49.07	49.58	0.50	1.02%
	IP	54.74	55.28	0.54	0.97%	55.26	55.77	0.51	0.92%
	PM	46.10	46.92	0.81	1.73%	48.05	48.51	0.46	0.95%
	OP	65.56	65.56	0.01	0.01%	66.75	66.87	0.12	0.18%

** These statistics are generated by assigning the reference matrix to the DM network.*

*** These statistics are generated by assigning the reference matrix to the DS network.*

**** These statistics are generated from the final VDM loop for the DM.*

***** These statistics are generated from the final VDM loop for the DS.*

Note: numbers in red signify a negative value.

Commentary on results

7.5.7 Table 7.31 and Table 7.32 show that the VDM runs for the Do Minimum and Do Something scenarios converged to within the desired criteria, requiring nine demand/supply loops in each case.

7.5.8 At the level of the whole model, the total variable demand over all modes, purposes and time periods increases slightly during the iterations. The increases are small, being approximately 0.9% for each scenario – the DM variable demand increases by 718,934 while the DS variable demand increases by 720,769. This increase in trips is predominantly in the external area and is likely due to increases in values of time in forecast years which are reflected in the model as a real term's decrease in travel cost.

7.5.9 These totals are calculated over all variable trips; therefore, the changes are caused solely by the LTAM's frequency response. This allows trips to be induced when overall costs decrease and deterred when overall costs increase. The increase over the loops in the DS scenario is very slightly greater than in the DM scenario; this is small enough to be caused by model noise but is as expected as the DS scenario provides more congestion relief than the DM, leading to lower travel costs overall.

7.5.10 Considering Table 7.33, which shows the highway trips produced by DIADEM at the level of all movements, the VDM is seen to generate a small increase in the numbers of home-based employer's business (HBEB) and small decreases in the numbers of home-based commuting (HBW) trips for the medium and high income segments. By contrast, there are larger increases in home-based other (HBO) trips in the range 0.5–2.2%. The impact is proportionally greater for those trips in the low-income segment. The magnitudes of the changes in the DM and DS are similar, though in general the changes from the reference matrices in the DS are less negative or more positive than in the DM.

7.5.11 The changes brought about by the VDM to HBEB and HBW matrices are small enough that they may be attributable to model noise. HBO trips have a larger elasticity than HBW and HBEB trips, so their response to changes in cost are likely to be larger than the random effects of model noise and hence the increases seen in the numbers of HBO trips are likely to be a real effect.

7.5.12 The numbers of trips in the LGV, HGV and port trip demand segments are unchanged from the reference matrices in both the DM and the DS because their OD trips are fixed in the demand model and do not respond to cost changes other than through re-routing between fixed origins and destinations.

7.5.13 Considering Table 7.34, which shows the highway trips produced by the LTAM for SATURN assignment, it is seen that, at the level of all movements, the employer's business and commuting trips each show some small decreases and some small increases for different time periods in both the DM and DS scenarios. In general, the highway trips decrease in the peaks for these purposes but have small increases for the inter-peak and off peak periods. In most cases, the proportional changes caused by the VDM for these purposes are small. When the irrelevant movements are removed from the analysis, the majority of the purposes show increases in the numbers of assigned trips. Where decreases still occur, these are in the peak periods, in which congestion is the greatest.

7.5.14 The reference highway matrices are what are expected to apply in the future scenario if the utilities of different options (derived from generalised costs) are unchanged. However, it is expected that, even with the introduction of committed road schemes in the DM and the addition of the Project in the DS, congestion will increase in some parts of the road network relative to the base year situation as a result of increased travel demand.

7.5.15 Looked at over all car user classes, there are increases in highway trips forecast for relevant movements in all periods, however the AM and PM peaks primarily see small decreases outside of Car EB and the low income user classes. Overall, the decreases seen are proportionally so small as to be consistent with being caused by model noise.

7.5.16 Hence, reductions in the numbers of trips relative to the reference matrix for some assignment purposes in the DM and DS scenarios are not entirely unexpected. Table 7.34 shows that for relevant movements these predominantly occur for the high-income commuting purpose and in the peaks for the high-income other purpose. That the reductions in trips at the all-movement level are not, in the main, seen for the relevant movements implies that trip deterrence is occurring in those parts of the model further away from the FMA. In these areas there are very large numbers of trips whose network costs are less accurately modelled than in the FMA, meaning that model noise may be overwhelming any actual small changes in travel behaviour on these parts of the network and the apparent decreases could be spurious.

7.5.17 Where there are reductions in the assigned trips, these are often seen to be less negative in the DS than in the DM scenario. This is due to the increased capacity of the network in the DS scenario, in particular, the Project provides more capacity across the River Thames than in the DM scenario.

7.5.18 These changes in the matrices are supported by the flow difference analysis. As can be seen in the Do Minimum scenario, there is a general decrease in flow along the M25 on the approach to the Dartford Crossing when compared to the reference matrix assignments. This is consistent across the time periods. In the Do Something scenario there is generally an increase in flow along this corridor as a result of redistribution which allows more trips to cross the River Thames in the Do Something due to the introduction of the Project.

7.5.19 The reference matrix assignments do not include this redistribution, which leads to lower flow over the Dartford Crossing (as the reference demand has the choice of using either Dartford Crossing or the Project). Therefore, in the with-Scheme scenario there is spare capacity to cross the River Thames. The VDM will redistribute some trips that currently do not cross the river into crossing the River Thames in order to take advantage of this spare capacity. Much of this cross-river demand is suppressed in the reference case due to the lack of available capacity. There is a general reduction in flow throughout London which is due to the lack of spare capacity in the highway network to accommodate the levels of growth in travel demand.

7.5.20 The comparison of overall network statistics in Table 7.35 shows that in the reference case assignments there are reductions in both journey time and distance travelled between the Do Minimum and Do Something scenarios. The reductions in time and distance are expected, since the Do Something introduces the Project, which allows existing destinations to be reached by some travellers more quickly via shorter routes than are available in the Do Minimum.

7.5.21 The post-VDM statistics show that both the DM and DS scenarios have increases in travel times in the IP and OP time periods, relative to their respective reference matrix assignments. While the AM and PM travel time decreases due to the decreased total travel time in the reference DS assignment, this means that the increase in total travel time in the DS post-VDM case is larger than in the DM case. However, both scenarios converge to a situation in which total network time is approximately the same.

7.5.22 By contrast, the final total network distance in the DS is noticeably larger than in the DM scenario, leading to the conclusion that the VDM has redistributed trips to take advantage of the travel time savings, resulting in longer distance journeys.

7.5.23 The average speeds over the entire network increase between the DM and DS scenarios in both the reference matrix assignment and post-VDM assignment. The speeds are higher in all periods in the post-VDM case for both scenarios than in the reference assignment case.

7.5.24 As expected, average speeds increase between the DM and DS due to the additional capacity and congestion relief introduced by the Project. Average speeds increase between the reference assignment and the post-VDM assignment as a result of trip redistribution, which allows trips to avoid existing congestion by changing their chosen destination. Average speeds in the OP period are almost unchanged relative to the reference matrix assignments.

7.6 LTAM 2045 core DM and DS forecasts

7.6.1 Section 5.2 describes how the reference matrices have been developed. Section 6.1 describes how the Do Minimum networks have been developed. Section 6.2 describes how the Do Something networks have been developed. The analysis presented below describes the impact that the VDM has on the reference matrices, assigned networks and some key network statistics.

VDM convergence statistics

7.6.2 Convergence statistics for the core 2045 forecasts are provided in Table 7.36 for the Do Minimum and in Table 7.37 for the Do Something.

Matrix totals – reference matrix vs VDM output matrix

7.6.3 As described in Section 5.3 it is necessary to report the matrix totals in two ways, firstly using the 17 demand segments used in DIADEM and secondly using the 10 user classes used in the highway assignment model. For presentation purposes HGV Port and HGV Non-Port trips were summed together providing total values for HGV movements.

7.6.4 Table 7.38 presents a comparison of the core 2045 reference matrices and VDM output matrices using the DIADEM 17 demand segment pattern. Table 7.39 presents a comparison between the core 2045 reference matrices and VDM output matrices using the SATURN 9 userclass pattern. In the case of the SATURN matrices, comparisons are shown at the level of all movements and for just relevant movements, as defined earlier in Section 7.3.

Table 7.36 Convergence and stability statistics (core 2045 DM)

Iteration	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	12.51%	18.76%	0	0	0	0%	0	0	0	0%	87,804,712
2	5.95%	7.91%	0.011	0.581	1.131	95.52%	0.128	0.034	4.850	30.13%	88,269,790
3	2.92%	3.75%	0.002	0.113	0.207	99.98%	0.052	0.017	2.422	59.29%	88,503,523
4	1.45%	1.84%	0.001	0.053	0.126	99.99%	0.025	0.008	1.211	88.06%	88,620,342
5	0.72%	0.93%	0.001	0.033	0.087	99.99%	0.013	0.004	0.605	98.30%	88,678,663
6	0.37%	0.51%	0.001	0.045	0.135	100.00%	0.007	0.002	0.305	99.64%	88,707,717
7	0.18%	0.27%	0.000	0.020	0.062	99.99%	0.004	0.001	0.151	99.91%	88,722,253
8	0.10%	0.16%	0.000	0.012	0.059	99.98%	0.002	0.001	0.076	99.98%	88,729,553
9	0.05%	0.11%	0.000	0.014	0.052	99.99%	0.001	0.000	0.047	99.98%	88,733,129
10	0.03%	0.09%	0.000	0.014	0.042	100.00%	0.001	0.000	0.020	99.99%	88,734,936

** The values in the Trips column numbers only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Table 7.37 Convergence and stability statistics (core 2045 DS)

Iteration	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	12.55%	19.25%	0	0	0	0%	0	0	0	0%	87,804,712
2	5.97%	8.15%	0.008	0.402	0.747	98.65%	0.159	0.034	4.850	29.50%	88,271,552
3	2.93%	3.85%	0.002	0.100	0.175	99.97%	0.057	0.017	2.422	57.28%	88,505,458
4	1.45%	1.86%	0.001	0.032	0.066	99.99%	0.026	0.008	1.210	86.07%	88,622,307
5	0.72%	0.92%	0.000	0.015	0.040	100.00%	0.013	0.004	0.606	98.35%	88,680,635
6	0.36%	0.48%	0.000	0.013	0.053	99.99%	0.006	0.002	0.303	99.66%	88,709,832
7	0.18%	0.26%	0.000	0.012	0.052	99.99%	0.003	0.001	0.155	99.89%	88,724,284
8	0.10%	0.17%	0.000	0.013	0.051	99.99%	0.002	0.001	0.076	99.99%	88,731,551
9	0.06%	0.13%	0.000	0.012	0.067	99.98%	0.001	0.000	0.048	99.98%	88,735,271
10	0.03%	0.11%	0.000	0.017	0.073	99.98%	0.001	0.000	0.040	99.97%	88,737,164

** The values in the Trips column numbers only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Table 7.38 LTAM DIADEM Matrix total comparison – reference matrix vs VDM output matrices (core 2045 reference DM and DS highway trips in PCUs)

Segment	Matrix type	Time period	Reference matrix (core 2045)	VDM output matrix (core 2045 DM)			VDM output matrix (core 2045 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
HBEB	24hr PA	N/A	3,147,878	3,151,107	3,229	0.1%	3,151,155	3,277	0.1%
HBW L	24hr PA	N/A	2,706,323	2,709,117	2,793	0.1%	2,709,140	2,817	0.1%
HBW M	24hr PA	N/A	4,778,135	4,777,960	-174	0.0%	4,778,043	-91	0.0%
HBW H	24hr PA	N/A	3,737,121	3,729,597	-7,524	-0.2%	3,729,715	-7,406	-0.2%
HBO L	24hr PA	N/A	7,981,403	8,202,528	221,125	2.8%	8,202,850	221,447	2.8%
HBO M	24hr PA	N/A	7,164,782	7,263,996	99,214	1.4%	7,264,269	99,486	1.4%
HBO H	24hr PA	N/A	5,160,986	5,192,514	31,527	0.6%	5,192,767	31,781	0.6%
NHBEB	By time period OD	AM	105,699	105,511	-188	-0.2%	105,564	-136	-0.1%
		IP	136,905	136,717	-187	-0.1%	136,723	-182	-0.1%
		PM	152,639	150,680	-1,960	-1.3%	150,692	-1,948	-1.3%
		OP	38,555	39,107	552	1.4%	39,094	539	1.4%
NHBO L	By time period OD	AM	156,073	160,386	4,313	2.8%	160,475	4,402	2.8%
		IP	414,052	424,727	10,675	2.6%	424,728	10,677	2.6%
		PM	327,017	332,380	5,363	1.6%	332,449	5,432	1.7%
		OP	91,094	94,870	3,776	4.1%	94,851	3,756	4.1%
NHBO M	By time period OD	AM	166,044	167,651	1,607	1.0%	167,721	1,677	1.0%
		IP	331,160	335,718	4,557	1.4%	335,753	4,593	1.4%
		PM	328,802	329,741	939	0.3%	329,770	967	0.3%
		OP	81,480	83,647	2,167	2.7%	83,625	2,145	2.6%

Segment	Matrix type	Time period	Reference matrix (core 2045)	VDM output matrix (core 2045 DM)			VDM output matrix (core 2045 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
NHBO H	By time period OD	AM	133,793	133,747	-46	0.0%	133,783	-10	0.0%
		IP	226,808	228,101	1,293	0.6%	228,117	1,308	0.6%
		PM	254,872	253,205	-1,667	-0.7%	253,299	-1,573	-0.6%
		OP	59,856	61,157	1,301	2.2%	61,134	1,279	2.1%
LGV	By time period OD	AM	1,051,706	1,051,706	0	0.0%	1,051,706	0	0.0%
		IP	908,220	908,220	0	0.0%	908,220	0	0.0%
		PM	759,043	759,043	0	0.0%	759,043	0	0.0%
		OP	366,148	366,148	0	0.0%	366,148	0	0.0%
HGV	By time period OD	AM	142,904	142,904	0	0.0%	142,904	0	0.0%
		IP	160,495	160,495	0	0.0%	160,495	0	0.0%
		PM	92,599	92,599	0	0.0%	92,599	0	0.0%
		OP	63,652	63,652	0	0.0%	63,652	0	0.0%
Port trips EB	By time period OD	AM	4,926	4,926	0	0.0%	4,926	0	0.0%
		IP	3,428	3,428	0	0.0%	3,428	0	0.0%
		PM	4,296	4,296	0	0.0%	4,296	0	0.0%
		OP	1,326	1,326	0	0.0%	1,326	0	0.0%
Port trips O LI	By time period OD	AM	2,859	2,859	0	0.0%	2,859	0	0.0%
		IP	3,517	3,517	0	0.0%	3,517	0	0.0%
		PM	3,495	3,495	0	0.0%	3,495	0	0.0%
		OP	1,141	1,141	0	0.0%	1,141	0	0.0%

Segment	Matrix type	Time period	Reference matrix (core 2045)	VDM output matrix (core 2045 DM)			VDM output matrix (core 2045 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Port trips O MI	By time period OD	AM	3,333	3,333	0	0.0%	3,333	0	0.0%
		IP	3,713	3,713	0	0.0%	3,713	0	0.0%
		PM	4,098	4,098	0	0.0%	4,098	0	0.0%
		OP	1,265	1,265	0	0.0%	1,265	0	0.0%
Port trips O HI	By time period OD	AM	4,728	4,728	0	0.0%	4,728	0	0.0%
		IP	3,951	3,951	0	0.0%	3,951	0	0.0%
		PM	5,234	5,234	0	0.0%	5,234	0	0.0%
		OP	1,513	1,513	0	0.0%	1,513	0	0.0%

Note: numbers in red signify a negative value

Table 7.39 LTAM SATURN matrix total comparison – reference matrix vs VDM output matrices (core 2045 reference DM and DS hourly PCUs)

Userclass	Time period	All movements							Relevant movements						
		Reference matrix (core 2045)	VDM output matrix (core 2045 DM)			VDM output matrix (core 2045 DS)			Reference matrix (core 2045)	VDM output matrix (core 2045 DM)			VDM output matrix (core 2045 DS)		
		Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %	Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Car employer's business	AM	546,177	546,692	515	0.09%	546,786	609	0.11%	45,708	45,586	-122	-0.27%	45,696	-12	-0.03%
	IP	476,086	475,899	-186	-0.04%	475,905	-181	-0.04%	31,688	31,672	-16	-0.05%	31,693	4	0.01%
	PM	656,487	652,902	-3,585	-0.55%	652,963	-3,524	-0.54%	46,320	45,284	-1,036	-2.24%	45,363	-957	-2.07%
	OP	187,851	188,949	1,098	0.58%	188,927	1,076	0.57%	12,665	13,636	971	7.67%	13,616	951	7.51%
Car commute low income	AM	500,525	496,834	-3,692	-0.74%	496,800	-3,725	-0.74%	36,797	37,106	309	0.84%	37,066	270	0.73%
	IP	228,146	229,615	1,469	0.64%	229,637	1,490	0.65%	20,847	21,258	411	1.97%	21,281	434	2.08%
	PM	573,085	572,009	-1,076	-0.19%	572,028	-1,057	-0.18%	38,657	39,020	363	0.94%	39,038	382	0.99%
	OP	91,274	92,026	752	0.82%	92,026	751	0.82%	7,697	8,019	321	4.17%	8,018	321	4.17%
Car commute medium income	AM	1,008,539	1,004,096	-4,443	-0.44%	1,004,196	-4,343	-0.43%	77,415	77,093	-322	-0.42%	77,192	-223	-0.29%
	IP	349,919	350,991	1,072	0.31%	350,987	1,068	0.31%	31,994	32,206	213	0.66%	32,205	211	0.66%
	PM	1,096,844	1,095,254	-1,590	-0.14%	1,095,306	-1,538	-0.14%	76,604	76,150	-453	-0.59%	76,204	-400	-0.52%
	OP	139,876	140,582	707	0.51%	140,569	693	0.50%	11,796	12,142	346	2.94%	12,129	333	2.82%
Car commute high income	AM	856,849	854,015	-2,833	-0.33%	853,946	-2,903	-0.34%	74,051	72,915	-1,136	-1.53%	72,846	-1,205	-1.63%
	IP	249,260	248,932	-328	-0.13%	248,941	-318	-0.13%	27,194	27,044	-149	-0.55%	27,057	-136	-0.50%
	PM	887,323	884,445	-2,878	-0.32%	884,645	-2,678	-0.30%	75,081	73,389	-1,691	-2.25%	73,593	-1,488	-1.98%
	OP	99,576	99,701	125	0.13%	99,694	118	0.12%	10,170	10,341	171	1.68%	10,334	164	1.62%
Car other low income	AM	847,582	871,698	24,116	2.85%	871,927	24,345	2.87%	90,661	92,119	1,458	1.61%	92,417	1,756	1.94%
	IP	1,501,655	1,539,655	38,000	2.53%	1,539,628	37,973	2.53%	125,942	129,767	3,825	3.04%	129,825	3,883	3.08%
	PM	1,469,935	1,501,652	31,717	2.16%	1,501,881	31,946	2.17%	135,210	134,698	-512	-0.38%	135,012	-198	-0.15%
	OP	469,893	486,214	16,321	3.47%	486,157	16,264	3.46%	40,427	44,691	4,264	10.55%	44,640	4,214	10.42%
Car other medium income	AM	904,929	915,156	10,227	1.13%	915,276	10,347	1.14%	100,334	98,803	-1,531	-1.53%	98,997	-1,337	-1.33%
	IP	1,201,577	1,217,217	15,640	1.30%	1,217,292	15,715	1.31%	117,089	118,036	947	0.81%	118,195	1,106	0.94%
	PM	1,481,861	1,493,117	11,255	0.76%	1,493,223	11,362	0.77%	150,564	146,687	-3,878	-2.58%	146,887	-3,677	-2.44%
	OP	420,669	429,396	8,727	2.07%	429,348	8,679	2.06%	40,852	43,785	2,934	7.18%	43,735	2,883	7.06%
Car other high income	AM	726,782	728,151	1,369	0.19%	728,209	1,427	0.20%	95,274	92,011	-3,263	-3.43%	92,149	-3,125	-3.28%
	IP	811,125	815,486	4,360	0.54%	815,492	4,366	0.54%	95,677	95,006	-671	-0.70%	95,086	-591	-0.62%
	PM	1,129,402	1,128,230	-1,172	-0.10%	1,128,538	-863	-0.08%	135,177	129,479	-5,698	-4.21%	129,897	-5,280	-3.91%
	OP	304,564	309,048	4,484	1.47%	308,999	4,434	1.46%	35,713	37,792	2,079	5.82%	37,742	2,029	5.68%

Userclass	Time period	All movements							Relevant movements						
		Reference matrix (core 2045)	VDM output matrix (core 2045 DM)			VDM output matrix (core 2045 DS)			Reference matrix (core 2045)	VDM output matrix (core 2045 DM)			VDM output matrix (core 2045 DS)		
		Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %	Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Car total	AM	5,391,383	5,416,642	25,259	0.47%	5,417,141	25,758	0.48%	520,240	515,633	-4,607	-0.89%	516,363	-3,877	-0.75%
	IP	4,817,768	4,877,794	60,026	1.25%	4,877,882	60,114	1.25%	450,431	454,991	4,560	1.01%	455,342	4,912	1.09%
	PM	7,294,937	7,327,609	32,671	0.45%	7,328,583	33,646	0.46%	657,612	644,707	-12,905	-1.96%	645,994	-11,618	-1.77%
	OP	1,713,703	1,745,916	32,213	1.88%	1,745,718	32,015	1.87%	159,320	170,406	11,086	6.96%	170,215	10,895	6.84%
LGV	AM	1,051,706	1,051,706	0	0.00%	1,051,706	0	0.00%	130,781	130,781	0	0.00%	130,781	0	0.00%
	IP	908,220	908,220	0	0.00%	908,220	0	0.00%	98,780	98,780	0	0.00%	98,780	0	0.00%
	PM	759,043	759,043	0	0.00%	759,043	0	0.00%	100,821	100,821	0	0.00%	100,821	0	0.00%
	OP	366,148	366,148	0	0.00%	366,148	0	0.00%	39,237	39,237	0	0.00%	39,237	0	0.00%
HGV	AM	142,904	142,904	0	0.00%	142,904	0	0.00%	58,542	58,542	0	0.00%	58,542	0	0.00%
	IP	160,495	160,495	0	0.00%	160,495	0	0.00%	64,351	64,351	0	0.00%	64,351	0	0.00%
	PM	92,599	92,599	0	0.00%	92,599	0	0.00%	36,953	36,953	0	0.00%	36,953	0	0.00%
	OP	63,652	63,652	0	0.00%	63,652	0	0.00%	25,221	25,221	0	0.00%	25,221	0	0.00%

Note: numbers in red signify a negative value

Assignments – reference matrix vs VDM output matrix

7.6.5 Plate 7.16 to Plate 7.18 provide a flow difference comparison between the reference matrix assignment and the VDM output assignment for the DM scenario for each time period. Plate 7.19 to Plate 7.21 provide a flow difference comparison between the reference matrix assignment and the VDM output assignment for the DS scenario for each time period. Blue colours show reductions in traffic, green colours show increases in traffic.

Plate 7.16 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DM AM peak)

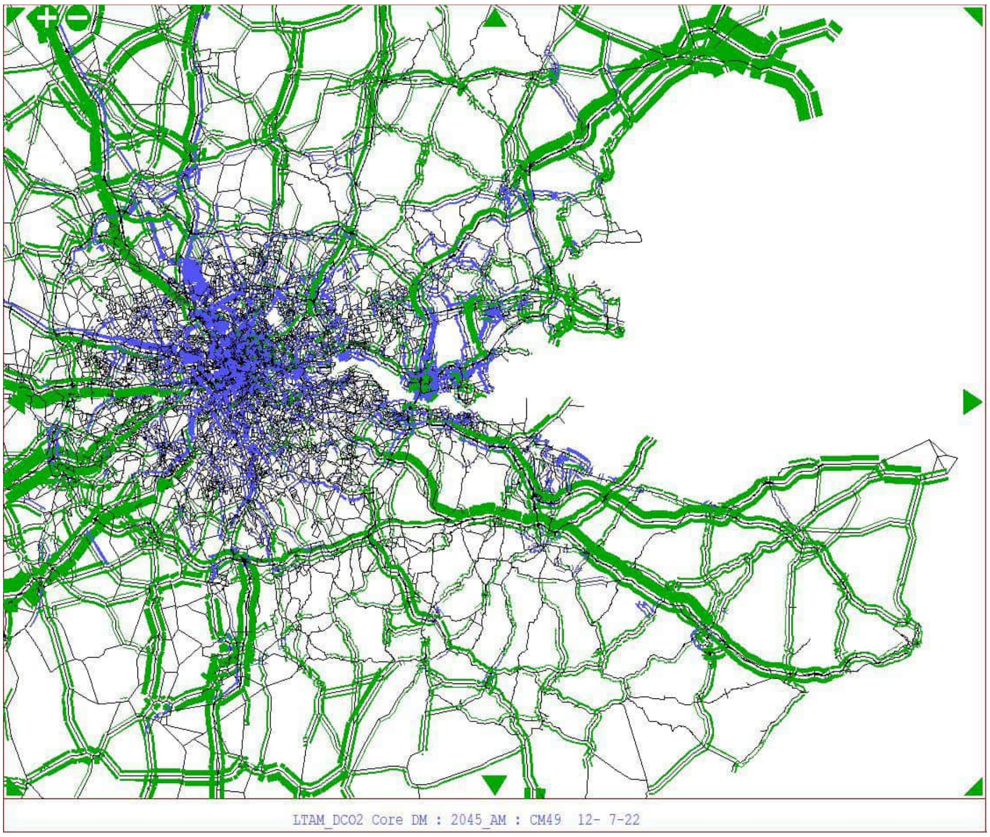


Plate 7.17 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DM inter-peak)

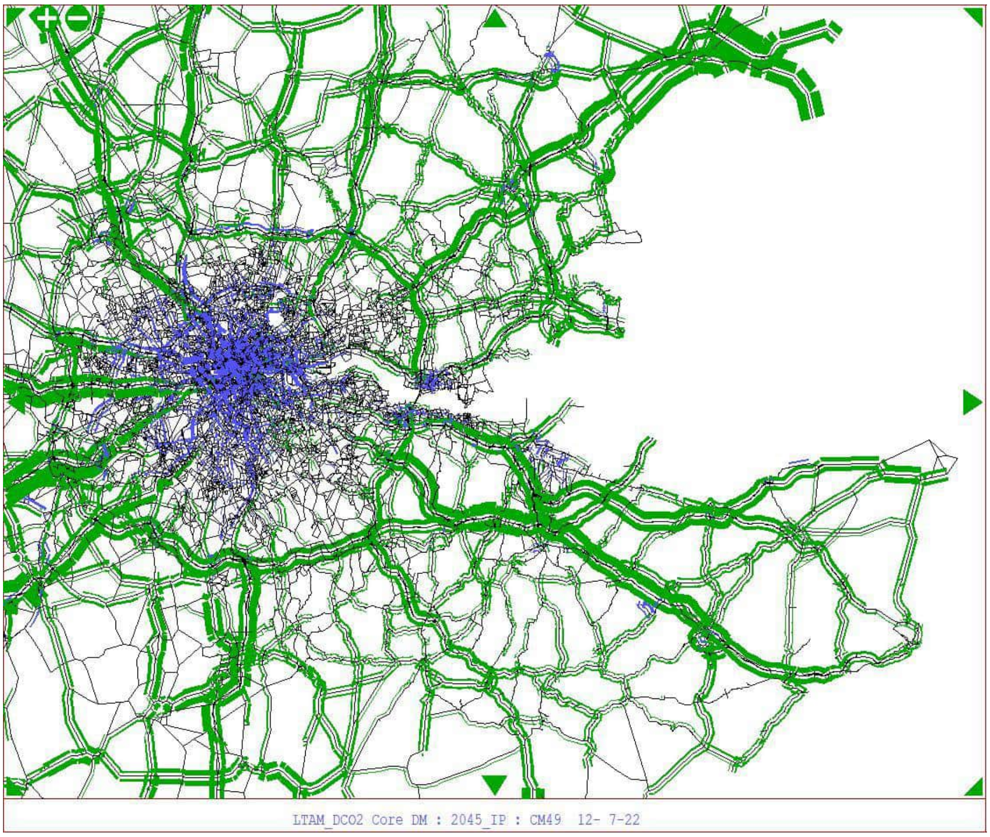


Plate 7.18 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DM PM peak)

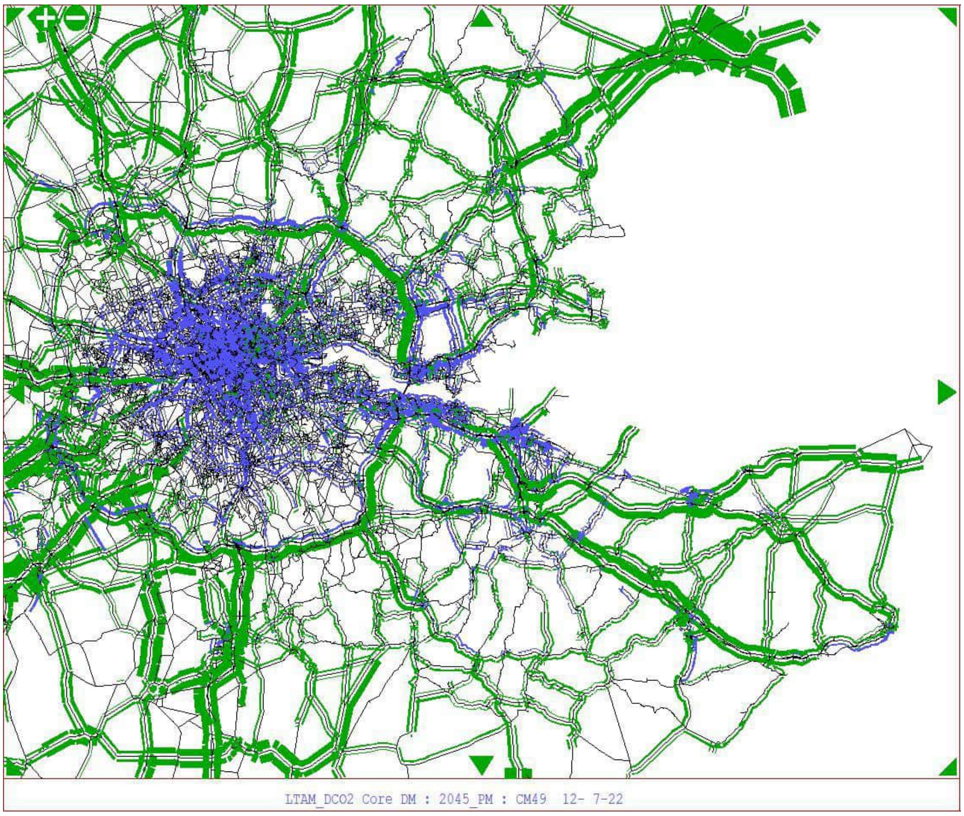


Plate 7.19 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DS AM peak)

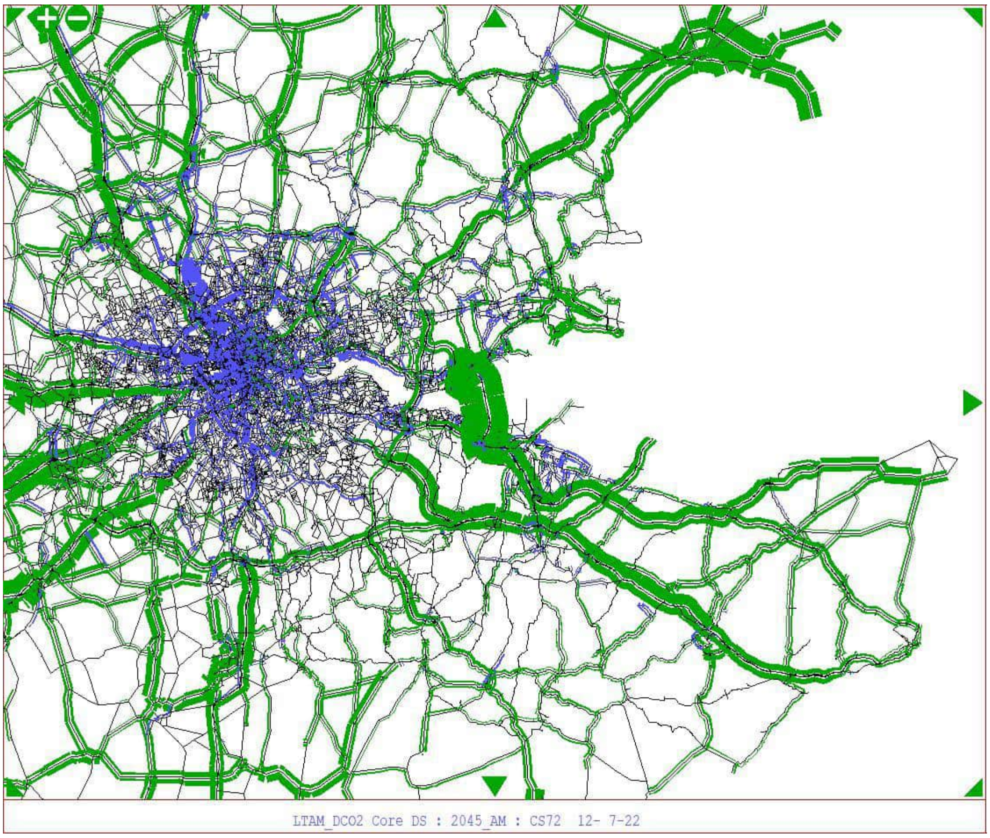


Plate 7.20 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DS inter-peak)

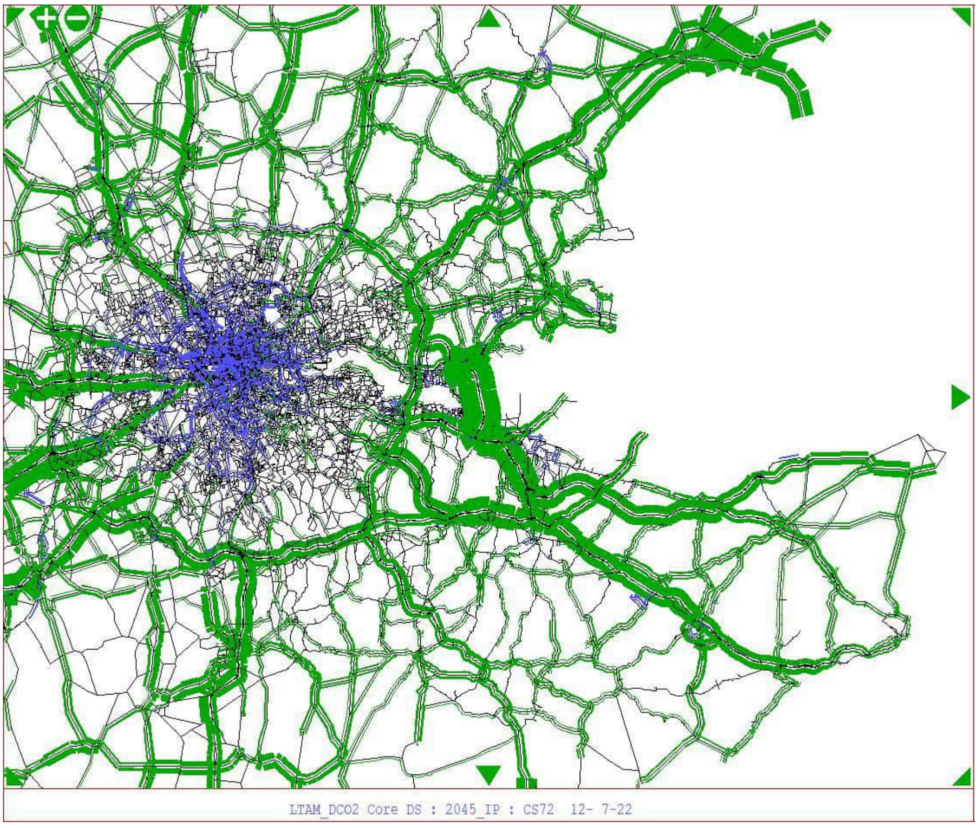
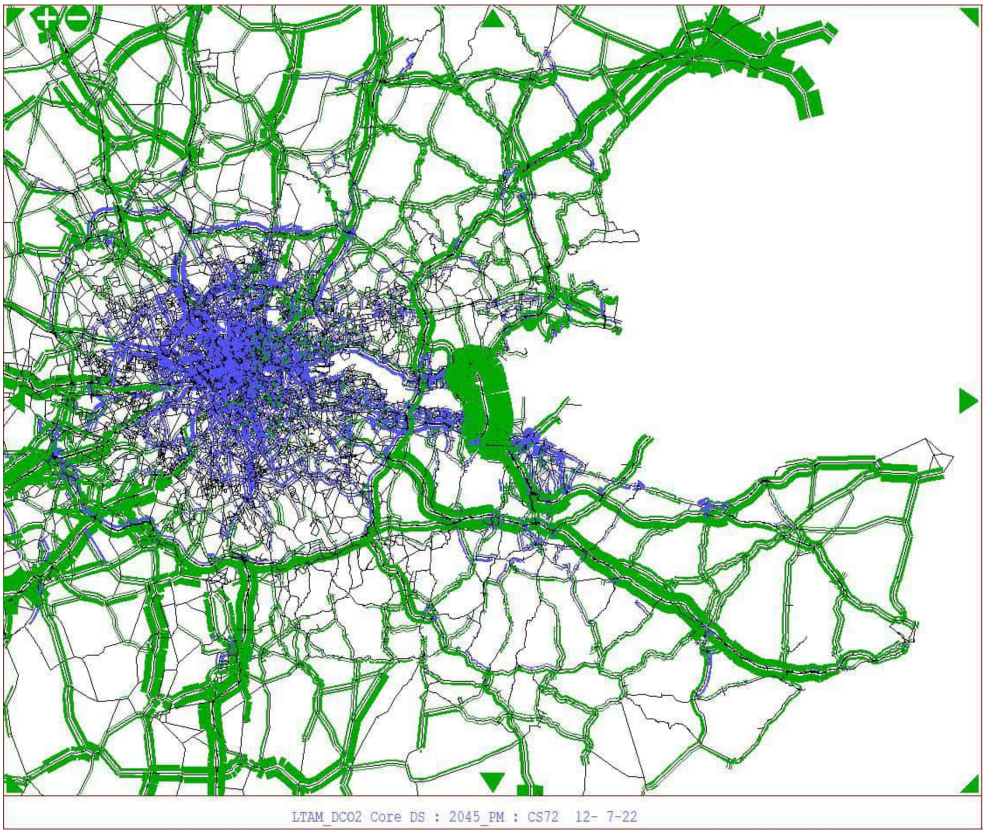


Plate 7.21 Assigned flow differences – reference matrix vs VDM output matrix (core 2045 reference vs 2045 DS PM peak)



Key statistics – reference matrix vs VDM output matrix

7.6.6 Table 7.40 provides some key network statistics from the reference matrix assignments and the VDM output matrix assignments.

Table 7.40 Key network statistics – reference matrix vs VDM output matrix (core 2045) (Simulation area only)

Metric	Time period	Reference matrix (core 2045)				VDM output matrix (core 2045)			
		DM*	DS**	Diff.	Diff. %	DM***	DS****	Diff.	Diff. %
Time (PCU hours)	AM	324,949	318,673	-6,275	-1.97%	317,150	317,455	305	0.10%
	IP	229,890	226,802	-3,088	-1.36%	235,957	235,603	-354	-0.15%
	PM	343,709	337,002	-6,707	-1.99%	325,983	326,625	642	0.20%
	OP	74,066	73,883	-183	-0.25%	83,679	83,693	14	0.02%
Distance (PCU km)	AM	14,908,631	14,859,898	-48,733	-0.33%	15,059,440	15,220,741	161,301	1.06%
	IP	12,179,062	12,147,779	-31,283	-0.26%	12,667,716	12,772,716	105,000	0.82%
	PM	15,079,764	15,040,844	-38,920	-0.26%	15,109,576	15,296,170	186,594	1.22%
	OP	4,858,232	4,847,421	-10,811	-0.22%	5,595,459	5,609,832	14,374	0.26%
Average speed (km/hr)	AM	45.88	46.63	0.75	1.61%	47.48	47.95	0.46	0.96%
	IP	52.98	53.56	0.58	1.09%	53.69	54.21	0.53	0.97%
	PM	43.87	44.63	0.76	1.70%	46.35	46.83	0.48	1.03%
	OP	65.59	65.61	0.02	0.03%	66.87	67.03	0.16	0.24%

** These statistics are generated by assigning the reference matrix to the DM network.*

*** These statistics are generated by assigning the reference matrix to the DS network.*

**** These statistics are generated from the final VDM loop for the DM.*

***** These statistics are generated from the final VDM loop for the DS.*

Note: numbers in red signify a negative value.

Commentary on results

7.6.7 Table 7.36 and Table 7.37 show that the VDM runs for the Do Minimum and Do Something scenarios converged to within the desired criteria, requiring 10 demand/supply loops in each case.

7.6.8 At the level of the whole model, the total variable demand over all modes, purposes and time periods increases slightly during the iterations. The increases are small, being approximately 1.1% for each scenario – the DM variable demand increases by 930,224 while the DS variable demand increases by 932,452. This increase in trips is predominantly in the external area and is likely due to increases in values of time in forecast years which are reflected in the model as a real term's decrease in travel cost.

7.6.9 These totals are calculated over all variable trips; therefore, the changes are caused solely by the LTAM's frequency response. This allows trips to be induced when overall costs decrease and deterred when overall costs increase. The increase over the loops in the DS scenario is very slightly greater than in the DM scenario; this is small enough to be caused by model noise but is as expected as the DS scenario provides more congestion relief than the DM, leading to lower travel costs overall.

7.6.10 Considering Table 7.38, which shows the highway trips produced by DIADEM at the level of all movements, the VDM is seen to generate a small increase in the numbers of home-based employer's business (HBEB) and small decreases in the numbers of home-based commuting (HBW) trips for the medium and high-income segments. By contrast, there are larger increases in home-based other (HBO) trips in the range 0.6–2.8%. The impact is proportionally greater for those trips in the low-income segment. This is expected because these trips have the highest elasticities with respect to cost of the three income segments. The magnitudes of the changes in the DM and DS are similar, though in general the changes from the reference matrices in the DS are slightly less negative or more positive than in the DM.

7.6.11 The changes brought about by the VDM to HBEB and HBW matrices are small enough that they may be attributable to model noise. HBO trips have a larger elasticity than HBW and HBEB trips, so their response to changes in cost are likely to be larger than the random effects of model noise and hence the increases seen in the numbers of HBO trips are likely to be a real effect.

7.6.12 The numbers of trips in the LGV, HGV and port trip demand segments are unchanged from the reference matrices in both the DM and the DS because their OD trips are fixed in the demand model and do not respond to cost changes other than through re-routing between fixed origins and destinations.

7.6.13 Considering Table 7.39, which shows the highway trips produced by the LTAM for SATURN assignment, it is seen that, at the level of all movements, the employer's business and commuting trips each show some small decreases and some small increases for different time periods in both the DM and DS scenarios. In most cases, the proportional changes caused by the VDM for these purposes are small. When the irrelevant movements are removed from the analysis, the majority of the purposes show non-trivial increases in the numbers of assigned trips. Where decreases still occur, these most often occur in the peak periods, in which congestion is the greatest.

7.6.14 The reference highway matrices are what are expected to apply in the future scenario if the utilities of different options (derived from generalised costs) are unchanged. However, it is expected that, even with the introduction of committed road schemes in the DM and the addition of the Project in the DS, congestion will increase in some parts of the road network relative to the base year situation as a result of increased travel demand.

7.6.15 Looked at over all car user classes, there are increases in highway trips forecast for relevant movements in all periods. Hence, reductions in the numbers of trips relative to the reference matrix for some assignment purposes in the DM and DS scenarios are not entirely unexpected. Table 7.39 shows that for relevant movements these predominantly occur for the high-income commuting purpose and the strongest effects are in the peaks for the high-income other purpose. That the reductions in trips at the all-movement level are not, in the main, seen for the relevant movements implies that trip deterrence is occurring in those parts of the model further away from the FMA. In these areas there are very large numbers of trips whose network costs are less accurately modelled than in the FMA, meaning that model noise may be overwhelming any actual small changes in travel behaviour on these parts of the network and the apparent decreases could be spurious.

7.6.16 Where there are reductions in the assigned trips, these are often seen to be less negative in the Do Something than in the Do Minimum scenario. This is due to the increased capacity of the network in the Do Something, in particular, the Project provides more capacity across the River Thames than in the Do Minimum scenario.

7.6.17 These changes in the matrices are supported by the flow difference analysis. As can be seen in the Do Minimum, there is a general decrease in flow along the M25 on the approaches to the Dartford Crossing when compared to the reference matrix assignments. This is consistent across the time periods. In the Do Something there is generally an increase in flow along this corridor as a result of redistribution which allows more trips to cross the River Thames in the Do Something due to the introduction of the Project.

7.6.18 The reference matrix assignments do not include this redistribution, which leads to lower flow over the Dartford Crossing (as the reference demand has the choice of using either the Dartford Crossing or the Project). Therefore, in the with-Scheme scenario there is spare capacity to cross the River Thames. The VDM will redistribute some trips that currently do not cross the River Thames into crossing the river in order to take advantage of this spare capacity. Much of this cross-river demand is suppressed in the reference case due to the lack of available capacity. There is a general reduction in flow throughout London which is due to the lack of spare capacity in the highway network to accommodate the levels of growth in travel demand.

7.6.19 The comparison of overall network statistics in Table 7.40 shows that in the reference case assignments there are large absolute reductions in both journey time and distance travelled between the Do Minimum and Do Something scenarios. These reductions are small in relative terms. These reductions in time and distance are expected, since the Do Something introduces the Project, which allows existing destinations to be reached by some travellers more quickly via shorter routes than are available in the Do Minimum.

7.6.20 The post-VDM statistics show that both the DM and DS scenarios have increases in travel times relative to their respective reference matrix assignments in the IP and OP time periods and a decrease in the AM and PM peaks. Due to the decreased total travel time in the reference DS assignment, this means that the increase in total travel time in the DS post-VDM case is larger than in the DM case. However, both scenarios converge to a situation in which total network time is approximately the same. By contrast, the final total network distance in the DS is noticeably larger than in the DM scenario, leading to the conclusion that the VDM has redistributed trips to take advantage of the travel time savings, resulting in longer distance journeys.

7.6.21 The average speeds over the entire network increase between the DM and DS scenarios in both the reference matrix assignment and post-VDM assignment. The speeds are higher in all periods in the post-VDM case for both scenarios than in the reference assignment case.

7.6.22 As expected, average speeds increase between the DM and DS due to the additional capacity and congestion relief introduced by the Project. Average speeds increase between the reference assignment and the post-VDM assignment as a result of trip redistribution, which allows trips to avoid existing congestion by changing their chosen destination. Average speeds in the OP period are almost unchanged relative to the reference matrix assignments.

7.7 LTAM 2051 core DM and DS forecasts

7.7.1 Section 5.2 describes how the reference matrices have been developed. Section 6.1 describes how the Do Minimum networks have been developed. Section 6.2 describes how the Do Something networks have been developed. The analysis presented below describes the impact that the VDM has on the reference matrices, assigned networks and some key network statistics.

VDM convergence statistics

7.7.2 Convergence statistics for the core 2051 forecasts are provided in Table 7.41 for the Do Minimum and in Table 7.42 for the Do Something.

Matrix totals – reference matrix vs VDM output matrix

7.7.3 As described in Section 5.3 it is necessary to report the matrix totals in two ways, firstly using the 17 demand segments used in DIADEM and secondly using the 10 user classes used in the highway assignment model. For presentation purposes HGV Port and HGV Non-Port trips were summed together providing total values for HGV movements.

7.7.4 Table 7.43 presents a comparison of the core 2051 reference matrices and VDM output matrices using the DIADEM 17 demand segment pattern. Table 7.44 presents a comparison between the core 2051 reference matrices and VDM output matrices using the SATURN 9 userclass pattern. In the case of the SATURN matrices, comparisons are shown at the level of all movements and for just relevant movements, as defined earlier in Section 7.3.

Table 7.41 Convergence and stability statistics (core 2051 DM)

Iteration	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	13.01%	20.18%	0	0	0	0%	0	0	0	0%	91,121,701
2	6.17%	8.34%	0.014	0.723	1.385	93.05%	0.137	0.037	5.361	27.94%	91,622,979
3	3.02%	3.93%	0.003	0.131	0.244	99.98%	0.056	0.018	2.678	56.22%	91,875,778
4	1.50%	1.93%	0.001	0.056	0.136	99.99%	0.027	0.009	1.339	85.54%	92,002,151
5	0.75%	0.97%	0.001	0.045	0.144	99.98%	0.014	0.004	0.669	97.72%	92,065,314
6	0.37%	0.50%	0.000	0.023	0.063	99.99%	0.007	0.002	0.336	99.56%	92,096,765
7	0.19%	0.28%	0.000	0.016	0.061	99.99%	0.004	0.001	0.167	99.90%	92,112,523
8	0.10%	0.16%	0.000	0.013	0.052	99.99%	0.002	0.001	0.085	99.98%	92,120,380
9	0.05%	0.11%	0.000	0.013	0.051	99.99%	0.001	0.000	0.045	99.99%	92,124,366
10	0.03%	0.10%	0.000	0.015	0.051	99.99%	0.001	0.000	0.024	99.99%	92,126,365

** The values in the Trips column numbers only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Table 7.42 Convergence and stability statistics (core 2051 DS)

Main	%GAP		Cost stability				Flow stability				Totals
	Full model	Subset area	RAAD	AAD	RMS	%<5%	RAAD	AAD	RMS	%<5%	Trips*
1	13.05%	20.63%	0	0	0	0%	0	0	0	0%	91,121,701
2	6.19%	8.59%	0.010	0.485	0.931	97.50%	0.169	0.037	5.362	27.55%	91,625,063
3	3.03%	4.02%	0.002	0.105	0.176	99.99%	0.060	0.018	2.678	54.30%	91,878,000
4	1.50%	1.95%	0.001	0.034	0.066	99.99%	0.028	0.009	1.339	83.76%	92,004,395
5	0.75%	0.97%	0.000	0.018	0.048	100.00%	0.014	0.004	0.670	97.88%	92,067,502
6	0.38%	0.50%	0.000	0.013	0.041	100.00%	0.007	0.002	0.335	99.57%	92,099,014
7	0.19%	0.27%	0.000	0.012	0.045	99.99%	0.004	0.001	0.170	99.90%	92,114,880
8	0.10%	0.17%	0.000	0.014	0.050	100.00%	0.002	0.001	0.085	99.98%	92,122,717
9	0.06%	0.13%	0.000	0.015	0.054	99.99%	0.001	0.000	0.043	99.99%	92,126,663
10	0.03%	0.10%	0.000	0.013	0.056	99.99%	0.001	0.000	0.026	99.98%	92,128,626

** The values in the Trips column numbers only refer to those trips in the VDM that are considered variable. These totals therefore are not expected to match matrix totals reported elsewhere in this report.*

Table 7.43 LTAM DIADEM matrix total comparison – reference matrix vs VDM output matrices (core 2051 reference DM and DS highway trips in PCUs)

Segment	Matrix type	Time period	Reference matrix (core 2051)	VDM output matrix (core 2051 DM)			VDM output matrix (core 2051 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
HBEB	24hr PA	N/A	3,268,348	3,271,716	3,368	0.1%	3,271,768	3,420	0.1%
HBW L	24hr PA	N/A	2,793,968	2,797,205	3,237	0.1%	2,797,227	3,259	0.1%
HBW M	24hr PA	N/A	4,931,050	4,930,705	-346	0.0%	4,930,789	-262	0.0%
HBW H	24hr PA	N/A	3,856,176	3,847,408	-8,769	-0.2%	3,847,528	-8,649	-0.2%
HBO L	24hr PA	N/A	8,317,083	8,561,299	244,216	2.9%	8,561,635	244,552	2.9%
HBO M	24hr PA	N/A	7,465,286	7,571,365	106,079	1.4%	7,571,638	106,352	1.4%
HBO H	24hr PA	N/A	5,377,704	5,408,711	31,007	0.6%	5,408,962	31,258	0.6%
NHBEB	By time period OD	AM	109,243	108,647	-595	-0.5%	108,709	-534	-0.5%
		IP	141,496	141,369	-127	-0.1%	141,374	-122	-0.1%
		PM	157,763	155,505	-2,258	-1.4%	155,513	-2,251	-1.4%
		OP	39,848	40,497	649	1.6%	40,483	635	1.6%
NHBO L	By time period OD	AM	161,986	166,212	4,226	2.6%	166,319	4,333	2.7%
		IP	429,606	441,525	11,919	2.8%	441,525	11,919	2.8%
		PM	339,264	344,663	5,399	1.6%	344,730	5,466	1.6%
		OP	94,477	98,773	4,296	4.5%	98,751	4,274	4.5%
NHBO M	By time period OD	AM	172,328	173,535	1,206	0.7%	173,620	1,291	0.7%
		IP	343,587	348,607	5,020	1.5%	348,646	5,059	1.5%
		PM	341,118	341,580	462	0.1%	341,605	487	0.1%
		OP	84,503	86,963	2,460	2.9%	86,935	2,433	2.9%

Segment	Matrix type	Time period	Reference matrix (core 2051)	VDM output matrix (core 2051 DM)			VDM output matrix (core 2051 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
NHBO H	By time period OD	AM	138,830	138,270	-560	-0.4%	138,316	-513	-0.4%
		IP	235,297	236,676	1,379	0.6%	236,694	1,397	0.6%
		PM	264,385	262,047	-2,338	-0.9%	262,141	-2,244	-0.8%
		OP	62,067	63,549	1,482	2.4%	63,522	1,455	2.3%
LGV	By time period OD	AM	1,100,079	1,100,079	0	0.0%	1,100,079	0	0.0%
		IP	950,137	950,137	0	0.0%	950,137	0	0.0%
		PM	794,072	794,072	0	0.0%	794,072	0	0.0%
		OP	383,049	383,049	0	0.0%	383,049	0	0.0%
HGV	By time period OD	AM	146,659	146,659	0	0.0%	146,659	0	0.0%
		IP	164,686	164,686	0	0.0%	164,686	0	0.0%
		PM	95,021	95,021	0	0.0%	95,021	0	0.0%
		OP	65,312	65,312	0	0.0%	65,312	0	0.0%
Port trips EB	By time period OD	AM	4,926	4,926	0	0.0%	4,926	0	0.0%
		IP	3,428	3,428	0	0.0%	3,428	0	0.0%
		PM	4,296	4,296	0	0.0%	4,296	0	0.0%
		OP	1,326	1,326	0	0.0%	1,326	0	0.0%
Port trips O LI	By time period OD	AM	2,859	2,859	0	0.0%	2,859	0	0.0%
		IP	3,517	3,517	0	0.0%	3,517	0	0.0%
		PM	3,495	3,495	0	0.0%	3,495	0	0.0%
		OP	1,141	1,141	0	0.0%	1,141	0	0.0%

Segment	Matrix type	Time period	Reference matrix (core 2051)	VDM output matrix (core 2051 DM)			VDM output matrix (core 2051 DS)		
			Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Port trips O MI	By time period OD	AM	3,333	3,333	0	0.0%	3,333	0	0.0%
		IP	3,713	3,713	0	0.0%	3,713	0	0.0%
		PM	4,098	4,098	0	0.0%	4,098	0	0.0%
		OP	1,265	1,265	0	0.0%	1,265	0	0.0%
Port trips O HI	By time period OD	AM	4,728	4,728	0	0.0%	4,728	0	0.0%
		IP	3,951	3,951	0	0.0%	3,951	0	0.0%
		PM	5,234	5,234	0	0.0%	5,234	0	0.0%
		OP	1,513	1,513	0	0.0%	1,513	0	0.0%

Note: numbers in red signify a negative value

Table 7.44 LTAM SATURN matrix total comparison – reference matrix vs VDM output matrices (core 2051 reference DM and DS hourly PCUs)

Userclass	Time period	All movements							Relevant movements						
		Reference matrix (core 2051)	VDM output matrix (core 2051 DM)			VDM output matrix (core 2051 DS)			Reference matrix (core 2051)	VDM output matrix (core 2051 DM)			VDM output matrix (core 2051 DS)		
		Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %	Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Car employer's business	AM	566,311	565,915	-396	-0.07%	566,029	-282	-0.05%	47,453	46,998	-455	-0.96%	47,122	-331	-0.70%
	IP	493,481	493,422	-59	-0.01%	493,428	-54	-0.01%	32,881	32,806	-74	-0.23%	32,828	-53	-0.16%
	PM	680,581	676,428	-4,153	-0.61%	676,480	-4,102	-0.60%	48,057	46,726	-1,332	-2.77%	46,798	-1,260	-2.62%
	OP	194,827	196,142	1,316	0.68%	196,119	1,292	0.66%	13,183	14,326	1,144	8.68%	14,309	1,127	8.55%
Car commute low income	AM	516,624	512,532	-4,091	-0.79%	512,499	-4,125	-0.80%	37,939	38,192	253	0.67%	38,152	212	0.56%
	IP	235,544	237,196	1,651	0.70%	237,218	1,674	0.71%	21,523	21,963	440	2.05%	21,987	464	2.15%
	PM	591,621	590,336	-1,284	-0.22%	590,350	-1,271	-0.21%	39,876	40,176	299	0.75%	40,191	315	0.79%
	OP	94,242	95,106	864	0.92%	95,107	865	0.92%	7,956	8,327	371	4.66%	8,328	372	4.67%
Car commute medium income	AM	1,040,633	1,035,727	-4,906	-0.47%	1,035,840	-4,793	-0.46%	79,762	79,224	-538	-0.67%	79,334	-428	-0.54%
	IP	361,151	362,333	1,181	0.33%	362,326	1,175	0.33%	33,034	33,229	196	0.59%	33,226	192	0.58%
	PM	1,131,894	1,129,878	-2,017	-0.18%	1,129,925	-1,969	-0.17%	78,912	78,206	-707	-0.90%	78,255	-657	-0.83%
	OP	144,367	145,179	812	0.56%	145,166	799	0.55%	12,190	12,589	399	3.28%	12,576	387	3.17%
Car commute high income	AM	883,920	880,737	-3,183	-0.36%	880,667	-3,253	-0.37%	76,645	75,165	-1,480	-1.93%	75,092	-1,553	-2.03%
	IP	257,277	256,904	-374	-0.15%	256,912	-365	-0.14%	28,214	27,998	-217	-0.77%	28,010	-204	-0.72%
	PM	915,402	911,849	-3,553	-0.39%	912,054	-3,348	-0.37%	77,702	75,583	-2,120	-2.73%	75,791	-1,911	-2.46%
	OP	102,781	102,944	163	0.16%	102,938	157	0.15%	10,566	10,762	196	1.86%	10,756	190	1.80%
Car other low income	AM	882,349	907,318	24,969	2.83%	907,597	25,248	2.86%	94,502	95,524	1,022	1.08%	95,859	1,357	1.44%
	IP	1,562,672	1,604,858	42,187	2.70%	1,604,825	42,153	2.70%	131,200	135,134	3,933	3.00%	135,183	3,983	3.04%
	PM	1,529,874	1,563,662	33,788	2.21%	1,563,882	34,007	2.22%	140,827	139,628	-1,199	-0.85%	139,936	-891	-0.63%
	OP	489,193	507,687	18,494	3.78%	507,620	18,427	3.77%	42,187	47,223	5,036	11.94%	47,177	4,991	11.83%
Car other medium income	AM	941,899	951,185	9,286	0.99%	951,350	9,450	1.00%	104,576	102,180	-2,395	-2.29%	102,396	-2,180	-2.08%
	IP	1,250,235	1,267,200	16,965	1.36%	1,267,289	17,054	1.36%	121,950	122,635	685	0.56%	122,800	850	0.70%
	PM	1,542,148	1,552,851	10,703	0.69%	1,552,942	10,794	0.70%	156,760	151,751	-5,009	-3.20%	151,930	-4,830	-3.08%
	OP	437,903	447,739	9,835	2.25%	447,675	9,771	2.23%	42,623	46,066	3,443	8.08%	46,022	3,399	7.97%
Car other high income	AM	756,268	755,898	-370	-0.05%	755,987	-281	-0.04%	99,331	94,988	-4,343	-4.37%	95,134	-4,197	-4.23%
	IP	843,911	848,362	4,451	0.53%	848,378	4,467	0.53%	99,686	98,569	-1,117	-1.12%	98,645	-1,041	-1.04%
	PM	1,175,227	1,172,357	-2,870	-0.24%	1,172,666	-2,561	-0.22%	140,823	133,787	-7,035	-5.00%	134,193	-6,629	-4.71%
	OP	317,022	322,082	5,060	1.60%	322,018	4,996	1.58%	37,277	39,694	2,418	6.49%	39,650	2,373	6.37%

Userclass	Time period	All movements							Relevant movements						
		Reference matrix (core 2051)	VDM output matrix (core 2051 DM)			VDM output matrix (core 2051 DS)			Reference matrix (core 2051)	VDM output matrix (core 2051 DM)			VDM output matrix (core 2051 DS)		
		Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %	Matrix total	Matrix total	Diff. to reference	Diff. %	Matrix total	Diff. to reference	Diff. %
Car total	AM	5,588,004	5,609,312	21,308	0.38%	5,609,969	21,965	0.39%	540,208	532,271	-7,937	-1.47%	533,090	-7,118	-1.32%
	IP	5,004,271	5,070,274	66,003	1.32%	5,070,375	66,105	1.32%	468,488	472,334	3,846	0.82%	472,678	4,190	0.89%
	PM	7,566,746	7,597,360	30,614	0.40%	7,598,298	31,552	0.42%	682,958	665,856	-17,102	-2.50%	667,094	-15,864	-2.32%
	OP	1,780,335	1,816,879	36,544	2.05%	1,816,642	36,307	2.04%	165,981	178,988	13,007	7.84%	178,819	12,838	7.73%
LGV	AM	1,100,079	1,100,079	0	0.00%	1,100,079	0	0.00%	136,526	136,526	0	0.00%	136,526	0	0.00%
	IP	950,137	950,137	0	0.00%	950,137	0	0.00%	103,246	103,246	0	0.00%	103,246	0	0.00%
	PM	794,072	794,072	0	0.00%	794,072	0	0.00%	105,414	105,414	0	0.00%	105,414	0	0.00%
	OP	383,049	383,049	0	0.00%	383,049	0	0.00%	41,032	41,032	0	0.00%	41,032	0	0.00%
HGV	AM	146,659	146,659	0	0.00%	146,659	0	0.00%	60,161	60,161	0	0.00%	60,161	0	0.00%
	IP	164,686	164,686	0	0.00%	164,686	0	0.00%	66,102	66,102	0	0.00%	66,102	0	0.00%
	PM	95,021	95,021	0	0.00%	95,021	0	0.00%	37,979	37,979	0	0.00%	37,979	0	0.00%
	OP	65,312	65,312	0	0.00%	65,312	0	0.00%	25,903	25,903	0	0.00%	25,903	0	0.00%

Note: numbers in red signify a negative value

Assignments – reference matrix vs VDM output matrix

7.7.5 Plate 7.22 to Plate 7.24 provide a flow difference comparison between the reference matrix assignment and the VDM output assignment for the DM scenario for each time period. Plate 7.25 to Plate 7.27 provide a flow difference comparison between the reference matrix assignment and the VDM output assignment for the DS scenario for each time period. Blue colours show reductions in traffic, green colours show increases in traffic.

Plate 7.22 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DM AM peak)

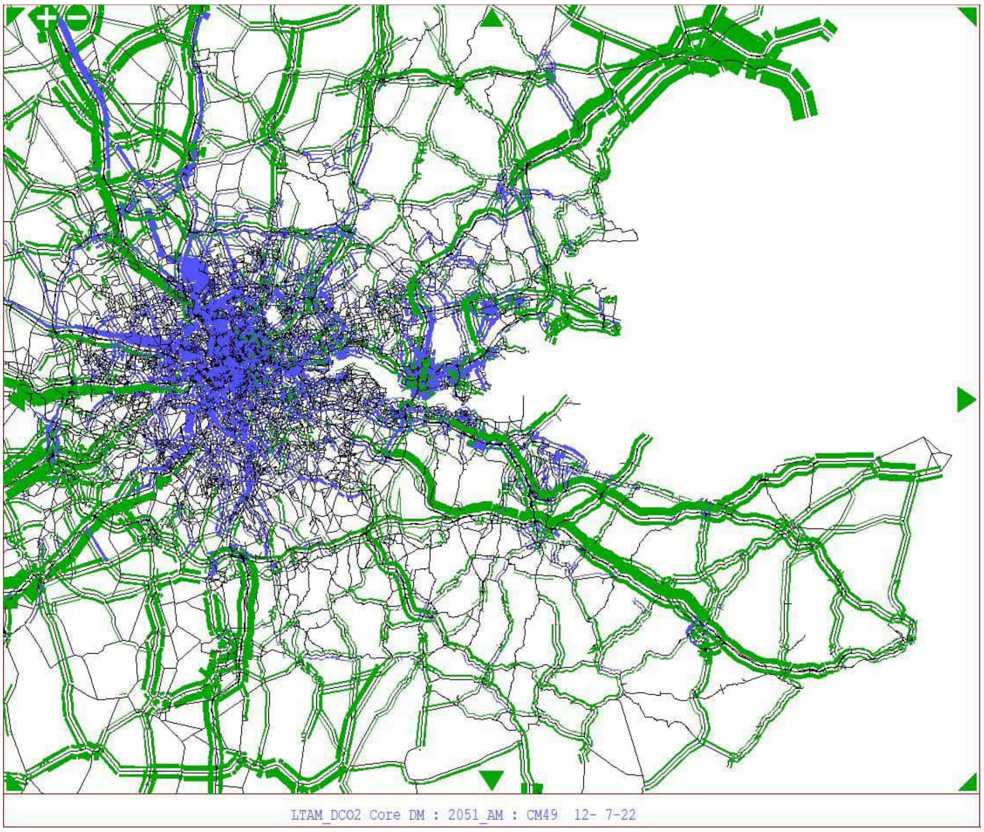


Plate 7.23 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DM inter-peak)

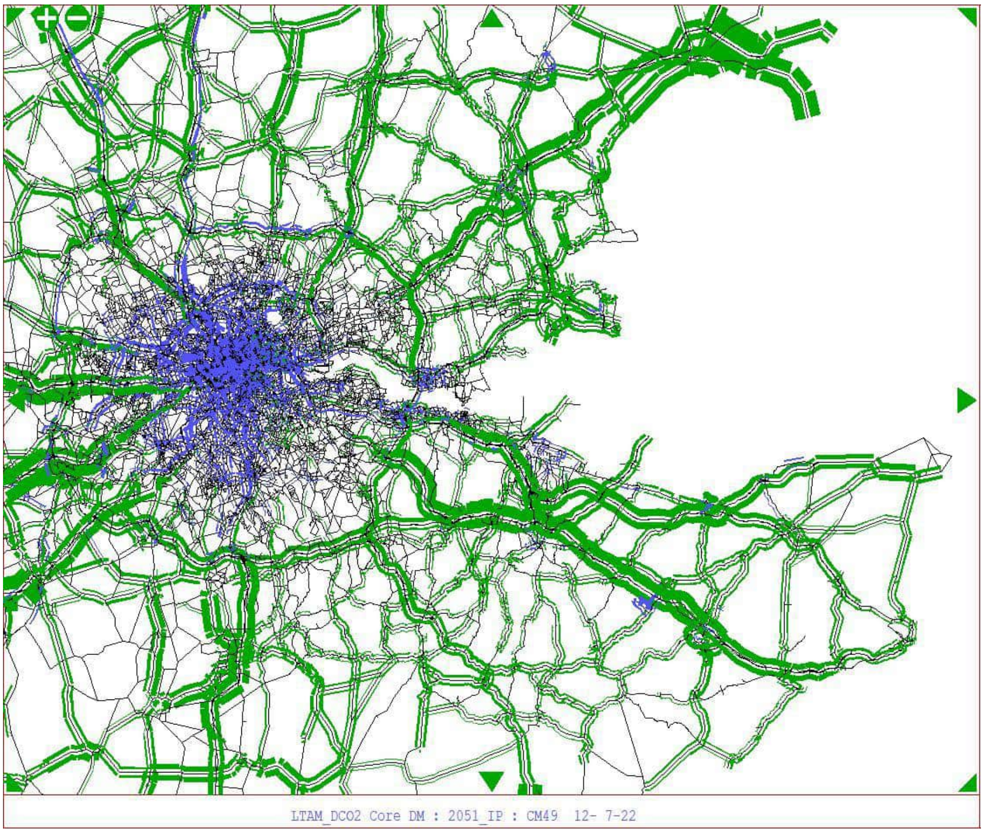


Plate 7.24 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DM PM peak)

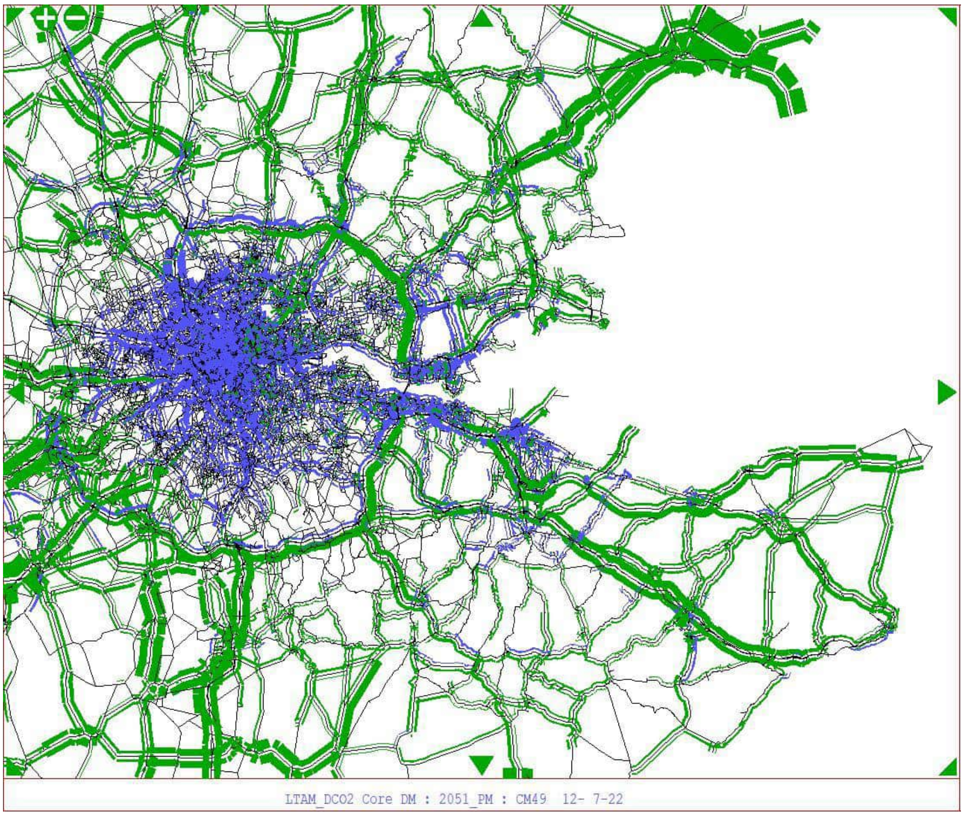


Plate 7.25 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DS AM peak)

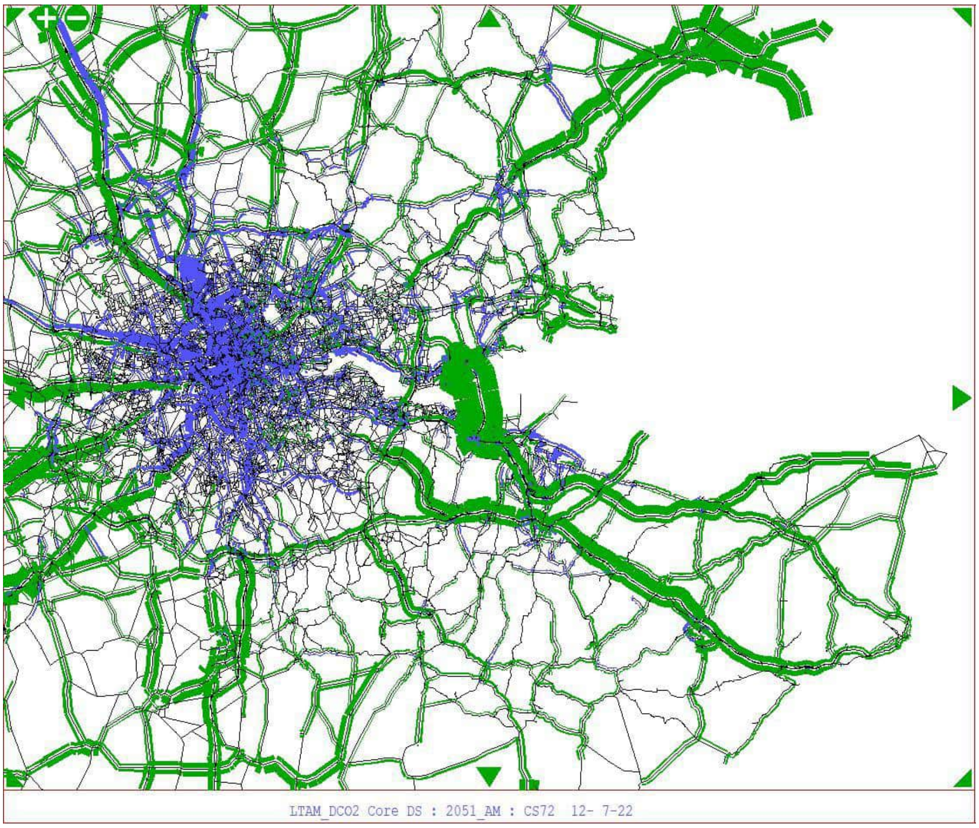


Plate 7.26 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DS inter-peak)

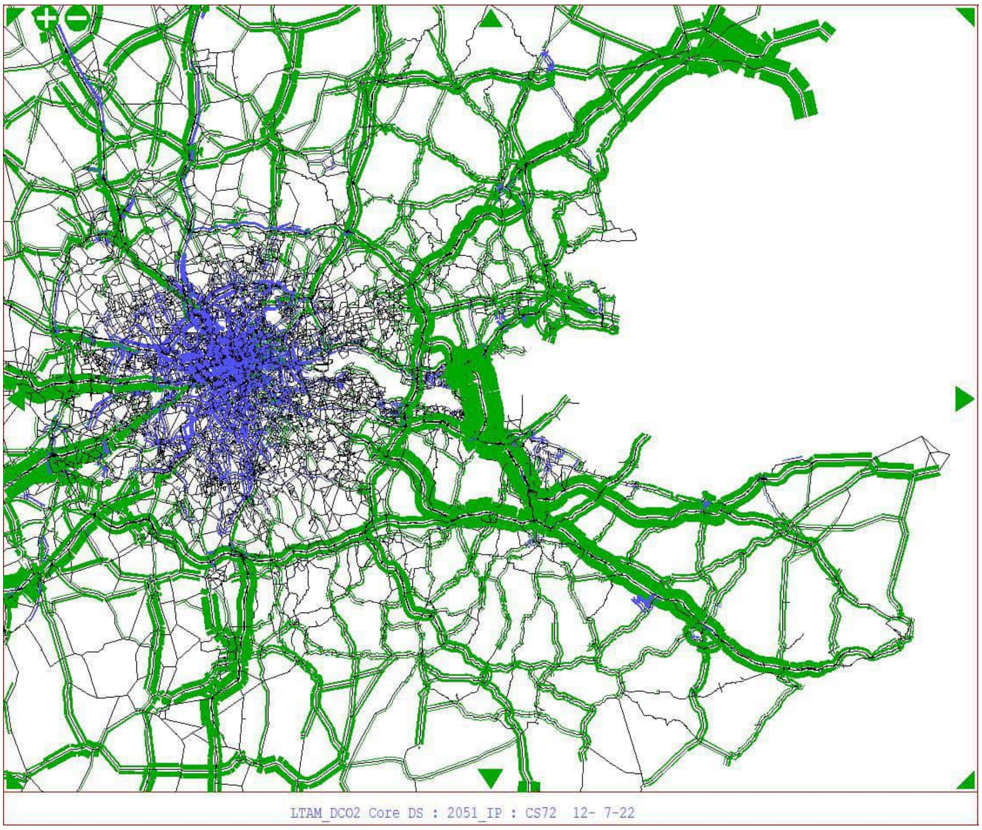
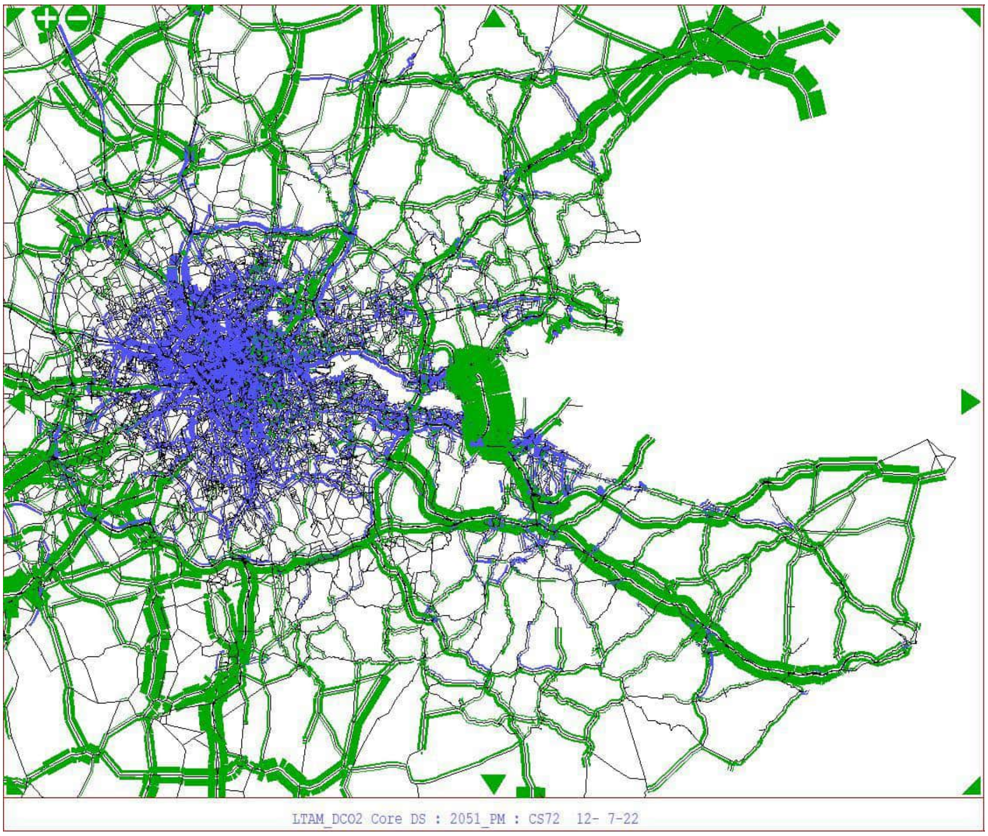


Plate 7.27 Assigned flow differences – reference matrix vs VDM output matrix (core 2051 reference vs 2051 DS PM peak)



Key statistics – reference matrix vs VDM output matrix

7.7.6 Table 7.45 provides some key network statistics from the reference matrix assignments and the VDM output matrix assignments.

Table 7.45 Key network statistics – reference matrix vs VDM output matrix (core 2051) (Simulation area only)

Metric	Time period	Reference matrix (core 2051)				VDM output matrix (core 2051)			
		DM*	DS**	Diff.	Diff. %	DM***	DS****	Diff.	Diff. %
Time (PCU hours)	AM	348,870	342,052	-6,818	-1.99%	333,479	333,870	390	0.12%
	IP	244,118	240,655	-3,463	-1.44%	248,235	247,909	-327	-0.13%
	PM	370,265	362,861	-7,404	-2.04%	342,841	343,784	943	0.27%
	OP	77,556	77,364	-192	-0.25%	88,392	88,448	56	0.06%
Distance (PCU km)	AM	15,483,667	15,423,248	-60,419	-0.39%	15,494,220	15,663,674	169,454	1.08%
	IP	12,620,472	12,588,430	-32,042	-0.25%	13,072,426	13,178,047	105,621	0.80%
	PM	15,637,876	15,595,925	-41,951	-0.27%	15,532,370	15,724,098	191,728	1.22%
	OP	5,085,371	5,074,500	-10,871	-0.21%	5,899,723	5,917,031	17,308	0.29%
Average speed (km/hr)	AM	44.38	45.09	0.71	1.57%	46.46	46.92	0.45	0.97%
	IP	51.70	52.31	0.61	1.17%	52.66	53.16	0.50	0.93%
	PM	42.23	42.98	0.75	1.74%	45.30	45.74	0.43	0.95%
	OP	65.57	65.59	0.02	0.03%	66.75	66.90	0.15	0.23%

** These statistics are generated by assigning the reference matrix to the DM network.*

*** These statistics are generated by assigning the reference matrix to the DS network.*

**** These statistics are generated from the final VDM loop for the DM.*

***** These statistics are generated from the final VDM loop for the DS.*

Note: numbers in red signify a negative value.

Commentary on results

7.7.7 Table 7.41 and Table 7.42 show that the VDM runs for the Do Minimum and Do Something scenarios converged to within the desired criteria, requiring 10 demand/supply loops in the Do Minimum and in the Do Something. It is likely that the convergence of the DS occurred earlier than the DM due to the ability of the demand model to find stable alternatives for travel due to the global increase in highway capacity introduced by the Project. This allowed the DS to overtake the DM with regard to convergence, though the initially larger changes in generalised cost due to the presence of the Project caused the gap value to start off higher than in the DM.

7.7.8 At the level of the whole model, the total variable demand over all modes, purposes and time periods increases slightly during the iterations. The increases are small, being approximately 1.1% for each scenario – the DM variable demand increases by 1,004,664 while the DS variable demand increases by 1,006,925. This increase in trips is predominantly in the external area and is likely due to increases in values of time in forecast years which are reflected in the model as a real term's decrease in travel cost.

7.7.9 These totals are calculated over all variable trips; therefore, the changes are caused solely by the LTAM's frequency response. This allows trips to be induced when overall costs decrease and deterred when overall costs increase. The increase over the loops in the DS scenario is very slightly greater than in the DM scenario; this is small enough to be caused by model noise but is as expected as the DS scenario provides more congestion relief than the DM, leading to lower travel costs overall.

7.7.10 Considering Table 7.43, which shows the highway trips produced by DIADEM at the level of all movements, the VDM is seen to generate a small increase in the numbers of home-based employer's business (HBEB) and small decreases in the numbers of home-based commuting (HBW) trips for the medium and high income segments. By contrast, there are larger increases in home-based other (HBO) trips in the range 0.6–2.9%. The impact is proportionally greater for those trips in the low-income segment. This is expected because these trips have the highest elasticities with respect to cost of the three income segments. The magnitudes of the changes in the DM and DS are similar, though in general the changes from the reference matrices in the DS are less negative or more positive than in the DM.

7.7.11 The changes brought about by the VDM to HBEB and HBW matrices are small enough in most cases that they may be attributable to model noise. HBO trips have a larger elasticity than HBW and HBEB trips, so their response to changes in cost are likely to be larger than the random effects of model noise and hence the increases seen in the numbers of HBO trips are likely to be a real effect.

7.7.12 The numbers of trips in the LGV, HGV and port trip demand segments are unchanged from the reference matrices in both the DM and the DS because their OD trips are fixed in the demand model and do not respond to cost changes other than through re-routing between fixed origins and destinations.

7.7.13 Considering Table 7.44, which shows the highway trips produced by the LTAM for SATURN assignment, it is seen that, at the level of all movements, the employer's business and commuting trips each show some decreases and increases for different time periods in both the DM and DS scenarios. In many cases, the proportional changes caused by the VDM for these purposes are small, though overall, they are generally relatively larger than the corresponding changes that were seen in the results of the 2045 forecast. When the irrelevant movements are removed from the analysis, the majority of the purposes show non-trivial increases in the numbers of assigned trips. Where decreases still occur, these most often occur in the peak periods, in which congestion is the greatest.

7.7.14 Looked at over all car user classes, there are increases in highway trips forecast for relevant movements in all periods with the exception of the AM peak period. Comparing the variations in total assigned car trips by period over the corresponding tables for each forecast year, it is seen that the proportional increases in relevant trips for the IP and OP periods get larger over time, but that the behaviour of the trips in the AM and PM peaks alters at or after 2045, with the size of the increases slowing or changing sign. It is expected that this is due to the increased congestion caused by background growth in travel demand even in the presence of the Project.

7.7.15 The reference highway matrices are what are expected to apply in the future scenario if the utilities of different options (derived from generalised costs) are unchanged. However, it is expected that, even with the introduction of committed road schemes in the DM and the addition of the Project in the DS, congestion will increase in some parts of the road network relative to the base year situation as a result of increased travel demand.

7.7.16 Hence, reductions in the numbers of trips relative to the reference matrix for some assignment purposes in the DM and DS scenarios are not entirely unexpected. Table 7.44 shows that for relevant movements these predominantly occur for the high-income commuting purpose and the strongest effects are in the peaks for the high-income other purpose.

7.7.17 Where there are reductions in the assigned trips, these are often seen to be less negative in the Do Something than in the Do Minimum scenario. This is believed to be due to the increased capacity of the network in the Do Something scenario, in particular, the Project provides more capacity across the River Thames than in the Do Minimum scenario.

7.7.18 These changes in the matrices are supported by the flow difference analysis. As can be seen in the Do Minimum scenario, there is a general decrease in flow along the M25 on the approaches to the Dartford Crossing when compared to the reference matrix assignments. This is consistent across the time periods. In the Do Something scenario there is generally an increase in flow along this corridor as a result of redistribution which allows more trips to cross the River Thames in the Do Something due to the introduction of the Project.

7.7.19 The reference matrix assignments do not include this redistribution, which leads to lower flow over the Dartford Crossing (as the reference demand has the choice of using either the Dartford Crossing or the Project). Therefore, in the with Scheme scenario there is spare capacity to cross the River Thames. The VDM will redistribute some trips that currently do not cross the River Thames into crossing the river in order to take advantage of this spare capacity. Much of this cross-river demand is suppressed in the reference case due to the lack of available capacity. There is a general reduction in flow throughout London which is due to the lack of spare capacity in the highway network to accommodate the levels of growth in travel demand.

7.7.20 The comparison of overall network statistics in Table 7.45 shows that in the reference case assignments there are large absolute reductions in both journey time and distance travelled between the Do Minimum and Do Something scenarios. These reductions are small in relative terms. These reductions in time and distance are expected, since the Do Something scenario introduces the Project, which allows existing destinations to be reached by some travellers more quickly via shorter routes than are available in the Do Minimum.

7.7.21 The post-VDM statistics show that both the DM and DS scenarios have increases in travel times relative to their respective reference matrix assignments in the IP and OP time periods and a decrease in the AM and PM peaks. Due to the decreased total travel time in the reference DS assignment, this means that the increase in total travel time in the DS post-VDM case is larger than in the DM case. However, both scenarios converge to a situation in which total network time is approximately the same. By contrast, the final total network distance in the DS is noticeably larger than in the DM scenario, leading to the conclusion that the VDM has redistributed trips to take advantage of the travel time savings, resulting in longer distance journeys.

7.7.22 The average speeds over the entire network increase between the DM and DS scenarios in both the reference matrix assignment and post-VDM assignment. The speeds are higher in all periods in the post-VDM case for both scenarios than in the reference assignment case.

7.7.23 As expected, average speeds increase between the DM and DS due to the additional capacity and congestion relief introduced by the Project. Average speeds increase between the reference assignment and the post-VDM assignment as a result of trip redistribution, which allows trips to avoid existing congestion by changing their chosen destination. Average speeds in the OP period are almost unchanged relative to the reference matrix assignments.

7.7.24 Comparing the network statistics tables for all forecast years, it is seen that average speeds across the model decrease over time in all time periods, which is caused by the overall increase in congestion due to increased travel demand and hence traffic on the network. These decreases occur in the reference DM and DS assignments and in the post-VDM DM and DS assignments. In all years and time periods, there are notable increases in average speed between the reference assignment and the post-VDM assignment of a given scenario. This is due to the VDM allowing trips to change their choices of destination, period or mode in order to reduce the effects of congestion. For a given assignment – either from the reference matrix or from the post-VDM matrix – the average speeds are slightly higher in the DS than the DM, due to the congestion-relieving effect of the Project.

8 Assignment results for economic assessment

8.1 Introduction

8.1.1 Outputs from the LTAM are used to inform the economic appraisal of the Project. This section of the report provides summary information on those forecasts provided for the economic appraisal. Current TAG guidance requires that this be provided for all years, all time periods and all scenarios. The sections below provide the required analysis for the core scenario. More detailed analysis of cross-river flows is presented in Annex B. Detailed journey time analysis is provided in Annex C. The low and high growth sensitivity test analysis is presented in Annex D. Flow difference plots comparing the core scenario with the low and high growth sensitivity tests are presented in Annex E.

8.2 LTAM 2030 core – outputs to economic assessment

8.2.1 The analysis presented below summarises the impact of the Project on forecast traffic flows and journey times for the 2030 core forecast. The statistics presented are from the final converged VDM loop as described in Chapter 7.

HAM convergence statistics

8.2.2 TAG Unit M3.1 (DfT, 2020c) specifies the acceptable convergence standards as shown in Table 8.1.

Table 8.1 TAG summary of convergence measures and acceptable values

Measure of convergence	Base model acceptable values
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P)<1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2)<1%	Four consecutive iterations greater than 98%

8.2.3 Table 8.2 to Table 8.4 provide the final VDM loop highway assignment model convergence statistics for the 2030 core DM forecasts.

8.2.4 Table 8.5 to Table 8.7 provide the final VDM loop highway assignment model convergence statistics for the 2030 core DS forecasts.

Table 8.2 HAM convergence statistics – 2030 core DM AM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
53	0.0057	0.0063	98.8	99.4
54	0.0038	0.0049	98.5	99.4
55	0.0039	0.0057	98.9	99.4
56	0.0050	0.0048	98.5	99.4

Table 8.3 HAM convergence statistics – 2030 core DM inter-peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
36	0.0024	0.0038	99.1	99.7
37	0.0025	0.0042	98.8	99.7
38	0.0031	0.0025	99.0	99.7
39	0.0029	0.0046	99.2	99.6

Table 8.4 HAM convergence statistics – 2030 core DM PM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
55	0.0035	0.0049	98.7	99.3
56	0.0033	0.0053	98.5	99.2
57	0.0035	0.0046	98.6	99.3
58	0.0034	0.0048	98.8	99.4

Table 8.5 HAM convergence statistics – 2030 core DS AM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
57	0.0038	0.0057	99.0	99.4
58	0.0035	0.0048	98.6	99.3
59	0.0039	0.0062	99.0	99.5
60	0.0053	0.0043	98.6	99.4

Table 8.6 HAM convergence statistics – 2030 core DS inter-peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
34	0.0026	0.0041	98.5	99.6
35	0.0033	0.0029	98.8	99.6
36	0.0025	0.0043	98.9	99.6
37	0.0030	0.0031	98.6	99.6

Table 8.7 HAM convergence statistics – 2030 core DS PM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
62	0.0027	0.0052	98.8	99.3
63	0.0032	0.004	98.5	99.3
64	0.0037	0.0042	98.8	99.4
65	0.0028	0.0036	98.7	99.3

8.2.5 These tables demonstrate that the LTAM has achieved the TAG convergence targets in all time periods for this scenario and year.

Movement patterns using the crossings

8.2.6 Plate 8.1 to Plate 8.9 provide select link analysis of movements using the Dartford Crossing and the Project for the Do Minimum and Do Something scenarios for each of the model time periods. These diagrams show the pattern of movements using each of the crossings in each of the time periods. Table 8.8 to Table 8.10 provide a summary of the main corridors using each of the crossings and a comparison between the DM and DS scenarios for each time period.

Plate 8.1 Select link analysis – Dartford Crossing DM 2030 core AM peak

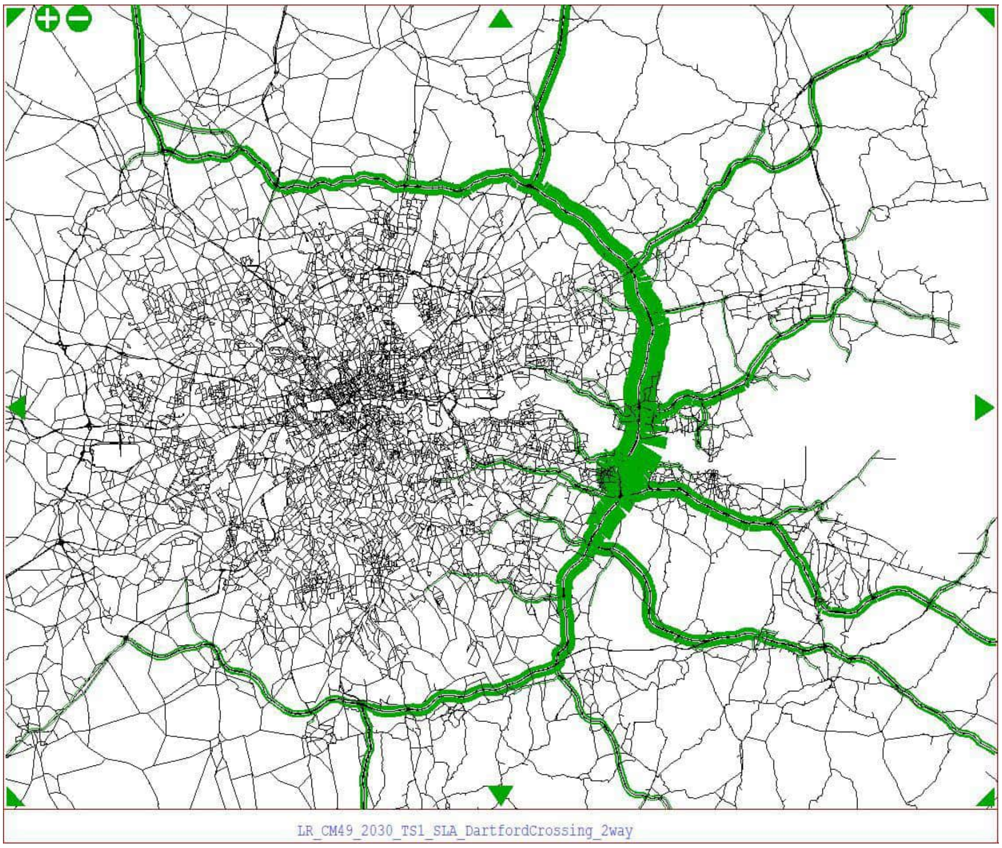


Plate 8.2 Select link analysis – Dartford Crossing DS 2030 core AM peak

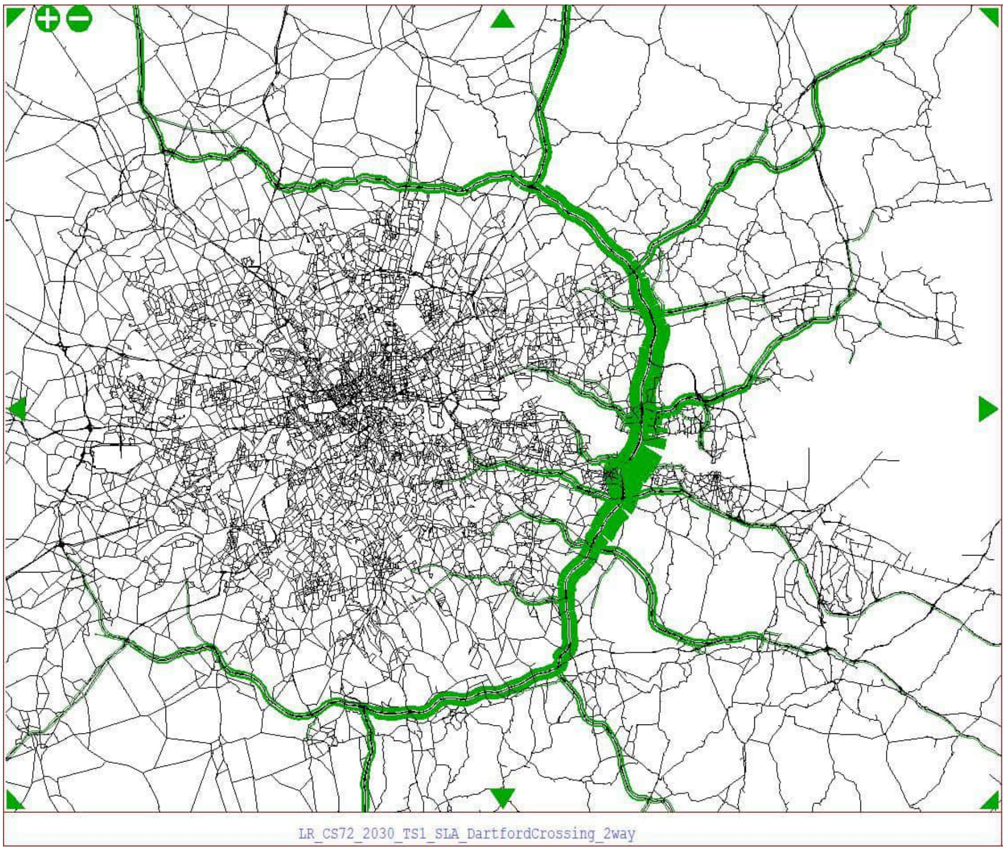


Plate 8.3 Select link analysis – Lower Thames Crossing DS 2030 core AM peak

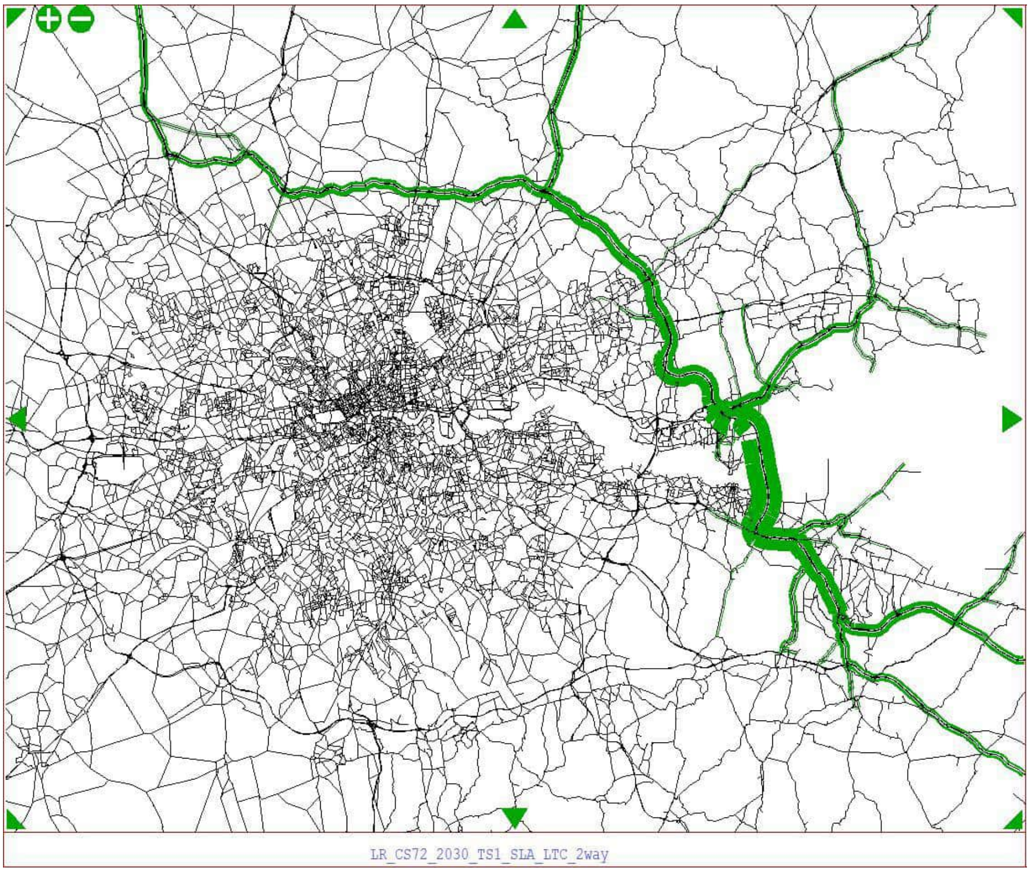


Table 8.8 Select link analysis – summary of primary corridors of movement 2030 AM peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		Select Link Analysis (SL)A flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,659	17%	3,212	24%	553	21%
	Local (outside M25)	1,928	12%	1,842	14%	-87	-4%
	M25 south (junctions 2–3)	7,431	48%	7,030	53%	-402	-5%
	A2/M2 to/from Kent	3,463	22%	1,193	9%	-2,269	-66%
Select link	Dartford Crossing	**15,481**	**100%**	**13,277**	**100%**	**-2,205**	**-14%**
North of River Thames	London north	2,249	15%	2,723	21%	474	21%
	Local traffic	1,480	10%	1,347	10%	-133	-9%
	M25 north (junctions 30–29)	8,591	55%	6,852	52%	-1,739	-20%
	A13 to/from Essex	3,162	20%	2,355	18%	-806	-26%
South of River Thames	Local traffic	n/a	n/a	729	9%	n/a	n/a
	A2 west of the Project	n/a	n/a	481	6%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	6,828	85%	n/a	n/a

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		Select Link Analysis (SL)A flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
Select link	Lower Thames Crossing	n/a	n/a	**8,038**	**100%**	n/a	n/a
North of River Thames	A1089	n/a	n/a	677	8%	n/a	n/a
	A13 west of the Project	n/a	n/a	64	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	3,292	41%	n/a	n/a
	M25 north of the Project	n/a	n/a	4,006	50%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings

Plate 8.4 Select link analysis – Dartford Crossing DM 2030 core inter-peak

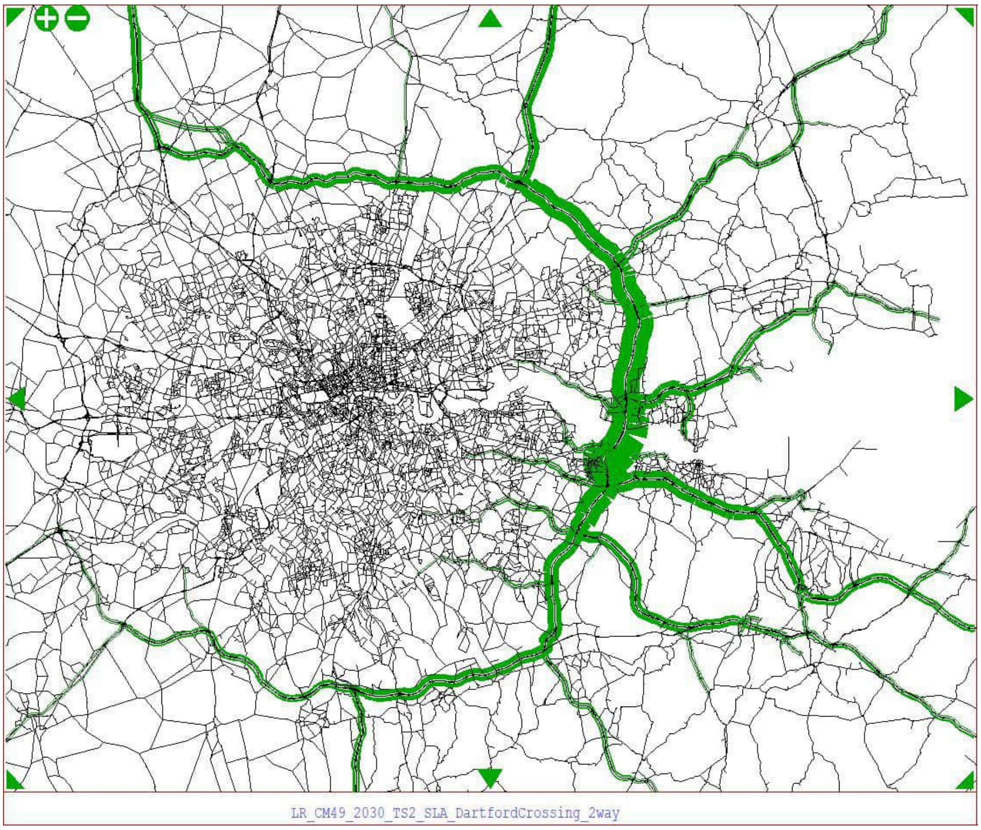
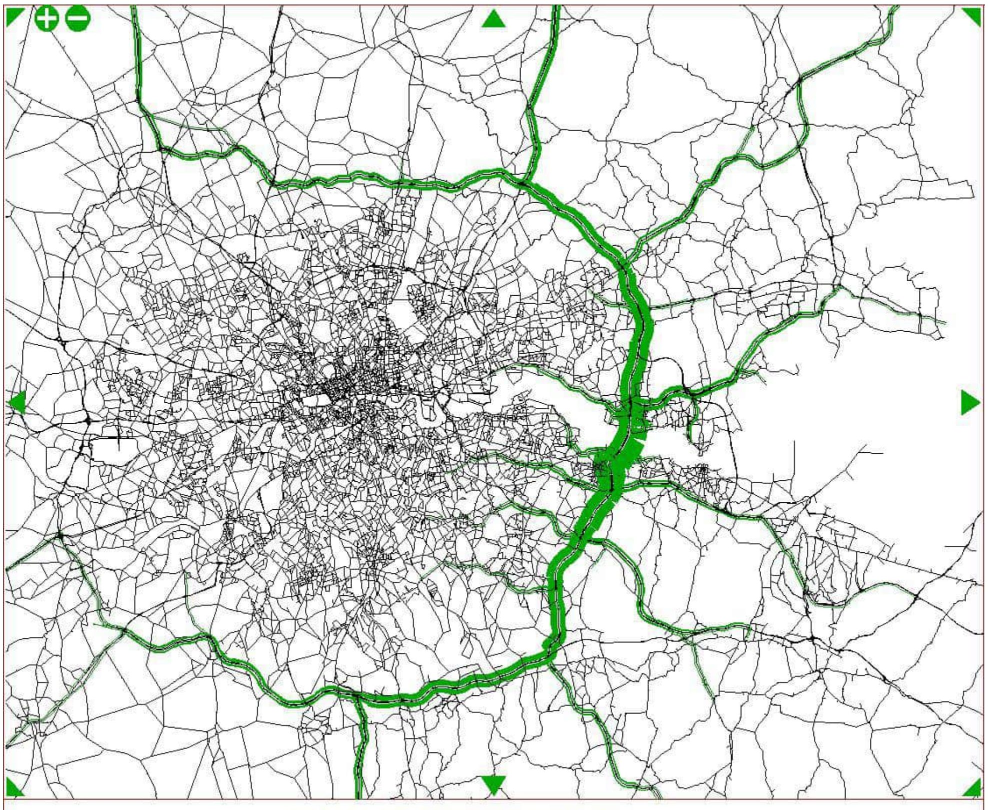


Plate 8.5 Select link analysis – Dartford Crossing DS 2030 core inter-peak



LR_CS72_2030_TS2_SLA_DartfordCrossing_2way

Plate 8.6 Select link analysis – Lower Thames Crossing DS 2030 core inter-peak

LR_CS72_2030_TS2_SLA_LTC_2way

Table 8.9 Select link analysis – summary of primary corridors of movement 2030 inter-peak two-way flow

Movement	**Corridor**	**DM**		**DS**		**DS-DM SLA flow (PCU)**	**% change (DM to DS) in SLA flow**
		SLA flow (PCU)	**% of selected link flow**	**SLA flow (PCU)**	**% of selected link flow**		
South of River Thames	Local (inside M25)	2,197	16%	2,477	23%	280	13%
	Local (outside M25)	1,378	10%	1,314	12%	-64	-5%
	M25 south (junctions 2–3)	6,597	47%	5,884	55%	-713	-11%
	A2/M2 to/from Kent	3,748	27%	1,101	10%	-2,647	-71%
Select link	Dartford Crossing	**13,921**	**100%**	**10,776**	**100%**	**-3,144**	**-23%**
North of River Thames	London north	1,755	13%	2,054	19%	299	17%
	Local traffic	1,440	10%	1,454	13%	14	1%
	M25 north (junctions 30–29)	7,615	55%	5,050	47%	-2,565	-34%
	A13 to/from Essex	3,110	22%	2,218	21%	-892	-29%
South of River Thames	Local traffic	n/a	n/a	680	10%	n/a	n/a
	A2 west of the Project	n/a	n/a	355	5%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	5,472	84%	n/a	n/a
Select link	Lower Thames Crossing	n/a	n/a	**6,506**	**100%**	n/a	n/a
North of River Thames	A1089	n/a	n/a	528	8%	n/a	n/a
	A13 west of the Project	n/a	n/a	22	0%	n/a	n/a
	A13 east of the Project	n/a	n/a	2,482	38%	n/a	n/a
	M25 north of the Project	n/a	n/a	3,475	53%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings

Plate 8.7 Select link analysis – Dartford Crossing DM 2030 core PM peak

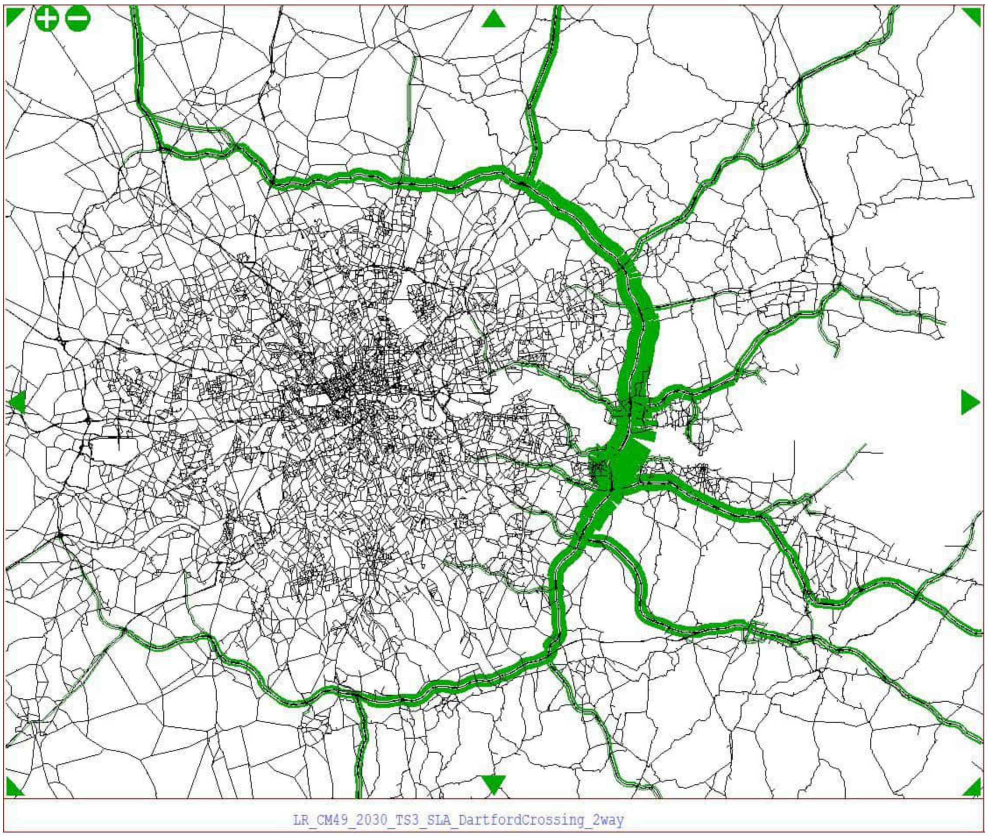


Plate 8.8 Select link analysis – Dartford Crossing DS 2030 core PM peak

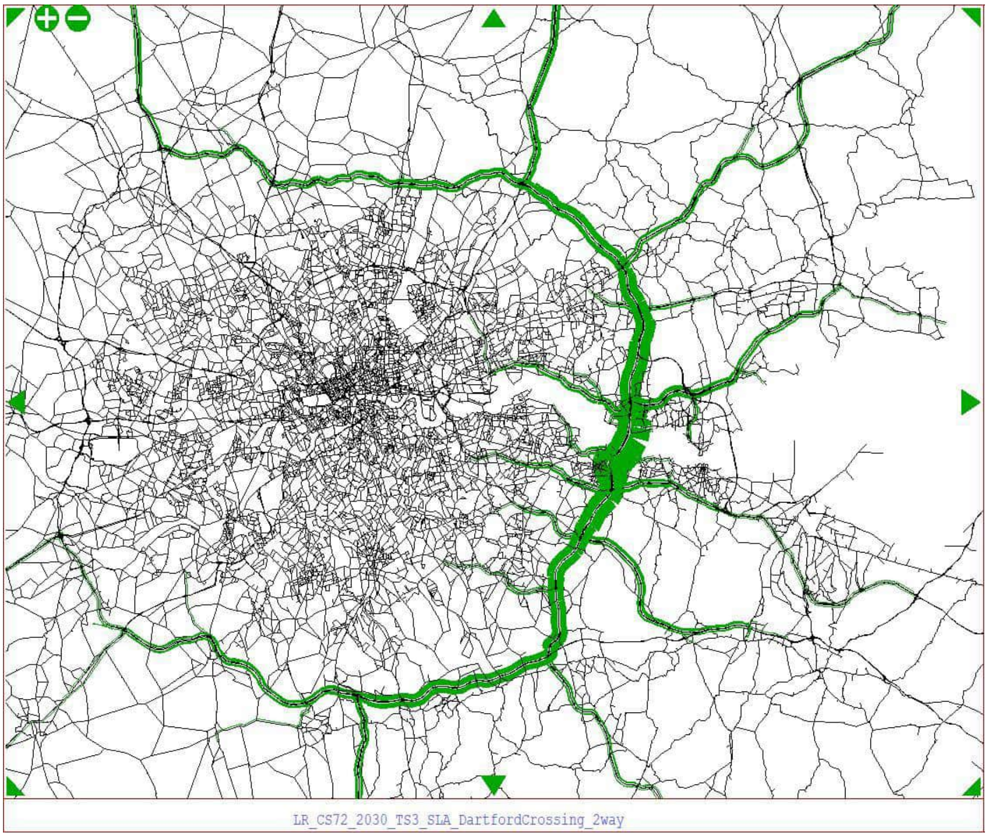


Plate 8.9 Select link analysis – Lower Thames Crossing DS 2030 core PM peak

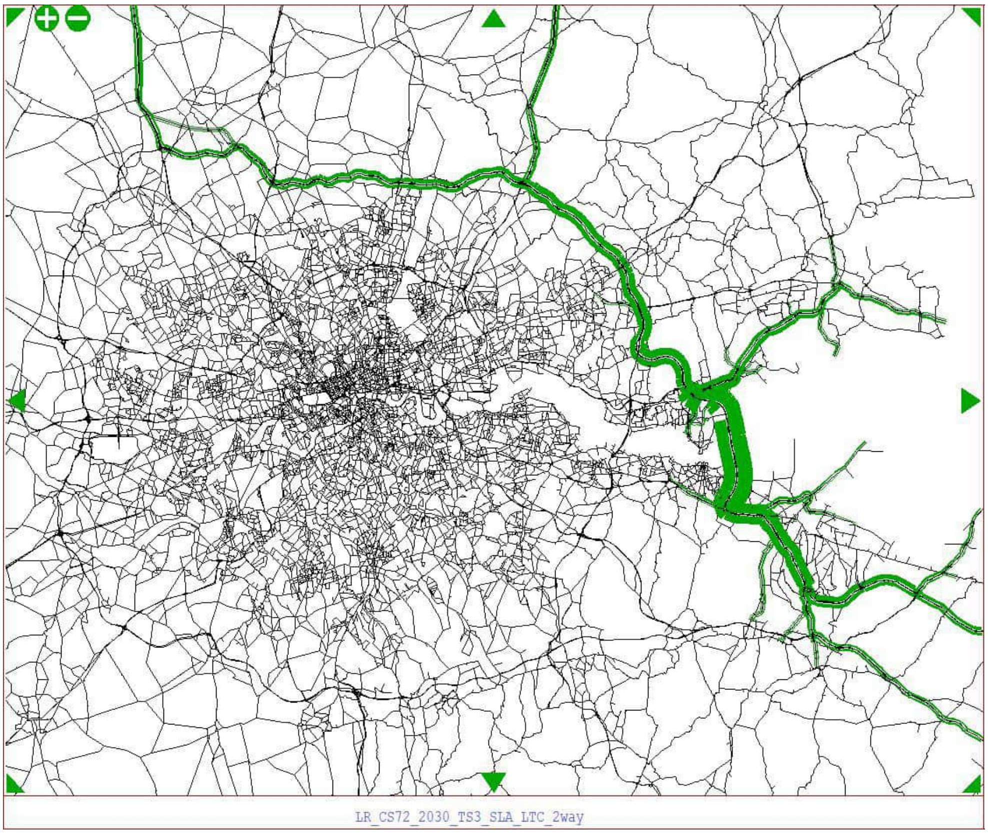


Table 8.10 Select link analysis – summary of primary corridors of movement 2030 PM peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,443	17%	2,877	24%	435	18%
	Local (outside M25)	1,675	11%	1,527	13%	-148	-9%
	M25 south (junctions 2–3)	6,749	46%	6,143	51%	-606	-9%
	A2/M2 to/from Kent	3,869	26%	1,473	12%	-2,395	-62%
Select link	Dartford Crossing	**14,736**	**100%**	**12,021**	**100%**	**-2,715**	**-18%**
North of River Thames	London north	2,398	16%	2,887	24%	488	20%
	Local traffic	1,443	10%	1,446	12%	2	0%
	M25 north (junctions 30–29)	7,707	52%	5,462	45%	-2,245	-29%
	A13 to/from Essex	3,187	22%	2,227	19%	-961	-30%
South of River Thames	Local traffic	n/a	n/a	1,022	13%	n/a	n/a
	A2 west of the Project	n/a	n/a	625	8%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	6,340	79%	n/a	n/a

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
Select link	Lower Thames Crossing	n/a	n/a	**7,988**	**100%**	n/a	n/a
North of River Thames	A1089	n/a	n/a	717	9%	n/a	n/a
	A13 west of the Project	n/a	n/a	28	0%	n/a	n/a
	A13 east of the Project	n/a	n/a	3,687	46%	n/a	n/a
	M25 north of the Project	n/a	n/a	3,556	45%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings

DM vs DS flow comparisons

8.2.7 The impacts of the Project on traffic flows are presented in a number of different ways below. Plate 8.10 to Plate 8.12 provide a flow difference plot between the DM and DS scenarios. Blue colours equate to reductions in flow, green colours indicate increases in flow. Flow differences of less than 100 PCUs per hour have been excluded from the colouring.

8.2.8 Traffic flow northbound at the Dartford Crossing is managed by the TMC. As described in other sections of this report, the TMC effectively constrains the capacity at Dartford through the use of traffic signals. Flows are presented for the section approaching the TMC and the section after the TMC, to demonstrate the impact of the capacity constraint. Table 8.11 provides a comparison of the cross-river traffic flows between the DM and DS scenarios for the link approaching the TMC. Table 8.12 provides a comparison of the cross-river traffic flows between the DM and DS scenarios for the link after the TMC.

8.2.9 The tables also show the effective capacities for the links. For the Dartford Crossing southbound this is the link capacity; for the Dartford Crossing northbound this is the TMC capacity. For the Lower Thames Crossing northbound and southbound the capacity is set by the inclining section, as defined in Section 6.2. The Volume/Capacity (V/C) ratio is also presented, with green shading indicating a V/C below 0.85, orange between 0.85 and 0.95 and red if 0.95 or above. Graphs showing a comparison of the cross-river flows across different years and growth assumptions are provided in Annex B.

Plate 8.10 Actual flow comparison plot – 2030 core DM vs DS AM peak

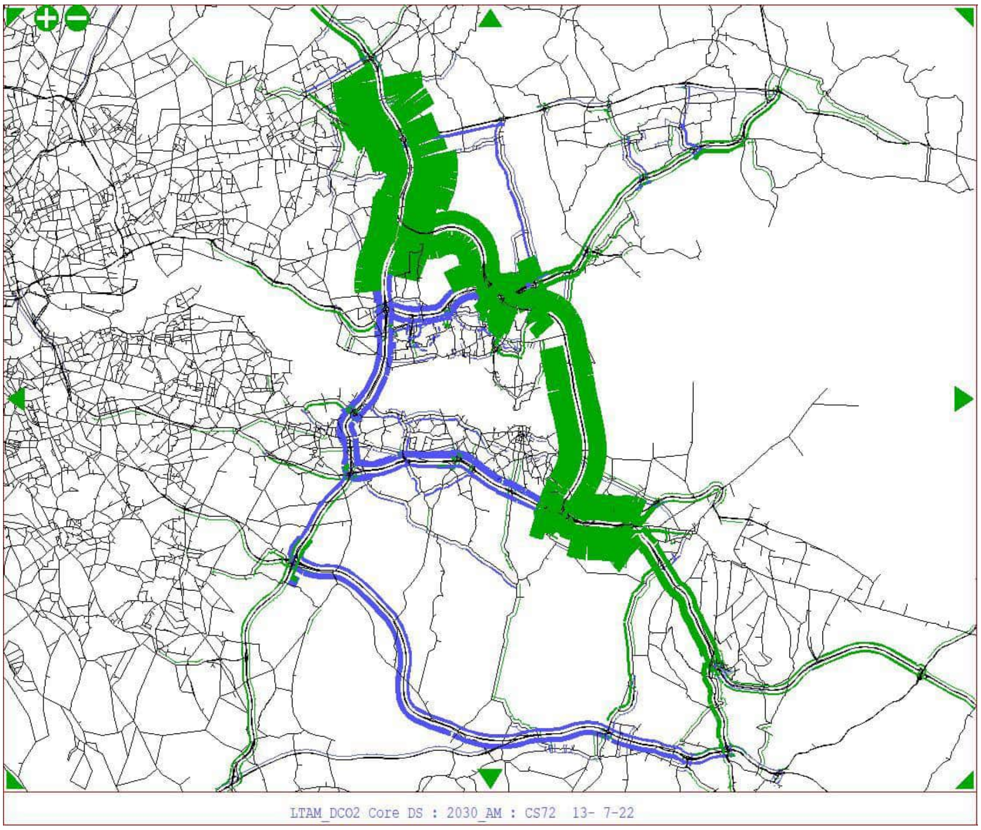


Plate 8.11 Actual flow comparison plot – 2030 core DM vs DS inter-peak

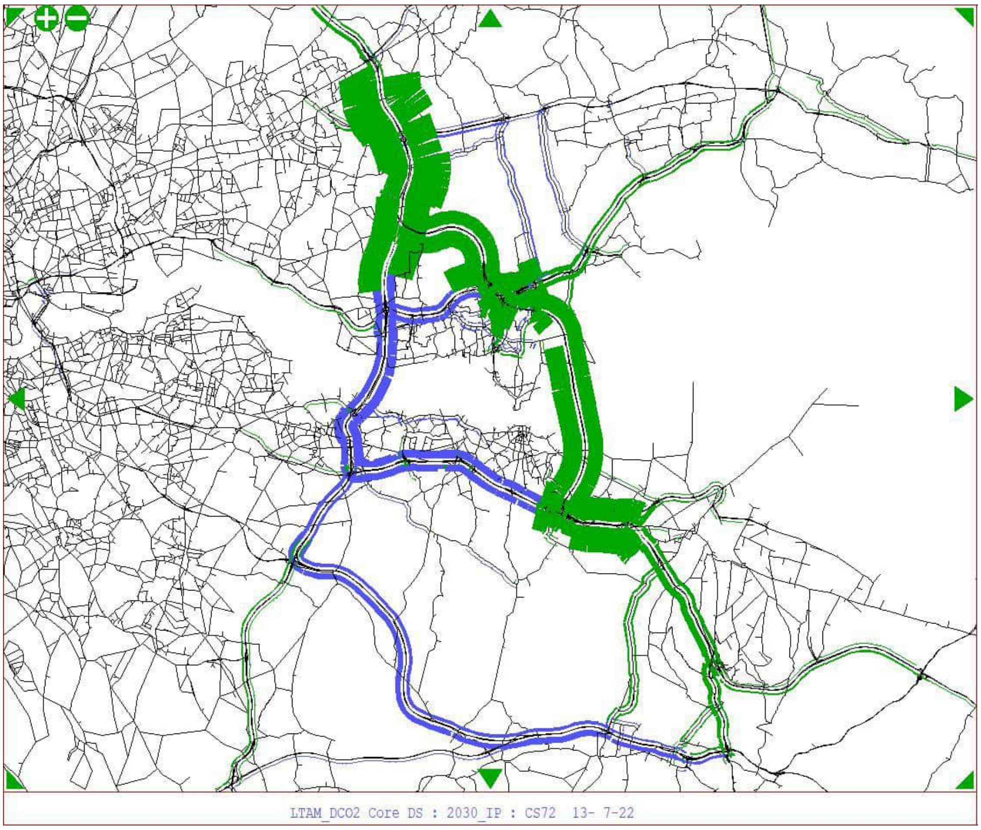


Plate 8.12 Actual flow comparison plot – 2030 core DM vs DS PM peak

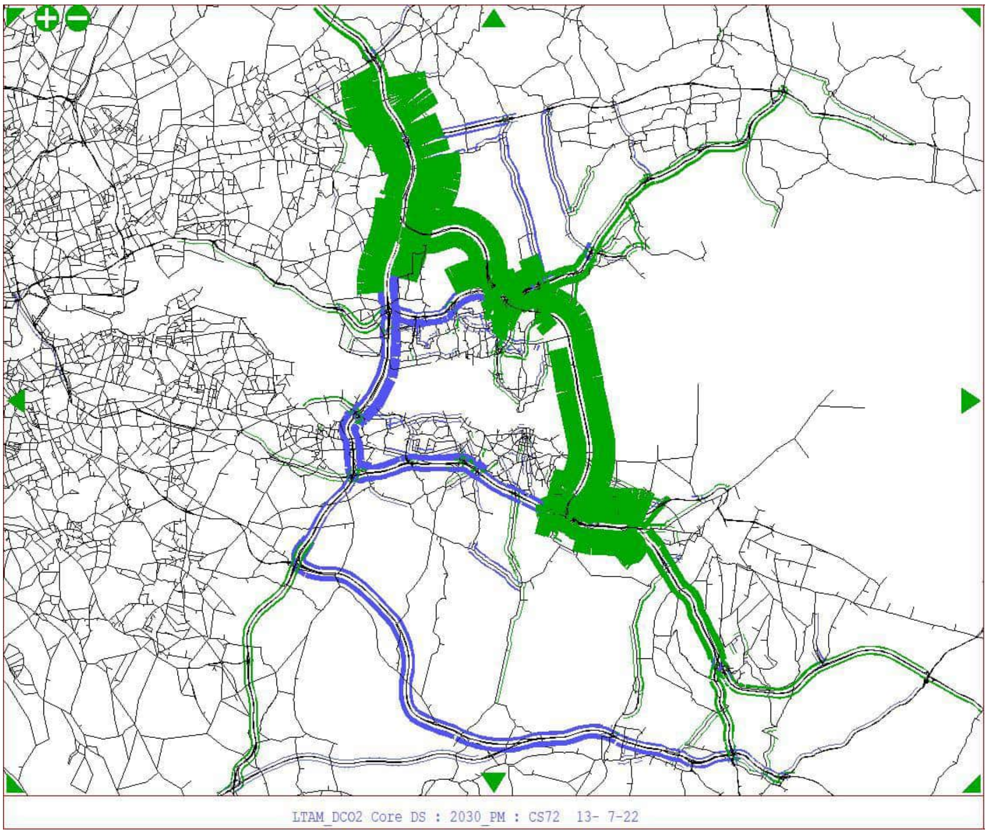


Table 8.11 Cross-river traffic flows (NB flows approaching TMC) – 2030 core DM vs DS (hourly flows in PCUs)

Direction	Crossing	Time period	Cars				LGV				HGV				Total				Effective capacity	Link V/C ratio	
			DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %		DM	DS
SB	Dartford Crossing	AM	3,526	3,452	-75	-2%	1,704	1,565	-139	-8%	3,270	2,514	-756	-23%	8,500	7,530	-970	-11%	8,500	1.00	0.89
		IP	3,223	2,665	-558	-17%	825	678	-147	-18%	2,983	1,936	-1,047	-35%	7,031	5,279	-1,752	-25%	8,500	0.83	0.62
		PM	4,819	3,914	-905	-19%	1,093	838	-255	-23%	2,062	1,318	-744	-36%	7,974	6,071	-1,904	-24%	8,500	0.94	0.71
	Lower Thames Crossing	AM	0	2,092	–	–	0	317	–	–	0	1,063	–	–	0	3,472	–	–	6,360	–	0.55
		IP	0	1,581	–	–	0	170	–	–	0	1,100	–	–	0	2,851	–	–	6,360	–	0.45
		PM	0	3,316	–	–	0	304	–	–	0	794	–	–	0	4,415	–	–	6,360	–	0.69
	Total	AM	3,526	5,543	2,017	57%	1,704	1,882	178	10%	3,270	3,577	307	9%	8,500	11,002	2,502	29%	14,860	–	0.74
		IP	3,223	4,246	1,023	32%	825	848	23	3%	2,983	3,036	54	2%	7,031	8,130	1,099	16%	14,860	–	0.55
		PM	4,819	7,230	2,412	50%	1,093	1,142	49	4%	2,062	2,112	50	2%	7,974	10,485	2,511	31%	14,860	–	0.71
NB	Dartford Crossing *	AM	3,683	3,190	-493	-13%	1,407	980	-426	-30%	2,427	1,577	-851	-35%	7,517	5,747	-1,771	-24%	6,981	1.08	0.82
		IP	3,112	2,746	-366	-12%	939	676	-263	-28%	3,327	2,075	-1,252	-38%	7,378	5,497	-1,881	-25%	6,890	1.07	0.80
		PM	4,416	3,911	-505	-11%	965	781	-184	-19%	1,958	1,258	-700	-36%	7,338	5,950	-1,388	-19%	6,762	1.09	0.88
	Lower Thames Crossing	AM	0	2,970	–	–	0	561	–	–	0	1,035	–	–	0	4,566	–	–	6,360	–	0.72
		IP	0	1,933	–	–	0	319	–	–	0	1,404	–	–	0	3,655	–	–	6,360	–	0.57
		PM	0	2,567	–	–	0	251	–	–	0	755	–	–	0	3,573	–	–	6,360	–	0.56
	Total	AM	3,683	6,160	2,477	67%	1,407	1,542	135	10%	2,427	2,611	184	8%	7,517	10,313	2,795	37%	13,341	–	0.77
		IP	3,112	4,679	1,567	50%	939	995	56	6%	3,327	3,478	151	5%	7,378	9,153	1,775	24%	13,250	–	0.69
		PM	4,416	6,478	2,062	47%	965	1,032	67	7%	1,958	2,013	55	3%	7,338	9,523	2,185	30%	13,122	–	0.73

** Flows are extracted for the link approaching the TMC*

Note: Red text indicates negative values. The V/C ratio is shaded green for a V/C below 0.85, orange 0.85 to 0.95 and red if 0.95 or above

Table 8.12 Cross-river traffic flows (NB flows after TMC) – 2030 core DM vs DS (hourly flows in PCUs)

Direction	Crossing	Time period	Cars				LGV				HGV				Total				Effective capacity	Link V/C ratio	
			DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %		DM	DS
SB	Dartford Crossing	AM	3,526	3,452	-75	-2%	1,704	1,565	-139	-8%	3,270	2,514	-756	-23%	8,500	7,530	-970	-11%	8,500	1.00	0.89
		IP	3,223	2,665	-558	-17%	825	678	-147	-18%	2,983	1,936	-1,047	-35%	7,031	5,279	-1,752	-25%	8,500	0.83	0.62
		PM	4,819	3,914	-905	-19%	1,093	838	-255	-23%	2,062	1,318	-744	-36%	7,974	6,071	-1,904	-24%	8,500	0.94	0.71
	Lower Thames Crossing	AM	0	2,092	–	–	0	317	–	–	0	1,063	–	–	0	3,472	–	–	6,360	–	0.55
		IP	0	1,581	–	–	0	170	–	–	0	1,100	–	–	0	2,851	–	–	6,360	–	0.45
		PM	0	3,316	–	–	0	304	–	–	0	794	–	–	0	4,415	–	–	6,360	–	0.69
	Total	AM	3,526	5,543	2,017	57%	1,704	1,882	178	10%	3,270	3,577	307	9%	8,500	11,002	2,502	29%	14,860	–	0.74
		IP	3,223	4,246	1,023	32%	825	848	23	3%	2,983	3,036	54	2%	7,031	8,130	1,099	16%	14,860	–	0.55
		PM	4,819	7,230	2,412	50%	1,093	1,142	49	4%	2,062	2,112	50	2%	7,974	10,485	2,511	31%	14,860	–	0.71
NB	Dartford Crossing*	AM	3,423	3,190	-233	-7%	1,307	980	-327	-25%	2,251	1,577	-675	-30%	6,981	5,747	-1,235	-18%	6,981	1.00	0.82
		IP	2,907	2,746	-161	-6%	877	676	-201	-23%	3,106	2,075	-1,031	-33%	6,890	5,497	-1,393	-20%	6,890	1.00	0.80
		PM	4,068	3,911	-157	-4%	889	781	-108	-12%	1,805	1,258	-547	-30%	6,762	5,950	-812	-12%	6,762	1.00	0.88
	Lower Thames Crossing	AM	0	2,970	–	–	0	561	–	–	0	1,035	–	–	0	4,566	–	–	6,360	–	0.72
		IP	0	1,933	–	–	0	319	–	–	0	1,404	–	–	0	3,655	–	–	6,360	–	0.57
		PM	0	2,567	–	–	0	251	–	–	0	755	–	–	0	3,573	–	–	6,360	–	0.56
	Total	AM	3,423	6,160	2,737	80%	1,307	1,542	235	18%	2,251	2,611	360	16%	6,981	10,313	3,332	48%	13,341	–	0.77
		IP	2,907	4,679	1,772	61%	877	995	118	13%	3,106	3,478	372	12%	6,890	9,153	2,263	33%	13,250	–	0.69
		PM	4,068	6,478	2,410	59%	889	1,032	143	16%	1,805	2,013	209	12%	6,762	9,523	2,762	41%	13,122	–	0.73

** Flows are extracted for the link after the TMC*

Note: Red text indicates negative values. The V/C ratio is shaded green for a V/C below 0.85, orange 0.85 to 0.95 and red if 0.95 or above

8.2.10 The impact on flows has also been analysed at other locations in the wider network considered critical to understanding the impacts of the Project. Plate 8.13 provides a graphical representation of these locations.

8.2.11 Table 8.13 provides a comparison of the flows at these strategic locations between the DM and DS in each time period. The V/C ratio is also presented, with green shading indicating a V/C below 0.85, orange between 0.85 and 0.95 and red if 0.95 or above.

Plate 8.13 Identification of key corridor locations

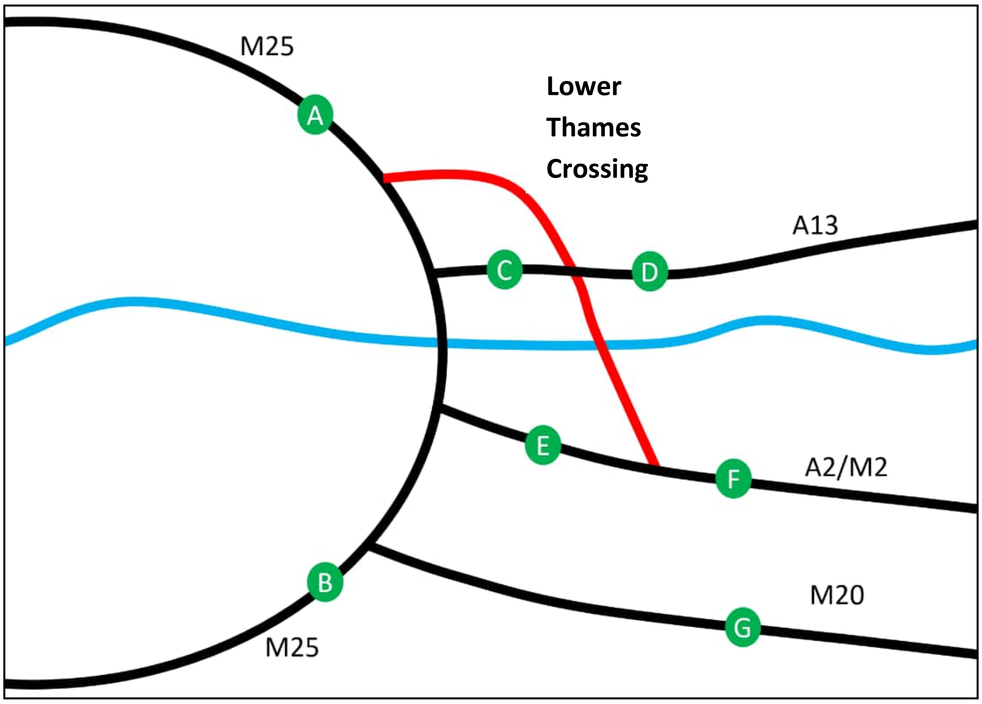


Table 8.13 Key corridor traffic flows – 2030 core DM vs DS (hourly flows in PCUs)

Location	Location description	Time period	DM			DS			Flow differences	
			Flow	Effective capacity	V/C	Flow	Effective capacity	V/C	Diff.	Diff. %
A	M25 junction 29 to M25 junction 28 (NB)	AM	7,370	9,180	0.80	8,554	9,180	0.93	1,184	16%
		IP	6,525	9,180	0.71	7,243	9,180	0.79	718	11%
		PM	6,712	9,180	0.73	7,458	9,180	0.81	746	11%
	M25 junction 28 to M25 junction 29 (SB)	AM	7,552	9,115	0.83	7,725	9,180	0.84	173	2%
		IP	7,033	9,115	0.77	7,334	9,180	0.80	301	4%
		PM	7,441	9,115	0.82	7,986	9,180	0.87	545	7%
B	M25 junction 4 to M25 junction 3 (NB)	AM	5,358	6,850	0.78	5,530	6,850	0.81	172	3%
		IP	5,316	6,850	0.78	5,476	6,850	0.80	160	3%
		PM	5,944	6,850	0.87	6,147	6,850	0.90	203	3%
	M25 junction 3 to M25 junction 4 (SB)	AM	6,730	6,850	0.98	6,842	6,850	1.00	112	2%
		IP	4,955	6,850	0.72	5,035	6,850	0.73	79	2%
		PM	5,541	6,850	0.81	5,741	6,850	0.84	199	4%
C	A13 A126 to A1012 (EB)	AM	4,918	6,310	0.78	3,947	6,296	0.63	-971	-20%
		IP	4,941	6,297	0.78	4,194	6,284	0.67	-746	-15%
		PM	5,752	6,265	0.92	5,518	6,237	0.88	-234	-4%
	A13 A1012 to A126 (WB)	AM	6,122	6,360	0.96	5,363	6,360	0.84	-759	-12%
		IP	5,288	6,360	0.83	4,388	6,360	0.69	-900	-17%
		PM	5,695	6,360	0.90	4,661	6,360	0.73	-1,033	-18%
D	A13 Orsett Cock to Manor Way (EB)	AM	4,591	6,370	0.72	5,213	6,370	0.82	622	14%
		IP	3,987	6,370	0.63	4,637	6,370	0.73	649	16%
		PM	4,871	6,370	0.76	5,744	6,370	0.90	873	18%
	A13 Manor Way to Orsett Cock (WB)	AM	5,136	6,220	0.83	5,782	6,220	0.93	646	13%
		IP	4,100	6,220	0.66	4,786	6,220	0.77	686	17%
		PM	4,449	6,220	0.72	5,609	6,220	0.90	1,160	26%
E	A2 A227 to Gravesend East (EB)	AM	5,781	9,238	0.63	4,729	9,232	0.51	-1,053	-18%
		IP	5,982	9,193	0.65	4,847	9,183	0.53	-1,135	-19%
		PM	9,016	9,184	0.98	8,431	9,171	0.92	-585	-6%
	A2 Gravesend East to A227 (WB)	AM	6,890	7,227	0.95	6,288	7,008	0.90	-602	-9%
		IP	5,723	7,058	0.81	4,675	6,877	0.68	-1,047	-18%
		PM	5,840	6,879	0.85	5,322	6,733	0.79	-518	-9%

Location	Location description	Time period	DM			DS			Flow differences	
			Flow	Effective capacity	V/C	Flow	Effective capacity	V/C	Diff.	Diff. %
F	M2 junction 1 to M2 junction 2 (EB)	AM	5,013	8,531	0.59	5,920	8,365	0.71	908	18%
		IP	4,221	8,647	0.49	4,999	8,429	0.59	778	18%
		PM	6,214	8,545	0.73	7,554	8,483	0.89	1,341	22%
	M2 junction 2 to M2 junction 1 (WB)	AM	5,570	8,810	0.63	7,201	8,632	0.83	1,631	29%
		IP	3,894	8,846	0.44	5,310	8,798	0.60	1,416	36%
		PM	4,993	8,919	0.56	6,094	8,711	0.70	1,101	22%
G	M20 junction 3 to M20 junction 4 (EB)	AM	5,528	9,115	0.61	5,025	9,115	0.55	-504	-9%
		IP	5,394	9,115	0.59	4,905	9,115	0.54	-489	-9%
		PM	8,378	9,115	0.92	7,857	9,115	0.86	-521	-6%
	M20 junction 4 to M20 junction 3 (WB)	AM	8,462	9,115	0.93	7,645	9,115	0.84	-816	-10%
		IP	5,180	9,115	0.57	4,179	9,115	0.46	-1,001	-19%
		PM	5,303	9,115	0.58	4,477	9,115	0.49	-826	-16%

Note: Red text indicates negative values

DM vs DS journey time comparisons

8.2.12 Another important metric used to measure the Project impact is journey times. These can be monitored in two separate ways:

a. **Link Based Impacts** – this is where the Project attracts traffic away from or on to specific corridors leading to either reduced or additional congestion which is reflected in the journey time along these corridors.

b. **Route Based Impacts** – this is where the Project provides an alternative route through the network for the same origin to destination movement.

8.2.13 Link-based impacts have been assessed by comparing journey times along key strategic corridors. The corridors analysed are shown diagrammatically in Plate 8.14. The journey times are presented in Table 8.14 to Table 8.16 by time period. A more detailed analysis of link-based journey times is provided in Annex C.

Plate 8.14 Link based journey time routes for comparison

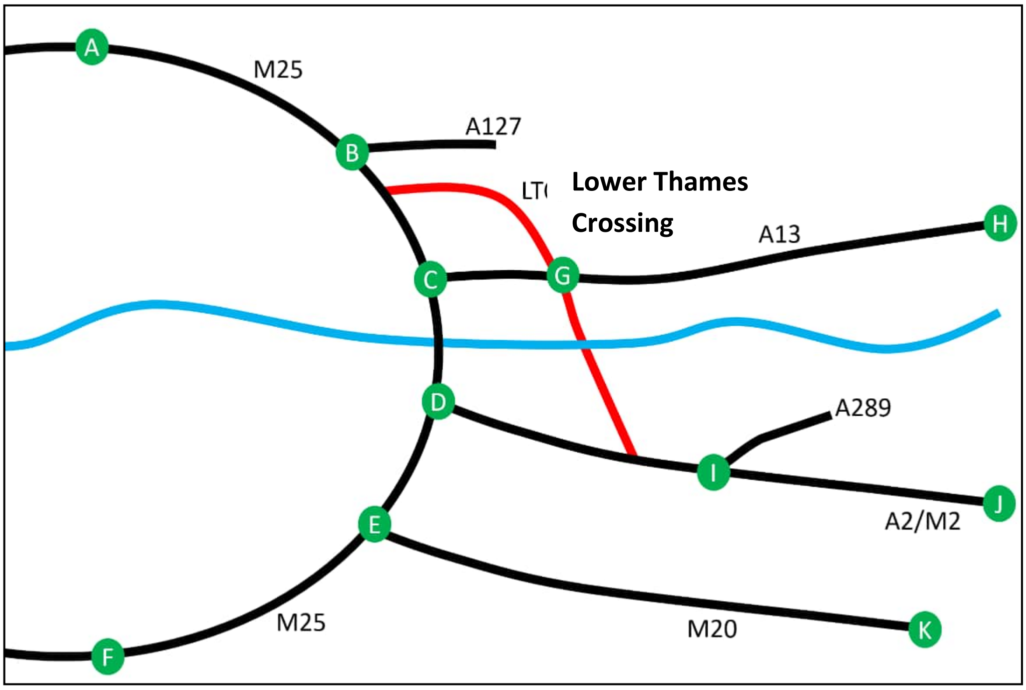


Table 8.14 Link based journey time scenario comparison (2030 core DM vs DS) AM peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)
M25 clockwise	A to B	M25 J26	M25 J29	23.5	16.2	87.0	23.5	16.5	85.3	0.0	0.3	-1.7	-0.1%	1.8%	-1.9%
	B to D	M25 J29	M25 J2	18.8	18.6	60.8	18.9	14.3	79.2	0.1	-4.3	18.4	0.3%	-23.1%	30.3%
	D to F	M25 J2	M25 J7	37.7	28.4	79.8	37.7	29.9	75.8	0.0	1.5	-4.1	0.0%	5.4%	-5.1%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	24.7	92.5	38.0	24.9	91.6	0.0	0.3	-0.9	0.0%	1.0%	-1.0%
	D to B	M25 J2	M25 J29	18.7	19.2	58.4	18.8	13.5	83.8	0.1	-5.7	25.4	0.6%	-29.9%	43.5%
	B to A	M25 J29	M25 J26	23.2	16.5	84.2	23.1	18.8	73.8	-0.1	2.3	-10.4	-0.3%	13.7%	-12.3%
A13 eastbound (EB)	C to G	M25 J30	A1089	5.2	4.8	64.6	5.3	4.1	76.3	0.0	-0.7	11.6	0.9%	-14.5%	18.0%
	G to H	A1089	A130	15.7	11.6	81.4	15.7	12.6	74.6	-0.1	1.0	-6.9	-0.4%	8.8%	-8.4%
A13 westbound (WB)	H to G	A130	A1089	15.3	14.5	63.3	15.2	15.5	58.5	-0.1	1.1	-4.7	-0.7%	7.4%	-7.5%
	G to C	A1089	M25 J30	5.5	8.6	38.5	5.6	5.6	59.4	0.1	-2.9	20.9	1.6%	-34.1%	54.2%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	9.2	100.1	15.3	8.8	104.6	0.1	-0.4	4.5	0.5%	-3.8%	4.5%
	I to J	M2 J1	M2 J4	14.7	8.4	105.5	14.7	8.6	102.6	0.0	0.2	-2.9	0.0%	2.8%	-2.7%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	9.0	101.0	15.1	9.7	92.9	-0.1	0.7	-8.1	-0.7%	7.9%	-8.0%
	I to D	M2 J1	M25 J2	14.8	17.5	50.6	14.8	12.7	70.1	0.1	-4.8	19.4	0.6%	-27.3%	38.4%
M20 EB	E to K	M25 J3	M20 J8	35.3	20.1	105.3	35.3	19.9	106.6	0.0	-0.3	1.3	0.0%	-1.2%	1.3%
M20 WB	K to E	M20 J8	M25 J3	35.3	24.1	88.1	35.3	22.4	94.5	0.0	-1.6	6.4	0.0%	-6.8%	7.3%

Table 8.15 Link based journey time scenario comparison (2030 core DM vs DS) inter-peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)
M25 clockwise	A to B	M25 J26	M25 J29	23.5	15.4	91.6	23.5	15.7	89.7	0.0	0.3	-1.9	-0.1%	2.1%	-2.1%
	B to D	M25 J29	M25 J2	18.8	13.3	84.7	18.9	12.2	93.1	0.1	-1.2	8.4	0.3%	-8.8%	9.9%
	D to F	M25 J2	M25 J7	37.7	23.4	96.8	37.7	23.3	97.0	0.0	-0.1	0.2	0.0%	-0.2%	0.2%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	24.0	95.1	38.0	24.2	94.3	0.0	0.2	-0.9	0.0%	0.9%	-0.9%
	D to B	M25 J2	M25 J29	18.7	17.3	64.9	18.8	13.0	86.7	0.1	-4.3	21.7	0.6%	-24.6%	33.5%
	B to A	M25 J29	M25 J26	23.2	14.3	97.6	23.1	15.1	92.1	-0.1	0.8	-5.5	-0.3%	5.6%	-5.6%
A13 EB	C to G	M25 J30	A1089	5.2	5.0	62.9	5.3	4.2	74.8	0.0	-0.8	11.9	0.9%	-15.1%	18.9%
	G to H	A1089	A130	15.7	11.1	85.1	15.7	11.7	80.1	-0.1	0.6	-5.0	-0.4%	5.9%	-5.9%
A13 WB	H to G	A130	A1089	15.3	11.0	83.1	15.2	11.7	78.0	-0.1	0.6	-5.2	-0.7%	5.9%	-6.2%
	G to C	A1089	M25 J30	5.5	5.7	58.3	5.6	4.6	73.0	0.1	-1.1	14.7	1.6%	-18.9%	25.2%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	9.2	100.1	15.3	8.8	104.8	0.1	-0.4	4.7	0.5%	-4.0%	4.7%
	I to J	M2 J1	M2 J4	14.7	8.2	107.4	14.7	8.3	105.9	0.0	0.1	-1.5	0.0%	1.4%	-1.4%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	8.4	107.9	15.1	8.6	105.3	-0.1	0.2	-2.6	-0.7%	1.8%	-2.4%
	I to D	M2 J1	M25 J2	14.8	10.6	83.4	14.8	8.8	100.8	0.1	-1.8	17.4	0.6%	-16.8%	20.9%
M20 EB	E to K	M25 J3	M20 J8	35.3	19.8	107.0	35.3	19.7	107.8	0.0	-0.2	0.8	0.0%	-0.8%	0.8%
M20 WB	K to E	M20 J8	M25 J3	35.3	20.0	106.1	35.3	19.7	107.6	0.0	-0.3	1.5	0.0%	-1.4%	1.4%

Note: Red text indicates negative values

Table 8.16 Link based journey time scenario comparison (2030 core DM vs DS) PM peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)
M25 clockwise	A to B	M25 J26	M25 J29	23.5	17.0	82.9	23.5	18.0	78.2	0.0	1.0	-4.8	-0.1%	6.0%	-5.7%
	B to D	M25 J29	M25 J2	18.8	15.8	71.3	18.9	12.8	88.6	0.1	-3.1	17.4	0.3%	-19.4%	24.4%
	D to F	M25 J2	M25 J7	37.7	23.7	95.6	37.7	23.9	94.8	0.0	0.2	-0.7	0.0%	0.8%	-0.8%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	27.3	83.5	38.0	27.9	81.7	0.0	0.6	-1.7	0.0%	2.1%	-2.1%
	D to B	M25 J2	M25 J29	18.7	17.5	64.0	18.8	13.3	84.6	0.1	-4.2	20.6	0.6%	-23.9%	32.2%
	B to A	M25 J29	M25 J26	23.2	14.2	97.9	23.1	15.0	92.8	-0.1	0.8	-5.2	-0.3%	5.3%	-5.3%
A13 EB	C to G	M25 J30	A1089	5.2	7.7	40.5	5.3	5.4	58.4	0.0	-2.3	17.9	0.9%	-30.0%	44.2%
	G to H	A1089	A130	15.7	12.8	73.5	15.7	14.2	66.4	-0.1	1.3	-7.1	-0.4%	10.3%	-9.7%
A13 WB	H to G	A130	A1089	15.3	11.0	83.4	15.2	13.0	70.0	-0.1	2.0	-13.3	-0.7%	18.2%	-16.0%
	G to C	A1089	M25 J30	5.5	6.6	50.3	5.6	4.7	70.7	0.1	-1.8	20.4	1.6%	-27.7%	40.6%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	14.1	65.0	15.3	10.8	85.5	0.1	-3.3	20.5	0.5%	-23.6%	31.6%
	I to J	M2 J1	M2 J4	14.7	9.2	95.6	14.7	10.8	81.3	0.0	1.6	-14.3	0.0%	17.5%	-14.9%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	8.7	104.6	15.1	8.9	101.6	-0.1	0.2	-3.0	-0.7%	2.3%	-2.9%
	I to D	M2 J1	M25 J2	14.8	12.6	70.1	14.8	10.1	88.2	0.1	-2.5	18.1	0.6%	-20.1%	25.8%
M20 EB	E to K	M25 J3	M20 J8	35.3	24.3	87.2	35.3	23.2	91.2	0.0	-1.1	4.0	0.0%	-4.4%	4.6%
M20 WB	K to E	M20 J8	M25 J3	35.3	20.2	104.8	35.3	19.9	106.5	0.0	-0.3	1.7	0.0%	-1.6%	1.6%

Note: Red text indicates negative values

8.2.14 Route-based impacts have been analysed by selecting a series of cross-river origin to destination movements, some of which are considered likely to have additional routing options, not related to increases or reductions in capacity on existing roads, with the introduction of the Project. Some of the movements do switch route to use the Project rather than the Dartford Crossing, some do not. Both of these types of movement are important to present as they demonstrate the range and scale of impact of the Project.

8.2.15 Table 8.17 to Table 8.22 provide the With and Without Scheme journey distances, times and average speeds for a selection of these movements for southbound and northbound movements. The locations are shown first in Plate 8.15.

8.2.16 It is important to note that the values presented in Table 8.17 to Table 8.22, and subsequent route-based journey time analysis, are extracted from the LTAM forest skim matrices. This means that they are values that have been averaged over all assigned paths in the assignment model. This can lead to some very small differences in, for example, the distances of the average path. Red values within these tables indicate a negative value, in this case a reduction in journey time.

Plate 8.15 Route based journey time comparison

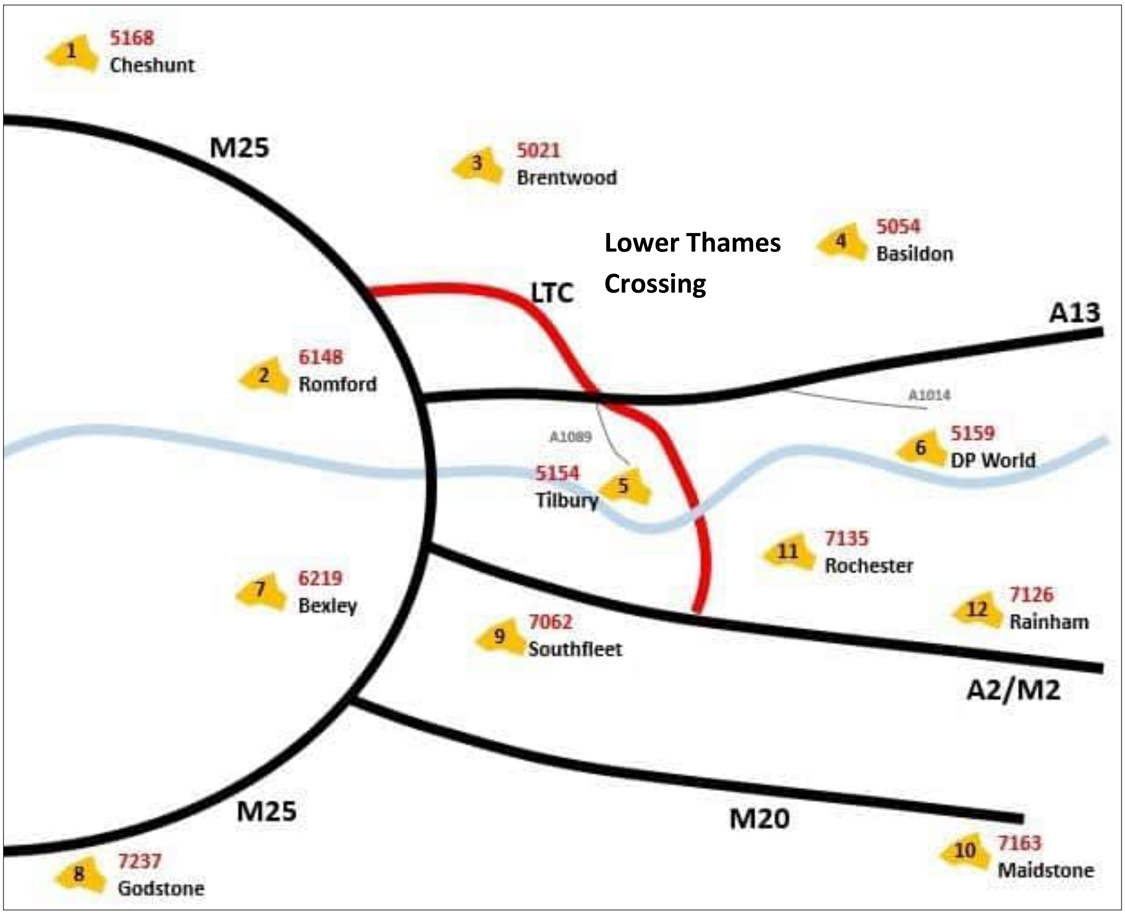


Table 8.17 Route based journey time comparison north to south movements (2030 core DM vs DS) AM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.8	60.2	61.7	61.8	57.7	64.3	0.0	-2.4	2.6	0.0%	-4.1%	4.3%
1 to 8	Cheshunt	Godstone	91.5	78.9	69.6	91.5	76.2	72.1	0.0	-2.8	2.5	0.0%	-3.5%	3.6%
1 to 9	Cheshunt	Southfleet	62.1	55.9	66.7	62.2	51.6	72.3	0.0	-4.4	5.7	0.0%	-7.8%	8.5%
1 to 10	Cheshunt	Maidstone	88.2	73.4	72.0	82.9	70.1	71.0	-5.3	-3.4	-1.0	-6.0%	-4.6%	-1.5%
1 to 11	Cheshunt	Rochester	74.4	72.1	62.0	70.2	62.9	67.0	-4.2	-9.1	5.0	-5.6%	-12.7%	8.1%
1 to 12	Cheshunt	Rainham	91.4	77.6	70.7	87.3	68.3	76.6	-4.1	-9.2	5.9	-4.5%	-11.9%	8.4%
2 to 7	Romford	Bexley	31.9	50.7	37.7	35.6	45.4	47.1	3.7	-5.4	9.4	11.7%	-10.6%	25.0%
2 to 8	Romford	Godstone	61.5	69.5	53.1	65.3	63.8	61.4	3.7	-5.7	8.2	6.1%	-8.2%	15.5%
2 to 9	Romford	Southfleet	32.2	46.5	41.5	35.9	39.2	55.0	3.7	-7.3	13.4	11.6%	-15.7%	32.4%
2 to 10	Romford	Maidstone	58.2	64.0	54.5	56.6	57.7	58.9	-1.6	-6.3	4.3	-2.7%	-9.9%	7.9%
2 to 11	Romford	Rochester	44.5	62.7	42.6	44.0	50.6	52.2	-0.5	-12.1	9.6	-1.1%	-19.3%	22.5%
2 to 12	Romford	Rainham	61.4	68.1	54.1	61.1	56.0	65.4	-0.4	-12.1	11.3	-0.6%	-17.8%	20.9%
3 to 7	Brentwood	Bexley	33.0	42.1	47.0	32.9	38.3	51.6	-0.1	-3.8	4.6	-0.3%	-9.1%	9.7%
3 to 8	Brentwood	Godstone	62.7	60.9	61.8	62.6	56.7	66.2	-0.1	-4.2	4.4	-0.1%	-6.8%	7.2%
3 to 9	Brentwood	Southfleet	33.3	37.9	52.8	33.2	32.1	62.1	-0.1	-5.8	9.3	-0.3%	-15.2%	17.6%
3 to 10	Brentwood	Maidstone	59.3	55.4	64.2	53.9	50.6	63.9	-5.4	-4.8	-0.3	-9.1%	-8.6%	-0.5%
3 to 11	Brentwood	Rochester	45.6	54.0	50.6	41.3	43.5	57.0	-4.3	-10.5	6.3	-9.4%	-19.5%	12.5%
3 to 12	Brentwood	Rainham	62.6	59.5	63.1	58.4	48.9	71.6	-4.2	-10.6	8.5	-6.7%	-17.8%	13.5%
4 to 7	Basildon	Bexley	37.1	52.5	42.5	39.6	49.4	48.1	2.5	-3.0	5.6	6.7%	-5.8%	13.2%
4 to 8	Basildon	Godstone	66.8	71.2	56.3	69.3	67.9	61.3	2.5	-3.3	5.0	3.7%	-4.7%	8.8%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	37.5	48.2	46.6	34.7	38.4	54.3	-2.7	-9.9	7.7	-7.3%	-20.5%	16.6%
4 to 10	Basildon	Maidstone	63.5	65.8	57.9	48.9	54.7	53.7	-14.5	-11.1	-4.2	-22.9%	-16.8%	-7.3%
4 to 11	Basildon	Rochester	49.7	64.4	46.4	36.3	47.6	45.8	-13.4	-16.8	-0.6	-27.0%	-26.1%	-1.2%
4 to 12	Basildon	Rainham	66.7	69.9	57.3	53.4	53.0	60.5	-13.3	-16.9	3.1	-20.0%	-24.2%	5.5%
5 to 7	Tilbury Port	Bexley	28.3	38.0	44.8	28.3	33.6	50.6	0.0	-4.4	5.9	0.0%	-11.6%	13.1%
5 to 8	Tilbury Port	Godstone	58.0	56.7	61.3	58.0	52.0	66.9	0.0	-4.7	5.6	0.0%	-8.3%	9.1%
5 to 9	Tilbury Port	Southfleet	28.6	33.7	51.0	27.7	22.3	74.5	-0.9	-11.4	23.5	-3.2%	-33.8%	46.1%
5 to 10	Tilbury Port	Maidstone	54.6	51.3	64.0	41.9	38.7	65.0	-12.7	-12.6	1.1	-23.3%	-24.5%	1.7%
5 to 11	Tilbury Port	Rochester	40.9	49.9	49.2	29.3	31.5	55.7	-11.6	-18.3	6.5	-28.4%	-36.7%	13.2%
5 to 12	Tilbury Port	Rainham	57.9	55.4	62.8	46.4	37.0	75.3	-11.5	-18.4	12.5	-19.9%	-33.2%	19.9%
6 to 7	DP World	Bexley	32.1	42.0	45.9	32.1	37.0	52.0	0.0	-5.0	6.1	0.0%	-11.8%	13.3%
6 to 8	DP World	Godstone	61.8	60.8	61.0	61.8	55.5	66.8	0.0	-5.3	5.8	0.0%	-8.7%	9.5%
6 to 9	DP World	Southfleet	32.4	37.8	51.5	29.0	24.2	71.9	-3.4	-13.5	20.4	-10.4%	-35.8%	39.5%
6 to 10	DP World	Maidstone	58.4	55.3	63.4	43.3	40.6	63.9	-15.2	-14.7	0.5	-26.0%	-26.6%	0.8%
6 to 11	DP World	Rochester	44.7	53.9	49.8	30.6	33.4	54.9	-14.1	-20.5	5.2	-31.5%	-38.0%	10.4%
6 to 12	DP World	Rainham	61.7	59.4	62.3	47.7	38.9	73.6	-14.0	-20.5	11.3	-22.7%	-34.6%	18.1%

Table 8.18 Route based journey time comparison north to south movements (2030 core DM vs DS) inter-peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.8	49.8	74.5	61.8	49.1	75.5	0.0	-0.7	1.1	0.0%	-1.4%	1.4%
1 to 8	Cheshunt	Godstone	91.5	65.7	83.6	91.5	64.9	84.6	0.0	-0.8	1.1	0.0%	-1.2%	1.3%
1 to 9	Cheshunt	Southfleet	62.1	47.1	79.1	62.1	46.1	80.9	0.0	-1.0	1.8	0.0%	-2.2%	2.3%
1 to 10	Cheshunt	Maidstone	88.1	63.2	83.7	82.8	59.8	83.1	-5.3	-3.4	-0.6	-6.0%	-5.4%	-0.7%
1 to 11	Cheshunt	Rochester	74.4	60.4	73.8	70.2	55.5	75.8	-4.2	-4.9	2.0	-5.7%	-8.2%	2.7%
1 to 12	Cheshunt	Rainham	91.4	67.9	80.8	87.3	62.8	83.4	-4.1	-5.1	2.6	-4.5%	-7.5%	3.2%
2 to 7	Romford	Bexley	35.6	39.1	54.6	35.6	37.4	57.1	0.0	-1.7	2.5	0.0%	-4.4%	4.6%
2 to 8	Romford	Godstone	65.2	55.0	71.2	65.3	53.2	73.6	0.0	-1.8	2.5	0.0%	-3.3%	3.5%
2 to 9	Romford	Southfleet	35.9	36.4	59.1	35.9	34.4	62.7	0.0	-2.1	3.6	0.0%	-5.7%	6.1%
2 to 10	Romford	Maidstone	61.9	52.5	70.7	56.6	48.1	70.6	-5.3	-4.4	-0.1	-8.6%	-8.4%	-0.2%
2 to 11	Romford	Rochester	48.2	49.7	58.1	43.9	43.8	60.2	-4.2	-6.0	2.1	-8.8%	-12.0%	3.6%
2 to 12	Romford	Rainham	65.2	57.2	68.4	61.0	51.1	71.7	-4.1	-6.1	3.3	-6.3%	-10.6%	4.9%
3 to 7	Brentwood	Bexley	33.1	32.2	61.7	33.2	31.1	64.0	0.0	-1.1	2.3	0.1%	-3.5%	3.7%
3 to 8	Brentwood	Godstone	62.8	48.1	78.3	62.8	46.9	80.4	0.0	-1.3	2.1	0.0%	-2.6%	2.7%
3 to 9	Brentwood	Southfleet	33.5	29.6	67.9	33.5	28.1	71.5	0.0	-1.5	3.7	0.1%	-5.1%	5.4%
3 to 10	Brentwood	Maidstone	59.5	45.6	78.2	54.2	41.8	77.8	-5.3	-3.9	-0.4	-8.9%	-8.4%	-0.5%
3 to 11	Brentwood	Rochester	45.7	42.9	64.0	41.5	37.5	66.4	-4.2	-5.4	2.4	-9.2%	-12.6%	3.8%
3 to 12	Brentwood	Rainham	62.7	50.3	74.8	58.6	44.8	78.5	-4.1	-5.5	3.7	-6.5%	-11.0%	5.0%
4 to 7	Basildon	Bexley	39.7	36.4	65.4	39.6	34.9	68.1	-0.1	-1.5	2.7	-0.2%	-4.1%	4.1%
4 to 8	Basildon	Godstone	69.4	52.3	79.6	69.3	50.7	82.0	-0.1	-1.6	2.5	-0.1%	-3.1%	3.1%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	40.0	33.8	71.1	33.8	27.5	73.8	-6.3	-6.3	2.6	-15.7%	-18.7%	3.7%
4 to 10	Basildon	Maidstone	66.0	49.8	79.5	48.0	39.7	72.5	-18.1	-10.1	-7.1	-27.4%	-20.3%	-8.9%
4 to 11	Basildon	Rochester	52.3	47.1	66.7	35.3	35.4	59.8	-17.0	-11.7	-6.9	-32.5%	-24.8%	-10.3%
4 to 12	Basildon	Rainham	69.3	54.5	76.3	52.4	42.7	73.6	-16.9	-11.8	-2.7	-24.4%	-21.6%	-3.5%
5 to 7	Tilbury Port	Bexley	28.3	28.8	58.9	28.3	27.0	62.9	0.0	-1.8	4.0	0.0%	-6.4%	6.8%
5 to 8	Tilbury Port	Godstone	58.0	44.7	77.8	58.0	42.8	81.4	0.0	-2.0	3.6	0.0%	-4.4%	4.6%
5 to 9	Tilbury Port	Southfleet	28.6	26.2	65.6	27.7	19.2	86.7	-0.9	-7.0	21.1	-3.2%	-26.7%	32.1%
5 to 10	Tilbury Port	Maidstone	54.6	42.2	77.6	41.9	31.4	80.0	-12.7	-10.8	2.4	-23.3%	-25.6%	3.1%
5 to 11	Tilbury Port	Rochester	40.9	39.5	62.2	29.3	27.1	64.7	-11.7	-12.3	2.5	-28.5%	-31.3%	4.0%
5 to 12	Tilbury Port	Rainham	57.9	46.9	74.1	46.4	34.4	80.8	-11.5	-12.5	6.8	-19.9%	-26.6%	9.1%
6 to 7	DP World	Bexley	32.1	32.3	59.6	32.1	30.7	62.8	0.0	-1.7	3.2	0.0%	-5.2%	5.4%
6 to 8	DP World	Godstone	61.8	48.2	76.9	61.8	46.4	79.8	0.0	-1.8	3.0	0.0%	-3.7%	3.8%
6 to 9	DP World	Southfleet	32.4	29.7	65.6	29.0	21.3	82.0	-3.4	-8.4	16.4	-10.4%	-28.3%	25.0%
6 to 10	DP World	Maidstone	58.4	45.7	76.7	43.2	33.5	77.4	-15.2	-12.2	0.7	-26.0%	-26.7%	1.0%
6 to 11	DP World	Rochester	44.7	43.0	62.4	30.6	29.2	62.8	-14.1	-13.7	0.4	-31.6%	-32.0%	0.6%
6 to 12	DP World	Rainham	61.7	50.4	73.5	47.7	36.5	78.4	-14.0	-13.9	4.9	-22.7%	-27.5%	6.7%

Table 8.19 Route based journey time comparison north to south movements (2030 core DM vs DS) PM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	62.0	57.5	64.7	61.9	55.9	66.5	0.0	-1.6	1.8	0.0%	-2.7%	2.8%
1 to 8	Cheshunt	Godstone	91.6	71.8	76.6	91.6	70.0	78.6	0.0	-1.8	2.0	0.0%	-2.5%	2.6%
1 to 9	Cheshunt	Southfleet	60.9	54.5	67.0	62.3	51.2	73.0	1.4	-3.3	6.0	2.3%	-6.1%	9.0%
1 to 10	Cheshunt	Maidstone	88.3	73.4	72.1	82.9	69.2	71.9	-5.3	-4.2	-0.2	-6.0%	-5.8%	-0.3%
1 to 11	Cheshunt	Rochester	74.9	73.6	61.1	70.8	65.1	65.3	-4.1	-8.5	4.2	-5.5%	-11.6%	6.9%
1 to 12	Cheshunt	Rainham	91.5	87.1	63.0	87.4	78.3	67.0	-4.1	-8.8	3.9	-4.5%	-10.1%	6.2%
2 to 7	Romford	Bexley	35.7	49.6	43.2	35.7	45.0	47.5	0.0	-4.5	4.3	-0.1%	-9.2%	10.0%
2 to 8	Romford	Godstone	65.3	63.9	61.4	65.3	59.1	66.3	0.0	-4.8	5.0	0.0%	-7.5%	8.1%
2 to 9	Romford	Southfleet	34.6	46.6	44.5	36.0	40.3	53.6	1.4	-6.3	9.1	4.1%	-13.6%	20.4%
2 to 10	Romford	Maidstone	62.0	65.5	56.8	56.7	58.3	58.3	-5.3	-7.2	1.5	-8.6%	-11.0%	2.7%
2 to 11	Romford	Rochester	48.7	65.7	44.4	44.6	54.2	49.3	-4.1	-11.5	4.9	-8.4%	-17.5%	11.0%
2 to 12	Romford	Rainham	65.3	79.2	49.4	61.1	67.4	54.4	-4.1	-11.8	5.0	-6.3%	-14.9%	10.0%
3 to 7	Brentwood	Bexley	33.0	39.2	50.6	32.9	36.5	54.2	-0.1	-2.7	3.6	-0.3%	-6.9%	7.1%
3 to 8	Brentwood	Godstone	62.7	53.5	70.3	62.6	50.5	74.3	-0.1	-3.0	4.0	-0.1%	-5.6%	5.8%
3 to 9	Brentwood	Southfleet	31.9	36.2	52.9	33.2	31.7	62.9	1.3	-4.5	10.0	4.2%	-12.4%	18.9%
3 to 10	Brentwood	Maidstone	59.3	55.2	64.5	53.9	49.8	65.0	-5.4	-5.4	0.5	-9.1%	-9.8%	0.7%
3 to 11	Brentwood	Rochester	46.0	55.4	49.9	41.8	45.7	54.9	-4.2	-9.7	5.1	-9.1%	-17.5%	10.2%
3 to 12	Brentwood	Rainham	62.6	68.8	54.5	58.4	58.9	59.5	-4.2	-10.0	4.9	-6.7%	-14.5%	9.1%
4 to 7	Basildon	Bexley	36.8	43.5	50.9	36.8	40.7	54.3	0.0	-2.8	3.4	-0.1%	-6.4%	6.7%
4 to 8	Basildon	Godstone	66.5	57.8	69.1	66.5	54.8	72.9	0.0	-3.0	3.8	0.0%	-5.2%	5.5%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	35.7	40.5	52.9	33.8	29.3	69.1	-2.0	-11.2	16.2	-5.5%	-27.6%	30.5%
4 to 10	Basildon	Maidstone	63.2	59.4	63.8	48.0	45.6	63.1	-15.2	-13.8	-0.7	-24.1%	-23.3%	-1.0%
4 to 11	Basildon	Rochester	49.8	59.6	50.1	35.9	41.5	51.8	-14.0	-18.1	1.7	-28.0%	-30.4%	3.4%
4 to 12	Basildon	Rainham	66.4	73.1	54.5	52.4	54.7	57.5	-14.0	-18.4	3.0	-21.1%	-25.2%	5.5%
5 to 7	Tilbury Port	Bexley	28.3	34.3	49.6	28.3	30.0	56.6	0.0	-4.3	7.1	0.0%	-12.5%	14.3%
5 to 8	Tilbury Port	Godstone	58.0	48.6	71.6	58.0	44.1	79.0	0.0	-4.6	7.4	0.0%	-9.4%	10.4%
5 to 9	Tilbury Port	Southfleet	27.2	31.3	52.1	27.7	20.2	82.4	0.5	-11.2	30.3	1.8%	-35.6%	58.2%
5 to 10	Tilbury Port	Maidstone	54.6	50.3	65.2	41.9	36.5	69.0	-12.7	-13.8	3.8	-23.3%	-27.5%	5.8%
5 to 11	Tilbury Port	Rochester	41.3	50.5	49.1	29.8	32.4	55.3	-11.5	-18.1	6.2	-27.8%	-35.9%	12.5%
5 to 12	Tilbury Port	Rainham	57.9	64.0	54.3	46.4	45.6	61.1	-11.5	-18.4	6.7	-19.9%	-28.7%	12.4%
6 to 7	DP World	Bexley	32.1	37.9	50.9	32.1	34.5	55.8	0.0	-3.4	4.9	-0.1%	-8.9%	9.7%
6 to 8	DP World	Godstone	61.8	52.2	71.0	61.8	48.6	76.3	0.0	-3.6	5.3	0.0%	-7.0%	7.4%
6 to 9	DP World	Southfleet	31.0	34.9	53.3	29.0	23.2	75.3	-2.0	-11.8	22.0	-6.3%	-33.7%	41.3%
6 to 10	DP World	Maidstone	58.4	53.9	65.1	43.2	39.4	65.8	-15.2	-14.4	0.7	-26.0%	-26.8%	1.1%
6 to 11	DP World	Rochester	45.1	54.1	50.1	31.1	35.3	52.9	-14.0	-18.7	2.8	-31.0%	-34.6%	5.6%
6 to 12	DP World	Rainham	61.7	67.6	54.8	47.7	48.6	58.9	-14.0	-19.0	4.1	-22.7%	-28.1%	7.6%

Table 8.20 Route based journey time comparison south to north movements (2030 core DM vs DS) AM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	56.6	65.3	61.6	53.8	68.8	0.0	-2.8	3.4	0.1%	-4.9%	5.3%
7 to 2	Bexley	Romford	34.7	44.2	47.1	34.7	38.7	53.8	0.0	-5.6	6.8	0.0%	-12.6%	14.4%
7 to 3	Bexley	Brentwood	33.1	39.4	50.5	33.2	35.2	56.6	0.0	-4.2	6.1	0.1%	-10.6%	12.0%
7 to 4	Bexley	Basildon	36.8	40.7	54.3	36.8	35.3	62.6	0.0	-5.4	8.3	-0.1%	-13.3%	15.3%
7 to 5	Bexley	Tilbury Port	28.6	37.4	45.8	28.6	31.3	54.8	0.0	-6.1	8.9	-0.1%	-16.4%	19.5%
7 to 6	Bexley	DP World	32.4	37.1	52.4	32.4	31.7	61.4	0.0	-5.4	8.9	-0.1%	-14.6%	17.1%
8 to 1	Godstone	Cheshunt	91.8	76.9	71.6	91.8	73.8	74.6	0.1	-3.0	3.0	0.1%	-3.9%	4.2%
8 to 2	Godstone	Romford	64.9	64.5	60.3	64.9	58.7	66.3	0.0	-5.8	6.0	0.0%	-9.0%	9.9%
8 to 3	Godstone	Brentwood	63.3	59.7	63.7	63.4	55.3	68.8	0.1	-4.4	5.2	0.1%	-7.4%	8.1%
8 to 4	Godstone	Basildon	67.0	61.0	65.9	67.0	55.3	72.6	0.0	-5.7	6.7	0.0%	-9.3%	10.2%
8 to 5	Godstone	Tilbury Port	58.7	57.7	61.1	58.7	51.3	68.6	0.0	-6.4	7.6	0.0%	-11.0%	12.4%
8 to 6	Godstone	DP World	62.6	57.4	65.4	62.6	51.7	72.6	0.0	-5.7	7.2	0.0%	-9.9%	10.9%
9 to 1	Southfleet	Cheshunt	60.7	56.4	64.6	60.8	51.8	70.4	0.0	-4.6	5.8	0.1%	-8.1%	9.0%
9 to 2	Southfleet	Romford	33.8	44.0	46.1	33.8	36.7	55.3	0.0	-7.4	9.2	0.0%	-16.7%	20.1%
9 to 3	Southfleet	Brentwood	32.3	39.2	49.4	32.3	33.2	58.4	0.0	-6.0	9.0	0.2%	-15.3%	18.2%
9 to 4	Southfleet	Basildon	36.0	40.5	53.3	35.8	28.5	75.5	-0.1	-12.0	22.2	-0.4%	-29.7%	41.6%
9 to 5	Southfleet	Tilbury Port	27.7	37.2	44.7	31.4	27.9	67.5	3.7	-9.3	22.8	13.4%	-24.9%	51.1%
9 to 6	Southfleet	DP World	31.5	36.9	51.3	31.4	24.9	75.7	-0.1	-12.0	24.5	-0.4%	-32.6%	47.7%
10 to 1	Maidstone	Cheshunt	88.3	76.7	69.1	83.3	67.0	74.6	-5.0	-9.7	5.6	-5.6%	-12.7%	8.1%
10 to 2	Maidstone	Romford	61.4	64.3	57.2	56.4	51.7	65.5	-5.0	-12.7	8.2	-8.2%	-19.7%	14.4%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	59.5	60.3	54.9	48.4	68.0	-5.0	-11.1	7.7	-8.3%	-18.6%	12.7%
10 to 4	Maidstone	Basildon	63.5	60.8	62.7	50.3	40.8	73.9	-13.2	-20.0	11.2	-20.8%	-32.8%	17.9%
10 to 5	Maidstone	Tilbury Port	55.2	57.5	57.6	45.9	40.3	68.3	-9.4	-17.2	10.7	-16.9%	-30.0%	18.6%
10 to 6	Maidstone	DP World	59.1	57.2	62.0	45.9	37.2	73.9	-13.2	-20.0	12.0	-22.3%	-34.9%	19.3%
11 to 1	Rochester	Cheshunt	75.7	80.2	56.6	70.3	64.0	65.9	-5.4	-16.2	9.3	-7.1%	-20.2%	16.4%
11 to 2	Rochester	Romford	48.8	67.9	43.2	43.3	48.7	53.4	-5.5	-19.2	10.3	-11.2%	-28.3%	23.8%
11 to 3	Rochester	Brentwood	47.3	63.0	45.0	41.8	45.4	55.3	-5.4	-17.6	10.3	-11.5%	-28.0%	22.9%
11 to 4	Rochester	Basildon	51.0	64.3	47.5	37.3	37.8	59.1	-13.7	-26.5	11.6	-26.8%	-41.2%	24.4%
11 to 5	Rochester	Tilbury Port	42.7	61.0	41.9	32.9	37.3	52.9	-9.8	-23.8	10.9	-23.0%	-38.9%	26.1%
11 to 6	Rochester	DP World	46.5	60.7	46.0	32.9	34.2	57.6	-13.7	-26.5	11.6	-29.4%	-43.6%	25.3%
12 to 1	Rainham	Cheshunt	91.7	93.0	59.2	87.7	76.8	68.5	-4.0	-16.2	9.3	-4.4%	-17.4%	15.7%
12 to 2	Rainham	Romford	64.8	80.7	48.2	60.7	61.5	59.2	-4.1	-19.2	11.0	-6.3%	-23.7%	22.9%
12 to 3	Rainham	Brentwood	63.3	75.8	50.0	59.2	58.3	61.0	-4.0	-17.6	10.9	-6.4%	-23.2%	21.9%
12 to 4	Rainham	Basildon	67.0	77.2	52.1	54.7	50.7	64.7	-12.3	-26.4	12.6	-18.3%	-34.3%	24.2%
12 to 5	Rainham	Tilbury Port	58.7	73.9	47.7	50.2	50.1	60.1	-8.4	-23.7	12.4	-14.4%	-32.1%	26.1%
12 to 6	Rainham	DP World	62.5	73.5	51.0	50.2	47.1	64.0	-12.3	-26.5	13.0	-19.6%	-36.0%	25.5%

Table 8.21 Route based journey time comparison south to north movements (2030 core DM vs DS) inter-peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	51.0	72.4	61.6	47.8	77.4	0.0	-3.2	5.0	0.1%	-6.4%	6.9%
7 to 2	Bexley	Romford	35.8	37.8	56.8	35.8	33.7	63.7	0.0	-4.1	6.9	0.0%	-10.9%	12.2%
7 to 3	Bexley	Brentwood	33.1	35.8	55.6	33.2	31.5	63.3	0.0	-4.3	7.7	0.1%	-12.1%	13.8%
7 to 4	Bexley	Basildon	36.8	39.0	56.7	36.8	34.0	65.0	0.0	-5.0	8.3	-0.1%	-12.8%	14.6%
7 to 5	Bexley	Tilbury Port	31.9	35.6	53.8	31.9	30.3	63.3	0.0	-5.3	9.5	0.0%	-15.0%	17.6%
7 to 6	Bexley	DP World	32.4	35.0	55.6	32.4	29.8	65.2	0.0	-5.2	9.6	-0.1%	-14.8%	17.2%
8 to 1	Godstone	Cheshunt	91.8	70.8	77.8	91.8	67.7	81.4	0.0	-3.1	3.7	0.1%	-4.4%	4.7%
8 to 2	Godstone	Romford	66.0	57.6	68.7	66.0	53.6	73.9	0.0	-4.0	5.1	0.0%	-7.0%	7.5%
8 to 3	Godstone	Brentwood	63.3	55.6	68.4	63.4	51.4	74.0	0.0	-4.2	5.7	0.1%	-7.6%	8.3%
8 to 4	Godstone	Basildon	67.0	58.8	68.4	67.0	53.9	74.7	0.0	-4.9	6.2	0.0%	-8.3%	9.1%
8 to 5	Godstone	Tilbury Port	62.1	55.4	67.3	62.1	50.1	74.3	0.0	-5.2	7.0	0.0%	-9.4%	10.4%
8 to 6	Godstone	DP World	62.6	54.8	68.6	62.6	49.7	75.5	0.0	-5.1	7.0	0.0%	-9.2%	10.2%
9 to 1	Southfleet	Cheshunt	60.2	51.9	69.6	60.8	46.7	78.2	0.6	-5.2	8.5	0.9%	-10.1%	12.2%
9 to 2	Southfleet	Romford	34.5	38.7	53.4	35.0	32.6	64.3	0.5	-6.1	10.9	1.5%	-15.8%	20.5%
9 to 3	Southfleet	Brentwood	31.8	36.7	52.0	32.3	30.3	63.9	0.6	-6.3	11.9	1.7%	-17.2%	22.9%
9 to 4	Southfleet	Basildon	35.5	39.8	53.4	35.8	27.8	77.3	0.4	-12.0	23.9	1.0%	-30.2%	44.7%
9 to 5	Southfleet	Tilbury Port	30.6	36.4	50.3	34.8	27.5	75.9	4.2	-9.0	25.6	13.8%	-24.6%	50.9%
9 to 6	Southfleet	DP World	31.0	35.8	51.9	31.4	23.7	79.6	0.4	-12.2	27.7	1.2%	-34.0%	53.3%
10 to 1	Maidstone	Cheshunt	88.3	67.0	79.1	83.3	59.9	83.4	-5.0	-7.0	4.3	-5.6%	-10.5%	5.5%
10 to 2	Maidstone	Romford	62.5	53.8	69.7	57.5	45.8	75.3	-5.0	-8.0	5.6	-8.0%	-14.8%	8.0%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	51.7	69.4	54.9	43.6	75.5	-4.9	-8.1	6.2	-8.3%	-15.7%	8.9%
10 to 4	Maidstone	Basildon	63.5	54.9	69.4	50.3	38.7	78.0	-13.2	-16.2	8.6	-20.8%	-29.5%	12.4%
10 to 5	Maidstone	Tilbury Port	58.6	51.5	68.2	49.2	38.4	77.0	-9.4	-13.2	8.8	-16.0%	-25.5%	12.9%
10 to 6	Maidstone	DP World	59.1	50.9	69.6	45.9	34.5	79.7	-13.2	-16.4	10.1	-22.3%	-32.1%	14.4%
11 to 1	Rochester	Cheshunt	74.5	67.9	65.8	70.3	56.2	75.1	-4.2	-11.7	9.3	-5.6%	-17.3%	14.1%
11 to 2	Rochester	Romford	48.7	54.7	53.4	44.5	42.1	63.4	-4.2	-12.6	10.0	-8.7%	-23.1%	18.7%
11 to 3	Rochester	Brentwood	46.0	52.7	52.4	41.9	39.8	63.0	-4.2	-12.8	10.6	-9.0%	-24.3%	20.2%
11 to 4	Rochester	Basildon	49.7	55.8	53.4	37.3	35.0	64.0	-12.4	-20.9	10.6	-25.0%	-37.4%	19.8%
11 to 5	Rochester	Tilbury Port	44.8	52.4	51.2	36.2	34.6	62.8	-8.6	-17.8	11.5	-19.1%	-34.0%	22.5%
11 to 6	Rochester	DP World	45.3	51.8	52.4	32.9	30.8	64.0	-12.4	-21.0	11.6	-27.4%	-40.6%	22.1%
12 to 1	Rainham	Cheshunt	91.7	75.0	73.3	87.7	63.2	83.2	-4.0	-11.8	9.9	-4.4%	-15.8%	13.5%
12 to 2	Rainham	Romford	65.9	61.8	64.0	61.8	49.1	75.6	-4.1	-12.8	11.6	-6.2%	-20.6%	18.2%
12 to 3	Rainham	Brentwood	63.3	59.8	63.5	59.2	46.9	75.8	-4.0	-12.9	12.4	-6.4%	-21.6%	19.5%
12 to 4	Rainham	Basildon	67.0	63.0	63.8	54.7	42.0	78.2	-12.3	-21.0	14.4	-18.3%	-33.3%	22.5%
12 to 5	Rainham	Tilbury Port	62.0	59.6	62.5	53.6	41.6	77.2	-8.4	-18.0	14.8	-13.6%	-30.1%	23.7%
12 to 6	Rainham	DP World	62.5	59.0	63.6	50.2	37.8	79.7	-12.3	-21.2	16.1	-19.6%	-35.9%	25.3%

Table 8.22 Route based journey time comparison south to north movements (2030 core DM vs DS) PM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey Time (mins)	Average Speed (km/h)	Distance (km)	Journey Time (mins)	Average Speed (km/h)	Distance (km)	Journey Time (mins)	Average Speed (km/h)	Distance	Journey Time	Average Speed
7 to 1	Bexley	Cheshunt	61.5	58.1	63.5	61.6	55.0	67.2	0.1	-3.1	3.7	0.1%	-5.4%	5.9%
7 to 2	Bexley	Romford	34.7	43.4	48.0	34.8	39.7	52.5	0.0	-3.7	4.5	0.1%	-8.6%	9.5%
7 to 3	Bexley	Brentwood	33.1	38.1	52.2	33.2	34.6	57.6	0.0	-3.5	5.4	0.1%	-9.3%	10.4%
7 to 4	Bexley	Basildon	36.8	46.0	48.1	36.8	40.4	54.7	0.0	-5.6	6.6	0.0%	-12.1%	13.8%
7 to 5	Bexley	Tilbury Port	28.6	36.0	47.6	28.6	29.6	57.9	0.0	-6.4	10.3	0.0%	-17.8%	21.6%
7 to 6	Bexley	DP World	32.4	40.0	48.5	32.4	34.6	56.2	0.0	-5.5	7.7	0.0%	-13.6%	15.8%
8 to 1	Godstone	Cheshunt	91.2	79.6	68.7	91.3	76.8	71.3	0.1	-2.8	2.6	0.1%	-3.5%	3.8%
8 to 2	Godstone	Romford	64.4	64.9	59.5	64.4	61.5	62.8	0.0	-3.4	3.3	0.0%	-5.2%	5.6%
8 to 3	Godstone	Brentwood	62.8	59.6	63.2	62.8	56.4	66.9	0.0	-3.2	3.7	0.1%	-5.4%	5.8%
8 to 4	Godstone	Basildon	66.5	67.5	59.1	66.5	62.2	64.1	0.0	-5.2	5.0	0.0%	-7.8%	8.4%
8 to 5	Godstone	Tilbury Port	58.2	57.5	60.7	58.2	51.4	67.9	0.0	-6.1	7.2	0.0%	-10.5%	11.8%
8 to 6	Godstone	DP World	62.0	61.5	60.5	62.0	56.4	66.0	0.0	-5.1	5.5	0.0%	-8.3%	9.1%
9 to 1	Southfleet	Cheshunt	60.6	56.3	64.6	60.7	52.2	69.8	0.1	-4.1	5.2	0.2%	-7.3%	8.0%
9 to 2	Southfleet	Romford	33.9	41.7	48.8	33.9	36.9	55.0	0.0	-4.7	6.3	0.1%	-11.3%	12.8%
9 to 3	Southfleet	Brentwood	32.3	36.3	53.3	32.3	31.8	61.0	0.0	-4.5	7.7	0.1%	-12.4%	14.4%
9 to 4	Southfleet	Basildon	36.0	44.2	48.8	35.9	32.1	67.1	-0.1	-12.1	18.3	-0.1%	-27.3%	37.4%
9 to 5	Southfleet	Tilbury Port	27.7	34.2	48.6	31.5	25.1	75.4	3.8	-9.2	26.9	13.7%	-26.8%	55.3%
9 to 6	Southfleet	DP World	31.5	38.3	49.5	31.5	26.3	71.8	0.0	-12.0	22.4	-0.2%	-31.3%	45.2%
10 to 1	Maidstone	Cheshunt	88.2	74.1	71.4	83.3	68.5	72.9	-4.9	-5.6	1.5	-5.6%	-7.6%	2.2%
10 to 2	Maidstone	Romford	61.4	59.4	62.0	56.4	53.2	63.6	-5.0	-6.2	1.6	-8.1%	-10.5%	2.6%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey Time (mins)	Average Speed (km/h)	Distance (km)	Journey Time (mins)	Average Speed (km/h)	Distance (km)	Journey Time (mins)	Average Speed (km/h)	Distance	Journey Time	Average Speed
10 to 3	Maidstone	Brentwood	59.8	54.1	66.3	54.9	48.1	68.4	-5.0	-6.0	2.1	-8.3%	-11.1%	3.2%
10 to 4	Maidstone	Basildon	63.5	62.0	61.5	50.3	45.2	66.9	-13.2	-16.8	5.3	-20.8%	-27.1%	8.7%
10 to 5	Maidstone	Tilbury Port	55.2	52.0	63.7	45.9	38.1	72.3	-9.4	-13.9	8.5	-16.9%	-26.7%	13.4%
10 to 6	Maidstone	DP World	59.1	56.0	63.3	45.9	39.3	70.0	-13.2	-16.7	6.7	-22.3%	-29.8%	10.6%
11 to 1	Rochester	Cheshunt	74.4	78.9	56.6	70.3	66.5	63.4	-4.1	-12.4	6.8	-5.5%	-15.7%	12.1%
11 to 2	Rochester	Romford	47.6	64.2	44.5	43.4	51.2	50.9	-4.2	-13.0	6.4	-8.8%	-20.3%	14.4%
11 to 3	Rochester	Brentwood	46.0	58.9	46.9	41.9	46.1	54.5	-4.2	-12.8	7.6	-9.0%	-21.7%	16.2%
11 to 4	Rochester	Basildon	49.7	66.8	44.7	37.3	43.2	51.9	-12.4	-23.6	7.2	-25.0%	-35.4%	16.1%
11 to 5	Rochester	Tilbury Port	41.5	56.8	43.8	32.9	36.1	54.7	-8.6	-20.7	10.9	-20.7%	-36.5%	24.8%
11 to 6	Rochester	DP World	45.3	60.8	44.7	32.9	37.3	52.8	-12.4	-23.5	8.2	-27.4%	-38.6%	18.3%
12 to 1	Rainham	Cheshunt	91.6	85.2	64.5	87.6	72.0	73.0	-4.0	-13.2	8.5	-4.3%	-15.5%	13.2%
12 to 2	Rainham	Romford	64.8	70.5	55.2	60.8	56.7	64.3	-4.1	-13.8	9.1	-6.3%	-19.6%	16.6%
12 to 3	Rainham	Brentwood	63.3	65.2	58.2	59.2	51.6	68.9	-4.0	-13.6	10.6	-6.4%	-20.8%	18.3%
12 to 4	Rainham	Basildon	67.0	73.0	55.0	54.7	48.7	67.4	-12.3	-24.4	12.4	-18.3%	-33.4%	22.6%
12 to 5	Rainham	Tilbury Port	58.7	63.1	55.8	50.2	41.6	72.5	-8.4	-21.5	16.7	-14.4%	-34.1%	29.9%
12 to 6	Rainham	DP World	62.5	67.1	55.9	50.2	42.8	70.4	-12.3	-24.3	14.5	-19.6%	-36.2%	25.9%

Commentary on the results

8.2.17 Table 8.2 to Table 8.7 demonstrate that the highway assignment models for each time period in the Do Minimum and Do Something scenarios have converged well within the TAG recommended convergence limits.

8.2.18 The select link analysis presented in Plate 8.1 to Plate 8.9 and associated Table 8.8 to Table 8.10 shows that the introduction of the Project has a significant impact on the patterns of movement using the Dartford Crossing. In particular, there is a substantial reduction in traffic to/from east Kent using the Dartford Crossing with the Project. As would be expected, in the Do Something situation the majority of this traffic uses the Project. There is also a substantial reduction north of the River Thames in trips to/from M25 north.

8.2.19 There is a small increase in the number of trips using the Dartford Crossing from within London, both north and south of the River Thames. This is likely due to some route switching of travellers from using Silvertown/Blackwall in the Do Minimum scenario to using the Dartford Crossing in the Do Something scenario due to the newly available capacity. This will also be caused by an increase in shorter distance trips switching destinations to cross the River Thames in the Do Something scenario. These movements are suppressed in the Do Minimum scenario due to the lack of available capacity at the Dartford Crossing.

8.2.20 Movements using the Project are predominantly from/to east Kent, M25 north and A13 east of the junction with the Project. In the south there is some local traffic (approximately 730–1,120 PCU/hr in the peak hours) and relatively few trips to/from Kent west of the Project's junction with the A2/M2 using the Project (up to 625 PCU/hr in the peak hours) and zero trips from M25 south of the A2 junction using the Project. These movements will continue to use the Dartford Crossing as to use the Project would require a considerable detour. In the north there is a small amount of traffic to/from A1089 using the Project (up to 720 PCU/hr in the peak hours). These patterns of movement are consistent across all time periods and accord well with *a priori* expectations.

8.2.21 Comparisons of traffic flows in the Do Minimum and Do Something scenarios are presented in Plate 8.10 to Plate 8.12 and in Table 8.11 to Table 8.13. Initially focussing on the impact of the Project on flows at the Dartford Crossing, it can be observed that the model is predicting a substantial reduction in flow. In the southbound direction, in the Do Minimum, the AM peak is at capacity (V/C ratio of 1.0) the PM peak is approaching capacity (V/C ratio of 0.94) and the inter-peak is operating below capacity (V/C ratio of 0.83). In the Do Something scenario, the model predicted flows at the Dartford Crossing are substantially reduced by between 11% and 24% leading to under capacity conditions, with V/C ratios between 0.62 and 0.89 across the different time periods.

8.2.22 In the northbound direction, in the Do Minimum scenario, the flows at the Dartford Crossing exceed the capacity of the TMC in all time periods with V/C ratios of between 1.07 and 1.09. In the AM and PM peaks the flows approaching the TMC exceed the capacity by approximately 500–600 PCU/hr. In the Do Something scenario these flows are significantly reduced by between 19% and 25% with the crossing operating well under the capacity of the TMC with V/C ratios ranging from 0.80 to 0.88 across the different time periods.

8.2.23 In particular, there is a substantial reduction in HGVs using the Dartford Crossing both northbound and southbound in all time periods, in the Do Something scenario compared to the Do Minimum. This is due to the alignment of the Project making it a very favourable route for HGVs accessing the ports in Kent and Essex. These reductions in flow at the Dartford Crossing, across all vehicle types, are as expected as this is one of the primary objectives of the Project.

8.2.24 The Project tunnel is operating well under capacity in both directions with V/C ratios of between 0.45 and 0.69 in the southbound direction and 0.57 to 0.72 in the northbound direction. It can also be observed that in the opening year, the flow on the Project is at approximately two full lanes worth of traffic southbound in the PM peak and northbound in the AM peak. More detailed information on the flows along the different sections of the Project and at its junctions is provided in Chapter 10.

8.2.25 When looking at both crossings combined, it can be seen that in the Do Something scenario there is sufficient cross-river capacity with V/C ratios of between 0.55 and 0.74 in the southbound direction and 0.69 to 0.77 in the northbound direction. This is in stark contrast to the Do Minimum situation where the Dartford Crossing is heavily congested southbound in the AM peak and northbound in all time periods, likely leading to long queues, unreliable journey times and a higher rate of incidents.

8.2.26 The analysis also shows that there are associated reductions in traffic flows along the A2 and A13 west of their junctions with the Project and also on the M20. These reductions in flow lead to reductions in congestion along these corridors. This is one of the major benefits of the Project and is from which a significant proportion of the economic benefits of the Project are derived.

8.2.27 There are also some increases in flow in the Do Something scenario compared to the Do Minimum on the A2/M2 corridor east of the Project, A13 east of the Project and on the M25 north of the Project. This is caused by the Project drawing more traffic to cross the river than in the constrained Do Minimum scenario. These increases in flow lead to additional congestion in these corridors and lead to disbenefits from the introduction of the Project.

8.2.28 These benefits and disbenefits are further illustrated by the link-based journey time analysis presented in Table 8.14 to Table 8.16. It can be observed that there are substantial increases in speed in the Dartford Crossing corridor between M25 junction 29 and M25 junction 2 in both directions (up to a 25km/h increase in the AM peak in the northbound direction). There are also significant journey time savings on the A2 between the junction with the Project and the M25 and on the A13 between the junction with the Project and the M25. There are some predicted reductions in speed on the A2 and A13 east of their junctions with the Project and on the wider M25 both north and south of the River Thames. These are in line with the increases in flows predicted in those corridors. This pattern is relatively consistent across all time periods.

8.2.29 There is additional detailed link-based journey time analysis presented in Annex C.

8.2.30 The route-based journey times presented in Table 8.17 to Table 8.22 show cross-river movements. As expected, all cross-river movements experience improved journey times in the Do Something scenario relative to the Do Minimum. Some cross-river movements also benefit substantially from a reduced journey distance. Using the Project rather than the Dartford Crossing provides a significant distance saving for movements from/to east Kent to/from east Essex.

8.2.31 It is for this reason that it is considered necessary to undertake a full 24 hours per day, 365 days per year economic assessment of the Project. Some movements will benefit significantly from the introduction of the Project even during the night when flow is predicted to be low. It is important that the associated benefits, and disbenefits, of movements at all times of day and night are captured in the economic analysis.

8.2.32 Most movements also experience an increase in average speed in the Do Something scenario. Some movements do not, however, primarily due to their using different parts of the network with different speed limits and links with higher congestion in the Do Something scenario, as described above. Overall though, the balance is positive, with almost all of the cross-river movements shown in Table 8.17 to Table 8.22 having increases in speed.

8.3 LTAM 2037 core – outputs to economic assessment

8.3.1 The analysis presented below summarises the impact of the Project on forecast traffic flows and journey times for the 2037 core forecast. The statistics presented are from the final converged VDM loop as described in Chapter 7.

HAM convergence statistics

8.3.2 Table 8.23 to Table 8.25 provide the final VDM loop highway assignment model convergence statistics for the 2037 core DM forecasts. Table 8.26 to Table 8.28 provide the final VDM loop highway assignment model convergence statistics for the 2037 core DS forecasts.

Table 8.23 HAM convergence statistics – 2037 core DM AM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
68	0.0057	0.0048	98.8	99.4
69	0.0036	0.0051	98.0	99.5
70	0.0041	0.0058	98.0	99.4
71	0.0036	0.0056	98.8	99.5

Table 8.24 HAM convergence statistics – 2037 core DM inter-peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
42	0.0039	0.0043	98.7	99.5
43	0.0040	0.0049	98.6	99.6
44	0.0030	0.0036	98.6	99.6
45	0.0031	0.0057	98.8	99.6

Table 8.25 HAM convergence statistics – 2037 core DM PM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
67	0.0036	0.0058	99.0	99.3
68	0.0039	0.0056	98.6	99.0
69	0.0034	0.0059	99.0	99.2
70	0.0036	0.0047	98.6	99.2

Table 8.26 HAM convergence statistics – 2037 core DS AM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
63	0.0047	0.0054	99.0	99.5
64	0.0040	0.0061	98.6	99.3
65	0.0037	0.0058	99.0	99.4
66	0.0036	0.0047	98.5	99.4

Table 8.27 HAM convergence statistics – 2037 core DS inter-peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
41	0.0026	0.0046	98.7	99.5
42	0.0030	0.0039	98.6	99.5
43	0.0031	0.0037	98.7	99.6
44	0.0025	0.004	98.8	99.6

Table 8.28 HAM convergence statistics – 2037 core DS PM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
69	0.0038	0.0059	98.6	99.1
70	0.0040	0.0052	98.8	99.3
71	0.0043	0.0048	98.8	99.3
72	0.0036	0.0061	98.9	99.2

8.3.3 These tables demonstrate that the LTAM has achieved the TAG convergence targets in all time periods for this scenario and year.

Movement patterns using the crossings

8.3.4 Plate 8.16 to Plate 8.24 provide select link analysis of movements using the Dartford Crossing and Lower Thames Crossing for the Do Minimum and Do Something scenarios for each of the model time periods. These diagrams show the pattern of movements using each of the crossings in each of the time periods. Table 8.29 to Table 8.31 provide a summary of the main corridors using each of the crossings and a comparison between the DM and DS scenarios for each time period.

Plate 8.16 Select link analysis – Dartford Crossing DM 2037 core AM peak

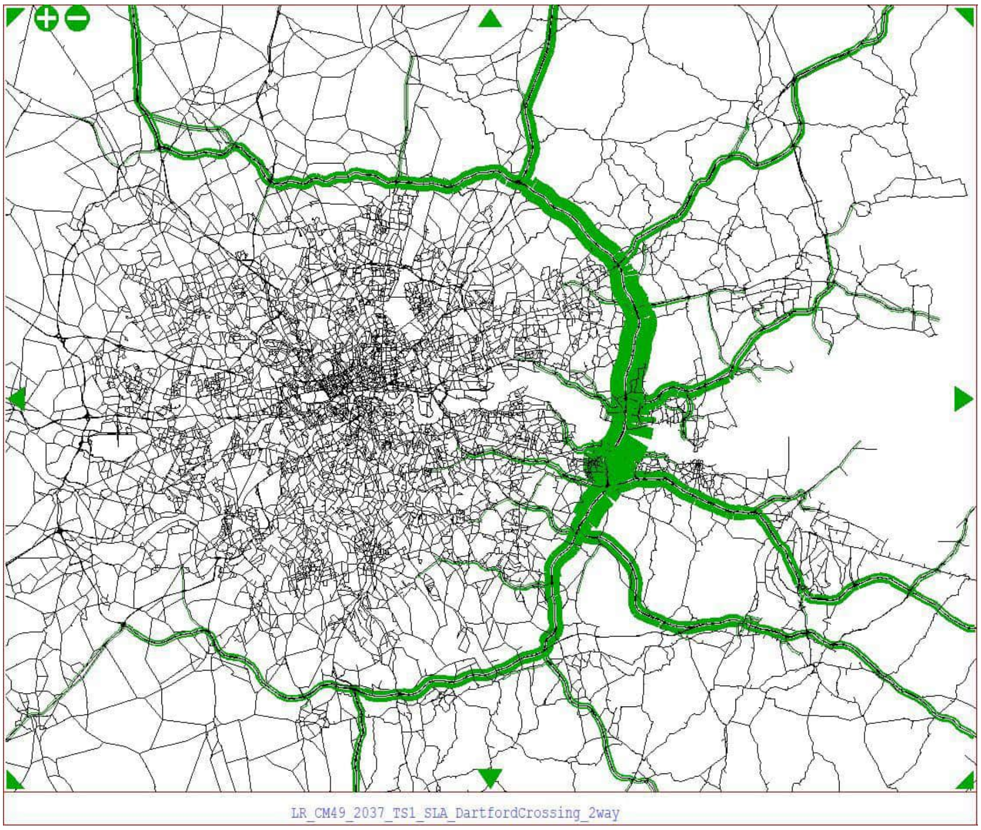


Plate 8.17 Select link analysis – Dartford Crossing DS 2037 core AM peak

Plate 8.18 Select link analysis – Lower Thames Crossing DS 2037 core AM peak

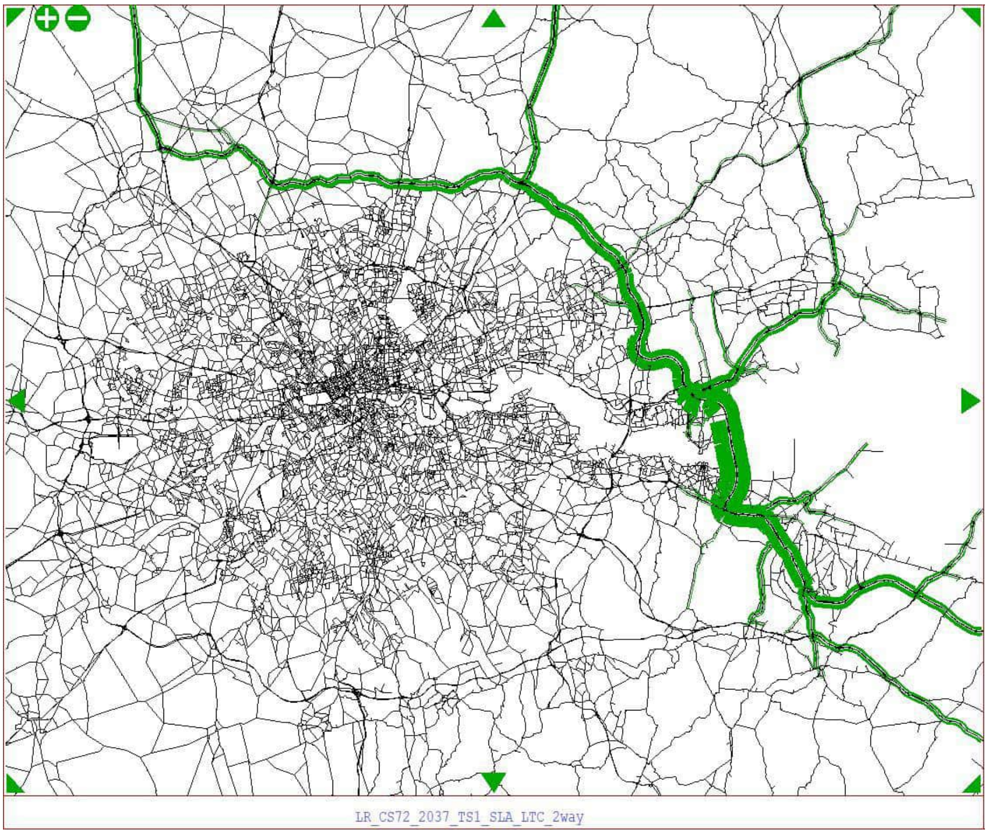


Table 8.29 Select link analysis – summary of primary corridors of movement 2037 AM peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,603	17%	3,447	24%	844	32%
	Local (outside M25)	2,007	13%	1,908	13%	-99	-5%
	M25 south (junctions 2–3)	7,439	48%	7,568	53%	129	2%
	A2/M2 to/from Kent	3,432	22%	1,338	9%	-2,094	-61%
Select link	Dartford Crossing	**15,481**	**100%**	**14,262**	**100%**	**-1,220**	**-8%**
North of River Thames	London north	2,237	14%	2,887	20%	650	29%
	Local traffic	1,500	10%	1,552	11%	52	3%
	M25 north (junctions 30–29)	8,630	56%	7,363	52%	-1,267	-15%
	A13 to/from Essex	3,114	20%	2,460	17%	-655	-21%
South of River Thames	Local traffic	n/a	n/a	801	9%	n/a	n/a
	A2 west of the Project	n/a	n/a	565	7%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	7,137	84%	n/a	n/a
Select link	Lower Thames Crossing	n/a	n/a	**8,503**	**100%**	n/a	n/a
North of River	A1089	n/a	n/a	775	9%	n/a	n/a

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
Thames	A13 west of the Project	n/a	n/a	71	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	3,445	41%	n/a	n/a
	M25 north of the Project	n/a	n/a	4,212	50%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings.

Plate 8.19 Select link analysis – Dartford Crossing DM 2037 core inter-peak

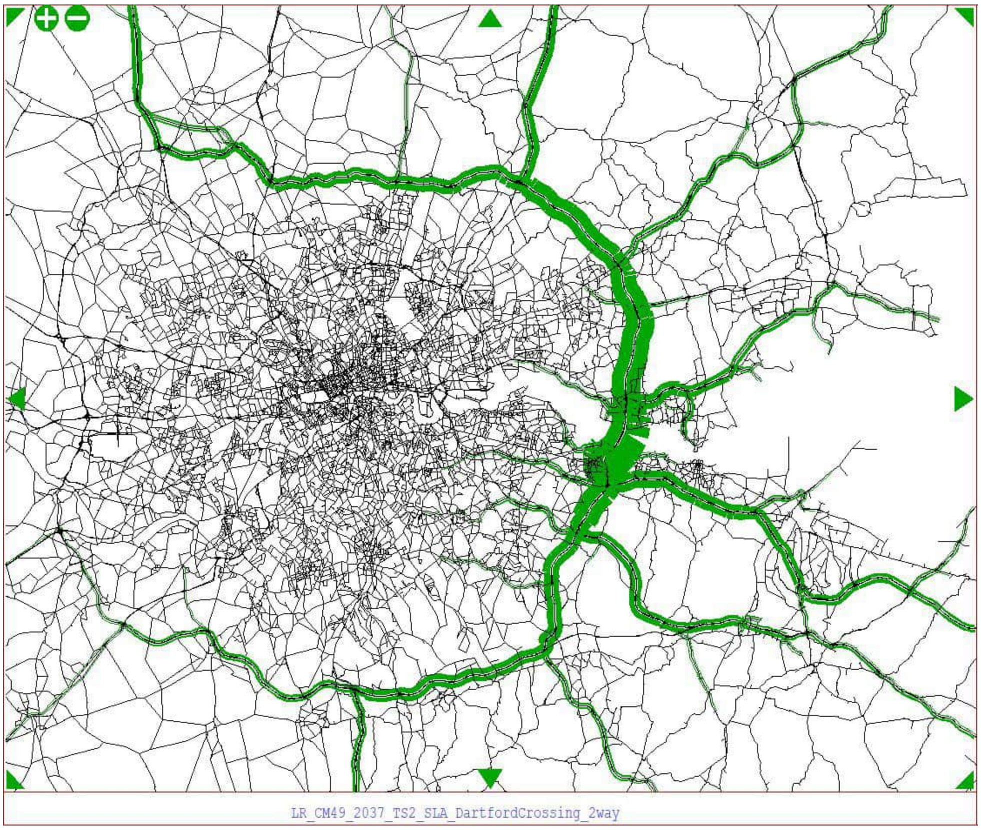
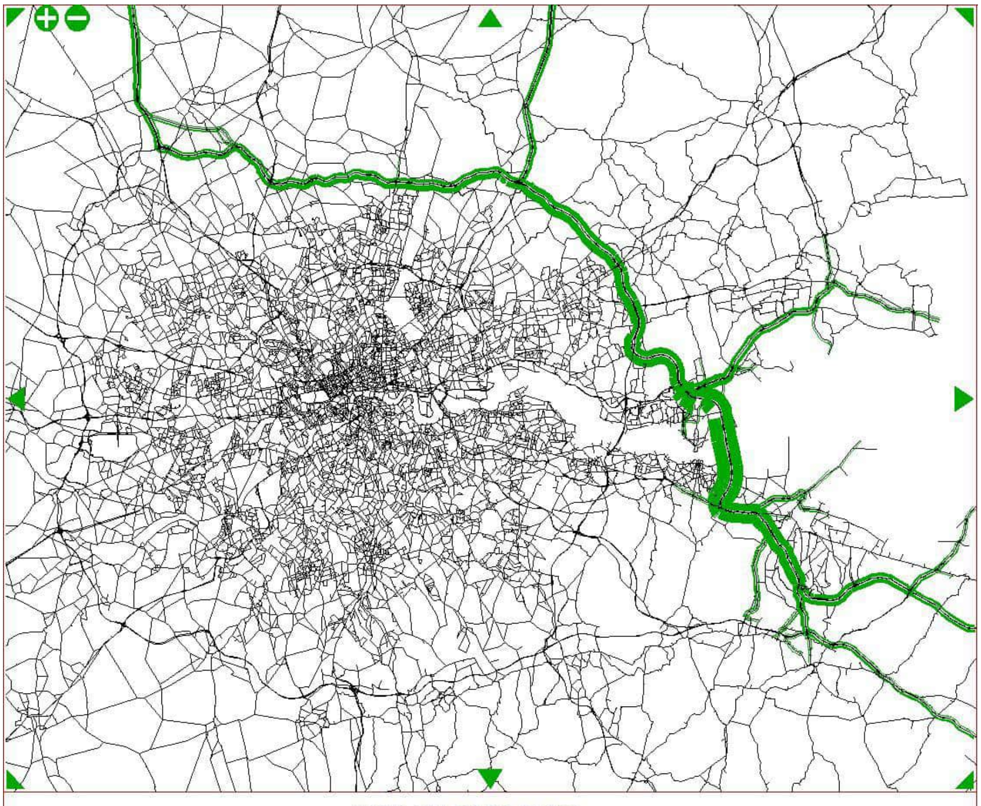


Plate 8.20 Select link analysis – Dartford Crossing DS 2037 core inter-peak

LR_CS72_2037_TS2_SLA_DartfordCrossing_2way

Plate 8.21 Select link analysis – Lower Thames Crossing DS 2037 core inter-peak



LR_CS72_2037_TS2_SLA_LTC_2way

Table 8.30 Select link analysis – summary of primary corridors of movement 2037 inter-peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,244	16%	2,703	23%	459	20%
	Local (outside M25)	1,470	10%	1,348	11%	-122	-8%
	M25 south (junctions 2–3)	6,917	48%	6,553	55%	-365	-5%
	A2/M2 to/from Kent	3,776	26%	1,262	11%	-2,514	-67%
Select link	Dartford Crossing	**14,407**	**100%**	**11,866**	**100%**	**-2,541**	**-18%**
North of River Thames	London north	1,791	12%	2,249	19%	458	26%
	Local traffic	1,539	11%	1,583	13%	44	3%
	M25 north (junctions 30–29)	7,909	55%	5,642	48%	-2,266	-29%
	A13 to/from Essex	3,168	22%	2,392	20%	-777	-25%
South of River Thames	Local traffic	n/a	n/a	764	11%	n/a	n/a
	A2 west of the Project	n/a	n/a	425	6%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	5,873	83%	n/a	n/a
Select link	Lower Thames Crossing	n/a	n/a	**7,062**	**100%**	n/a	n/a
North of River Thames	A1089	n/a	n/a	607	9%	n/a	n/a
	A13 west of the Project	n/a	n/a	34	0%	n/a	n/a
	A13 east of the Project	n/a	n/a	2,777	39%	n/a	n/a
	M25 north of the Project	n/a	n/a	3,644	52%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings.

Plate 8.22 Select link analysis – Dartford Crossing DM 2037 core PM peak

Plate 8.23 Select link analysis – Dartford Crossing DS 2037 core PM peak

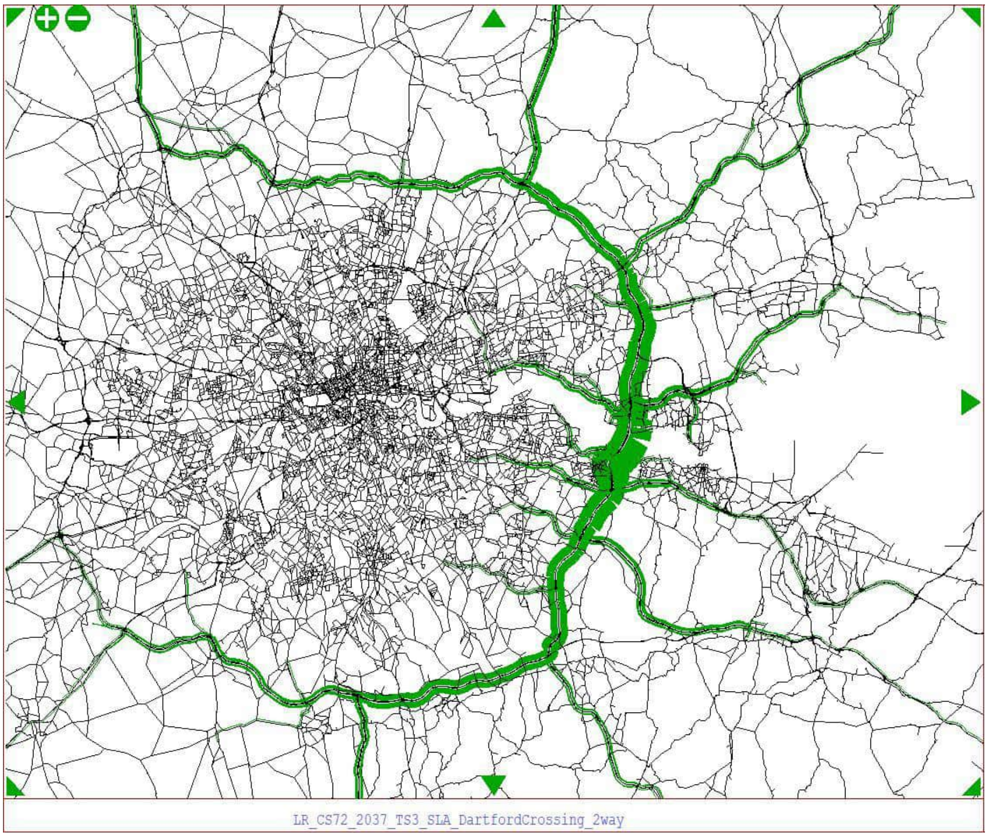


Plate 8.24 Select link analysis – Lower Thames Crossing DS 2037 core PM peak

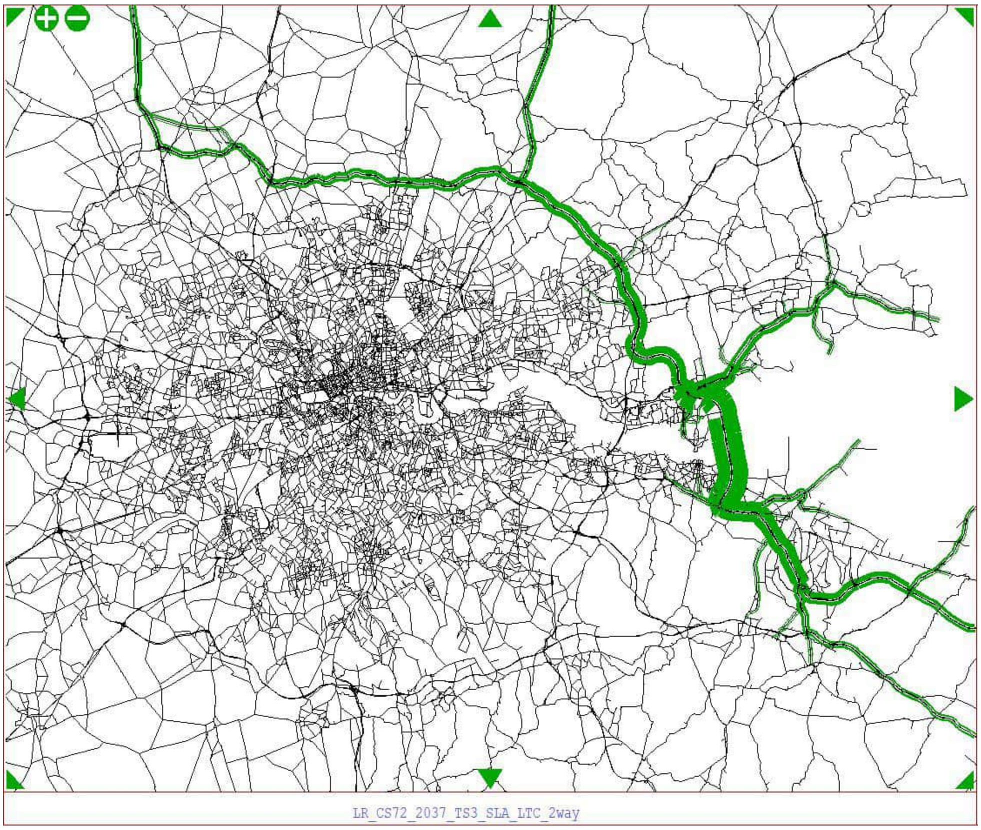


Table 8.31 Select link analysis – summary of primary corridors of movement 2037 PM peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,462	16%	3,033	23%	571	23%
	Local (outside M25)	1,747	12%	1,579	12%	-168	-10%
	M25 south (junctions 2–3)	6,991	47%	6,739	52%	-252	-4%
	A2/M2 to/from Kent	3,806	25%	1,625	13%	-2,180	-57%
Select link	Dartford Crossing	**15,006**	**100%**	**12,977**	**100%**	**-2,029**	**-14%**
North of River Thames	London north	2,407	16%	3,060	24%	653	27%
	Local traffic	1,480	10%	1,591	12%	111	7%
	M25 north (junctions 30–29)	7,894	53%	6,007	46%	-1,888	-24%
	A13 to/from Essex	3,224	21%	2,319	18%	-905	-28%
South of River Thames	Local traffic	n/a	n/a	1,170	14%	n/a	n/a
	A2 west of the Project	n/a	n/a	698	8%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	6,545	78%	n/a	n/a

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
Select link	Lower Thames Crossing	n/a	n/a	**8,414**	**100%**	n/a	n/a
North of River Thames	A1089	n/a	n/a	830	10%	n/a	n/a
	A13 west of the Project	n/a	n/a	49	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	3,910	46%	n/a	n/a
	M25 north of the Project	n/a	n/a	3,625	43%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings

DM vs DS flow comparisons

8.3.5 The impacts of the Project on traffic flows are presented in a number of different ways below. Plate 8.25 to Plate 8.27 provide a flow difference plot between the DM and DS scenarios. Blue colours equate to reductions in flow, green colours indicate increases in flow. Flow differences of less than 100 PCUs per hour have been excluded from the colouring.

8.3.6 Table 8.32 provides a comparison of the cross-river traffic flows between the DM and DS scenarios. For the northbound approach at the Dartford Crossing, flow is presented for the link approaching the TMC. Table 8.33 provides a comparison of the cross-river traffic flows between the DM and DS scenarios. For the northbound approach at the Dartford Crossing flow is presented for the link after the TMC. The V/C ratio is also presented, with green shading indicating a V/C below 0.85, orange between 0.85 and 0.95 and red if 0.95 or above.

Plate 8.25 Actual flow comparison plot – 2037 core DM vs DS AM peak

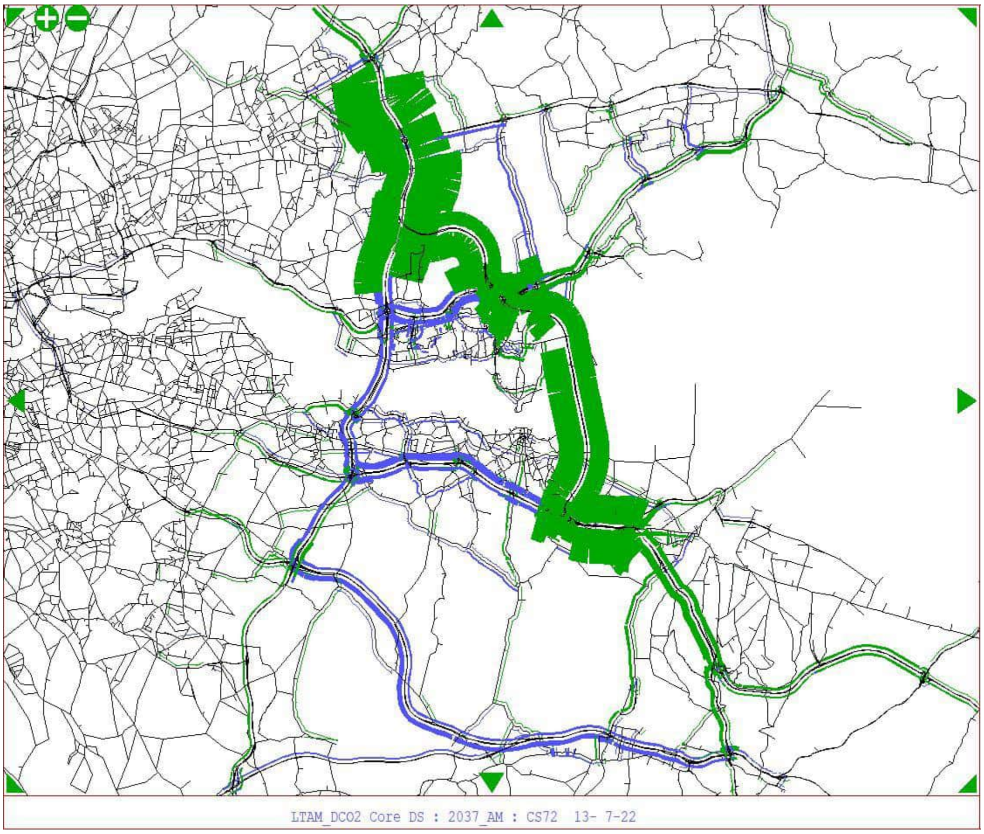


Plate 8.26 Actual flow comparison plot – 2037 core DM vs DS inter-peak

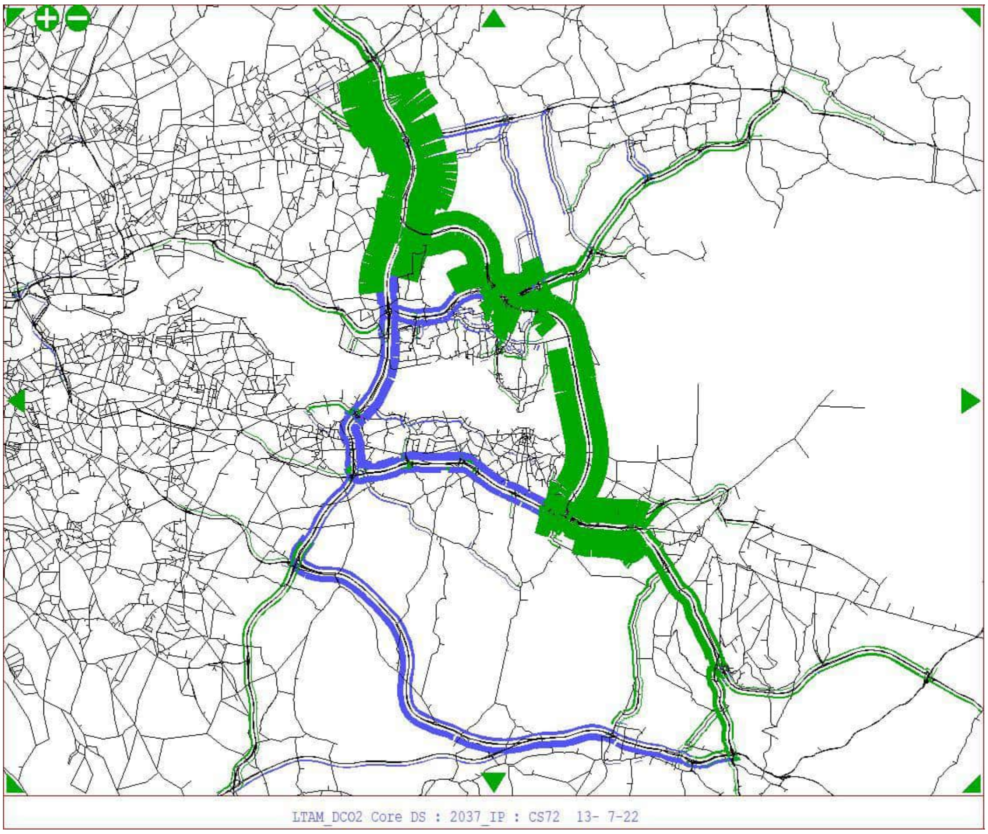


Plate 8.27 Actual flow comparison plot – 2037 core DM vs DS PM peak

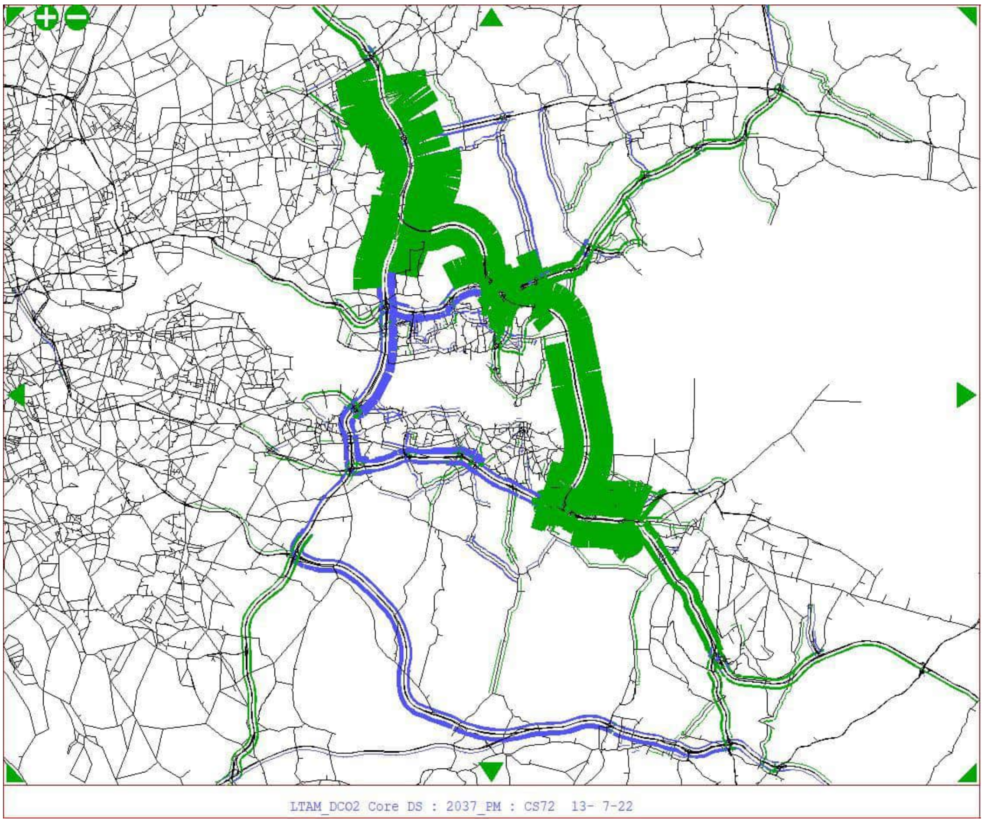


Table 8.32 Cross-river traffic flows (NB flows approaching TMC) – 2037 core DM vs DS (hourly flows in PCUs)

Direction	Crossing	Time period	Cars				LGV				HGV				Total				Effective capacity	Link V/C ratio	
			DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %		DM	DS
SB	Dartford Crossing	AM	3,554	3,768	215	6%	1,785	1,703	-82	-5%	3,161	2,635	-526	-17%	8,500	8,106	-394	-5%	8,500	1.00	0.95
		IP	3,535	3,019	-515	-15%	900	749	-151	-17%	3,082	2,099	-983	-32%	7,517	5,868	-1,649	-22%	8,500	0.88	0.69
		PM	4,970	4,244	-726	-15%	1,166	908	-258	-22%	2,109	1,381	-727	-34%	8,244	6,533	-1,711	-21%	8,500	0.97	0.77
	Lower Thames Crossing	AM	0	2,325	–	–	0	348	–	–	0	1,011	–	–	0	3,684	–	–	6,360	–	0.58
		IP	0	1,829	–	–	0	189	–	–	0	1,054	–	–	0	3,072	–	–	6,360	–	0.48
		PM	0	3,463	–	–	0	322	–	–	0	783	–	–	0	4,568	–	–	6,360	–	0.72
	Total	AM	3,554	6,094	2,540	71%	1,785	2,051	266	15%	3,161	3,646	485	15%	8,500	11,791	3,291	39%	14,860	–	0.79
		IP	3,535	4,849	1,314	37%	900	939	39	4%	3,082	3,153	71	2%	7,517	8,941	1,423	19%	14,860	–	0.60
		PM	4,970	7,707	2,737	55%	1,166	1,229	64	5%	2,109	2,165	56	3%	8,244	11,101	2,857	35%	14,860	–	0.75
NB	Dartford Crossing*	AM	3,755	3,441	-314	-8%	1,496	1,072	-424	-28%	2,446	1,643	-804	-33%	7,697	6,155	-1,542	-20%	6,981	1.10	0.88
		IP	3,247	3,090	-157	-5%	986	737	-248	-25%	3,359	2,170	-1,189	-35%	7,592	5,998	-1,595	-21%	6,890	1.10	0.87
		PM	4,598	4,253	-345	-8%	1,035	839	-196	-19%	1,996	1,352	-644	-32%	7,629	6,444	-1,185	-16%	6,762	1.13	0.95
	Lower Thames Crossing	AM	0	3,167	–	–	0	595	–	–	0	1,056	–	–	0	4,819	–	–	6,360	–	0.76
		IP	0	2,202	–	–	0	348	–	–	0	1,440	–	–	0	3,989	–	–	6,360	–	0.63
		PM	0	2,860	–	–	0	279	–	–	0	706	–	–	0	3,846	–	–	6,360	–	0.60
	Total	AM	3,755	6,608	2,853	76%	1,496	1,667	171	11%	2,446	2,699	253	10%	7,697	10,974	3,277	43%	13,341	–	0.82
		IP	3,247	5,292	2,045	63%	986	1,085	99	10%	3,359	3,610	251	7%	7,592	9,987	2,395	32%	13,250	–	0.75
		PM	4,598	7,113	2,515	55%	1,035	1,119	83	8%	1,996	2,058	62	3%	7,629	10,289	2,660	35%	13,122	–	0.78

** Flows are extracted for the link approaching the TMC*

Table 8.33 Cross-river traffic flows (NB flows after TMC) – 2037 core DM vs DS (hourly flows in PCUs)

Direction	Crossing	Time Period	Cars				LGV				HGV				Total				Effective capacity	Link V/C ratio	
			DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %		DM	DS
SB	Dartford Crossing	AM	3,554	3,768	215	6%	1,785	1,703	-82	-5%	3,161	2,635	-526	-17%	8,500	8,106	-394	-5%	8,500	1.00	0.95
		IP	3,535	3,019	-515	-15%	900	749	-151	-17%	3,082	2,099	-983	-32%	7,517	5,868	-1,649	-22%	8,500	0.88	0.69
		PM	4,970	4,244	-726	-15%	1,166	908	-258	-22%	2,109	1,381	-727	-34%	8,244	6,533	-1,711	-21%	8,500	0.97	0.77
	Lower Thames Crossing	AM	0	2,325	–	–	0	348	–	–	0	1,011	–	–	0	3,684	–	–	6,360	–	0.58
		IP	0	1,829	–	–	0	189	–	–	0	1,054	–	–	0	3,072	–	–	6,360	–	0.48
		PM	0	3,463	–	–	0	322	–	–	0	783	–	–	0	4,568	–	–	6,360	–	0.72
	Total	AM	3,554	6,094	2,540	71%	1,785	2,051	266	15%	3,161	3,646	485	15%	8,500	11,791	3,291	39%	14,860	–	0.79
		IP	3,535	4,849	1,314	37%	900	939	39	4%	3,082	3,153	71	2%	7,517	8,941	1,423	19%	14,860	–	0.60
		PM	4,970	7,707	2,737	55%	1,166	1,229	64	5%	2,109	2,165	56	3%	8,244	11,101	2,857	35%	14,860	–	0.75
NB	Dartford Crossing*	AM	3,409	3,441	31	1%	1,358	1,072	-286	-21%	2,214	1,643	-571	-26%	6,981	6,155	-826	-12%	6,981	1.00	0.88
		IP	2,948	3,090	143	5%	895	737	-158	-18%	3,047	2,170	-877	-29%	6,890	5,998	-892	-13%	6,890	1.00	0.87
		PM	4,074	4,253	179	4%	918	839	-79	-9%	1,770	1,352	-418	-24%	6,762	6,444	-318	-5%	6,762	1.00	0.95
	Lower Thames Crossing	AM	0	3,167	–	–	0	595	–	–	0	1,056	–	–	0	4,819	–	–	6,360	–	0.76
		IP	0	2,202	–	–	0	348	–	–	0	1,440	–	–	0	3,989	–	–	6,360	–	0.63
		PM	0	2,860	–	–	0	279	–	–	0	706	–	–	0	3,846	–	–	6,360	–	0.60
	Total	AM	3,409	6,608	3,198	94%	1,358	1,667	309	23%	2,214	2,699	485	22%	6,981	10,974	3,993	57%	13,341	–	0.82
		IP	2,948	5,292	2,344	80%	895	1,085	190	21%	3,047	3,610	563	18%	6,890	9,987	3,097	45%	13,250	–	0.75
		PM	4,074	7,113	3,039	75%	918	1,119	201	22%	1,770	2,058	288	16%	6,762	10,289	3,528	52%	13,122	–	0.78

** Flows are extracted for the link after the TMC*

8.3.7 The movements considered critical to understanding the impacts of the Project are the same as those described under Section 8.2 and previously illustrated in Plate 8.13. Table 8.34 provides a comparison of the flows at these strategic locations between the DM and DS in each time period. The V/C ratio is also presented, with green shading indicating a V/C below 0.85, orange between 0.85 and 0.95 and red if 0.95 or above. Values have been rounded to two decimal places.

Table 8.34 Key corridor traffic flows – 2037 core DM vs DS (hourly flows in PCUs)

Location	Location description	Time period	DM			DS			Flow differences	
			Flow	Effective capacity	V/C	Flow	Effective capacity	V/C	Diff.	Diff. %
A	M25 junction 29 to M25 junction 28 (NB)	AM	7,651	9,180	0.83	8,941	9,180	0.97	1,290	17%
		IP	6,854	9,180	0.75	7,818	9,180	0.85	965	14%
		PM	6,969	9,180	0.76	7,942	9,180	0.87	972	14%
	M25 junction 28 to M25 junction 29 (SB)	AM	7,804	9,115	0.86	7,965	9,180	0.87	161	2%
		IP	7,452	9,115	0.82	7,802	9,180	0.85	349	5%
		PM	7,778	9,115	0.85	8,324	9,180	0.91	545	7%
B	M25 junction 4 to M25 junction 3 (NB)	AM	5,597	6,850	0.82	5,770	6,850	0.84	174	3%
		IP	5,649	6,850	0.82	5,895	6,850	0.86	246	4%
		PM	6,250	6,850	0.91	6,406	6,850	0.94	156	2%
	M25 junction 3 to M25 junction 4 (SB)	AM	6,840	6,850	1.00	6,843	6,850	1.00	4	0%
		IP	5,401	6,850	0.79	5,523	6,850	0.81	122	2%
		PM	5,806	6,850	0.85	6,097	6,850	0.89	291	5%
C	A13 A126 to A1012 (EB)	AM	5,127	6,311	0.81	4,221	6,296	0.67	-906	-18%
		IP	5,150	6,299	0.82	4,392	6,282	0.70	-758	-15%
		PM	5,752	6,266	0.92	5,647	6,237	0.91	-105	-2%
	A13 A1012 to A126 (WB)	AM	6,150	6,360	0.97	5,423	6,360	0.85	-727	-12%
		IP	5,497	6,360	0.86	4,622	6,360	0.73	-875	-16%
		PM	5,910	6,360	0.93	4,847	6,360	0.76	-1,063	-18%
D	A13 Orsett Cock to Manor Way (EB)	AM	4,902	6,370	0.77	5,490	6,370	0.86	588	12%
		IP	4,217	6,370	0.66	4,941	6,370	0.78	724	17%
		PM	4,953	6,370	0.78	5,870	6,370	0.92	917	19%
	A13 Manor Way to Orsett Cock (WB)	AM	5,200	6,220	0.84	5,854	6,220	0.94	653	13%
		IP	4,359	6,220	0.70	5,061	6,220	0.81	702	16%
		PM	4,784	6,220	0.77	5,826	6,220	0.94	1,042	22%

Location	Location description	Time period	DM			DS			Flow differences	
			Flow	Effective capacity	V/C	Flow	Effective capacity	V/C	Diff.	Diff. %
E	A2 A227 to Gravesend East (EB)	AM	6,288	9,236	0.68	5,231	9,229	0.57	-1,057	-17%
		IP	6,557	9,191	0.71	5,425	9,182	0.59	-1,131	-17%
		PM	9,047	9,185	0.98	8,617	9,170	0.94	-430	-5%
	A2 Gravesend East to A227 (WB)	AM	7,130	7,266	0.98	6,452	7,007	0.92	-679	-10%
		IP	5,967	7,056	0.85	5,122	6,894	0.74	-845	-14%
		PM	6,099	6,822	0.89	5,639	6,725	0.84	-460	-8%
F	M2 junction 1 to M2 junction 2 (EB)	AM	5,517	8,557	0.64	6,372	8,396	0.76	854	15%
		IP	4,730	8,680	0.54	5,504	8,541	0.64	774	16%
		PM	6,453	8,581	0.75	7,715	8,453	0.91	1,262	20%
	M2 junction 2 to M2 junction 1 (WB)	AM	6,011	8,794	0.68	7,522	8,603	0.87	1,510	25%
		IP	4,169	8,848	0.47	5,854	8,749	0.67	1,685	40%
		PM	5,346	8,930	0.60	6,428	8,749	0.73	1,083	20%
G	M20 junction 3 to M20 junction 4 (EB)	AM	6,005	9,115	0.66	5,672	9,115	0.62	-334	-6%
		IP	5,943	9,115	0.65	5,498	9,115	0.60	-445	-7%
		PM	8,699	9,115	0.95	8,303	9,115	0.91	-396	-5%
	M20 junction 4 to M20 junction 3 (WB)	AM	8,706	9,115	0.96	7,972	9,115	0.87	-733	-8%
		IP	5,820	9,115	0.64	4,680	9,115	0.51	-1,140	-20%
		PM	5,905	9,115	0.65	5,108	9,115	0.56	-797	-14%

Note: Red text indicates negative values

DM vs DS journey time comparisons

8.3.8 The same link-based and route-based journey time comparisons introduced under Section 8.2 are repeated for this year scenario combination.

8.3.9 The link-based corridors analysed are as previously shown diagrammatically in Plate 8.14.

8.3.10 The link-based journey time comparisons for this scenario are presented in Table 8.35 to Table 8.37.

8.3.11 The route-based movements analysed are as previously shown diagrammatically in Plate 8.15.

8.3.12 Table 8.38 to Table 8.43 provide the With and Without Scheme journey distances, times and average speeds for a selection of these movements for southbound and northbound movements.

Table 8.35 Link based journey time scenario comparison (2037 core DM vs DS) AM peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	16.9	83.6	23.5	17.3	81.3	0.0	0.4	-2.3	-0.1%	2.7%	-2.7%
	B to D	M25 J29	M25 J2	18.8	20.4	55.4	18.9	15.3	74.2	0.1	-5.1	18.8	0.3%	-25.1%	33.9%
	D to F	M25 J2	M25 J7	37.7	30.4	74.4	37.7	32.3	70.1	0.0	1.9	-4.3	0.0%	6.1%	-5.7%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	25.9	88.0	38.0	26.1	87.4	0.0	0.2	-0.7	0.0%	0.8%	-0.8%
	D to B	M25 J2	M25 J29	18.7	20.5	54.7	18.8	14.1	79.8	0.1	-6.4	25.1	0.6%	-31.1%	46.0%
	B to A	M25 J29	M25 J26	23.2	17.3	80.3	23.1	20.3	68.4	-0.1	3.0	-11.9	-0.3%	17.0%	-14.8%
A13 EB	C to G	M25 J30	A1089	5.2	5.2	60.3	5.3	4.2	74.8	0.0	-1.0	14.5	0.9%	-18.6%	24.1%
	G to H	A1089	A130	15.7	12.4	76.2	15.7	13.6	68.9	-0.1	1.3	-7.2	-0.4%	10.1%	-9.5%
A13 WB	H to G	A130	A1089	15.3	14.9	61.3	15.2	16.6	54.7	-0.1	1.7	-6.6	-0.7%	11.4%	-10.8%
	G to C	A1089	M25 J30	5.5	9.0	36.7	5.6	5.8	57.7	0.1	-3.2	21.0	1.6%	-35.4%	57.4%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	9.4	97.6	15.3	9.0	102.9	0.1	-0.4	5.2	0.5%	-4.6%	5.4%
	I to J	M2 J1	M2 J4	14.7	8.5	103.4	14.7	8.8	99.9	0.0	0.3	-3.5	0.0%	3.5%	-3.4%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	9.2	99.1	15.1	10.2	89.1	-0.1	1.0	-10.0	-0.7%	10.5%	-10.1%
	I to D	M2 J1	M25 J2	14.8	18.5	48.0	14.8	13.3	66.8	0.1	-5.1	18.9	0.6%	-27.8%	39.3%
M20 EB	E to K	M25 J3	M20 J8	35.3	20.5	103.5	35.3	20.3	104.6	0.0	-0.2	1.1	0.0%	-1.1%	1.1%
M20 WB	K to E	M20 J8	M25 J3	35.3	25.5	83.3	35.3	23.5	90.3	0.0	-2.0	7.0	0.0%	-7.8%	8.5%

Note: Red text indicate negative values

Table 8.36 Link based journey time scenario comparison (2037 core DM vs DS) inter-peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	16.3	86.7	23.5	16.7	84.2	0.0	0.5	-2.5	-0.1%	2.9%	-2.9%
	B to D	M25 J29	M25 J2	18.8	14.0	80.4	18.9	12.5	90.9	0.1	-1.6	10.5	0.3%	-11.3%	13.0%
	D to F	M25 J2	M25 J7	37.7	24.7	91.5	37.7	24.7	91.5	0.0	0.0	0.0	0.0%	0.0%	0.0%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	25.5	89.4	38.0	26.1	87.4	0.0	0.6	-2.0	0.0%	2.3%	-2.2%
	D to B	M25 J2	M25 J29	18.7	19.4	58.0	18.8	13.5	83.9	0.1	-5.9	25.9	0.6%	-30.5%	44.8%
	B to A	M25 J29	M25 J26	23.2	14.6	95.3	23.1	16.2	86.0	-0.1	1.5	-9.3	-0.3%	10.5%	-9.8%
A13 EB	C to G	M25 J30	A1089	5.2	5.4	58.4	5.3	4.4	72.5	0.0	-1.0	14.1	0.9%	-18.7%	24.1%
	G to H	A1089	A130	15.7	11.5	82.2	15.7	12.6	74.5	-0.1	1.2	-7.8	-0.4%	10.0%	-9.5%
A13 WB	H to G	A130	A1089	15.3	11.4	80.1	15.2	12.5	72.9	-0.1	1.0	-7.1	-0.7%	9.0%	-8.9%
	G to C	A1089	M25 J30	5.5	6.2	53.0	5.6	4.7	71.0	0.1	-1.5	18.0	1.6%	-24.1%	33.9%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	9.5	96.6	15.3	9.0	102.9	0.1	-0.5	6.3	0.5%	-5.6%	6.5%
	I to J	M2 J1	M2 J4	14.7	8.3	105.7	14.7	8.5	103.6	0.0	0.2	-2.1	0.0%	2.0%	-2.0%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	8.5	107.1	15.1	8.8	103.1	-0.1	0.3	-4.0	-0.7%	3.1%	-3.7%
	I to D	M2 J1	M25 J2	14.8	11.5	77.3	14.8	9.1	97.7	0.1	-2.3	20.4	0.6%	-20.4%	26.3%
M20 EB	E to K	M25 J3	M20 J8	35.3	20.2	105.1	35.3	20.0	106.0	0.0	-0.2	1.0	0.0%	-0.9%	0.9%
M20 WB	K to E	M20 J8	M25 J3	35.3	20.3	104.2	35.3	19.9	106.4	0.0	-0.4	2.2	0.0%	-2.0%	2.1%

Note: Red text indicate negative values

Table 8.37 Link based journey time scenario comparison (2037 core DM vs DS) PM peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	18.1	77.8	23.5	19.5	72.5	0.0	1.3	-5.3	-0.1%	7.3%	-6.9%
	B to D	M25 J29	M25 J2	18.8	16.9	66.8	18.9	13.3	85.2	0.1	-3.6	18.3	0.3%	-21.3%	27.5%
	D to F	M25 J2	M25 J7	37.7	24.4	92.6	37.7	25.0	90.6	0.0	0.6	-2.0	0.0%	2.3%	-2.2%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	29.6	77.0	38.0	30.4	75.0	0.0	0.8	-2.0	0.0%	2.6%	-2.6%
	D to B	M25 J2	M25 J29	18.7	19.1	58.6	18.8	13.9	81.2	0.1	-5.2	22.6	0.6%	-27.4%	38.5%
	B to A	M25 J29	M25 J26	23.2	14.5	96.0	23.1	15.8	87.9	-0.1	1.3	-8.2	-0.3%	9.0%	-8.5%
A13 EB	C to G	M25 J30	A1089	5.2	8.4	37.2	5.3	5.7	55.8	0.0	-2.8	18.6	0.9%	-32.7%	50.0%
	G to H	A1089	A130	15.7	13.1	72.3	15.7	14.6	64.4	-0.1	1.5	-7.8	-0.4%	11.7%	-10.9%
A13 WB	H to G	A130	A1089	15.3	11.7	78.4	15.2	14.4	63.2	-0.1	2.7	-15.2	-0.7%	23.3%	-19.4%
	G to C	A1089	M25 J30	5.5	7.3	45.1	5.6	5.1	66.3	0.1	-2.3	21.1	1.6%	-30.8%	46.9%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	14.9	61.7	15.3	11.3	81.7	0.1	-3.6	20.0	0.5%	-24.1%	32.5%
	I to J	M2 J1	M2 J4	14.7	9.6	91.6	14.7	11.7	75.2	0.0	2.1	-16.4	0.0%	21.8%	-17.9%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	8.8	103.1	15.1	9.1	99.4	-0.1	0.3	-3.7	-0.7%	3.0%	-3.6%
	I to D	M2 J1	M25 J2	14.8	14.3	62.1	14.8	11.0	81.0	0.1	-3.3	18.8	0.6%	-22.8%	30.3%
M20 EB	E to K	M25 J3	M20 J8	35.3	25.7	82.4	35.3	24.5	86.5	0.0	-1.2	4.0	0.0%	-4.7%	4.9%
M20 WB	K to E	M20 J8	M25 J3	35.3	20.6	102.8	35.3	20.2	104.8	0.0	-0.4	2.0	0.0%	-1.9%	2.0%

Note: Red text indicate negative values

Table 8.38 Route based journey time comparison north to south movements (2037 core DM vs DS) AM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.8	63.8	58.1	61.9	61.2	60.7	0.0	-2.7	2.5	0.0%	-4.2%	4.4%
1 to 8	Cheshunt	Godstone	91.5	83.6	65.7	91.5	80.8	67.9	0.0	-2.8	2.3	0.0%	-3.3%	3.5%
1 to 9	Cheshunt	Southfleet	62.1	59.1	63.0	62.2	54.3	68.8	0.1	-4.9	5.8	0.2%	-8.2%	9.1%
1 to 10	Cheshunt	Maidstone	88.2	76.7	68.9	84.0	73.0	69.0	-4.2	-3.8	0.1	-4.8%	-4.9%	0.1%
1 to 11	Cheshunt	Rochester	74.4	75.8	58.9	70.3	65.5	64.4	-4.2	-10.4	5.5	-5.6%	-13.7%	9.3%
1 to 12	Cheshunt	Rainham	91.4	81.6	67.3	87.3	71.1	73.6	-4.1	-10.4	6.4	-4.5%	-12.8%	9.5%
2 to 7	Romford	Bexley	31.9	53.9	35.5	35.6	48.5	44.0	3.7	-5.4	8.6	11.8%	-9.9%	24.1%
2 to 8	Romford	Godstone	61.5	73.6	50.1	65.3	68.2	57.5	3.7	-5.5	7.3	6.1%	-7.5%	14.6%
2 to 9	Romford	Southfleet	32.1	49.1	39.2	35.9	41.6	51.9	3.8	-7.6	12.7	11.9%	-15.4%	32.3%
2 to 10	Romford	Maidstone	58.2	66.8	52.3	57.7	60.3	57.4	-0.5	-6.5	5.1	-0.8%	-9.7%	9.8%
2 to 11	Romford	Rochester	44.5	65.8	40.5	44.0	52.8	50.0	-0.5	-13.1	9.5	-1.0%	-19.8%	23.5%
2 to 12	Romford	Rainham	61.5	71.6	51.5	61.1	58.5	62.7	-0.4	-13.1	11.2	-0.6%	-18.3%	21.7%
3 to 7	Brentwood	Bexley	33.0	45.1	43.9	32.9	40.5	48.8	-0.1	-4.6	4.9	-0.3%	-10.2%	11.1%
3 to 8	Brentwood	Godstone	62.7	64.9	58.0	62.6	60.2	62.4	-0.1	-4.7	4.5	-0.1%	-7.3%	7.7%
3 to 9	Brentwood	Southfleet	33.2	40.4	49.4	33.2	33.6	59.4	0.0	-6.8	10.0	0.0%	-16.9%	20.3%
3 to 10	Brentwood	Maidstone	59.3	58.0	61.4	55.0	52.3	63.1	-4.3	-5.7	1.8	-7.3%	-9.8%	2.9%
3 to 11	Brentwood	Rochester	45.6	57.1	47.9	41.3	44.8	55.4	-4.3	-12.3	7.4	-9.4%	-21.6%	15.5%
3 to 12	Brentwood	Rainham	62.6	62.8	59.8	58.4	50.5	69.4	-4.2	-12.4	9.6	-6.7%	-19.7%	16.1%
4 to 7	Basildon	Bexley	39.7	56.6	42.1	39.6	52.4	45.4	-0.1	-4.3	3.3	-0.2%	-7.5%	7.9%
4 to 8	Basildon	Godstone	69.4	76.4	54.5	69.3	72.0	57.7	-0.1	-4.4	3.3	-0.1%	-5.7%	6.0%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	40.0	51.9	46.2	34.9	40.0	52.3	-5.1	-11.9	6.2	-12.7%	-23.0%	13.3%
4 to 10	Basildon	Maidstone	66.0	69.5	57.0	49.1	57.3	51.5	-16.9	-12.3	-5.5	-25.6%	-17.7%	-9.7%
4 to 11	Basildon	Rochester	52.3	68.6	45.7	36.5	49.5	44.2	-15.8	-19.1	-1.5	-30.3%	-27.9%	-3.3%
4 to 12	Basildon	Rainham	69.3	74.4	55.9	53.6	55.2	58.2	-15.8	-19.2	2.3	-22.7%	-25.8%	4.1%
5 to 7	Tilbury Port	Bexley	28.3	41.6	40.8	28.3	37.0	45.9	0.0	-4.6	5.1	0.0%	-11.1%	12.5%
5 to 8	Tilbury Port	Godstone	58.0	61.4	56.7	58.0	56.6	61.4	0.0	-4.8	4.8	0.0%	-7.7%	8.4%
5 to 9	Tilbury Port	Southfleet	28.6	36.9	46.5	27.7	24.3	68.3	-0.8	-12.5	21.9	-2.9%	-34.0%	47.1%
5 to 10	Tilbury Port	Maidstone	54.6	54.5	60.2	41.9	41.6	60.5	-12.7	-12.9	0.3	-23.2%	-23.7%	0.6%
5 to 11	Tilbury Port	Rochester	40.9	53.6	45.8	29.3	33.9	52.0	-11.6	-19.7	6.1	-28.3%	-36.8%	13.4%
5 to 12	Tilbury Port	Rainham	57.9	59.3	58.6	46.4	39.5	70.4	-11.5	-19.8	11.8	-19.9%	-33.3%	20.2%
6 to 7	DP World	Bexley	32.1	45.0	42.8	32.1	39.6	48.6	0.0	-5.4	5.8	0.0%	-12.1%	13.7%
6 to 8	DP World	Godstone	61.8	64.8	57.2	61.8	59.2	62.6	0.0	-5.6	5.4	0.0%	-8.6%	9.4%
6 to 9	DP World	Southfleet	32.3	40.3	48.2	29.0	25.4	68.7	-3.3	-14.9	20.5	-10.2%	-37.1%	42.6%
6 to 10	DP World	Maidstone	58.4	57.9	60.5	43.3	42.6	60.9	-15.2	-15.3	0.4	-26.0%	-26.4%	0.6%
6 to 11	DP World	Rochester	44.7	57.0	47.1	30.6	34.9	52.7	-14.1	-22.1	5.6	-31.5%	-38.8%	12.0%
6 to 12	DP World	Rainham	61.7	62.7	59.0	47.7	40.6	70.6	-14.0	-22.2	11.6	-22.7%	-35.3%	19.6%

Note: Red text indicates negative values

Table 8.39 Route based journey time comparison north to south movements (2037 core DM vs DS) inter-peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed (
1 to 7	Cheshunt	Bexley	61.9	51.8	71.6	61.9	50.9	72.9	0.0	-0.9	1.3	0.0%	-1.8%	1.8%
1 to 8	Cheshunt	Godstone	91.5	68.6	80.1	91.5	67.5	81.3	0.0	-1.1	1.3	0.0%	-1.6%	1.6%
1 to 9	Cheshunt	Southfleet	62.2	49.3	75.8	62.2	47.8	78.1	0.0	-1.5	2.3	0.0%	-3.0%	3.1%
1 to 10	Cheshunt	Maidstone	88.2	65.7	80.5	82.9	61.8	80.5	-5.3	-4.0	0.0	-6.1%	-6.0%	0.0%
1 to 11	Cheshunt	Rochester	74.5	62.9	71.0	70.2	57.3	73.5	-4.3	-5.6	2.5	-5.7%	-8.9%	3.5%
1 to 12	Cheshunt	Rainham	91.5	70.6	77.8	87.3	64.9	80.7	-4.1	-5.7	3.0	-4.5%	-8.1%	3.8%
2 to 7	Romford	Bexley	35.6	41.0	52.0	35.6	38.2	55.8	0.0	-2.8	3.8	0.0%	-6.7%	7.3%
2 to 8	Romford	Godstone	65.2	57.8	67.7	65.3	54.9	71.4	0.0	-2.9	3.6	0.0%	-5.1%	5.4%
2 to 9	Romford	Southfleet	35.9	38.4	56.0	35.9	35.1	61.4	0.0	-3.3	5.3	0.0%	-8.7%	9.5%
2 to 10	Romford	Maidstone	61.9	54.9	67.6	56.6	49.1	69.1	-5.3	-5.8	1.5	-8.6%	-10.6%	2.2%
2 to 11	Romford	Rochester	48.2	52.1	55.5	44.0	44.7	59.1	-4.3	-7.5	3.5	-8.8%	-14.3%	6.4%
2 to 12	Romford	Rainham	65.2	59.8	65.4	61.0	52.2	70.1	-4.1	-7.5	4.7	-6.3%	-12.6%	7.2%
3 to 7	Brentwood	Bexley	33.0	33.9	58.3	32.9	32.1	61.5	-0.1	-1.8	3.2	-0.3%	-5.4%	5.5%
3 to 8	Brentwood	Godstone	62.7	50.7	74.1	62.6	48.7	77.1	-0.1	-2.0	3.0	-0.1%	-4.0%	4.0%
3 to 9	Brentwood	Southfleet	33.3	31.4	63.7	33.2	29.0	68.9	-0.1	-2.4	5.1	-0.3%	-7.7%	8.1%
3 to 10	Brentwood	Maidstone	59.3	47.8	74.4	53.9	42.9	75.3	-5.4	-4.9	0.9	-9.1%	-10.2%	1.2%
3 to 11	Brentwood	Rochester	45.7	45.1	60.8	41.3	38.5	64.3	-4.3	-6.5	3.5	-9.5%	-14.5%	5.8%
3 to 12	Brentwood	Rainham	62.6	52.7	71.3	58.4	46.1	76.0	-4.2	-6.6	4.8	-6.7%	-12.6%	6.7%
4 to 7	Basildon	Bexley	39.7	38.0	62.6	39.6	36.0	66.0	-0.1	-2.0	3.4	-0.2%	-5.4%	5.5%
4 to 8	Basildon	Godstone	69.4	54.8	75.9	69.3	52.6	79.0	-0.1	-2.2	3.1	-0.1%	-4.0%	4.1%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed (
4 to 9	Basildon	Southfleet	40.0	35.5	67.7	33.8	28.2	71.7	-6.3	-7.2	4.0	-15.7%	-20.4%	6.0%
4 to 10	Basildon	Maidstone	66.0	52.0	76.3	48.0	40.8	70.6	-18.1	-11.2	-5.7	-27.4%	-21.5%	-7.5%
4 to 11	Basildon	Rochester	52.4	49.2	63.9	35.4	36.4	58.3	-17.0	-12.8	-5.6	-32.5%	-26.0%	-8.7%
4 to 12	Basildon	Rainham	69.3	56.8	73.2	52.4	43.9	71.6	-16.9	-12.9	-1.6	-24.4%	-22.7%	-2.1%
5 to 7	Tilbury Port	Bexley	28.3	30.1	56.4	28.3	27.5	61.7	0.0	-2.6	5.3	0.0%	-8.6%	9.4%
5 to 8	Tilbury Port	Godstone	58.0	46.9	74.2	58.0	44.2	78.8	0.0	-2.7	4.6	0.0%	-5.8%	6.2%
5 to 9	Tilbury Port	Southfleet	28.6	27.6	62.4	27.7	19.5	85.5	-0.9	-8.1	23.1	-3.2%	-29.4%	37.1%
5 to 10	Tilbury Port	Maidstone	54.6	44.0	74.5	41.9	32.0	78.6	-12.7	-12.0	4.1	-23.3%	-27.3%	5.5%
5 to 11	Tilbury Port	Rochester	41.0	41.2	59.6	29.3	27.6	63.8	-11.7	-13.7	4.1	-28.5%	-33.1%	7.0%
5 to 12	Tilbury Port	Rainham	57.9	48.9	71.1	46.4	35.1	79.2	-11.5	-13.7	8.1	-19.9%	-28.1%	11.4%
6 to 7	DP World	Bexley	32.1	33.6	57.3	32.1	31.4	61.3	0.0	-2.2	4.0	0.0%	-6.6%	7.0%
6 to 8	DP World	Godstone	61.8	50.4	73.5	61.8	48.0	77.1	0.0	-2.4	3.6	0.0%	-4.7%	4.9%
6 to 9	DP World	Southfleet	32.4	31.1	62.6	29.0	21.7	80.1	-3.4	-9.3	17.5	-10.4%	-30.0%	27.9%
6 to 10	DP World	Maidstone	58.4	47.5	73.8	43.2	34.3	75.7	-15.2	-13.2	1.9	-26.0%	-27.9%	2.6%
6 to 11	DP World	Rochester	44.8	44.8	60.0	30.6	29.9	61.5	-14.1	-14.9	1.5	-31.6%	-33.2%	2.5%
6 to 12	DP World	Rainham	61.7	52.4	70.7	47.7	37.4	76.5	-14.0	-15.0	5.8	-22.7%	-28.6%	8.2%

Note: Red text indicates negative values

Table 8.40 Route based journey time comparison north to south movements (2037 core DM vs DS) PM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.9	61.1	60.8	61.9	59.4	62.5	0.0	-1.7	1.7	0.0%	-2.7%	2.8%
1 to 8	Cheshunt	Godstone	91.6	75.5	72.8	91.6	73.7	74.5	0.0	-1.8	1.7	0.0%	-2.3%	2.4%
1 to 9	Cheshunt	Southfleet	60.8	57.7	63.2	62.2	54.1	69.0	1.4	-3.6	5.7	2.3%	-6.2%	9.1%
1 to 10	Cheshunt	Maidstone	88.2	77.8	68.0	82.9	73.5	67.7	-5.3	-4.3	-0.4	-6.0%	-5.5%	-0.6%
1 to 11	Cheshunt	Rochester	74.9	77.7	57.8	70.8	68.7	61.8	-4.1	-9.0	4.0	-5.5%	-11.6%	6.9%
1 to 12	Cheshunt	Rainham	91.5	92.4	59.4	87.4	82.9	63.2	-4.1	-9.4	3.8	-4.5%	-10.2%	6.4%
2 to 7	Romford	Bexley	35.9	52.6	40.9	35.8	47.3	45.5	0.0	-5.4	4.6	-0.1%	-10.2%	11.3%
2 to 8	Romford	Godstone	65.5	67.1	58.6	65.5	61.6	63.8	0.0	-5.5	5.2	0.0%	-8.1%	8.8%
2 to 9	Romford	Southfleet	34.8	49.3	42.3	36.2	42.0	51.6	1.4	-7.3	9.3	4.0%	-14.7%	22.0%
2 to 10	Romford	Maidstone	62.2	69.4	53.8	56.8	61.4	55.5	-5.3	-8.0	1.8	-8.6%	-11.5%	3.3%
2 to 11	Romford	Rochester	48.9	69.3	42.3	44.7	56.6	47.4	-4.1	-12.7	5.1	-8.5%	-18.3%	12.1%
2 to 12	Romford	Rainham	65.4	83.9	46.8	61.3	70.8	52.0	-4.1	-13.1	5.2	-6.3%	-15.7%	11.1%
3 to 7	Brentwood	Bexley	33.0	41.5	47.7	32.9	38.2	51.6	-0.1	-3.2	3.9	-0.3%	-7.8%	8.2%
3 to 8	Brentwood	Godstone	62.7	56.0	67.2	62.6	52.6	71.4	-0.1	-3.3	4.2	-0.1%	-6.0%	6.2%
3 to 9	Brentwood	Southfleet	31.9	38.1	50.2	33.2	33.0	60.5	1.3	-5.1	10.3	4.2%	-13.5%	20.4%
3 to 10	Brentwood	Maidstone	59.3	58.3	61.1	53.9	52.4	61.8	-5.4	-5.9	0.6	-9.1%	-10.1%	1.1%
3 to 11	Brentwood	Rochester	46.0	58.2	47.5	41.8	47.6	52.7	-4.2	-10.6	5.3	-9.2%	-18.2%	11.1%
3 to 12	Brentwood	Rainham	62.6	72.8	51.6	58.4	61.8	56.7	-4.2	-11.0	5.1	-6.7%	-15.2%	9.9%
4 to 7	Basildon	Bexley	36.8	46.1	47.9	36.8	42.8	51.6	0.0	-3.4	3.7	0.0%	-7.3%	7.8%
4 to 8	Basildon	Godstone	66.5	60.6	65.9	66.5	57.1	69.8	0.0	-3.5	4.0	0.0%	-5.7%	6.0%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	35.7	42.8	50.1	33.8	30.6	66.2	-2.0	-12.2	16.1	-5.5%	-28.4%	32.1%
4 to 10	Basildon	Maidstone	63.2	62.9	60.3	48.0	48.2	59.7	-15.2	-14.7	-0.5	-24.1%	-23.4%	-0.9%
4 to 11	Basildon	Rochester	49.9	62.8	47.6	35.9	43.4	49.6	-14.0	-19.4	2.0	-28.1%	-30.9%	4.1%
4 to 12	Basildon	Rainham	66.4	77.4	51.5	52.4	57.6	54.6	-14.0	-19.9	3.2	-21.1%	-25.6%	6.2%
5 to 7	Tilbury Port	Bexley	28.3	36.3	46.8	28.3	31.3	54.2	0.0	-5.0	7.5	0.0%	-13.8%	16.0%
5 to 8	Tilbury Port	Godstone	58.0	50.8	68.5	58.0	45.7	76.2	0.0	-5.1	7.7	0.0%	-10.1%	11.2%
5 to 9	Tilbury Port	Southfleet	27.2	33.0	49.5	27.7	20.7	80.3	0.5	-12.3	30.8	1.9%	-37.2%	62.1%
5 to 10	Tilbury Port	Maidstone	54.6	53.1	61.8	41.9	38.3	65.7	-12.7	-14.8	3.9	-23.3%	-27.8%	6.3%
5 to 11	Tilbury Port	Rochester	41.3	53.0	46.8	29.8	33.5	53.4	-11.5	-19.5	6.6	-27.9%	-36.8%	14.1%
5 to 12	Tilbury Port	Rainham	57.9	67.6	51.4	46.4	47.7	58.4	-11.5	-19.9	7.0	-19.9%	-29.5%	13.6%
6 to 7	DP World	Bexley	32.1	40.1	48.1	32.1	36.8	52.3	0.0	-3.3	4.2	-0.1%	-8.1%	8.8%
6 to 8	DP World	Godstone	61.8	54.5	68.0	61.8	51.2	72.4	0.0	-3.4	4.4	0.0%	-6.2%	6.5%
6 to 9	DP World	Southfleet	31.0	36.7	50.7	29.0	24.7	70.7	-2.0	-12.1	20.0	-6.3%	-32.8%	39.4%
6 to 10	DP World	Maidstone	58.4	56.8	61.7	43.2	42.3	61.4	-15.2	-14.6	-0.3	-26.0%	-25.7%	-0.5%
6 to 11	DP World	Rochester	45.1	56.8	47.7	31.1	37.5	49.9	-14.0	-19.3	2.2	-31.0%	-34.0%	4.6%
6 to 12	DP World	Rainham	61.7	71.4	51.9	47.7	51.6	55.4	-14.0	-19.8	3.6	-22.7%	-27.7%	6.9%

Note: Red text indicates negative values

Table 8.41 Route based journey time comparison south to north movements (2037 core DM vs DS) AM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	59.7	61.9	61.6	56.4	65.6	0.0	-3.3	3.6	0.1%	-5.5%	5.9%
7 to 2	Bexley	Romford	34.7	46.6	44.7	34.7	40.0	52.0	0.0	-6.6	7.3	0.0%	-14.1%	16.4%
7 to 3	Bexley	Brentwood	33.1	41.6	47.9	33.2	36.6	54.4	0.0	-4.9	6.5	0.1%	-11.9%	13.6%
7 to 4	Bexley	Basildon	36.8	43.3	51.1	36.8	36.4	60.6	0.0	-6.8	9.5	-0.1%	-15.8%	18.7%
7 to 5	Bexley	Tilbury Port	28.6	38.8	44.2	28.6	30.3	56.5	0.0	-8.5	12.3	0.0%	-21.8%	27.8%
7 to 6	Bexley	DP World	32.4	39.4	49.3	32.4	32.5	59.8	0.0	-6.9	10.5	-0.1%	-17.6%	21.2%
8 to 1	Godstone	Cheshunt	91.8	80.8	68.1	91.8	77.9	70.7	0.0	-2.9	2.6	0.0%	-3.6%	3.8%
8 to 2	Godstone	Romford	64.9	67.7	57.5	64.9	61.5	63.3	0.0	-6.2	5.8	0.0%	-9.2%	10.1%
8 to 3	Godstone	Brentwood	63.3	62.7	60.6	63.4	58.1	65.4	0.0	-4.6	4.8	0.1%	-7.3%	7.9%
8 to 4	Godstone	Basildon	67.0	64.4	62.4	67.0	57.9	69.4	0.0	-6.5	7.0	0.0%	-10.1%	11.1%
8 to 5	Godstone	Tilbury Port	58.7	59.9	58.8	58.7	51.8	68.0	0.0	-8.1	9.2	0.0%	-13.5%	15.6%
8 to 6	Godstone	DP World	62.6	60.5	62.0	62.6	54.0	69.5	0.0	-6.5	7.5	0.0%	-10.8%	12.1%
9 to 1	Southfleet	Cheshunt	60.7	59.4	61.4	60.8	54.6	66.8	0.0	-4.8	5.5	0.1%	-8.1%	8.9%
9 to 2	Southfleet	Romford	33.8	46.3	43.9	33.8	38.2	53.2	0.0	-8.1	9.3	0.0%	-17.5%	21.2%
9 to 3	Southfleet	Brentwood	32.3	41.3	46.9	32.3	34.8	55.7	0.0	-6.5	8.8	0.1%	-15.7%	18.8%
9 to 4	Southfleet	Basildon	36.0	43.0	50.2	35.8	29.6	72.7	-0.1	-13.4	22.5	-0.4%	-31.2%	44.8%
9 to 5	Southfleet	Tilbury Port	27.7	38.5	43.2	31.4	27.0	69.8	3.7	-11.5	26.7	13.4%	-29.9%	61.8%
9 to 6	Southfleet	DP World	31.5	39.1	48.4	31.4	25.6	73.5	-0.1	-13.5	25.1	-0.4%	-34.5%	52.0%
10 to 1	Maidstone	Cheshunt	88.3	81.3	65.2	83.3	71.7	69.7	-5.0	-9.6	4.6	-5.6%	-11.8%	7.0%
10 to 2	Maidstone	Romford	61.4	68.2	54.0	56.4	55.0	61.5	-5.0	-13.1	7.4	-8.2%	-19.2%	13.7%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	63.1	56.8	54.3	51.9	62.9	-5.5	-11.3	6.0	-9.2%	-17.9%	10.6%
10 to 4	Maidstone	Basildon	63.5	64.9	58.8	50.3	43.9	68.8	-13.2	-21.0	10.1	-20.8%	-32.4%	17.1%
10 to 5	Maidstone	Tilbury Port	55.2	60.4	54.9	45.9	41.3	66.7	-9.4	-19.1	11.8	-16.9%	-31.6%	21.5%
10 to 6	Maidstone	DP World	59.1	61.0	58.1	45.9	39.9	69.0	-13.2	-21.1	10.8	-22.3%	-34.6%	18.7%
11 to 1	Rochester	Cheshunt	76.2	84.6	54.1	70.3	67.5	62.5	-5.9	-17.1	8.4	-7.8%	-20.3%	15.6%
11 to 2	Rochester	Romford	49.4	71.5	41.4	43.4	50.8	51.2	-6.0	-20.6	9.7	-12.2%	-28.9%	23.5%
11 to 3	Rochester	Brentwood	47.8	66.5	43.1	41.3	47.6	52.0	-6.5	-18.8	8.9	-13.6%	-28.3%	20.6%
11 to 4	Rochester	Basildon	51.5	68.2	45.3	37.3	39.6	56.5	-14.2	-28.5	11.1	-27.6%	-41.8%	24.6%
11 to 5	Rochester	Tilbury Port	43.2	63.7	40.7	32.9	37.1	53.2	-10.3	-26.6	12.5	-23.9%	-41.8%	30.7%
11 to 6	Rochester	DP World	47.0	64.3	43.9	32.9	35.7	55.2	-14.2	-28.6	11.3	-30.2%	-44.5%	25.8%
12 to 1	Rainham	Cheshunt	91.7	98.5	55.8	87.7	81.4	64.6	-4.0	-17.1	8.8	-4.4%	-17.4%	15.7%
12 to 2	Rainham	Romford	64.8	85.4	45.5	60.7	64.8	56.2	-4.1	-20.6	10.7	-6.3%	-24.2%	23.6%
12 to 3	Rainham	Brentwood	63.3	80.4	47.2	58.7	61.6	57.1	-4.6	-18.8	10.0	-7.2%	-23.4%	21.1%
12 to 4	Rainham	Basildon	67.0	82.1	48.9	54.7	53.6	61.2	-12.3	-28.5	12.3	-18.3%	-34.7%	25.1%
12 to 5	Rainham	Tilbury Port	58.7	77.7	45.3	50.2	51.0	59.1	-8.4	-26.6	13.7	-14.4%	-34.3%	30.3%
12 to 6	Rainham	DP World	62.5	78.3	47.9	50.2	49.7	60.7	-12.3	-28.6	12.8	-19.6%	-36.5%	26.6%

Note: Red text indicates negative values

Table 8.42 Route based journey time comparison south to north movements (2037 core DM vs DS) inter-peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	54.7	67.5	61.6	51.1	72.4	0.0	-3.7	4.9	0.1%	-6.7%	7.3%
7 to 2	Bexley	Romford	35.8	40.7	52.8	35.7	35.4	60.5	-0.1	-5.3	7.7	-0.4%	-13.1%	14.6%
7 to 3	Bexley	Brentwood	33.2	38.6	51.5	33.2	33.3	59.9	0.0	-5.4	8.4	0.1%	-13.9%	16.2%
7 to 4	Bexley	Basildon	36.8	42.1	52.5	36.8	35.9	61.6	0.0	-6.3	9.1	-0.1%	-14.9%	17.4%
7 to 5	Bexley	Tilbury Port	31.9	38.5	49.7	31.9	31.6	60.6	0.0	-6.9	10.9	0.0%	-18.0%	21.9%
7 to 6	Bexley	DP World	32.4	37.9	51.2	32.4	31.4	61.9	0.0	-6.6	10.7	-0.1%	-17.3%	20.9%
8 to 1	Godstone	Cheshunt	91.8	75.2	73.2	91.8	71.7	76.9	0.0	-3.6	3.7	0.1%	-4.7%	5.0%
8 to 2	Godstone	Romford	66.0	61.2	64.7	65.9	56.0	70.6	-0.1	-5.2	5.9	-0.2%	-8.5%	9.1%
8 to 3	Godstone	Brentwood	63.3	59.1	64.3	63.4	53.9	70.6	0.0	-5.3	6.3	0.1%	-8.9%	9.8%
8 to 4	Godstone	Basildon	67.0	62.6	64.2	67.0	56.5	71.2	0.0	-6.2	7.0	0.0%	-9.8%	10.9%
8 to 5	Godstone	Tilbury Port	62.1	59.0	63.1	62.1	52.2	71.4	0.0	-6.8	8.2	0.0%	-11.5%	13.1%
8 to 6	Godstone	DP World	62.6	58.4	64.3	62.6	52.0	72.2	0.0	-6.5	8.0	0.0%	-11.1%	12.4%
9 to 1	Southfleet	Cheshunt	60.7	55.0	66.2	60.8	49.3	74.0	0.0	-5.7	7.8	0.1%	-10.4%	11.7%
9 to 2	Southfleet	Romford	35.0	41.0	51.2	34.8	33.6	62.2	-0.1	-7.4	11.0	-0.4%	-18.0%	21.5%
9 to 3	Southfleet	Brentwood	32.3	38.9	49.8	32.3	31.5	61.6	0.0	-7.4	11.8	0.1%	-19.1%	23.7%
9 to 4	Southfleet	Basildon	36.0	42.4	50.9	35.8	28.7	74.8	-0.1	-13.7	23.9	-0.4%	-32.2%	47.0%
9 to 5	Southfleet	Tilbury Port	31.1	38.8	48.0	34.8	27.9	74.7	3.7	-10.9	26.7	11.9%	-28.0%	55.5%
9 to 6	Southfleet	DP World	31.5	38.2	49.5	31.4	24.2	77.7	-0.1	-14.0	28.2	-0.4%	-36.5%	56.9%
10 to 1	Maidstone	Cheshunt	88.3	71.2	74.4	83.3	62.6	79.8	-5.0	-8.6	5.4	-5.6%	-12.0%	7.3%
10 to 2	Maidstone	Romford	62.5	57.1	65.6	57.3	46.9	73.4	-5.2	-10.3	7.8	-8.2%	-18.0%	11.9%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	55.1	65.2	54.9	44.4	74.1	-5.0	-10.6	8.9	-8.3%	-19.3%	13.7%
10 to 4	Maidstone	Basildon	63.5	58.6	65.1	50.3	39.8	75.8	-13.2	-18.8	10.8	-20.8%	-32.0%	16.5%
10 to 5	Maidstone	Tilbury Port	58.6	55.0	64.0	49.2	39.0	75.8	-9.4	-16.0	11.8	-16.0%	-29.1%	18.5%
10 to 6	Maidstone	DP World	59.1	54.4	65.2	45.9	35.3	77.9	-13.2	-19.1	12.8	-22.3%	-35.1%	19.6%
11 to 1	Rochester	Cheshunt	74.5	71.9	62.2	70.3	58.9	71.6	-4.2	-12.9	9.4	-5.6%	-18.0%	15.1%
11 to 2	Rochester	Romford	48.7	57.8	50.5	44.3	43.2	61.6	-4.4	-14.6	11.1	-9.0%	-25.3%	21.9%
11 to 3	Rochester	Brentwood	46.0	55.7	49.5	41.9	40.7	61.7	-4.2	-15.0	12.1	-9.0%	-26.9%	24.5%
11 to 4	Rochester	Basildon	49.7	59.2	50.4	37.3	36.1	62.0	-12.4	-23.1	11.6	-25.0%	-39.1%	23.1%
11 to 5	Rochester	Tilbury Port	44.8	55.6	48.3	36.2	35.3	61.6	-8.6	-20.4	13.3	-19.1%	-36.6%	27.5%
11 to 6	Rochester	DP World	45.3	55.1	49.3	32.9	31.6	62.4	-12.4	-23.4	13.0	-27.4%	-42.6%	26.4%
12 to 1	Rainham	Cheshunt	91.7	79.2	69.5	87.7	66.2	79.5	-4.0	-13.0	10.0	-4.4%	-16.5%	14.5%
12 to 2	Rainham	Romford	65.9	65.2	60.7	61.7	50.4	73.4	-4.2	-14.8	12.7	-6.4%	-22.6%	21.0%
12 to 3	Rainham	Brentwood	63.3	63.1	60.1	59.2	48.0	74.1	-4.0	-15.1	14.0	-6.4%	-24.0%	23.2%
12 to 4	Rainham	Basildon	67.0	66.6	60.3	54.7	43.3	75.7	-12.3	-23.3	15.4	-18.3%	-34.9%	25.5%
12 to 5	Rainham	Tilbury Port	62.0	63.0	59.1	53.6	42.5	75.6	-8.4	-20.5	16.6	-13.6%	-32.5%	28.0%
12 to 6	Rainham	DP World	62.5	62.4	60.1	50.2	38.8	77.6	-12.3	-23.6	17.5	-19.6%	-37.8%	29.1%

Note: Red text indicates negative values

Table 8.43 Route based journey time comparison south to north movements (2037 core DM vs DS) PM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	61.1	60.5	61.6	57.2	64.6	0.1	-3.8	4.1	0.1%	-6.3%	6.8%
7 to 2	Bexley	Romford	34.8	46.8	44.6	34.8	41.7	50.0	0.0	-5.1	5.4	0.0%	-10.9%	12.2%
7 to 3	Bexley	Brentwood	33.1	40.5	49.1	33.2	35.7	55.8	0.0	-4.8	6.7	0.1%	-11.8%	13.6%
7 to 4	Bexley	Basildon	36.8	49.1	45.0	36.8	42.1	52.5	0.0	-7.0	7.5	0.0%	-14.3%	16.7%
7 to 5	Bexley	Tilbury Port	28.6	38.9	44.1	28.6	30.9	55.5	0.0	-8.0	11.5	0.0%	-20.6%	26.0%
7 to 6	Bexley	DP World	32.4	43.0	45.2	32.4	36.1	53.9	0.0	-7.0	8.7	0.0%	-16.2%	19.2%
8 to 1	Godstone	Cheshunt	91.2	83.8	65.3	91.3	80.8	67.8	0.1	-3.0	2.5	0.1%	-3.6%	3.8%
8 to 2	Godstone	Romford	64.4	69.5	55.6	64.4	65.3	59.2	0.0	-4.2	3.6	0.0%	-6.1%	6.5%
8 to 3	Godstone	Brentwood	62.8	63.2	59.6	62.8	59.2	63.6	0.0	-3.9	4.0	0.1%	-6.2%	6.7%
8 to 4	Godstone	Basildon	66.5	71.8	55.5	66.5	65.6	60.8	0.0	-6.2	5.2	0.0%	-8.6%	9.4%
8 to 5	Godstone	Tilbury Port	58.2	61.6	56.7	58.2	54.4	64.2	0.0	-7.2	7.5	0.0%	-11.6%	13.2%
8 to 6	Godstone	DP World	62.0	65.8	56.6	62.0	59.6	62.4	0.0	-6.1	5.8	0.0%	-9.3%	10.2%
9 to 1	Southfleet	Cheshunt	60.7	58.9	61.9	60.8	54.3	67.1	0.1	-4.6	5.2	0.1%	-7.7%	8.5%
9 to 2	Southfleet	Romford	33.9	44.6	45.7	33.9	38.8	52.5	0.0	-5.8	6.8	0.0%	-13.0%	15.0%
9 to 3	Southfleet	Brentwood	32.3	38.3	50.6	32.3	32.8	59.2	0.0	-5.5	8.6	0.1%	-14.4%	17.0%
9 to 4	Southfleet	Basildon	36.0	46.9	46.0	36.2	33.2	65.5	0.3	-13.7	19.5	0.7%	-29.2%	42.3%
9 to 5	Southfleet	Tilbury Port	27.7	36.7	45.3	31.8	26.0	73.3	4.1	-10.7	28.0	14.8%	-29.1%	61.8%
9 to 6	Southfleet	DP World	31.5	40.8	46.3	31.8	27.2	70.1	0.3	-13.6	23.8	0.8%	-33.4%	51.3%
10 to 1	Maidstone	Cheshunt	88.3	77.5	68.3	83.3	71.9	69.6	-4.9	-5.7	1.3	-5.6%	-7.3%	1.8%
10 to 2	Maidstone	Romford	61.5	63.2	58.3	56.4	56.3	60.2	-5.0	-6.9	1.9	-8.1%	-11.0%	3.2%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	56.9	63.1	54.9	50.3	65.5	-5.0	-6.6	2.4	-8.3%	-11.6%	3.8%
10 to 4	Maidstone	Basildon	63.5	65.5	58.2	50.3	47.5	63.6	-13.2	-18.0	5.4	-20.8%	-27.5%	9.3%
10 to 5	Maidstone	Tilbury Port	55.2	55.3	59.9	45.9	40.3	68.3	-9.4	-15.0	8.4	-16.9%	-27.1%	14.0%
10 to 6	Maidstone	DP World	59.1	59.5	59.6	45.9	41.5	66.3	-13.2	-18.0	6.7	-22.3%	-30.2%	11.3%
11 to 1	Rochester	Cheshunt	74.5	83.7	53.4	70.3	69.3	60.9	-4.2	-14.4	7.5	-5.6%	-17.2%	14.1%
11 to 2	Rochester	Romford	47.7	69.4	41.2	43.4	53.7	48.5	-4.2	-15.7	7.3	-8.9%	-22.6%	17.8%
11 to 3	Rochester	Brentwood	46.0	63.1	43.8	41.9	47.7	52.6	-4.2	-15.4	8.9	-9.1%	-24.4%	20.2%
11 to 4	Rochester	Basildon	49.7	71.7	41.6	37.3	45.0	49.8	-12.4	-26.8	8.2	-25.0%	-37.3%	19.8%
11 to 5	Rochester	Tilbury Port	41.4	61.5	40.4	32.9	37.8	52.2	-8.6	-23.8	11.8	-20.7%	-38.6%	29.2%
11 to 6	Rochester	DP World	45.3	65.7	41.4	32.9	39.0	50.6	-12.4	-26.7	9.3	-27.4%	-40.7%	22.4%
12 to 1	Rainham	Cheshunt	91.7	90.0	61.1	87.7	74.6	70.6	-4.0	-15.4	9.4	-4.4%	-17.1%	15.4%
12 to 2	Rainham	Romford	64.9	75.6	51.5	60.8	59.0	61.9	-4.1	-16.7	10.4	-6.3%	-22.0%	20.2%
12 to 3	Rainham	Brentwood	63.2	69.3	54.7	59.2	53.0	67.1	-4.0	-16.4	12.3	-6.4%	-23.6%	22.5%
12 to 4	Rainham	Basildon	66.9	78.0	51.5	54.7	50.2	65.4	-12.3	-27.8	13.8	-18.3%	-35.6%	26.9%
12 to 5	Rainham	Tilbury Port	58.7	67.8	52.0	50.2	43.0	70.1	-8.4	-24.7	18.1	-14.4%	-36.5%	34.9%
12 to 6	Rainham	DP World	62.5	71.9	52.2	50.2	44.2	68.2	-12.3	-27.7	16.0	-19.6%	-38.5%	30.8%

Note: Red text indicates negative values

Commentary on the results

8.3.13 Table 8.23 to Table 8.28 demonstrate that the highway assignment models for each time period in the Do Minimum and Do Something scenarios have converged well within the TAG recommended convergence limits.

8.3.14 The select link analysis presented in Plate 8.16 to Plate 8.24 and associated Table 8.29 to Table 8.31 shows that the introduction of the Project has a significant impact on the patterns of movement using the Dartford Crossing. In particular, there is a substantial reduction in traffic to/from east Kent using the Dartford Crossing with the Project. As would be expected, in the Do Something situation the majority of this traffic uses the Project. There is also a substantial reduction north of the River Thames in trips to/from M25 north.

8.3.15 There is an increase in the number of trips using the Dartford Crossing from within London both north and south of the River Thames. This is likely due to some route switching of travellers from using Silvertown/Blackwall in the Do Minimum scenario to using the Dartford Crossing in the Do Something scenario due to the newly available capacity. This will also be caused by an increase in shorter distance trips switching destinations to cross the River Thames in the Do Something scenario. These movements are suppressed in the Do Minimum scenario due to the lack of available capacity at the Dartford Crossing.

8.3.16 Movements using the Project are predominantly from/to east Kent, M25 north and A13 east of the junction with the Project. In the south there is some local traffic (approximately 800–1,170 PCU/hr in the peak hours) and relatively few trips to/from Kent west of the A2 junction with the Project using the Project (up to 700 PCU/hr in the peak hours) and zero trips from M25 south of the A2 junction using the Project. These movements will continue to use the Dartford Crossing as to use the Project would require a considerable detour. In the north there is a small amount of traffic to/from A1089 using the Project (up to 830 PCU/hr in the peak hours). These patterns of movement are consistent across all time periods and accord well with *a priori* expectations.

8.3.17 Comparisons of traffic flows in the Do Minimum and Do Something scenarios are presented in Plate 8.25 to Plate 8.27 and in Table 8.32 to Table 8.34. Initially focussing on the impact of the Project on flows at the Dartford Crossing, it can be observed that the model is predicting a substantial reduction in flow. In the southbound direction, in the Do Minimum scenario, the AM peak is at capacity (V/C ratio of 1.0) the PM peak is approaching capacity (V/C ratio of 0.97) and the inter-peak is operating below capacity (V/C ratio of 0.88). In the Do Something scenario, the model predicted flows at the Dartford Crossing are substantially reduced by between 5% and 22% with V/C ratios between 0.69 and 0.95 across the different time periods.

8.3.18 In the northbound direction, in the Do Minimum scenario, the flows at the Dartford Crossing exceed the capacity of the TMC in all time periods with V/C ratios of between 1.10 and 1.13. In the AM and PM peaks the flows approaching the TMC exceed the capacity by between 700 and 830 PCU/hr. In the Do Something scenario these flows are significantly reduced by between 16% and 21% with the crossing operating under the capacity of the TMC with V/C ratios ranging from 0.87 to 0.95 across the different time periods.

8.3.19 In particular, there is a substantial reduction in HGVs using the Dartford Crossing both northbound and southbound in all time periods, in the Do Something scenario compared to the Do Minimum scenario. This is due to the alignment of the Project making it a very favourable route for HGVs accessing the ports in Kent and Essex. These reductions in flow at the Dartford Crossing, across all vehicle types, are as expected as this is one of the primary objectives of the Project.

8.3.20 The Project tunnel is operating well under capacity in both directions with V/C ratios of between 0.48 and 0.72 in the southbound direction and 0.60 to 0.76 in the northbound direction. It can also be observed that in 2037, the flow on the Project is over two full lanes worth of traffic southbound in the PM peak and northbound in the AM peak. More detailed information on the flows along the different sections of the Project and at its junctions is provided in Chapter 10.

8.3.21 When looking at both crossings combined, it can be seen that in the Do Something scenario there is sufficient cross-river capacity with V/C ratios of between 0.60 and 0.79 in the southbound direction and 0.75 to 0.82 in the northbound direction. This is in stark contrast to the Do Minimum situation where the Dartford Crossing is heavily congested southbound in the peak hours and northbound in all time periods, likely leading to long queues, unreliable journey times and a higher rate of incidents.

8.3.22 The analysis also shows that there are associated reductions in traffic flows along the A2 and A13 west of their junctions with the Project and also on the M20. These reductions in flow lead to reductions in congestion along these corridors. This is one of the major benefits of the Project and is from which a significant proportion of the economic benefits of the Project are derived.

8.3.23 There are some increases in flow in the Do Something scenario compared to the Do Minimum scenario on the A2/M2 corridor east of the Project, the A13 east of the Project and on the M25 north of the Project. This is caused by the Project drawing more traffic to cross the River Thames than in the constrained Do Minimum scenario. These increases in flow lead to additional congestion in these corridors and leads to disbenefits from the introduction of the Project. Some of these increases in flow increase congestion in these corridors. In particular, M25 junctions 29–28 is worse in the Do Something scenario when compared with the Do Minimum scenario.

8.3.24 These benefits and disbenefits are further illustrated by the link-based journey time analysis presented in Table 8.35 to Table 8.37. It can be observed that there are substantial increases in speed in the Dartford Crossing corridor between M25 junction 29 and M25 junction 2 in both directions (up to a 25km/h increase in the AM peak in the northbound direction). There are also significant journey time savings and increases in speed on the A2 between the junction with the Project and the M25 and on the A13 between the junction with the Project and the M25. There are some mostly modest predicted reductions in speed on the A2 and A13 east of their junctions with the Project and on the wider M25 both north and south of the River Thames. These are in line with the increases in flows predicted in those corridors. This pattern is relatively consistent across all time periods.

8.3.25 There is additional detailed link-based journey time analysis presented in Annex C.

8.3.26 The route-based journey times presented in Table 8.38 to Table 8.43 show cross-river movements. As expected, all cross-river movements experience improved journey times in the Do Something scenario relative to the Do Minimum. Some cross-river movements also benefit substantially from a reduced journey distance. Using the Project rather than the Dartford Crossing provides a significant distance saving for movements from/to east Kent to/from east Essex.

8.3.27 It is for this reason that it is considered necessary to undertake a full 24 hours per day, 365 days per year economic assessment of the Project. Some movements will benefit significantly from the introduction of the Project even during the night when flow is predicted to be low. It is important that the associated benefits, and disbenefits, of movements at all times of day and night are captured in the economic analysis.

8.3.28 Most movements also experience an increase in average speed in the Do Something scenario. Some movements do not however, primarily due to their using different parts of the network with different speed limits and links with higher congestion in the Do Something scenario as described above. Overall though, the balance is substantially positive, with almost all of the cross-river movements shown in Table 8.38 to Table 8.43 having increases in speed.

8.4 LTAM 2045 core – outputs to economic assessment

8.4.1 The analysis presented below summarises the impact of the Project on forecast traffic flows and journey times for the 2045 core forecast. The statistics presented are from the final converged VDM loop as described in Chapter 7.

HAM convergence statistics

8.4.2 Table 8.44 to Table 8.46 provide the final VDM loop highway assignment model convergence statistics for the 2045 core DM forecasts. Table 8.47 to Table 8.49 provide the final VDM loop highway assignment model convergence statistics for the 2045 core DS forecasts.

Table 8.44 HAM convergence statistics – 2045 core DM AM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
69	0.0064	0.008	98.8	99.4
70	0.0066	0.0067	98.5	99.3
71	0.0050	0.0074	99.0	99.4
72	0.0060	0.0065	98.6	99.4

Table 8.45 HAM convergence statistics – 2045 core DM inter-peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
83	0.0028	0.0043	98.6	99.4
84	0.0031	0.0039	98.5	99.4
85	0.0026	0.0038	98.9	99.5
86	0.0024	0.0061	98.8	99.4

Table 8.46 HAM convergence statistics – 2045 core DM PM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
74	0.0044	0.0059	98.9	99.2
75	0.0041	0.0075	98.9	99.2
76	0.0046	0.0063	98.7	99.1
77	0.0038	0.006	98.8	99.1

Table 8.47 HAM convergence statistics – 2045 core DS AM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
63	0.0046	0.0079	98.6	99.1
64	0.0048	0.0083	98.6	99.2
65	0.0083	0.0069	98.5	99.3
66	0.0065	0.0086	98.8	99.3

Table 8.48 HAM convergence statistics – 2045 core DS inter-peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
90	0.0033	0.004	98.7	99.3
91	0.0028	0.0031	98.7	99.5
92	0.0028	0.0035	99.0	99.6
93	0.0029	0.0057	98.8	99.6

Table 8.49 HAM convergence statistics – 2045 core DS PM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
64	0.0047	0.0079	98.5	98.9
65	0.0046	0.0069	98.5	99.1
66	0.0044	0.0068	98.8	99.2
67	0.0047	0.0079	98.7	99.1

8.4.3 These tables demonstrate that the LTAM has achieved the TAG convergence targets in all time periods for this scenario and year.

Movement patterns using the crossings

8.4.4 Plate 8.28 to Plate 8.36 provide select link analysis of movements using the Dartford Crossing and the Lower Thames Crossing for the Do Minimum and Do Something scenarios for each of the model time periods. These diagrams show the pattern of movements using each of the crossings in each of the time periods. Table 8.50 to Table 8.52 provide a summary of the main corridors using each of the crossings and a comparison between the DM and DS scenarios for each time period.

Plate 8.28 Select link analysis – Dartford Crossing DM 2045 core AM peak

Plate 8.29 Select link analysis – Dartford Crossing DS 2045 core AM peak

Plate 8.30 Select link analysis – Lower Thames Crossing DS 2045 core AM peak

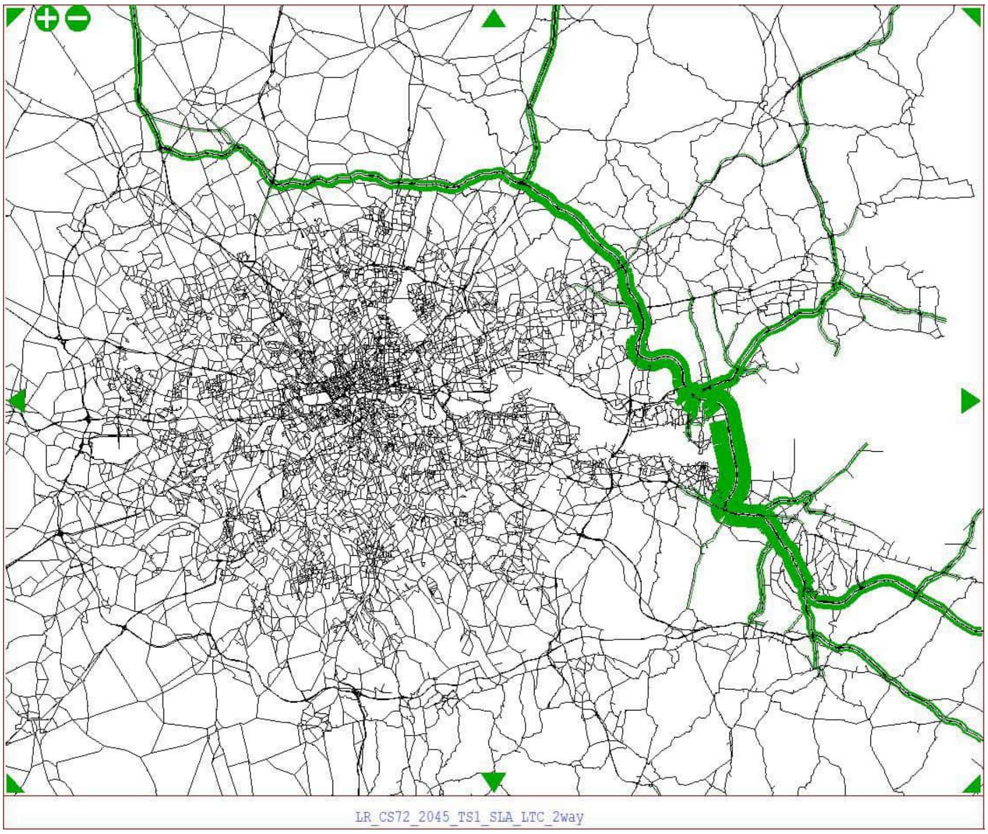


Table 8.50 Select link analysis – summary of primary corridors of movement 2045 AM peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,576	17%	3,671	25%	1,095	43%
	Local (outside M25)	2,029	13%	2,006	13%	-23	-1%
	M25 south (junctions 2–3)	7,543	49%	7,864	53%	322	4%
	A2/M2 to/from Kent	3,333	22%	1,327	9%	-2,007	-60%
Select link	Dartford Crossing	**15,481**	**100%**	**14,868**	**100%**	**-613**	**-4%**
North of River Thames	London north	2,179	14%	2,984	20%	805	37%
	Local traffic	1,538	10%	1,715	12%	177	12%
	M25 north (junctions 30–29)	8,744	56%	7,635	51%	-1,108	-13%
	A13 to/from Essex	3,020	20%	2,533	17%	-487	-16%
South of River Thames	Local traffic	n/a	n/a	880	10%	n/a	n/a
	A2 west of the Project	n/a	n/a	625	7%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	7,439	83%	n/a	n/a
Select link	Lower Thames Crossing	n/a	n/a	**8,944**	**100%**	n/a	n/a
North of River	A1089	n/a	n/a	833	9%	n/a	n/a

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
Thames	A13 west of the Project	n/a	n/a	91	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	3,602	40%	n/a	n/a
	M25 north of the Project	n/a	n/a	4,417	49%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows are the two river crossings

Plate 8.31 Select link analysis – Dartford Crossing DM 2045 core inter-peak

Plate 8.32 Select link analysis – Dartford Crossing DS 2045 core inter-peak

Plate 8.33 Select link analysis – Lower Thames Crossing DS 2045 core inter-peak

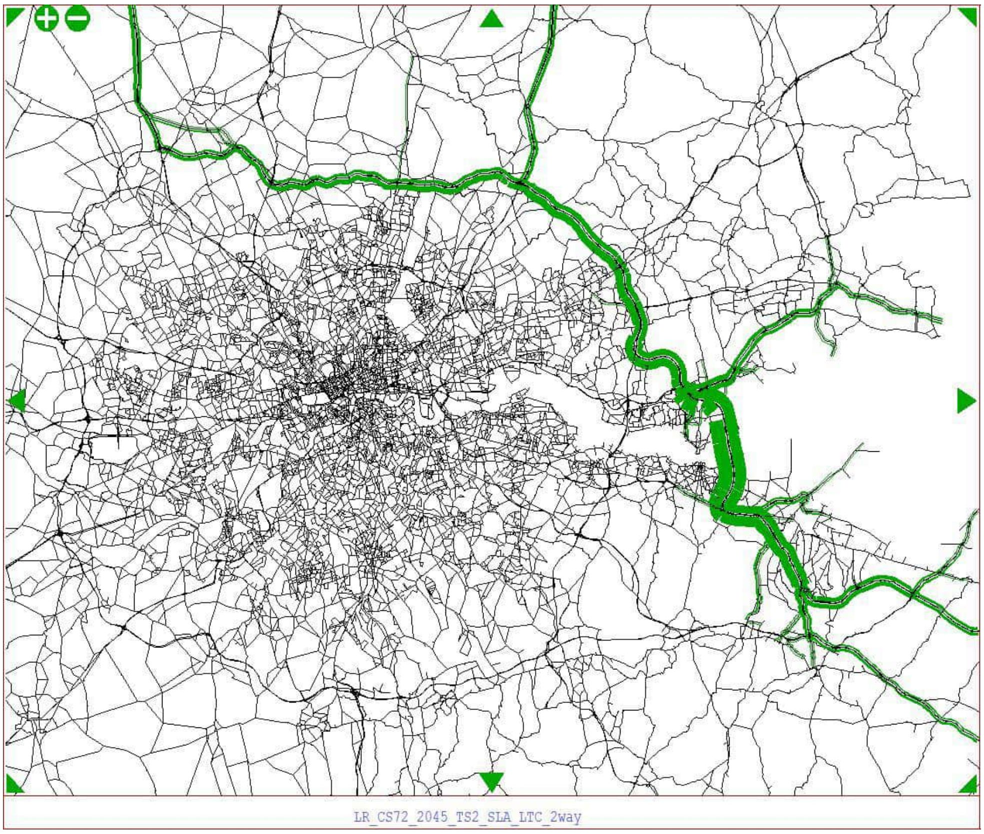


Table 8.51 Select link analysis – summary of primary corridors of movement 2045 inter-peak two-way flow

Movement	**Corridor**	**DM**		**DS**		**DS-DM SLA Flow (PCU)**	**% change (DM to DS) in SLA Flow**
		SLA Flow (PCU)	**% of Selected Link Flow**	**SLA Flow (PCU)**	**% of Selected Link Flow**		
South of River	Local (inside M25)	2,325	16%	2,894	23%	569	24%
	Local (outside M25)	1,559	11%	1,430	11%	-130	-8%
	M25 south (junctions 2–3)	7,189	49%	7,123	56%	-67	-1%
	A2/M2 to/from Kent	3,721	25%	1,327	10%	-2,395	-64%
Select link	Dartford Crossing	**14,795**	**100%**	**12,773**	**100%**	**-2,022**	**-14%**
North of River	London north	1,827	12%	2,401	19%	574	31%
	Local traffic	1,635	11%	1,696	13%	62	4%
	M25 north (junctions 30–29)	8,129	55%	6,146	48%	-1,983	-24%
	A13 to/from Essex	3,204	22%	2,529	20%	-674	-21%
South of River	Local traffic	n/a	n/a	852	11%	n/a	n/a
	A2 west of the Project	n/a	n/a	498	7%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	6,240	82%	n/a	n/a
Select link	Lower Thames Crossing	n/a	n/a	**7,590**	**100%**	n/a	n/a
North of River	A1089	n/a	n/a	685	9%	n/a	n/a
	A13 west of the Project	n/a	n/a	65	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	3,044	40%	n/a	n/a
	M25 north of the Project	n/a	n/a	3,795	50%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows are the two river crossings

Plate 8.34 Select link analysis – Dartford Crossing DM 2045 core PM peak

Plate 8.35 Select link analysis – Dartford Crossing DS 2045 core PM peak

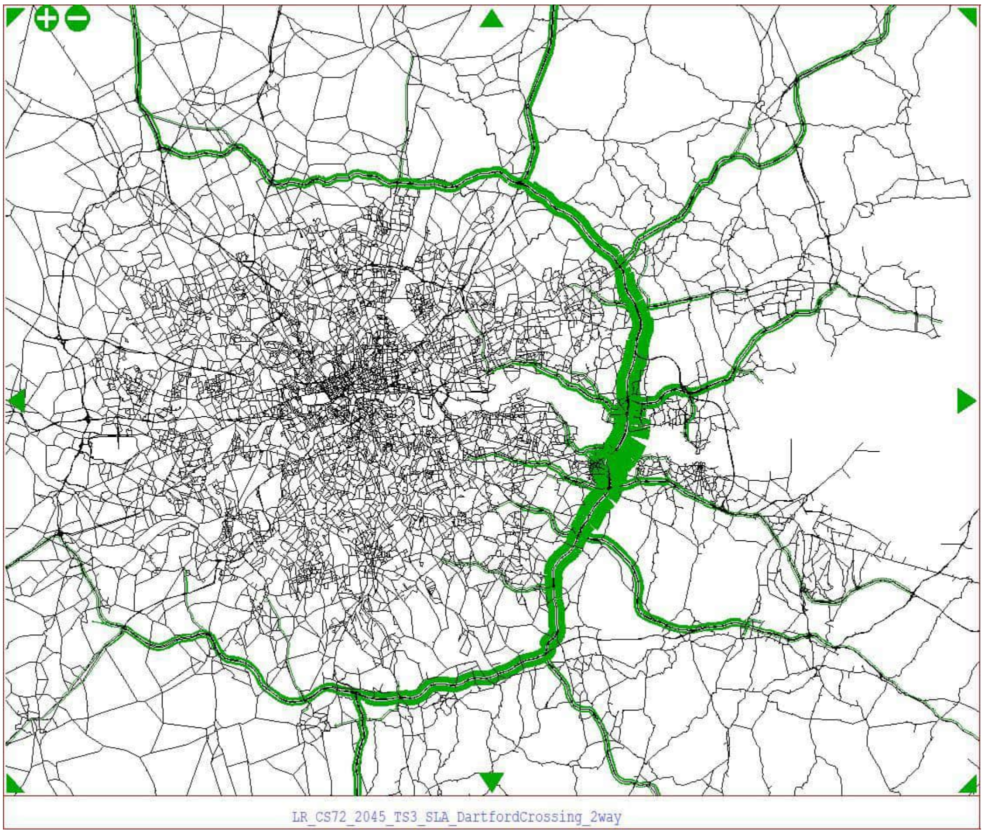


Plate 8.36 Select link analysis – Lower Thames Crossing DS 2045 core PM peak

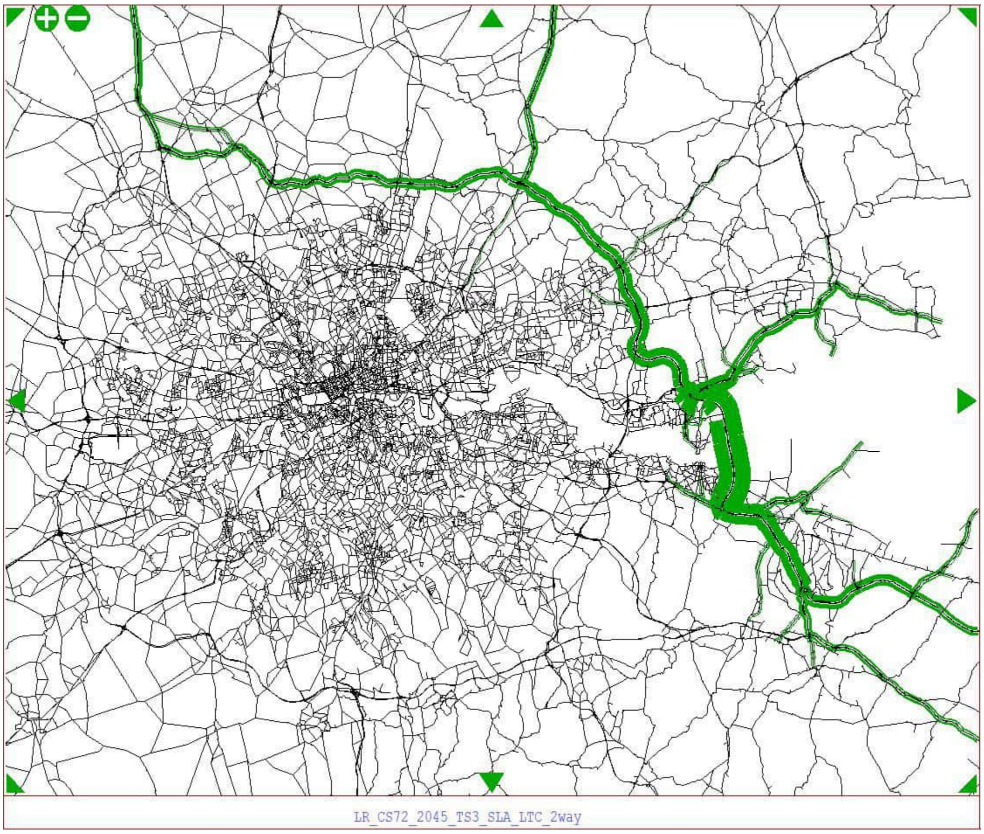


Table 8.52 Select link analysis – summary of primary corridors of movement 2045 PM peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,519	17%	3,140	23%	621	25%
	Local (outside M25)	1,654	11%	1,620	12%	-34	-2%
	M25 south (junctions 2–3)	7,176	47%	7,102	52%	-74	-1%
	A2/M2 to/from Kent	3,897	26%	1,666	12%	-2,230	-57%
Select link	Dartford Crossing	**15,246**	**100%**	**13,529**	**100%**	**-1,717**	**-11%**
North of River Thames	London north	2,400	16%	3,172	23%	773	32%
	Local traffic	1,544	10%	1,694	13%	150	10%
	M25 north (junctions 30–29)	8,064	53%	6,299	47%	-1,765	-22%
	A13 to/from Essex	3,238	21%	2,364	17%	-875	-27%
South of River Thames	Local traffic	n/a	n/a	1,291	15%	n/a	n/a
	A2 west of the Project	n/a	n/a	778	9%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	6,760	77%	n/a	n/a

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
Select link	Lower Thames Crossing	n/a	n/a	**8,829**	**100%**	n/a	n/a
North of River Thames	A1089	n/a	n/a	926	10%	n/a	n/a
	A13 west of the Project	n/a	n/a	63	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	4,103	46%	n/a	n/a
	M25 north of the Project	n/a	n/a	3,737	42%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows are the two river crossings

DM vs DS flow comparisons

8.4.5 The impacts of the Project on traffic flows are presented in a number of different ways below. Plate 8.37 to Plate 8.39 provide a flow difference plot between the DM and DS scenarios. Blue colours equate to reductions in flow, green colours indicate increases in flow. Flow differences of less than 100 PCUs per hour have been excluded from the colouring.

8.4.6 Table 8.53 provides a comparison of the cross-river traffic flows between the DM and DS scenarios. For the northbound approach at the Dartford Crossing, flow is presented for the link approaching the TMC. Table 8.54 provides a comparison of the cross-river traffic flows between the DM and DS scenarios. For the northbound approach at the Dartford Crossing flow is presented for the link after the TMC. The Volume/Capacity (V/C) ratio is also presented, with green shading indicating a V/C below 0.85, orange between 0.85 and 0.95 and red if 0.95 or above.

Plate 8.37 Actual flow comparison plot – 2045 core DM vs DS AM peak

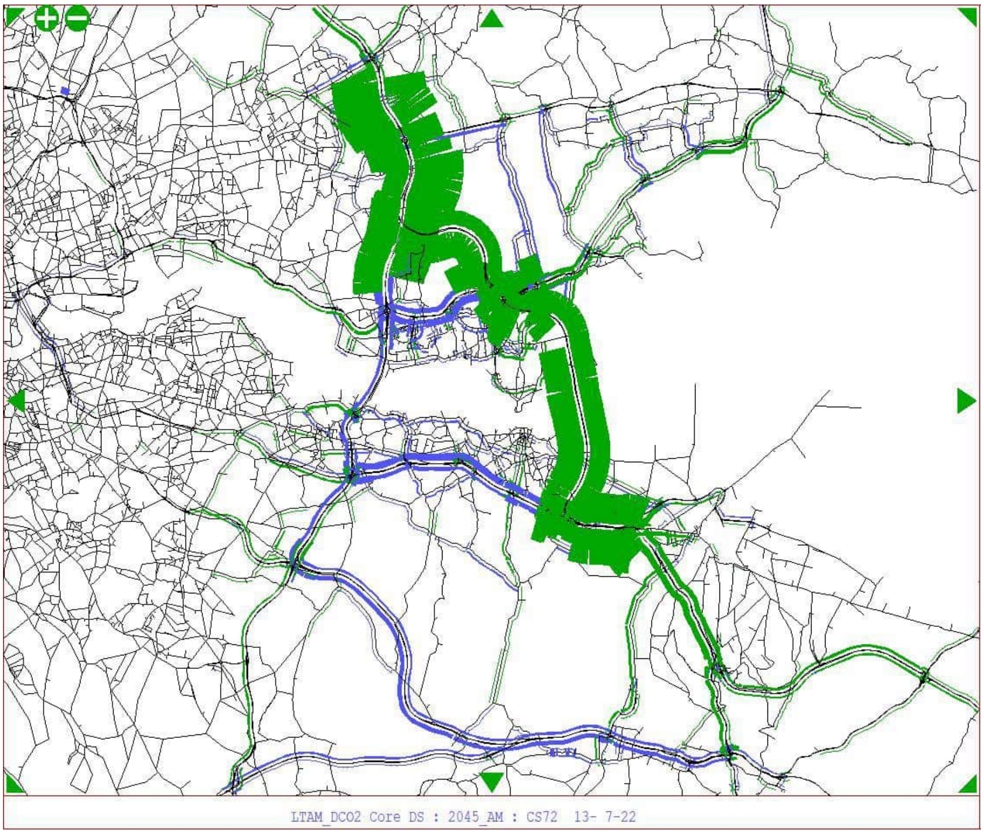


Plate 8.38 Actual flow comparison plot – 2045 core DM vs DS inter-peak

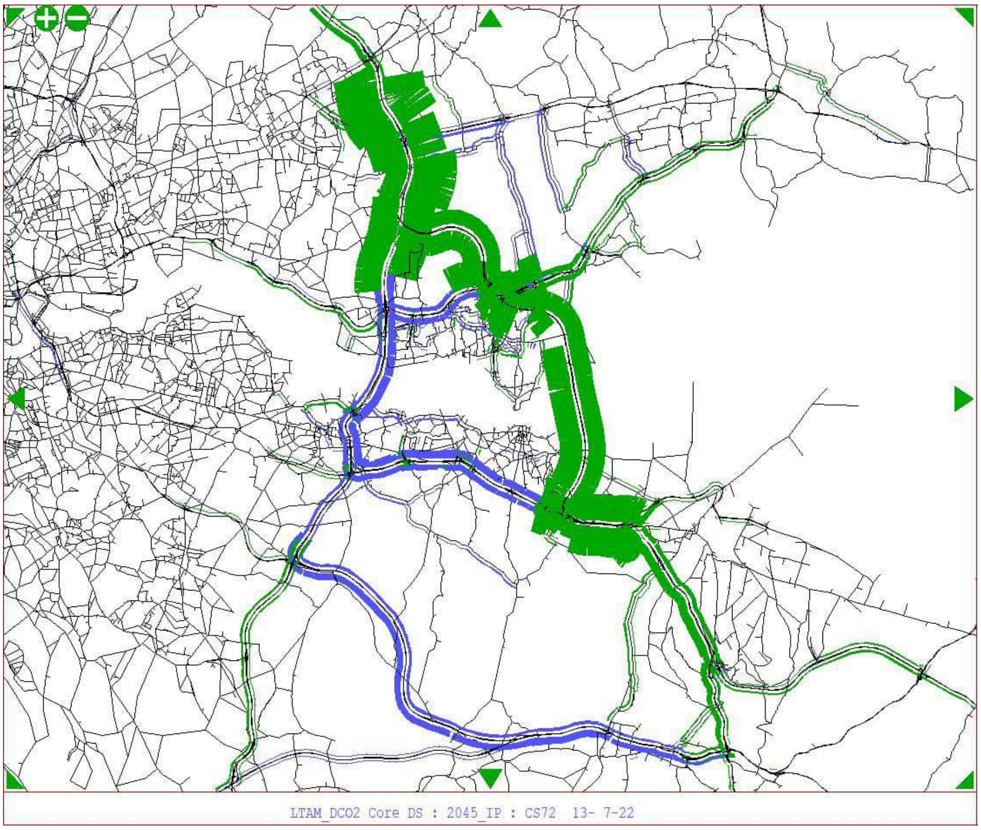


Plate 8.39 Actual flow comparison plot – 2045 core DM vs DS PM peak

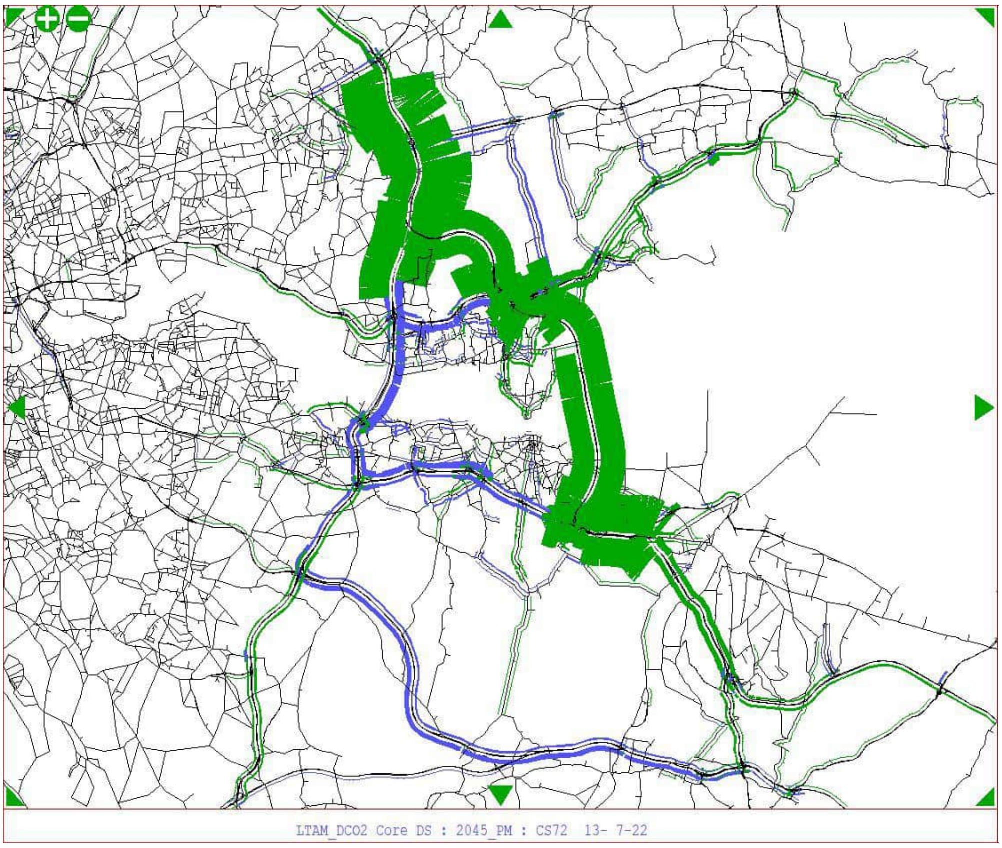


Table 8.53 Cross-river traffic flows (NB flows approaching TMC) – 2045 core DM vs DS (hourly flows in PCUs)

Direction	Crossing	Time period	Cars				LGV				HGV				Total				Effective capacity	Link V/C ratio	
			DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %		DM	DS
SB	Dartford Crossing	AM	3,517	3,899	382	11%	1,858	1,824	-34	-2%	3,124	2,719	-405	-13%	8,500	8,443	-57	-1%	8,500	1.00	0.99
		IP	3,735	3,281	-454	-12%	973	819	-154	-16%	3,197	2,289	-908	-28%	7,905	6,389	-1,516	-19%	8,500	0.93	0.75
		PM	5,083	4,450	-633	-12%	1,240	962	-279	-22%	2,161	1,422	-739	-34%	8,484	6,834	-1,651	-19%	8,500	1.00	0.80
	Lower Thames Crossing	AM	0	2,484	–	–	0	371	–	–	0	1,012	–	–	0	3,867	–	–	6,360	–	0.61
		IP	0	2,051	–	–	0	209	–	–	0	1,014	–	–	0	3,273	–	–	6,360	–	0.51
		PM	0	3,579	–	–	0	349	–	–	0	787	–	–	0	4,715	–	–	6,360	–	0.74
	Total	AM	3,517	6,383	2,866	81%	1,858	2,195	337	18%	3,124	3,731	607	19%	8,500	12,310	3,810	45%	14,860	–	0.83
		IP	3,735	5,332	1,597	43%	973	1,028	54	6%	3,197	3,303	107	3%	7,905	9,663	1,758	22%	14,860	–	0.65
		PM	5,083	8,029	2,946	58%	1,240	1,311	70	6%	2,161	2,209	48	2%	8,484	11,549	3,064	36%	14,860	–	0.78
NB	Dartford* Crossing*	AM	3,783	3,600	-183	-5%	1,580	1,136	-444	-28%	2,396	1,689	-706	-29%	7,759	6,425	-1,333	-17%	6,981	1.11	0.92
		IP	3,301	3,310	9	0%	1,038	799	-239	-23%	3,415	2,274	-1,140	-33%	7,754	6,384	-1,370	-18%	6,890	1.13	0.93
		PM	4,660	4,394	-266	-6%	1,108	908	-200	-18%	2,027	1,405	-621	-31%	7,794	6,707	-1,087	-14%	6,762	1.15	0.99
	Lower Thames Crossing	AM	0	3,314	–	–	0	668	–	–	0	1,095	–	–	0	5,077	–	–	6,360	–	0.80
		IP	0	2,478	–	–	0	380	–	–	0	1,458	–	–	0	4,316	–	–	6,360	–	0.68
		PM	0	3,108	–	–	0	292	–	–	0	714	–	–	0	4,114	–	–	6,360	–	0.65
	Total	AM	3,783	6,914	3,131	83%	1,580	1,804	224	14%	2,396	2,784	388	16%	7,759	11,502	3,744	48%	13,341	–	0.86
		IP	3,301	5,788	2,487	75%	1,038	1,180	141	14%	3,415	3,732	318	9%	7,754	10,700	2,946	38%	13,250	–	0.81
		PM	4,660	7,502	2,843	61%	1,108	1,199	91	8%	2,027	2,119	92	5%	7,794	10,821	3,027	39%	13,122	–	0.82

** Flows are extracted for the link approaching the TMC*

Note: Red text indicates negative values

Table 8.54 Cross-river traffic flows (NB flows after TMC) – 2045 core DM vs DS (hourly flows in PCUs)

Direction	Crossing	Time period	Cars				LGV				HGV				Total				Effective capacity	Link V/C ratio	
			DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %		DM	DS
SB	Dartford Crossing	AM	3,517	3,899	382	11%	1,858	1,824	-34	-2%	3,124	2,719	-405	-13%	8,500	8,443	-57	-1%	8,500	1.00	0.99
		IP	3,735	3,281	-454	-12%	973	819	-154	-16%	3,197	2,289	-908	-28%	7,905	6,389	-1,516	-19%	8,500	0.93	0.75
		PM	5,083	4,450	-633	-12%	1,240	962	-279	-22%	2,161	1,422	-739	-34%	8,484	6,834	-1,651	-19%	8,500	1.00	0.80
	Lower Thames Crossing	AM	0	2,484	–	–	0	371	–	–	0	1,012	–	–	0	3,867	–	–	6,360	–	0.61
		IP	0	2,051	–	–	0	209	–	–	0	1,014	–	–	0	3,273	–	–	6,360	–	0.51
		PM	0	3,579	–	–	0	349	–	–	0	787	–	–	0	4,715	–	–	6,360	–	0.74
	Total	AM	3,517	6,383	2,866	81%	1,858	2,195	337	18%	3,124	3,731	607	19%	8,500	12,310	3,810	45%	14,860	–	0.83
		IP	3,735	5,332	1,597	43%	973	1,028	54	6%	3,197	3,303	107	3%	7,905	9,663	1,758	22%	14,860	–	0.65
		PM	5,083	8,029	2,946	58%	1,240	1,311	70	6%	2,161	2,209	48	2%	8,484	11,549	3,064	36%	14,860	–	0.78
NB	Dartford Crossing*	AM	3,409	3,600	191	6%	1,423	1,136	-287	-20%	2,150	1,689	-460	-21%	6,981	6,425	-556	-8%	6,981	1.00	0.92
		IP	2,934	3,310	376	13%	923	799	-124	-13%	3,033	2,274	-759	-25%	6,890	6,384	-506	-7%	6,890	1.00	0.93
		PM	4,041	4,386	345	9%	962	906	-55	-6%	1,759	1,403	-356	-20%	6,762	6,695	-66	-1%	6,762	1.00	0.99
	Lower Thames Crossing	AM	0	3,314	–	–	0	668	–	–	0	1,095	–	–	0	5,077	–	–	6,360	–	0.80
		IP	0	2,478	–	–	0	380	–	–	0	1,458	–	–	0	4,316	–	–	6,360	–	0.68
		PM	0	3,108	–	–	0	292	–	–	0	714	–	–	0	4,114	–	–	6,360	–	0.65
	Total	AM	3,409	6,914	3,505	103%	1,423	1,804	381	27%	2,150	2,784	635	30%	6,981	11,502	4,521	65%	13,341	–	0.86
		IP	2,934	5,788	2,854	97%	923	1,180	257	28%	3,033	3,732	699	23%	6,890	10,700	3,810	55%	13,250	–	0.81
		PM	4,041	7,495	3,453	85%	962	1,198	236	25%	1,759	2,116	358	20%	6,762	10,809	4,047	60%	13,122	–	0.82

** Flows are extracted for the link after the TMC*

Note: Red text indicates negative values

8.4.7 The movements considered critical to understanding the impacts of the Project are the same as those described under Section 7.2 and previously illustrated in Plate 8.13. Table 8.55 provides a comparison of the flows at these strategic locations between the DM and DS in each time period. The V/C ratio is also presented, with green shading indicating a V/C below 0.85, orange between 0.85 and 0.95 and red if 0.95 or above.

Table 8.55 Key corridor traffic flows – 2045 core DM vs DS (hourly flows in PCUs)

Location	Location description	Time period	DM			DS			Flow differences	
			Flow	Effective capacity	V/C	Flow	Effective capacity	V/C	Diff.	Diff. %
A	M25 junction 29 to M25 junction 28 (NB)	AM	7,814	9,180	0.85	9,124	9,180	0.99	1,310	17%
		IP	7,098	9,180	0.77	8,273	9,180	0.90	1,176	17%
		PM	7,165	9,180	0.78	8,278	9,180	0.90	1,112	16%
	M25 junction 28 to M25 junction 29 (SB)	AM	7,930	9,115	0.87	8,115	9,180	0.88	184	2%
		IP	7,767	9,115	0.85	8,151	9,180	0.89	385	5%
		PM	8,040	9,115	0.88	8,485	9,180	0.92	445	6%
B	M25 junction 4 to M25 junction 3 (NB)	AM	5,747	6,850	0.84	5,940	6,850	0.87	193	3%
		IP	5,853	6,850	0.85	6,166	6,850	0.90	313	5%
		PM	6,431	6,850	0.94	6,582	6,850	0.96	151	2%
	M25 junction 3 to M25 junction 4 (SB)	AM	6,843	6,850	1.00	6,844	6,850	1.00	1	0%
		IP	5,723	6,850	0.84	5,872	6,850	0.86	149	3%
		PM	6,008	6,850	0.88	6,317	6,850	0.92	309	5%
C	A13 A126 to A1012 (EB)	AM	5,226	6,310	0.83	4,386	6,295	0.70	-840	-16%
		IP	5,283	6,299	0.84	4,575	6,280	0.73	-708	-13%
		PM	5,752	6,268	0.92	5,719	6,236	0.92	-33	-1%
	A13 A1012 to A126 (WB)	AM	6,155	6,360	0.97	5,469	6,360	0.86	-686	-11%
		IP	5,685	6,360	0.89	4,791	6,360	0.75	-894	-16%
		PM	6,015	6,360	0.95	4,971	6,360	0.78	-1,044	-17%
D	A13 Orsett Cock to Manor Way (EB)	AM	5,099	6,370	0.80	5,669	6,370	0.89	571	11%
		IP	4,404	6,370	0.69	5,207	6,370	0.82	803	18%
		PM	5,069	6,370	0.80	5,950	6,370	0.93	880	17%
	A13 Manor Way to Orsett Cock (WB)	AM	5,261	6,220	0.85	5,870	6,220	0.94	609	12%
		IP	4,570	6,220	0.73	5,300	6,220	0.85	730	16%
		PM	4,968	6,220	0.80	5,865	6,220	0.94	897	18%

Location	Location description	Time period	DM			DS			Flow differences	
			Flow	Effective capacity	V/C	Flow	Effective capacity	V/C	Diff.	Diff. %
E	A2 A227 to Gravesend East (EB)	AM	6,528	9,231	0.71	5,549	9,226	0.60	-979	-15%
		IP	6,862	9,189	0.75	5,758	9,181	0.63	-1,104	-16%
		PM	9,071	9,187	0.99	8,751	9,168	0.95	-321	-4%
	A2 Gravesend East to A227 (WB)	AM	7,258	7,296	0.99	6,542	7,002	0.93	-716	-10%
		IP	6,156	7,051	0.87	5,354	6,890	0.78	-802	-13%
		PM	6,260	6,824	0.92	5,796	6,701	0.87	-464	-7%
F	M2 junction 1 to M2 junction 2 (EB)	AM	5,829	8,561	0.68	6,699	8,420	0.80	871	15%
		IP	5,117	8,700	0.59	5,910	8,630	0.68	793	15%
		PM	6,651	8,619	0.77	7,858	8,441	0.93	1,206	18%
	M2 junction 2 to M2 junction 1 (WB)	AM	6,391	8,811	0.73	7,736	8,584	0.90	1,345	21%
		IP	4,478	8,860	0.51	6,279	8,707	0.72	1,801	40%
		PM	5,643	8,936	0.63	6,678	8,761	0.76	1,035	18%
G	M20 junction 3 to M20 junction 4 (EB)	AM	6,469	9,115	0.71	6,077	9,115	0.67	-392	-6%
		IP	6,435	9,115	0.71	5,974	9,115	0.66	-461	-7%
		PM	8,823	9,115	0.97	8,576	9,115	0.94	-247	-3%
	M20 junction 4 to M20 junction 3 (WB)	AM	8,853	9,115	0.97	8,203	9,115	0.90	-650	-7%
		IP	6,316	9,115	0.69	5,131	9,115	0.56	-1,185	-19%
		PM	6,287	9,115	0.69	5,504	9,115	0.60	-783	-12%

DM vs DS journey time comparisons

8.4.8 The same link-based and route-based journey time comparisons introduced under Section 7.2 are repeated for this year scenario combination.

8.4.9 The link-based corridors analysed are as previously shown diagrammatically in Plate 8.14.

8.4.10 The link-based journey time comparisons for this scenario are presented in Table 8.56 to Table 8.58.

8.4.11 The route-based movements analysed are as previously shown diagrammatically in Plate 8.15.

8.4.12 Table 8.59 to Table 8.64 provide the With and Without Scheme journey distances, times and average speeds for a selection of these movements for southbound and northbound movements.

Table 8.56 Link based journey time scenario comparison (2045 core DM vs DS) AM peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	17.5	80.7	23.5	18.2	77.7	0.0	0.7	-3.0	-0.1%	3.8%	-3.8%
	B to D	M25 J29	M25 J2	18.8	21.9	51.6	18.9	16.4	68.9	0.1	-5.4	17.2	0.3%	-24.8%	33.3%
	D to F	M25 J2	M25 J7	37.7	32.0	70.8	37.7	34.1	66.4	0.0	2.1	-4.4	0.0%	6.6%	-6.2%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	26.9	84.9	38.0	27.2	83.9	0.0	0.3	-0.9	0.0%	1.1%	-1.1%
	D to B	M25 J2	M25 J29	18.7	21.5	52.2	18.8	14.7	76.8	0.1	-6.8	24.6	0.6%	-31.6%	47.1%
	B to A	M25 J29	M25 J26	23.2	17.8	78.1	23.1	21.4	64.9	-0.1	3.6	-13.2	-0.3%	19.9%	-16.8%
A13 EB	C to G	M25 J30	A1089	5.2	5.4	57.9	5.3	4.3	73.3	0.0	-1.1	15.5	0.9%	-20.4%	26.7%
	G to H	A1089	A130	15.7	13.4	70.6	15.7	14.4	65.2	-0.1	1.0	-5.3	-0.4%	7.7%	-7.5%
A13 WB	H to G	A130	A1089	15.3	15.2	60.4	15.2	17.4	52.2	-0.1	2.3	-8.2	-0.7%	14.8%	-13.5%
	G to C	A1089	M25 J30	5.5	9.2	35.7	5.6	6.0	55.9	0.1	-3.3	20.3	1.6%	-35.2%	56.8%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	9.5	96.1	15.3	9.1	101.5	0.1	-0.5	5.4	0.5%	-4.9%	5.7%
	I to J	M2 J1	M2 J4	14.7	8.7	101.8	14.7	9.2	96.1	0.0	0.5	-5.7	0.0%	6.0%	-5.6%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	9.4	96.5	15.1	10.6	85.6	-0.1	1.1	-10.9	-0.7%	12.0%	-11.3%
	I to D	M2 J1	M25 J2	14.8	20.0	44.3	14.8	13.8	64.4	0.1	-6.2	20.1	0.6%	-30.8%	45.4%
M20 EB	E to K	M25 J3	M20 J8	35.3	20.8	101.7	35.3	20.6	103.0	0.0	-0.3	1.3	0.0%	-1.3%	1.3%
M20 WB	K to E	M20 J8	M25 J3	35.3	26.6	79.7	35.3	24.4	86.9	0.0	-2.2	7.2	0.0%	-8.3%	9.0%

Note: Red text indicates negative values

Table 8.57 Link based journey time scenario comparison (2045 core DM vs DS) inter-peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	17.2	82.3	23.5	17.8	79.4	0.0	0.6	-2.9	-0.1%	3.5%	-3.5%
	B to D	M25 J29	M25 J2	18.8	15.0	75.3	18.9	12.9	87.9	0.1	-2.1	12.6	0.3%	-14.1%	16.8%
	D to F	M25 J2	M25 J7	37.7	26.4	85.9	37.7	26.6	85.3	0.0	0.2	-0.6	0.0%	0.8%	-0.8%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	27.0	84.4	38.0	28.0	81.4	0.0	1.0	-3.0	0.0%	3.7%	-3.6%
	D to B	M25 J2	M25 J29	18.7	21.3	52.7	18.8	13.9	81.0	0.1	-7.4	28.3	0.6%	-34.5%	53.7%
	B to A	M25 J29	M25 J26	23.2	15.1	92.0	23.1	17.0	81.5	-0.1	1.9	-10.5	-0.3%	12.6%	-11.4%
A13 EB	C to G	M25 J30	A1089	5.2	5.6	55.5	5.3	4.6	69.3	0.0	-1.1	13.8	0.9%	-19.2%	25.0%
	G to H	A1089	A130	15.7	11.8	79.9	15.7	13.1	71.9	-0.1	1.3	-8.0	-0.4%	10.7%	-10.0%
A13 WB	H to G	A130	A1089	15.3	11.9	76.9	15.2	13.4	67.8	-0.1	1.5	-9.2	-0.7%	12.7%	-11.9%
	G to C	A1089	M25 J30	5.5	6.7	48.9	5.6	5.0	67.4	0.1	-1.8	18.5	1.6%	-26.2%	37.7%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	9.8	93.6	15.3	9.1	101.7	0.1	-0.7	8.1	0.5%	-7.5%	8.6%
	I to J	M2 J1	M2 J4	14.7	8.5	104.0	14.7	8.7	101.6	0.0	0.2	-2.4	0.0%	2.4%	-2.3%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	8.6	106.1	15.1	8.9	101.4	-0.1	0.3	-4.7	-0.7%	3.9%	-4.4%
	I to D	M2 J1	M25 J2	14.8	12.2	72.8	14.8	9.5	94.1	0.1	-2.7	21.3	0.6%	-22.2%	29.3%
M20 EB	E to K	M25 J3	M20 J8	35.3	20.5	103.2	35.3	20.3	104.4	0.0	-0.2	1.2	0.0%	-1.1%	1.1%
M20 WB	K to E	M20 J8	M25 J3	35.3	20.7	102.5	35.3	20.2	105.2	0.0	-0.5	2.6	0.0%	-2.5%	2.6%

Note: Red text indicates negative values

Table 8.58 Link based journey time scenario comparison (2045 core DM vs DS) PM peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	19.1	74.1	23.5	20.1	70.0	0.0	1.1	-4.1	-0.1%	5.7%	-5.5%
	B to D	M25 J29	M25 J2	18.8	17.7	63.8	18.9	13.8	82.3	0.1	-4.0	18.5	0.3%	-22.3%	29.1%
	D to F	M25 J2	M25 J7	37.7	25.2	90.0	37.7	26.0	87.2	0.0	0.8	-2.8	0.0%	3.2%	-3.1%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	32.1	71.0	38.0	32.8	69.5	0.0	0.7	-1.5	0.0%	2.2%	-2.1%
	D to B	M25 J2	M25 J29	18.7	20.3	55.4	18.8	14.5	77.6	0.1	-5.7	22.3	0.6%	-28.2%	40.2%
	B to A	M25 J29	M25 J26	23.2	14.9	93.6	23.1	16.5	84.4	-0.1	1.6	-9.3	-0.3%	10.7%	-9.9%
A13 EB	C to G	M25 J30	A1089	5.2	8.9	35.2	5.3	5.8	54.1	0.0	-3.0	18.8	0.9%	-34.2%	53.4%
	G to H	A1089	A130	15.7	13.3	71.1	15.7	15.0	62.8	-0.1	1.7	-8.3	-0.4%	12.8%	-11.7%
A13 WB	H to G	A130	A1089	15.3	12.7	72.0	15.2	15.0	60.6	-0.1	2.3	-11.4	-0.7%	18.1%	-15.9%
	G to C	A1089	M25 J30	5.5	8.0	41.4	5.6	5.3	63.3	0.1	-2.7	21.9	1.6%	-33.5%	52.9%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	15.3	59.8	15.3	11.6	79.7	0.1	-3.8	19.9	0.5%	-24.6%	33.3%
	I to J	M2 J1	M2 J4	14.7	9.9	89.4	14.7	12.7	69.5	0.0	2.8	-19.9	0.0%	28.6%	-22.2%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	9.0	101.3	15.1	9.3	97.6	-0.1	0.3	-3.8	-0.7%	3.2%	-3.7%
	I to D	M2 J1	M25 J2	14.8	15.7	56.3	14.8	11.5	77.4	0.1	-4.2	21.0	0.6%	-26.7%	37.3%
M20 EB	E to K	M25 J3	M20 J8	35.3	27.0	78.6	35.3	25.6	82.7	0.0	-1.3	4.1	0.0%	-4.9%	5.2%
M20 WB	K to E	M20 J8	M25 J3	35.3	20.9	101.3	35.3	20.5	103.5	0.0	-0.4	2.1	0.0%	-2.1%	2.1%

Note: Red text indicates negative values

Table 8.59 Route based journey time comparison north to south movements (2045 core DM vs DS) AM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.9	66.8	55.6	61.9	64.4	57.6	0.0	-2.4	2.1	0.0%	-3.5%	3.7%
1 to 8	Cheshunt	Godstone	91.5	87.5	62.8	91.6	85.0	64.7	0.0	-2.6	1.9	0.0%	-2.9%	3.0%
1 to 9	Cheshunt	Southfleet	62.1	61.8	60.3	62.2	56.8	65.7	0.1	-5.0	5.3	0.1%	-8.0%	8.9%
1 to 10	Cheshunt	Maidstone	88.2	79.7	66.4	87.7	75.0	70.2	-0.5	-4.7	3.8	-0.5%	-5.9%	5.8%
1 to 11	Cheshunt	Rochester	74.5	79.2	56.4	70.4	67.6	62.5	-4.1	-11.6	6.1	-5.5%	-14.7%	10.8%
1 to 12	Cheshunt	Rainham	91.4	84.9	64.6	87.3	73.7	71.1	-4.1	-11.2	6.5	-4.5%	-13.2%	10.1%
2 to 7	Romford	Bexley	31.9	56.7	33.8	35.6	51.4	41.6	3.7	-5.2	7.7	11.5%	-9.2%	22.9%
2 to 8	Romford	Godstone	61.6	77.4	47.8	65.3	72.0	54.4	3.7	-5.4	6.7	6.0%	-7.0%	14.0%
2 to 9	Romford	Southfleet	32.2	51.7	37.4	35.9	43.9	49.2	3.7	-7.8	11.8	11.6%	-15.2%	31.6%
2 to 10	Romford	Maidstone	58.3	69.6	50.2	61.5	62.0	59.5	3.2	-7.6	9.3	5.5%	-10.9%	18.4%
2 to 11	Romford	Rochester	44.6	69.1	38.7	44.1	54.6	48.5	-0.4	-14.5	9.8	-1.0%	-21.0%	25.4%
2 to 12	Romford	Rainham	61.5	74.8	49.4	61.1	60.7	60.4	-0.4	-14.1	11.0	-0.7%	-18.9%	22.4%
3 to 7	Brentwood	Bexley	33.0	47.5	41.7	32.9	42.7	46.2	-0.1	-4.8	4.6	-0.3%	-10.1%	11.0%
3 to 8	Brentwood	Godstone	62.7	68.3	55.1	62.6	63.3	59.4	-0.1	-5.0	4.3	-0.1%	-7.3%	7.8%
3 to 9	Brentwood	Southfleet	33.3	42.6	46.9	33.2	35.1	56.7	0.0	-7.4	9.8	-0.1%	-17.4%	21.0%
3 to 10	Brentwood	Maidstone	59.3	60.5	58.9	58.8	53.3	66.2	-0.6	-7.2	7.3	-1.0%	-11.9%	12.4%
3 to 11	Brentwood	Rochester	45.6	59.9	45.7	41.4	45.9	54.2	-4.2	-14.1	8.5	-9.2%	-23.5%	18.6%
3 to 12	Brentwood	Rainham	62.6	65.6	57.2	58.4	52.0	67.4	-4.2	-13.7	10.2	-6.7%	-20.8%	17.8%
4 to 7	Basildon	Bexley	39.7	59.8	39.8	39.6	54.4	43.7	-0.1	-5.4	3.9	-0.2%	-9.0%	9.7%
4 to 8	Basildon	Godstone	69.4	80.5	51.7	69.3	74.9	55.5	-0.1	-5.6	3.8	-0.1%	-6.9%	7.3%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	40.0	54.8	43.7	34.9	41.6	50.4	-5.1	-13.2	6.6	-12.7%	-24.2%	15.2%
4 to 10	Basildon	Maidstone	66.0	72.8	54.5	49.1	59.9	49.2	-16.9	-12.8	-5.2	-25.6%	-17.7%	-9.6%
4 to 11	Basildon	Rochester	52.3	72.2	43.5	36.6	51.3	42.8	-15.7	-20.9	-0.7	-30.1%	-28.9%	-1.6%
4 to 12	Basildon	Rainham	69.3	77.9	53.4	53.6	57.5	55.9	-15.7	-20.5	2.6	-22.7%	-26.3%	4.8%
5 to 7	Tilbury Port	Bexley	28.3	45.5	37.3	28.3	40.9	41.6	0.0	-4.6	4.2	0.0%	-10.2%	11.3%
5 to 8	Tilbury Port	Godstone	58.0	66.2	52.5	58.0	61.4	56.7	0.0	-4.8	4.1	0.0%	-7.3%	7.9%
5 to 9	Tilbury Port	Southfleet	28.6	40.5	42.3	27.7	27.2	61.2	-0.9	-13.3	18.9	-3.0%	-32.9%	44.6%
5 to 10	Tilbury Port	Maidstone	54.6	58.4	56.1	42.0	45.5	55.3	-12.7	-12.9	-0.8	-23.2%	-22.1%	-1.4%
5 to 11	Tilbury Port	Rochester	40.9	57.9	42.4	29.4	36.9	47.7	-11.5	-20.9	5.3	-28.2%	-36.2%	12.6%
5 to 12	Tilbury Port	Rainham	57.9	63.6	54.6	46.4	43.1	64.6	-11.5	-20.5	10.0	-19.9%	-32.3%	18.3%
6 to 7	DP World	Bexley	32.1	47.6	40.5	32.1	42.5	45.3	0.0	-5.0	4.8	0.0%	-10.6%	11.8%
6 to 8	DP World	Godstone	61.8	68.3	54.3	61.8	63.1	58.8	0.0	-5.2	4.5	0.0%	-7.7%	8.3%
6 to 9	DP World	Southfleet	32.4	42.6	45.6	29.0	26.7	65.3	-3.3	-15.9	19.7	-10.3%	-37.3%	43.1%
6 to 10	DP World	Maidstone	58.4	60.5	57.9	43.3	45.0	57.7	-15.2	-15.5	-0.3	-25.9%	-25.6%	-0.5%
6 to 11	DP World	Rochester	44.7	60.0	44.7	30.7	36.5	50.6	-14.0	-23.5	5.8	-31.3%	-39.2%	13.0%
6 to 12	DP World	Rainham	61.7	65.7	56.4	47.7	42.6	67.2	-14.0	-23.1	10.9	-22.7%	-35.2%	19.3%

Note: Red text indicates negative values

Table 8.60 Route based journey time comparison north to south movements (2045 core DM vs DS) inter-peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time)	Average speed
1 to 7	Cheshunt	Bexley	62.0	53.9	68.9	61.9	52.7	70.4	-0.1	-1.2	1.5	-0.1%	-2.2%	2.2%
1 to 8	Cheshunt	Godstone	91.7	71.8	76.6	91.6	70.5	77.9	-0.1	-1.3	1.4	-0.1%	-1.8%	1.8%
1 to 9	Cheshunt	Southfleet	62.3	51.6	72.5	62.2	49.5	75.5	-0.1	-2.1	3.0	-0.1%	-4.1%	4.1%
1 to 10	Cheshunt	Maidstone	88.3	68.3	77.6	82.9	63.9	77.8	-5.4	-4.4	0.2	-6.1%	-6.4%	0.3%
1 to 11	Cheshunt	Rochester	74.6	65.5	68.3	70.3	59.1	71.4	-4.3	-6.4	3.1	-5.8%	-9.8%	4.5%
1 to 12	Cheshunt	Rainham	91.6	73.6	74.7	87.4	67.2	78.0	-4.2	-6.4	3.4	-4.6%	-8.7%	4.5%
2 to 7	Romford	Bexley	35.6	42.9	49.7	35.6	39.5	54.0	0.0	-3.4	4.3	0.0%	-8.0%	8.7%
2 to 8	Romford	Godstone	65.2	60.8	64.4	65.3	57.3	68.4	0.0	-3.5	4.0	0.0%	-5.8%	6.2%
2 to 9	Romford	Southfleet	35.9	40.5	53.1	35.9	36.2	59.5	0.0	-4.3	6.3	0.0%	-10.6%	11.9%
2 to 10	Romford	Maidstone	61.9	57.3	64.8	56.6	50.7	67.0	-5.3	-6.6	2.1	-8.6%	-11.5%	3.3%
2 to 11	Romford	Rochester	48.2	54.5	53.1	44.0	45.9	57.5	-4.2	-8.7	4.5	-8.8%	-15.9%	8.4%
2 to 12	Romford	Rainham	65.2	62.6	62.5	61.0	53.9	67.9	-4.1	-8.6	5.4	-6.3%	-13.8%	8.6%
3 to 7	Brentwood	Bexley	33.0	35.2	56.3	32.9	33.1	59.7	-0.1	-2.1	3.4	-0.3%	-6.0%	6.1%
3 to 8	Brentwood	Godstone	62.7	53.1	70.8	62.6	50.9	73.8	-0.1	-2.2	3.0	-0.1%	-4.2%	4.2%
3 to 9	Brentwood	Southfleet	33.3	32.8	60.9	33.2	29.8	66.9	-0.1	-3.0	6.0	-0.3%	-9.2%	9.8%
3 to 10	Brentwood	Maidstone	59.3	49.6	71.8	53.9	44.3	73.0	-5.4	-5.3	1.2	-9.1%	-10.6%	1.7%
3 to 11	Brentwood	Rochester	45.7	46.8	58.5	41.3	39.5	62.8	-4.3	-7.3	4.3	-9.5%	-15.7%	7.4%
3 to 12	Brentwood	Rainham	62.6	54.8	68.5	58.4	47.5	73.7	-4.2	-7.3	5.2	-6.7%	-13.3%	7.6%
4 to 7	Basildon	Bexley	39.7	39.6	60.1	39.6	37.1	64.1	-0.1	-2.5	4.0	-0.2%	-6.4%	6.6%
4 to 8	Basildon	Godstone	69.4	57.5	72.4	69.3	54.9	75.8	-0.1	-2.7	3.4	-0.1%	-4.6%	4.7%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time)	Average speed
4 to 9	Basildon	Southfleet	40.0	37.3	64.5	33.8	29.0	69.8	-6.3	-8.2	5.3	-15.7%	-22.1%	8.3%
4 to 10	Basildon	Maidstone	66.1	54.0	73.4	48.0	41.9	68.6	-18.1	-12.1	-4.7	-27.4%	-22.4%	-6.5%
4 to 11	Basildon	Rochester	52.4	51.3	61.3	35.4	37.1	57.2	-17.0	-14.1	-4.1	-32.4%	-27.6%	-6.7%
4 to 12	Basildon	Rainham	69.3	59.3	70.2	52.4	45.2	69.6	-16.9	-14.1	-0.5	-24.4%	-23.8%	-0.7%
5 to 7	Tilbury Port	Bexley	28.3	31.4	54.1	28.3	28.2	60.2	0.0	-3.2	6.2	0.0%	-10.2%	11.4%
5 to 8	Tilbury Port	Godstone	58.0	49.3	70.6	58.0	46.0	75.7	0.0	-3.3	5.1	0.0%	-6.7%	7.2%
5 to 9	Tilbury Port	Southfleet	28.6	29.0	59.2	27.7	19.9	83.8	-0.9	-9.2	24.6	-3.2%	-31.6%	41.5%
5 to 10	Tilbury Port	Maidstone	54.6	45.8	71.6	41.9	32.8	76.8	-12.7	-13.0	5.1	-23.3%	-28.4%	7.2%
5 to 11	Tilbury Port	Rochester	41.0	43.0	57.1	29.3	27.9	63.0	-11.6	-15.1	5.9	-28.4%	-35.0%	10.2%
5 to 12	Tilbury Port	Rainham	57.9	51.0	68.1	46.4	36.0	77.3	-11.5	-15.0	9.2	-19.9%	-29.4%	13.5%
6 to 7	DP World	Bexley	32.1	35.0	55.1	32.1	32.3	59.7	0.0	-2.7	4.6	0.0%	-7.8%	8.4%
6 to 8	DP World	Godstone	61.8	52.9	70.1	61.8	50.0	74.1	0.0	-2.8	3.9	0.0%	-5.3%	5.6%
6 to 9	DP World	Southfleet	32.4	32.6	59.7	29.0	22.3	78.0	-3.4	-10.3	18.3	-10.4%	-31.5%	30.7%
6 to 10	DP World	Maidstone	58.4	49.3	71.1	43.2	35.2	73.6	-15.2	-14.1	2.5	-26.0%	-28.6%	3.6%
6 to 11	DP World	Rochester	44.8	46.6	57.7	30.7	30.4	60.5	-14.1	-16.2	2.8	-31.5%	-34.7%	4.9%
6 to 12	DP World	Rainham	61.7	54.6	67.8	47.7	38.5	74.4	-14.0	-16.1	6.6	-22.7%	-29.5%	9.7%

Note: Red text indicates negative values

Table 8.61 Route based journey time comparison north to south movements (2045 core DM vs DS) PM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.8	63.7	58.2	61.9	61.9	60.0	0.0	-1.8	1.7	0.0%	-2.9%	3.0%
1 to 8	Cheshunt	Godstone	91.5	78.5	70.0	91.5	76.4	71.9	0.0	-2.0	1.9	0.0%	-2.6%	2.7%
1 to 9	Cheshunt	Southfleet	60.7	60.1	60.6	62.2	56.0	66.6	1.4	-4.1	6.0	2.4%	-6.9%	9.9%
1 to 10	Cheshunt	Maidstone	88.2	81.4	65.0	82.9	76.5	65.0	-5.3	-4.9	0.0	-6.0%	-6.0%	0.0%
1 to 11	Cheshunt	Rochester	74.8	81.0	55.4	70.7	71.1	59.7	-4.1	-10.0	4.3	-5.5%	-12.3%	7.7%
1 to 12	Cheshunt	Rainham	91.4	96.5	56.8	87.3	86.6	60.5	-4.1	-9.9	3.7	-4.5%	-10.3%	6.5%
2 to 7	Romford	Bexley	35.9	54.9	39.3	36.0	49.3	43.9	0.1	-5.6	4.6	0.3%	-10.1%	11.6%
2 to 8	Romford	Godstone	65.6	69.6	56.5	65.7	63.8	61.8	0.1	-5.8	5.2	0.2%	-8.3%	9.2%
2 to 9	Romford	Southfleet	34.8	51.3	40.7	36.4	43.4	50.2	1.5	-7.9	9.5	4.4%	-15.3%	23.3%
2 to 10	Romford	Maidstone	62.3	72.5	51.5	57.0	63.9	53.6	-5.2	-8.6	2.1	-8.4%	-11.9%	4.0%
2 to 11	Romford	Rochester	48.9	72.2	40.6	44.9	58.5	46.0	-4.0	-13.7	5.4	-8.2%	-19.0%	13.3%
2 to 12	Romford	Rainham	65.5	87.7	44.8	61.5	74.0	49.9	-4.0	-13.7	5.0	-6.1%	-15.6%	11.2%
3 to 7	Brentwood	Bexley	33.0	43.2	45.8	32.9	39.9	49.5	-0.1	-3.4	3.7	-0.3%	-7.8%	8.1%
3 to 8	Brentwood	Godstone	62.7	58.0	64.8	62.6	54.4	69.0	-0.1	-3.6	4.2	-0.1%	-6.2%	6.4%
3 to 9	Brentwood	Southfleet	31.9	39.7	48.3	33.2	34.0	58.6	1.3	-5.7	10.4	4.2%	-14.3%	21.5%
3 to 10	Brentwood	Maidstone	59.3	60.9	58.4	53.9	54.5	59.4	-5.4	-6.4	0.9	-9.1%	-10.6%	1.6%
3 to 11	Brentwood	Rochester	46.0	60.6	45.6	41.8	49.1	51.0	-4.2	-11.5	5.5	-9.2%	-19.0%	12.1%
3 to 12	Brentwood	Rainham	62.6	76.1	49.4	58.4	64.6	54.2	-4.2	-11.5	4.9	-6.7%	-15.1%	9.9%
4 to 7	Basildon	Bexley	36.8	48.1	45.9	37.5	45.5	49.4	0.6	-2.6	3.5	1.7%	-5.5%	7.7%
4 to 8	Basildon	Godstone	66.5	62.9	63.4	67.1	60.0	67.1	0.6	-2.9	3.7	1.0%	-4.5%	5.8%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	35.7	44.6	48.1	33.8	32.5	62.4	-2.0	-12.1	14.3	-5.5%	-27.2%	29.8%
4 to 10	Basildon	Maidstone	63.2	65.8	57.6	48.0	51.1	56.3	-15.2	-14.7	-1.3	-24.1%	-22.4%	-2.2%
4 to 11	Basildon	Rochester	49.8	65.5	45.7	35.8	45.7	47.0	-14.0	-19.8	1.4	-28.1%	-30.2%	3.0%
4 to 12	Basildon	Rainham	66.4	81.0	49.2	52.4	61.2	51.4	-14.0	-19.8	2.2	-21.1%	-24.4%	4.4%
5 to 7	Tilbury Port	Bexley	28.3	37.8	45.0	28.3	32.7	52.0	0.0	-5.1	7.0	0.0%	-13.4%	15.5%
5 to 8	Tilbury Port	Godstone	58.0	52.5	66.2	58.0	47.2	73.7	0.0	-5.3	7.4	0.0%	-10.1%	11.2%
5 to 9	Tilbury Port	Southfleet	27.2	34.2	47.8	27.7	21.3	78.2	0.5	-12.9	30.4	1.8%	-37.8%	63.7%
5 to 10	Tilbury Port	Maidstone	54.6	55.4	59.2	41.9	39.9	63.0	-12.7	-15.5	3.9	-23.3%	-28.0%	6.6%
5 to 11	Tilbury Port	Rochester	41.3	55.1	45.0	29.8	34.5	51.7	-11.5	-20.6	6.8	-27.9%	-37.3%	15.0%
5 to 12	Tilbury Port	Rainham	57.9	70.6	49.2	46.4	50.0	55.6	-11.5	-20.6	6.4	-19.9%	-29.1%	13.0%
6 to 7	DP World	Bexley	32.1	41.7	46.2	32.1	39.5	48.8	0.0	-2.2	2.6	-0.1%	-5.3%	5.6%
6 to 8	DP World	Godstone	61.8	56.4	65.7	61.8	54.0	68.6	0.0	-2.4	2.9	0.0%	-4.3%	4.5%
6 to 9	DP World	Southfleet	31.0	38.1	48.8	29.0	26.5	65.8	-2.0	-11.6	17.0	-6.3%	-30.6%	34.9%
6 to 10	DP World	Maidstone	58.4	59.4	59.1	43.2	45.1	57.5	-15.2	-14.3	-1.5	-26.0%	-24.0%	-2.6%
6 to 11	DP World	Rochester	45.1	59.0	45.8	31.1	39.7	47.0	-14.0	-19.3	1.1	-31.1%	-32.7%	2.4%
6 to 12	DP World	Rainham	61.7	74.5	49.7	47.7	55.2	51.9	-14.0	-19.3	2.2	-22.7%	-25.9%	4.3%

Note: Red text indicates negative values

Table 8.62 Route based journey time comparison south to north movements (2045 core DM vs DS) AM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	61.5	60.1	61.6	58.4	63.3	0.0	-3.1	3.2	0.1%	-5.1%	5.4%
7 to 2	Bexley	Romford	34.7	47.6	43.7	34.7	41.3	50.4	0.0	-6.3	6.7	0.0%	-13.2%	15.2%
7 to 3	Bexley	Brentwood	33.1	43.0	46.3	32.7	38.0	51.6	-0.5	-5.0	5.3	-1.4%	-11.6%	11.5%
7 to 4	Bexley	Basildon	36.8	45.0	49.1	36.8	37.3	59.3	0.0	-7.8	10.2	-0.1%	-17.2%	20.7%
7 to 5	Bexley	Tilbury Port	28.6	39.4	43.5	28.6	30.2	56.7	0.0	-9.2	13.2	-0.1%	-23.3%	30.3%
7 to 6	Bexley	DP World	32.4	40.7	47.8	32.4	33.2	58.6	0.0	-7.5	10.8	-0.1%	-18.5%	22.7%
8 to 1	Godstone	Cheshunt	91.8	83.8	65.7	91.8	81.0	68.0	0.0	-2.8	2.3	0.0%	-3.3%	3.5%
8 to 2	Godstone	Romford	64.9	69.9	55.7	64.9	64.0	60.9	0.0	-5.9	5.2	0.0%	-8.5%	9.3%
8 to 3	Godstone	Brentwood	63.3	65.3	58.2	62.9	60.7	62.2	-0.5	-4.6	4.0	-0.7%	-7.1%	6.9%
8 to 4	Godstone	Basildon	67.0	67.3	59.7	67.0	59.9	67.1	0.0	-7.4	7.4	0.0%	-11.0%	12.3%
8 to 5	Godstone	Tilbury Port	58.7	61.7	57.2	58.7	52.8	66.7	0.0	-8.8	9.5	0.0%	-14.3%	16.7%
8 to 6	Godstone	DP World	62.6	63.0	59.6	62.6	55.8	67.3	0.0	-7.2	7.7	0.0%	-11.4%	12.9%
9 to 1	Southfleet	Cheshunt	60.7	61.4	59.3	60.8	56.6	64.4	0.0	-4.8	5.1	0.1%	-7.8%	8.5%
9 to 2	Southfleet	Romford	33.8	47.5	42.7	33.9	39.6	51.3	0.0	-8.0	8.6	0.0%	-16.7%	20.2%
9 to 3	Southfleet	Brentwood	32.3	42.9	45.1	31.8	36.3	52.7	-0.5	-6.6	7.5	-1.4%	-15.5%	16.6%
9 to 4	Southfleet	Basildon	36.0	44.9	48.1	35.8	30.2	71.1	-0.1	-14.7	23.1	-0.4%	-32.7%	48.0%
9 to 5	Southfleet	Tilbury Port	27.7	39.3	42.3	31.4	26.8	70.4	3.7	-12.5	28.1	13.4%	-31.8%	66.4%
9 to 6	Southfleet	DP World	31.5	40.6	46.6	31.4	26.2	72.0	-0.1	-14.5	25.5	-0.4%	-35.6%	54.7%
10 to 1	Maidstone	Cheshunt	88.3	84.8	62.5	83.3	75.7	66.0	-5.0	-9.1	3.5	-5.6%	-10.7%	5.7%
10 to 2	Maidstone	Romford	61.4	70.9	51.9	56.4	58.4	57.9	-5.0	-12.5	6.0	-8.1%	-17.6%	11.5%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	66.3	54.1	54.3	55.1	59.1	-5.5	-11.2	5.0	-9.2%	-16.9%	9.2%
10 to 4	Maidstone	Basildon	63.5	68.3	55.8	50.3	46.6	64.8	-13.2	-21.7	9.0	-20.8%	-31.8%	16.2%
10 to 5	Maidstone	Tilbury Port	55.2	62.7	52.9	45.9	43.1	63.9	-9.4	-19.6	11.0	-16.9%	-31.2%	20.8%
10 to 6	Maidstone	DP World	59.1	64.0	55.4	45.9	42.5	64.8	-13.2	-21.5	9.4	-22.3%	-33.6%	17.0%
11 to 1	Rochester	Cheshunt	76.2	88.4	51.7	70.4	70.3	60.0	-5.9	-18.1	8.3	-7.7%	-20.5%	16.1%
11 to 2	Rochester	Romford	49.4	74.5	39.7	43.4	53.0	49.2	-5.9	-21.6	9.5	-12.0%	-28.9%	23.9%
11 to 3	Rochester	Brentwood	47.8	69.9	41.0	41.4	49.7	50.0	-6.4	-20.3	9.0	-13.4%	-29.0%	21.9%
11 to 4	Rochester	Basildon	51.5	71.9	42.9	37.4	41.1	54.5	-14.1	-30.8	11.6	-27.4%	-42.8%	27.0%
11 to 5	Rochester	Tilbury Port	43.2	66.3	39.1	32.9	37.7	52.5	-10.3	-28.6	13.4	-23.8%	-43.2%	34.2%
11 to 6	Rochester	DP World	47.0	67.7	41.7	32.9	37.0	53.3	-14.1	-30.6	11.6	-30.0%	-45.2%	27.8%
12 to 1	Rainham	Cheshunt	91.7	103.9	53.0	87.7	85.7	61.4	-4.0	-18.2	8.4	-4.4%	-17.5%	15.8%
12 to 2	Rainham	Romford	64.8	90.0	43.2	60.7	68.4	53.3	-4.1	-21.6	10.1	-6.3%	-24.0%	23.3%
12 to 3	Rainham	Brentwood	63.3	85.4	44.5	58.7	65.1	54.1	-4.6	-20.3	9.6	-7.2%	-23.8%	21.7%
12 to 4	Rainham	Basildon	67.0	87.4	46.0	54.7	56.5	58.0	-12.3	-30.8	12.0	-18.3%	-35.3%	26.2%
12 to 5	Rainham	Tilbury Port	58.7	81.7	43.1	50.2	53.1	56.8	-8.4	-28.7	13.7	-14.4%	-35.1%	31.9%
12 to 6	Rainham	DP World	62.5	83.1	45.1	50.2	52.5	57.5	-12.3	-30.6	12.3	-19.6%	-36.9%	27.3%

Note: Red text indicates negative values

Table 8.63 Route based journey time comparison south to north movements (2045 core DM vs DS) inter-peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	58.4	63.3	61.6	53.9	68.6	0.0	-4.5	5.4	0.1%	-7.8%	8.5%
7 to 2	Bexley	Romford	35.8	43.5	49.4	35.8	36.8	58.3	0.0	-6.7	8.9	0.0%	-15.4%	18.1%
7 to 3	Bexley	Brentwood	33.1	41.4	48.1	33.2	34.9	57.1	0.0	-6.5	9.0	0.1%	-15.7%	18.8%
7 to 4	Bexley	Basildon	36.8	45.1	49.1	36.8	37.4	59.1	0.0	-7.7	10.0	-0.1%	-17.0%	20.4%
7 to 5	Bexley	Tilbury Port	31.9	41.3	46.4	31.9	33.0	58.1	0.0	-8.3	11.7	0.0%	-20.2%	25.2%
7 to 6	Bexley	DP World	32.4	40.7	47.7	32.4	32.9	59.0	0.0	-7.8	11.3	-0.1%	-19.2%	23.6%
8 to 1	Godstone	Cheshunt	91.8	79.5	69.3	91.8	75.4	73.1	0.0	-4.1	3.8	0.1%	-5.2%	5.5%
8 to 2	Godstone	Romford	66.0	64.6	61.3	66.0	58.3	67.9	0.0	-6.2	6.6	0.0%	-9.7%	10.7%
8 to 3	Godstone	Brentwood	63.3	62.5	60.8	63.4	56.4	67.4	0.0	-6.1	6.6	0.1%	-9.7%	10.9%
8 to 4	Godstone	Basildon	67.0	66.1	60.8	67.0	58.9	68.3	0.0	-7.2	7.4	0.0%	-10.9%	12.2%
8 to 5	Godstone	Tilbury Port	62.1	62.3	59.8	62.1	54.5	68.4	0.0	-7.9	8.7	0.0%	-12.6%	14.5%
8 to 6	Godstone	DP World	62.6	61.8	60.8	62.6	54.4	69.0	0.0	-7.4	8.2	0.0%	-11.9%	13.5%
9 to 1	Southfleet	Cheshunt	60.7	57.9	63.0	60.8	51.5	70.8	0.0	-6.4	7.8	0.1%	-11.0%	12.5%
9 to 2	Southfleet	Romford	35.0	43.0	48.8	35.0	34.5	60.9	0.0	-8.5	12.1	0.0%	-19.8%	24.7%
9 to 3	Southfleet	Brentwood	32.3	40.8	47.4	32.3	32.5	59.7	0.0	-8.3	12.3	0.2%	-20.4%	25.9%
9 to 4	Southfleet	Basildon	36.0	44.5	48.5	35.8	29.3	73.4	-0.1	-15.2	24.9	-0.4%	-34.1%	51.3%
9 to 5	Southfleet	Tilbury Port	31.1	40.7	45.7	34.8	28.4	73.5	3.7	-12.4	27.8	12.0%	-30.3%	60.7%
9 to 6	Southfleet	DP World	31.5	40.2	47.1	31.4	24.8	75.9	-0.1	-15.4	28.8	-0.4%	-38.2%	61.2%
10 to 1	Maidstone	Cheshunt	88.3	75.2	70.4	83.3	65.0	76.9	-5.0	-10.2	6.4	-5.6%	-13.5%	9.1%
10 to 2	Maidstone	Romford	62.5	60.3	62.2	57.5	47.9	72.0	-5.0	-12.4	9.8	-8.0%	-20.6%	15.8%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	58.2	61.7	54.9	45.3	72.7	-4.9	-12.9	11.0	-8.3%	-22.1%	17.8%
10 to 4	Maidstone	Basildon	63.5	61.8	61.6	50.3	40.7	74.3	-13.2	-21.2	12.6	-20.8%	-34.3%	20.5%
10 to 5	Maidstone	Tilbury Port	58.6	58.1	60.6	49.2	39.7	74.4	-9.4	-18.3	13.8	-16.0%	-31.6%	22.9%
10 to 6	Maidstone	DP World	59.1	57.5	61.6	45.9	36.2	76.1	-13.2	-21.3	14.5	-22.3%	-37.1%	23.5%
11 to 1	Rochester	Cheshunt	74.5	75.6	59.1	70.3	61.4	68.7	-4.2	-14.3	9.6	-5.6%	-18.8%	16.3%
11 to 2	Rochester	Romford	48.7	60.7	48.1	44.5	44.3	60.3	-4.2	-16.5	12.2	-8.7%	-27.1%	25.3%
11 to 3	Rochester	Brentwood	46.0	58.6	47.1	41.9	41.7	60.3	-4.2	-17.0	13.2	-9.0%	-28.9%	28.0%
11 to 4	Rochester	Basildon	49.7	62.3	47.9	37.3	37.0	60.5	-12.4	-25.3	12.6	-25.0%	-40.6%	26.3%
11 to 5	Rochester	Tilbury Port	44.8	58.5	45.9	36.2	36.1	60.3	-8.6	-22.4	14.3	-19.1%	-38.3%	31.2%
11 to 6	Rochester	DP World	45.3	57.9	46.9	32.9	32.5	60.6	-12.4	-25.4	13.7	-27.4%	-43.9%	29.3%
12 to 1	Rainham	Cheshunt	91.7	83.8	65.6	87.7	69.2	76.0	-4.0	-14.6	10.3	-4.4%	-17.4%	15.8%
12 to 2	Rainham	Romford	65.9	69.0	57.4	61.8	52.1	71.2	-4.1	-16.8	13.8	-6.2%	-24.4%	24.1%
12 to 3	Rainham	Brentwood	63.3	66.8	56.8	59.2	49.5	71.8	-4.0	-17.3	15.0	-6.4%	-25.9%	26.4%
12 to 4	Rainham	Basildon	67.0	70.5	57.0	54.7	44.9	73.1	-12.3	-25.6	16.1	-18.3%	-36.3%	28.3%
12 to 5	Rainham	Tilbury Port	62.0	66.7	55.8	53.6	43.9	73.2	-8.4	-22.8	17.4	-13.6%	-34.2%	31.2%
12 to 6	Rainham	DP World	62.5	66.2	56.7	50.2	40.4	74.6	-12.3	-25.8	18.0	-19.6%	-39.0%	31.7%

Note: Red text indicates negative values

Table 8.64 Route based journey time comparison south to north movements (2045 core DM vs DS) PM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	63.6	58.1	61.6	59.9	61.8	0.0	-3.7	3.7	0.1%	-5.9%	6.3%
7 to 2	Bexley	Romford	34.8	49.2	42.4	34.8	43.5	47.9	0.0	-5.7	5.5	0.0%	-11.6%	13.1%
7 to 3	Bexley	Brentwood	33.1	42.2	47.1	33.2	36.9	54.0	0.0	-5.3	6.8	0.1%	-12.5%	14.5%
7 to 4	Bexley	Basildon	36.8	51.5	42.9	36.8	43.9	50.3	0.0	-7.6	7.4	0.0%	-14.7%	17.2%
7 to 5	Bexley	Tilbury Port	28.6	41.0	41.8	28.6	32.5	52.7	0.0	-8.5	10.9	0.0%	-20.8%	26.2%
7 to 6	Bexley	DP World	32.4	45.3	42.9	32.4	37.7	51.5	0.0	-7.6	8.6	0.0%	-16.7%	20.0%
8 to 1	Godstone	Cheshunt	91.2	87.6	62.5	91.3	84.6	64.7	0.0	-3.0	2.2	0.1%	-3.4%	3.6%
8 to 2	Godstone	Romford	64.4	73.2	52.8	64.4	68.3	56.6	0.0	-4.9	3.8	0.0%	-6.7%	7.2%
8 to 3	Godstone	Brentwood	62.8	66.2	56.9	62.8	61.7	61.1	0.0	-4.5	4.2	0.1%	-6.8%	7.4%
8 to 4	Godstone	Basildon	66.5	75.5	52.9	66.5	68.7	58.1	0.0	-6.8	5.2	0.0%	-9.0%	9.9%
8 to 5	Godstone	Tilbury Port	58.2	65.0	53.7	58.2	57.3	61.0	0.0	-7.7	7.3	0.0%	-11.9%	13.5%
8 to 6	Godstone	DP World	62.0	69.3	53.7	62.0	62.5	59.6	0.0	-6.8	5.8	0.0%	-9.8%	10.8%
9 to 1	Southfleet	Cheshunt	60.7	61.2	59.5	60.8	56.5	64.5	0.0	-4.7	5.0	0.1%	-7.7%	8.4%
9 to 2	Southfleet	Romford	33.9	46.8	43.5	33.9	40.2	50.7	0.0	-6.7	7.2	0.0%	-14.2%	16.5%
9 to 3	Southfleet	Brentwood	32.3	39.8	48.7	32.3	33.5	57.8	0.0	-6.2	9.1	0.1%	-15.7%	18.7%
9 to 4	Southfleet	Basildon	36.0	49.1	44.0	35.9	34.8	61.9	-0.1	-14.3	17.9	-0.4%	-29.2%	40.8%
9 to 5	Southfleet	Tilbury Port	27.7	38.6	43.0	31.4	27.4	68.7	3.7	-11.2	25.6	13.4%	-28.9%	59.6%
9 to 6	Southfleet	DP World	31.5	42.9	44.1	31.4	28.6	66.0	-0.1	-14.3	21.9	-0.4%	-33.4%	49.6%
10 to 1	Maidstone	Cheshunt	88.3	80.4	65.9	83.3	75.0	66.7	-4.9	-5.4	0.8	-5.6%	-6.7%	1.2%
10 to 2	Maidstone	Romford	61.5	66.0	55.8	56.4	58.6	57.8	-5.0	-7.4	1.9	-8.2%	-11.3%	3.5%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	59.0	60.8	54.9	52.0	63.3	-5.0	-7.0	2.4	-8.3%	-11.8%	4.0%
10 to 4	Maidstone	Basildon	63.5	68.3	55.8	50.3	49.6	60.9	-13.2	-18.8	5.2	-20.8%	-27.5%	9.2%
10 to 5	Maidstone	Tilbury Port	55.2	57.8	57.3	45.9	42.2	65.2	-9.4	-15.6	7.9	-16.9%	-27.0%	13.8%
10 to 6	Maidstone	DP World	59.1	62.1	57.1	45.9	43.4	63.5	-13.2	-18.8	6.4	-22.3%	-30.2%	11.3%
11 to 1	Rochester	Cheshunt	74.5	88.4	50.5	70.3	72.6	58.1	-4.2	-15.9	7.6	-5.6%	-18.0%	15.1%
11 to 2	Rochester	Romford	47.7	74.1	38.6	43.4	56.2	46.4	-4.2	-17.9	7.8	-8.9%	-24.2%	20.2%
11 to 3	Rochester	Brentwood	46.0	67.0	41.2	41.9	49.6	50.6	-4.2	-17.4	9.4	-9.0%	-26.0%	22.9%
11 to 4	Rochester	Basildon	49.7	76.4	39.1	37.3	47.1	47.5	-12.4	-29.2	8.4	-25.0%	-38.3%	21.6%
11 to 5	Rochester	Tilbury Port	41.4	65.9	37.7	32.9	39.8	49.6	-8.6	-26.1	11.8	-20.7%	-39.6%	31.3%
11 to 6	Rochester	DP World	45.3	70.1	38.7	32.9	40.9	48.2	-12.4	-29.2	9.5	-27.4%	-41.7%	24.4%
12 to 1	Rainham	Cheshunt	91.7	94.1	58.5	87.7	77.4	68.0	-4.0	-16.7	9.5	-4.4%	-17.7%	16.2%
12 to 2	Rainham	Romford	64.9	79.7	48.8	60.8	61.0	59.8	-4.1	-18.7	10.9	-6.3%	-23.4%	22.4%
12 to 3	Rainham	Brentwood	63.2	72.7	52.2	59.2	54.5	65.3	-4.0	-18.2	13.0	-6.4%	-25.1%	25.0%
12 to 4	Rainham	Basildon	66.9	82.0	49.0	54.7	52.0	63.1	-12.3	-30.0	14.1	-18.3%	-36.6%	28.8%
12 to 5	Rainham	Tilbury Port	58.7	71.5	49.2	50.2	44.7	67.5	-8.4	-26.9	18.3	-14.4%	-37.6%	37.1%
12 to 6	Rainham	DP World	62.5	75.8	49.5	50.2	45.8	65.8	-12.3	-30.0	16.4	-19.6%	-39.6%	33.1%

Note: Red text indicates negative values

Commentary on the results

8.4.13 Table 8.44 to Table 8.49 demonstrate that the highway assignment models for each time period in the Do Minimum and Do Something scenarios have converged well within the TAG recommended convergence limits.

8.4.14 The select link analysis presented in Plate 8.28 to Plate 8.36 and associated Table 8.50 to Table 8.52 shows that the introduction of the Project has a significant impact on the patterns of movement using the Dartford Crossing. In particular, there is a substantial reduction in traffic to/from east Kent using the Dartford Crossing with the Project. As would be expected, in the Do Something situation the majority of this traffic uses the Project. There is also a substantial reduction north of the River Thames in trips to/from M25 north.

8.4.15 There is a notable increase in the number of trips using the Dartford Crossing from within London both north and south of the River Thames. This is likely due to route switching of travellers from using Silvertown/Blackwall in the Do Minimum scenario to using the Dartford Crossing in the Do Something scenario due to the newly available capacity. This will also be caused by an increase in shorter distance trips switching destinations to cross the River Thames in the Do Something scenario. These movements are suppressed in the Do Minimum scenario due to the lack of available capacity at the Dartford Crossing.

8.4.16 Movements using the Project are predominantly from/to east Kent, M25 north and A13 east of the junction with the Project. In the south there is some local traffic (approximately 880–1,290 PCU/hr in the peak hours) and relatively few trips to/from Kent west of the Project's junction with the A2 using the Project (up to 780 PCU/hr in the peak hours) and zero trips from the M25 south of the A2 junction using the Project. These movements will continue to use the Dartford Crossing as to use the Project requires a considerable detour. In the north there is traffic to/from the A1089 using the Project (up to 930 PCU/hr in the peak hours). These patterns of movement are consistent across all time periods and accord well with *a priori* expectations.

8.4.17 Comparisons of traffic flows in the Do Minimum and Do Something scenarios are presented in Plate 8.37 to Plate 8.39 and in Table 8.53 to Table 8.55. Initially focussing on the impact of the Project on flows at the Dartford Crossing, it can be observed that generally the model is predicting a substantial reduction in flow. In the southbound direction, in the Do Minimum scenario, the AM and PM peaks are at capacity (V/C ratio of 1.0) and the inter-peak is operating below capacity (V/C ratio of 0.93). In the Do Something scenario, the model predicted flows at the Dartford Crossing are reduced by between 1% and 19%. The relatively small reduction in flow in the AM peak leads to operating conditions approaching capacity (V/C ratio of 0.99). The PM peak and inter-peak experience under-capacity conditions with V/C ratios 0.80 and 0.75 respectively.

8.4.18 In the northbound direction, in the Do Minimum, the flows at the Dartford Crossing exceed the capacity of the TMC in all time periods with V/C ratios of between 1.11 and 1.15. In the AM and PM peaks the flows approaching the TMC exceed the capacity by between 800 and 1,000 PCU/hr. In the Do Something scenario these flows are significantly reduced by between 14% and 17% and the flow approaching the TMC is below the TMC capacity in all time periods. In the PM peak the flows are approaching the capacity of the TMC, with a V/C ratio of 0.99.

8.4.19 In particular, there is a substantial reduction in HGVs using the Dartford Crossing both northbound and southbound in all time periods, in the Do Something scenario compared to the Do Minimum scenario. This is due to the alignment of the Project making it a very favourable route for HGVs accessing the ports in Kent and Essex. These reductions in flow at the Dartford Crossing, across all vehicle types, are as expected as this is one of the primary objectives of the Project.

8.4.20 The Project tunnel is operating well under capacity in both directions with V/C ratios of between 0.51 and 0.74 in the southbound direction and 0.65 to 0.80 in the northbound direction. It can also be observed that in 2045, the flow on the Project is over two full lanes worth of traffic southbound in the PM peak and northbound in the AM peak. More detailed information on the flows along the different sections of the Project and at its junctions is provided in Chapter 10.

8.4.21 When looking at both crossings combined, it can be seen that in the Do Something scenario there is sufficient cross-river capacity with V/C ratios of between 0.65 and 0.83 in the southbound direction and 0.81 to 0.86 in the northbound direction. This is in stark contrast to the Do Minimum situation where the Dartford Crossing is heavily congested in all time periods, likely leading to long queues, unreliable journey times and a higher rate of incidents.

8.4.22 The analysis shows that there are associated reductions in traffic flows along the A2 and A13 west of their junctions with the Project and also on the M20. These reductions in flow lead to reductions in congestion along these corridors. This is one of the major benefits of the Project and is from which a significant proportion of the economic benefits of the Project are derived.

8.4.23 There are also some increases in flow in the Do Something scenario compared to the Do Minimum scenario on the A2/M2 corridor east of the Project, the A13 east of the Project and on the M25 north of the Project. This is caused by the Project drawing more traffic to cross the River Thames than in the constrained Do Minimum scenario. These increases in flow lead to additional congestion in these corridors and leads to disbenefits from the introduction of the Project. Some of these increases in flow increase congestion in these corridors. In particular, M25 junctions 28–29 and A13 Orsett Cock to Manor Way (and the reverse directions) are significantly worse in the Do Something scenario when compared with the Do Minimum scenario.

8.4.24 These benefits and disbenefits are further illustrated by the link-based journey time analysis presented in Table 8.56 to Table 8.58. It can be observed that there are substantial increases in speed in the Dartford Crossing corridor between M25 junction 29 and M25 junction 2 in both directions (up to a 25km/h increase in the AM peak in the northbound direction, and up to a 28km/h increase in the IP). There are also significant journey time savings on the A2 between the junction with the Project and the M25 and on the A13 between the junction with the Project and the M25. There are some predicted reductions in speed on the A2 and A13 east of their junctions with the Project and on the wider M25 both north and south of the River Thames. These are in line with the increases in flows predicted in those corridors. This pattern is relatively consistent across all time periods.

8.4.25 There is additional detailed link-based journey time analysis presented in Annex C.

8.4.26 The route-based journey times presented in Table 8.59 to Table 8.64 show cross-river movements. As expected, all cross-river movements experience improved journey times in the Do Something scenario relative to the Do Minimum. Some cross-river movements also benefit substantially from a reduced journey distance. Using the Project rather than the Dartford Crossing provides a significant distance saving for movements from/to east Kent to/from east Essex.

8.4.27 It is for this reason that it is considered necessary to undertake a full 24 hours per day, 365 days per year economic assessment of the Project. Some movements will benefit significantly from the introduction of the Project even during the night when flow is predicted to be low. It is important that the associated benefits, and disbenefits, of movements at all times of day and night are captured in the economic analysis.

8.4.28 Most movements also experience an increase in average speed in the Do Something scenario. Some movements do not however, primarily due to their using different parts of the network with different speed limits and links with higher congestion in the Do Something scenario as described above. Overall though, the balance is substantially positive, with almost all of the cross-river movements shown in Table 8.59 to Table 8.64 having increases in speed.

8.5 LTAM 2051 core – outputs to economic assessment

8.5.1 The analysis presented below summarises the impact of the Project on forecast traffic flows and journey times for the 2051 core forecast. The statistics presented are from the final converged VDM loop as described under Chapter 7.

HAM convergence statistics

8.5.2 Table 8.65 to Table 8.67 provide the final VDM loop highway assignment model convergence statistics for the 2051 core DM forecasts.

8.5.3 Table 8.68 to Table 8.70 provide the final VDM loop highway assignment model convergence statistics for the 2051 core DS forecasts.

Table 8.65 HAM convergence statistics – 2051 core DM AM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
68	0.0057	0.0088	98.6	99.2
69	0.0053	0.0091	98.6	99.2
70	0.0068	0.0085	98.5	99.3
71	0.0041	0.0071	98.7	99.3

Table 8.66 HAM convergence statistics – 2051 core DM inter-peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
87	0.0026	0.0045	98.8	99.5
88	0.0032	0.0032	98.7	99.6

Iteration	Delta (%)	%GAP	%Flows	%Delays
89	0.0023	0.0048	98.9	99.5
90	0.0023	0.0067	98.7	99.5

Table 8.67 HAM convergence statistics – 2051 core DM PM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
95	0.0057	0.0064	98.6	99.0
96	0.0046	0.0077	98.7	98.9
97	0.0038	0.0076	98.7	98.9
98	0.0041	0.0056	98.5	98.9

Table 8.68 HAM convergence statistics – 2051 core DS AM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
75	0.0051	0.0081	98.6	99.1
76	0.0049	0.0073	98.7	99.2
77	0.0062	0.007	98.9	99.3
78	0.0059	0.0064	98.6	99.3

Table 8.69 HAM convergence statistics – 2051 core DS inter-peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
81	0.0034	0.0042	98.6	99.4
82	0.0026	0.0044	98.6	99.4
83	0.0026	0.0038	98.7	99.5
84	0.0026	0.0064	98.7	99.5

Table 8.70 HAM convergence statistics – 2051 core DS PM peak

Iteration	Delta (%)	%GAP	%Flows	%Delays
87	0.0050	0.0076	98.8	99.0
88	0.0046	0.0076	98.6	99.0
89	0.0038	0.0071	98.8	99.0
90	0.0047	0.0061	98.7	99.0

8.5.4 These tables demonstrate that the LTAM has achieved the TAG convergence targets in all time periods for this scenario and year.

Movement patterns using the crossings

8.5.5 Plate 8.40 to Plate 8.48 provide select link analysis of movements using the Dartford Crossing and the Lower Thames Crossing for the Do Minimum and Do Something scenarios for each of the model time periods. These diagrams show the pattern of movements using each of the crossings in each of the time periods. Table 8.71 to Table 8.73 provide a summary of the main corridors using each of the crossings and a comparison between the DM and DS scenarios for each time period.

Plate 8.40 Select link analysis – Dartford Crossing DM 2051 core AM peak

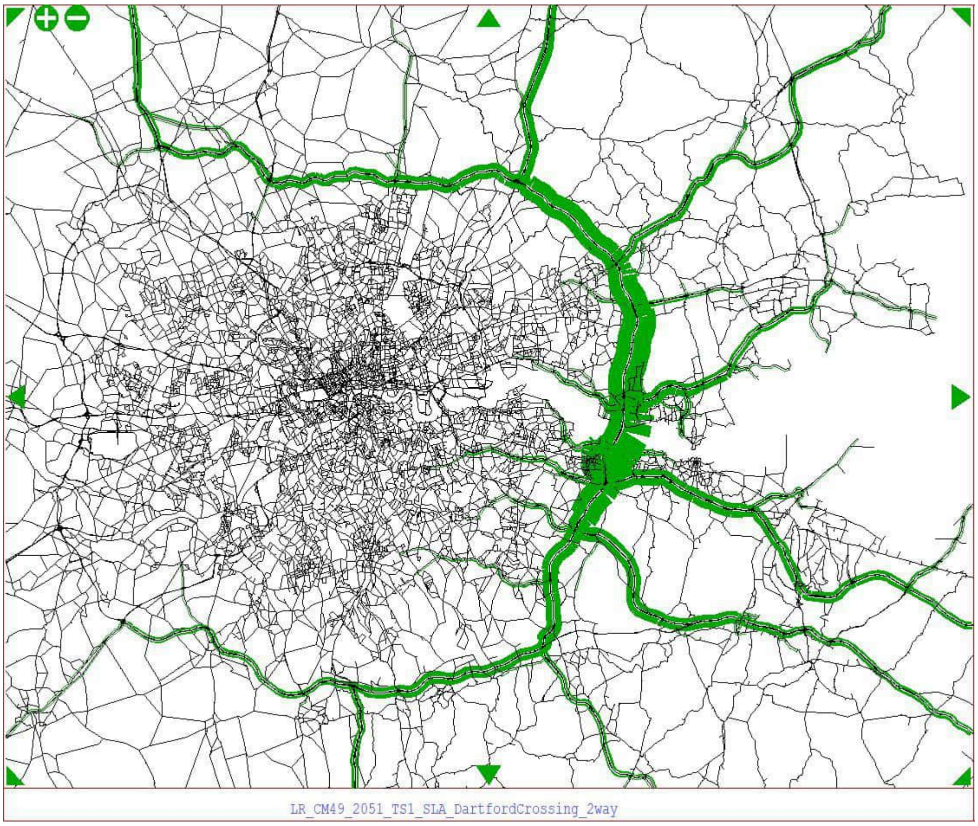


Plate 8.41 Select link analysis – Dartford Crossing DS 2051 core AM peak

Plate 8.42 Select link analysis – Lower Thames Crossing DS 2051 core AM peak

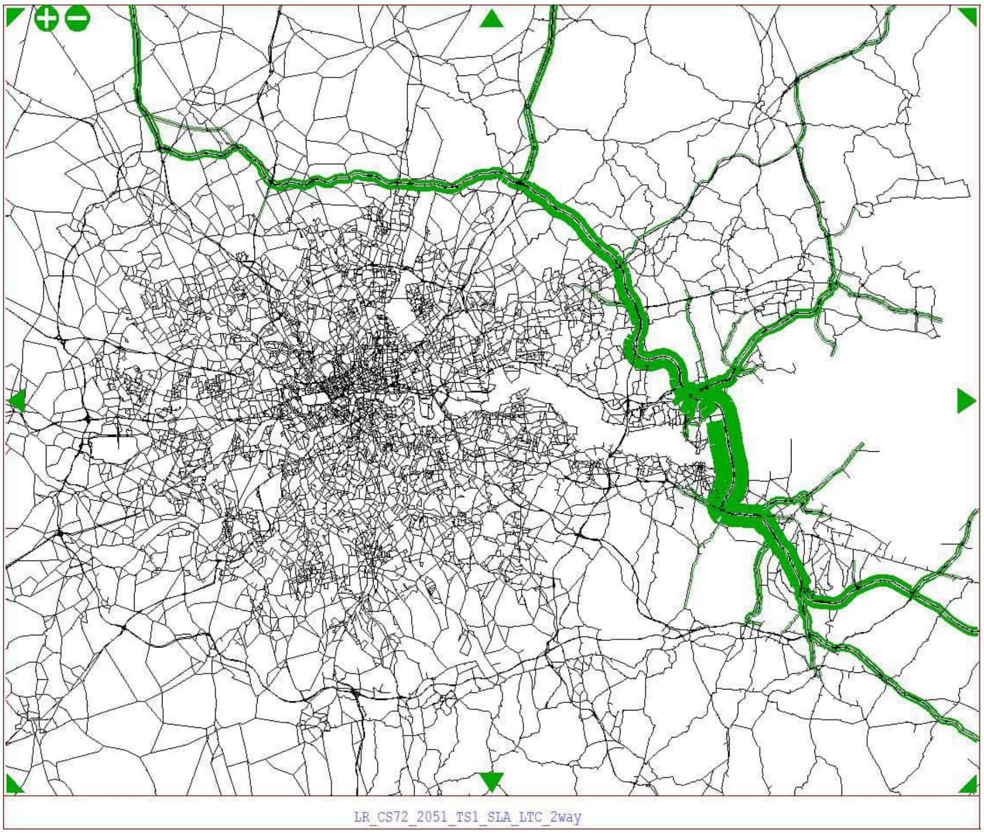


Table 8.71 Select link analysis – summary of primary corridors of movement 2051 AM peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,586	17%	3,768	25%	1,183	46%
	Local (outside M25)	2,039	13%	2,050	14%	10	1%
	M25 south (junctions 2–3)	7,581	49%	7,915	53%	333	4%
	A2/M2 to/from Kent	3,275	21%	1,338	9%	-1,937	-59%
Select link	Dartford Crossing	**15,481**	**100%**	**15,071**	**100%**	**-410**	**-3%**
North of River Thames	London north	2,104	14%	3,055	20%	951	45%
	Local traffic	1,582	10%	1,763	12%	182	11%
	M25 north (junctions 30–29)	8,895	57%	7,702	51%	-1,192	-13%
	A13 to/from Essex	2,901	19%	2,550	17%	-351	-12%
South of River Thames	Local traffic	n/a	n/a	915	10%	n/a	n/a
	A2 west of the Project	n/a	n/a	667	7%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	7,589	83%	n/a	n/a
Select link	Lower Thames Crossing	n/a	n/a	**9,171**	**100%**	n/a	n/a
North of River Thames	A1089	n/a	n/a	870	9%	n/a	n/a
	A13 west of the Project	n/a	n/a	100	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	3,686	40%	n/a	n/a
	M25 north of the Project	n/a	n/a	4,515	49%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings

Plate 8.43 Select link analysis – Dartford Crossing DM 2051 core inter-peak

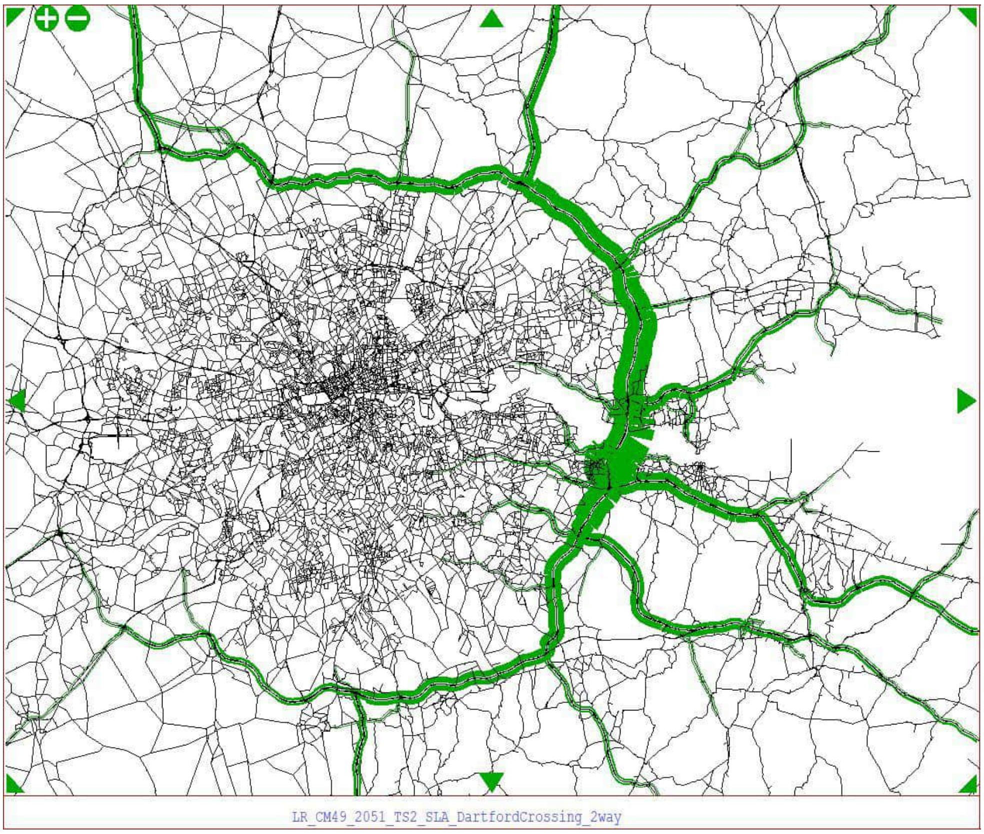


Plate 8.44 Select link analysis – Dartford Crossing DS 2051 core inter-peak

Plate 8.45 Select link analysis – Lower Thames Crossing DS 2051 core inter-peak

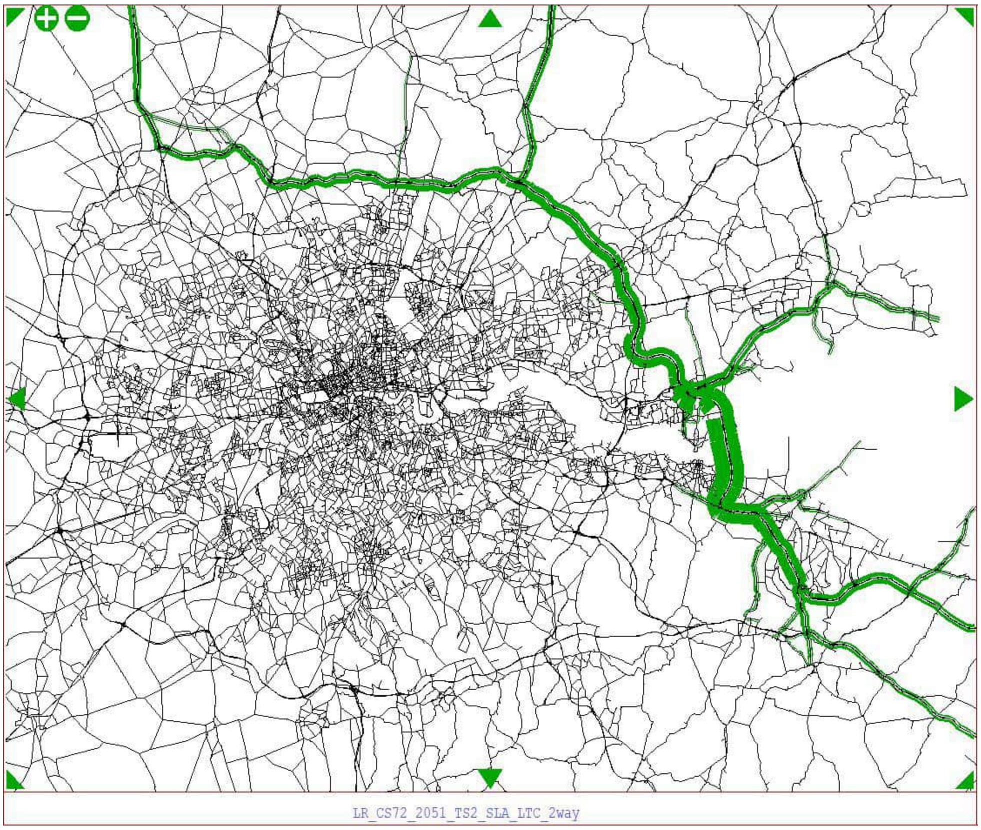


Table 8.72 Select link analysis – summary of primary corridors of movement 2051 inter-peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,388	16%	3,009	23%	621	26%
	Local (outside M25)	1,625	11%	1,472	11%	-153	-9%
	M25 south (junctions 2–3)	7,246	48%	7,365	56%	119	2%
	A2/M2 to/from Kent	3,728	25%	1,351	10%	-2,377	-64%
Select link	Dartford Crossing	**14,987**	**100%**	**13,198**	**100%**	**-1,790**	**-12%**
North of River Thames	London north	1,850	12%	2,475	19%	624	34%
	Local traffic	1,683	11%	1,776	13%	92	5%
	M25 north (junctions 30–29)	8,236	55%	6,367	48%	-1,869	-23%
	A13 to/from Essex	3,218	21%	2,580	20%	-637	-20%
South of River Thames	Local traffic	n/a	n/a	903	11%	n/a	n/a
	A2 west of the Project	n/a	n/a	546	7%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	6,457	82%	n/a	n/a
Select link	Lower Thames Crossing	n/a	n/a	**7,905**	**100%**	n/a	n/a

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
North of River Thames	A1089	n/a	n/a	732	9%	n/a	n/a
	A13 west of the Project	n/a	n/a	94	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	3,191	40%	n/a	n/a
	M25 north of the Project	n/a	n/a	3,888	49%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings

Plate 8.46 Select link analysis – Dartford Crossing DM 2051 core PM peak

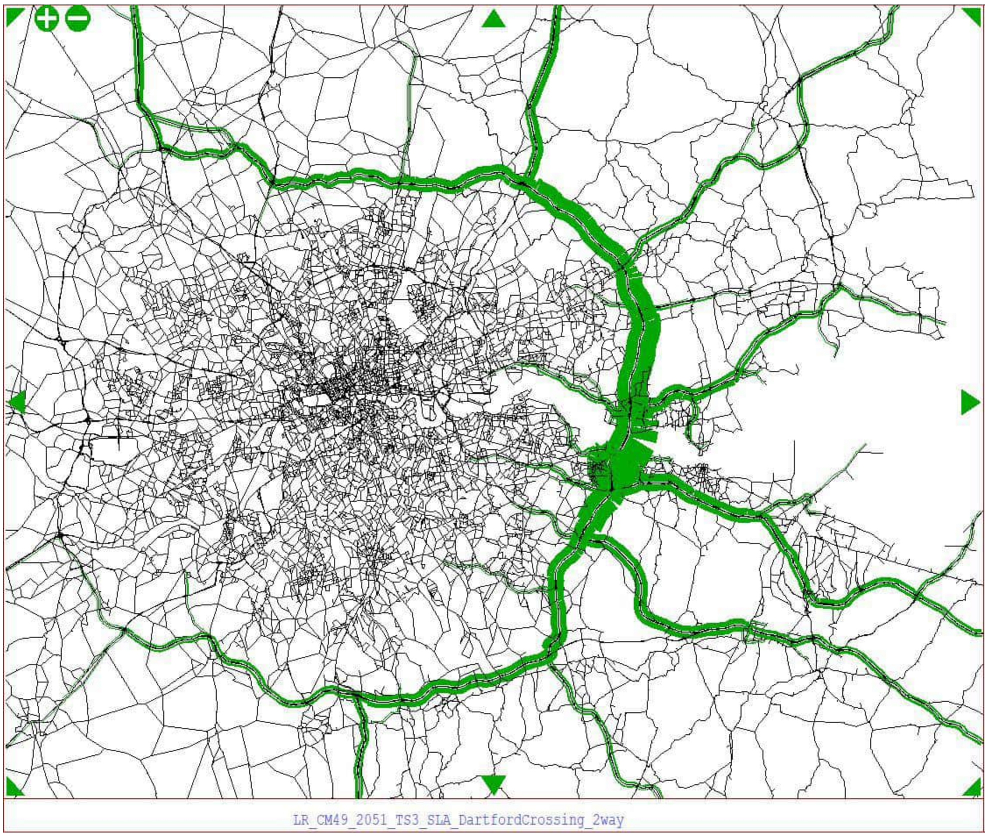


Plate 8.47 Select link analysis – Dartford Crossing DS 2051 core PM peak

Plate 8.48 Select link analysis – Lower Thames Crossing DS 2051 core PM peak

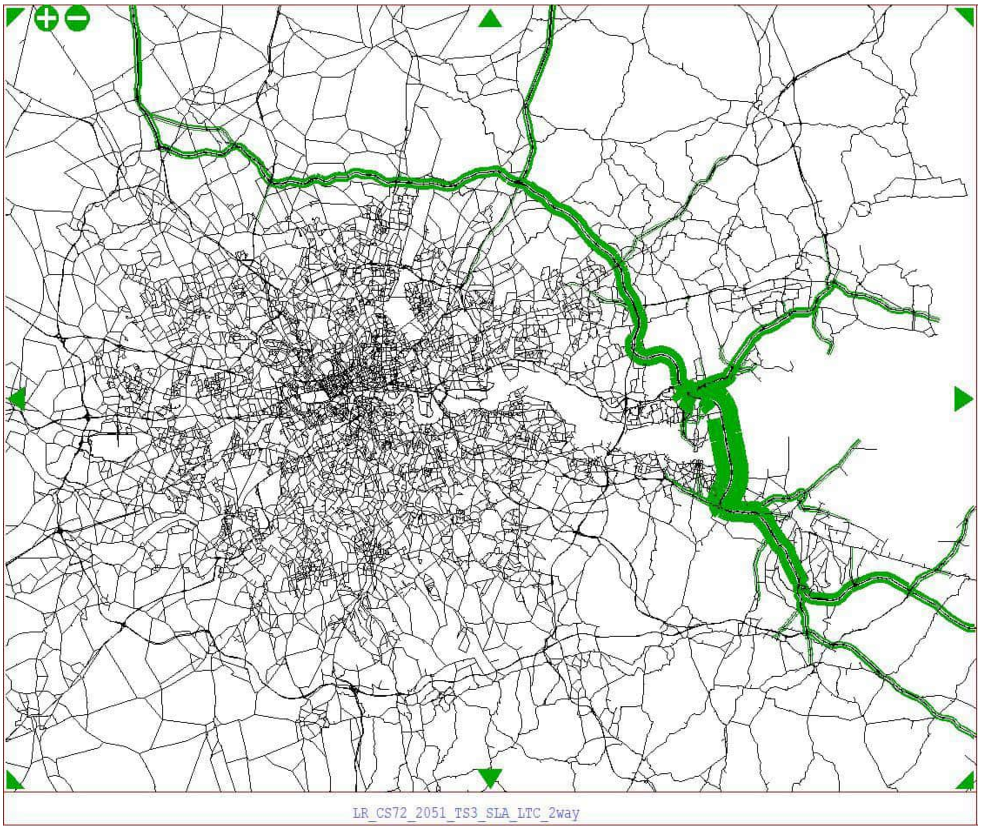


Table 8.73 Select link analysis – summary of primary corridors of movement 2051 PM peak two-way flow

Movement	Corridor	DM		DS		DS-DM SLA flow (PCU)	% change (DM to DS) in SLA flow
		SLA flow (PCU)	% of selected link flow	SLA flow (PCU)	% of selected link flow		
South of River Thames	Local (inside M25)	2,515	16%	3,170	23%	655	26%
	Local (outside M25)	1,634	11%	1,635	12%	1	0%
	M25 south (junctions 2–3)	7,210	47%	7,226	53%	16	0%
	A2/M2 to/from Kent	3,902	26%	1,682	12%	-2,220	-57%
Select link	Dartford Crossing	**15,262**	**100%**	**13,714**	**100%**	**-1,548**	**-10%**
North of River Thames	London north	2,410	16%	3,201	23%	792	33%
	Local traffic	1,609	11%	1,746	13%	138	9%
	M25 north (junctions 30–29)	8,027	53%	6,409	47%	-1,618	-20%
	A13 to/from Essex	3,216	21%	2,358	17%	-859	-27%
South of River Thames	Local traffic	n/a	n/a	1,359	15%	n/a	n/a
	A2 west of the Project	n/a	n/a	821	9%	n/a	n/a
	A2/A2M east of the Project	n/a	n/a	6,874	76%	n/a	n/a
Select link	Lower Thames Crossing	n/a	n/a	**9,053**	**100%**	n/a	n/a
North of River Thames	A1089	n/a	n/a	978	11%	n/a	n/a
	A13 west of the Project	n/a	n/a	70	1%	n/a	n/a
	A13 east of the Project	n/a	n/a	4,210	47%	n/a	n/a
	M25 north of the Project	n/a	n/a	3,796	42%	n/a	n/a
	M25 south of the Project	n/a	n/a	0	0%	n/a	n/a

Note: Shaded rows indicate the two river crossings

DM vs DS flow comparisons

8.5.6 The impacts of the Project on traffic flows are presented in a number of different ways below. Plate 8.49 to Plate 8.51 provide a flow difference plot between the DM and DS scenarios. Blue colours equate to reductions in flow, green colours indicate increases in flow. Flow differences of less than 100 PCUs per hour have been excluded from the colouring.

8.5.7 Table 8.74 provides a comparison of the cross-river traffic flows between the DM and DS scenarios. For the northbound approach at the Dartford Crossing, flow is presented for the link approaching the TMC. Table 8.75 provides a comparison of the cross-river traffic flows between the DM and DS scenarios. For the northbound approach at the Dartford Crossing flow is presented for the link after the TMC. The V/C ratio is also presented in these tables, with green shading indicating a V/C below 0.85, orange between 0.85 and 0.95 and red if 0.95 or above.

Plate 8.49 Actual flow comparison plot – 2051 core DM vs DS AM peak

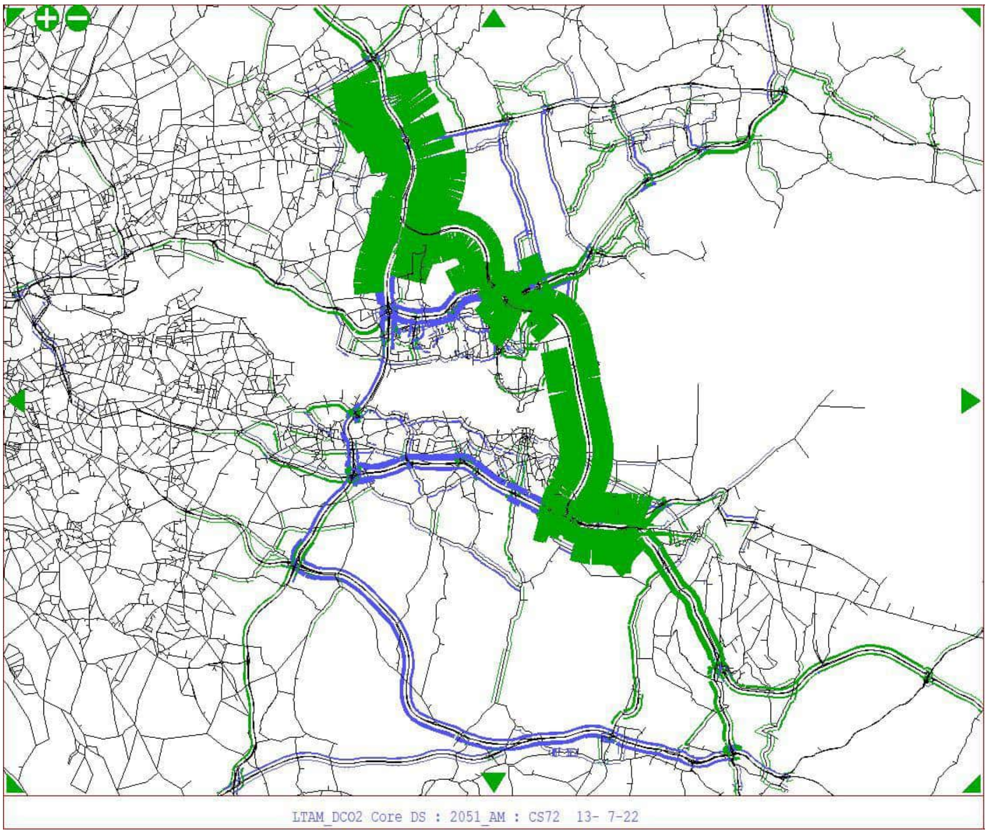


Plate 8.50 Actual flow comparison plot – 2051 core DM vs DS inter-peak

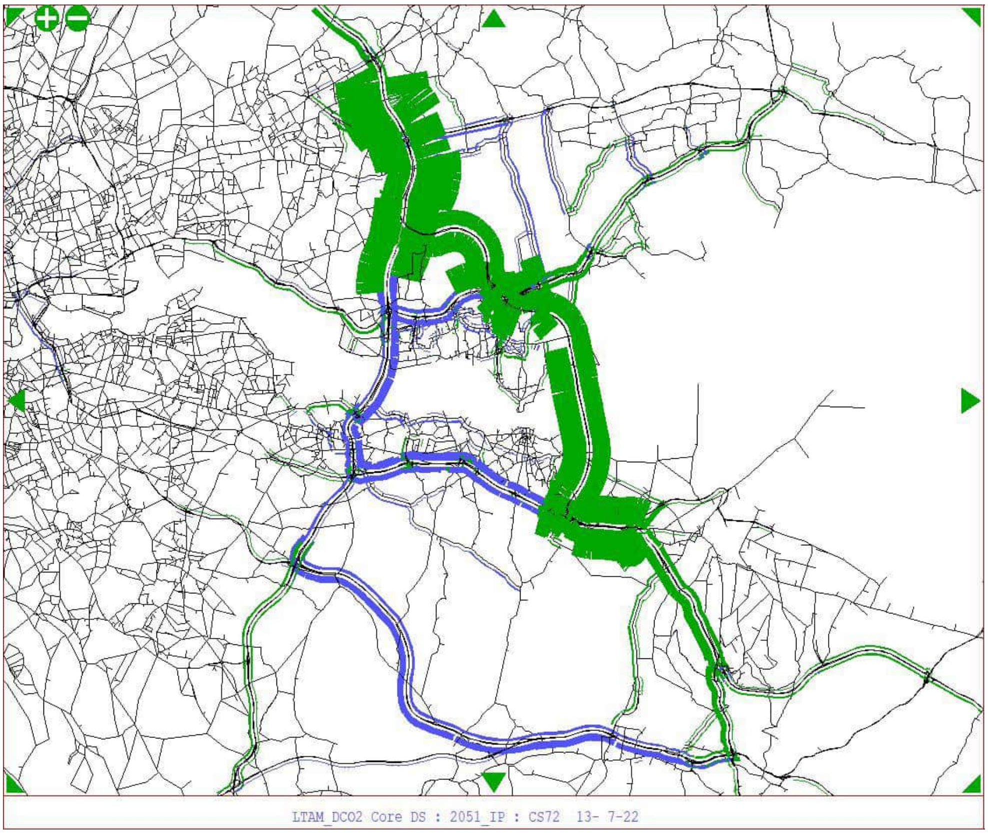


Plate 8.51 Actual flow comparison plot – 2051 core DM vs DS PM peak

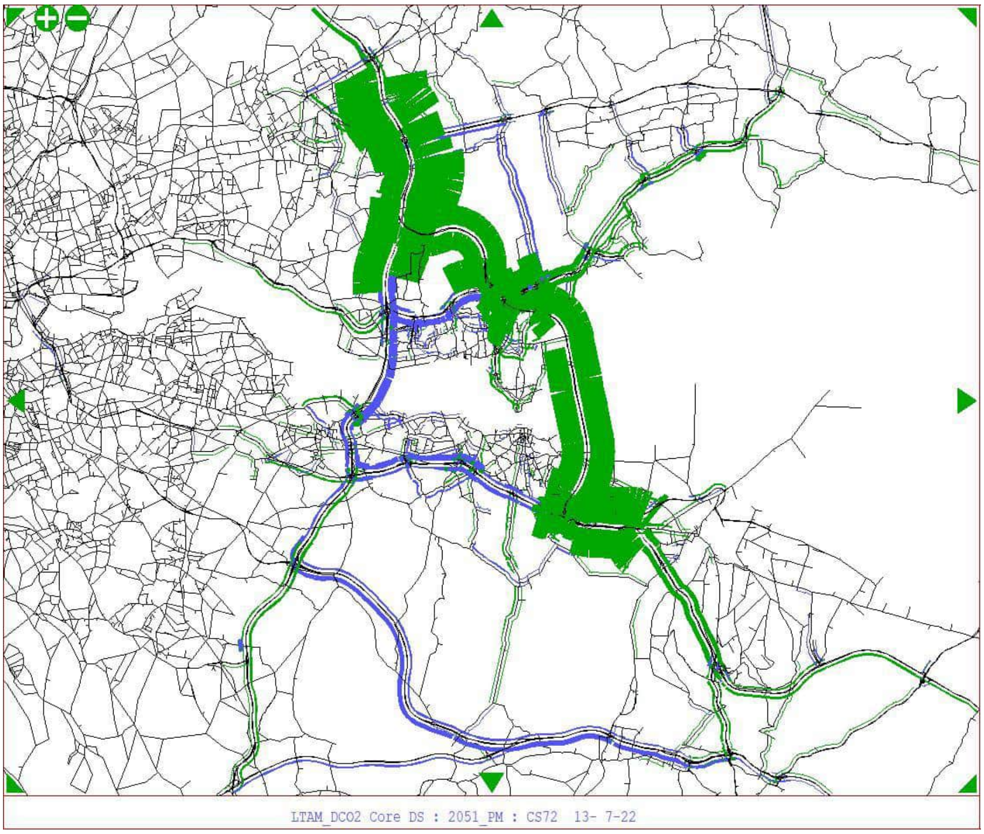


Table 8.74 Cross-river traffic flows (NB flows approaching TMC) – 2051 core DM vs DS (hourly flows in PCUs)

Direction	Crossing	Time period	Cars				LGV				HGV				Total				Effective capacity	Link V/C ratio	
			DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %		DM	DS
SB	Dartford Crossing	AM	3,482	3,940	458	13%	1,885	1,878	-7	0%	3,133	2,682	-451	-14%	8,500	8,500	0	0%	8,500	1.00	1.00
		IP	3,825	3,418	-407	-11%	1,010	857	-154	-15%	3,262	2,348	-915	-28%	8,097	6,622	-1,475	-18%	8,500	0.95	0.78
		PM	5,069	4,511	-558	-11%	1,269	988	-281	-22%	2,162	1,453	-709	-33%	8,500	6,952	-1,548	-18%	8,500	1.00	0.82
	Lower Thames Crossing	AM	0	2,582	–	–	0	380	–	–	0	1,022	–	–	0	3,984	–	–	6,360	–	0.63
		IP	0	2,156	–	–	0	215	–	–	0	1,039	–	–	0	3,410	–	–	6,360	–	0.54
		PM	0	3,633	–	–	0	361	–	–	0	785	–	–	0	4,779	–	–	6,360	–	0.75
	Total	AM	3,482	6,522	3,040	87%	1,885	2,258	373	20%	3,133	3,704	571	18%	8,500	12,484	3,984	47%	14,860	–	0.84
		IP	3,825	5,574	1,749	46%	1,010	1,072	62	6%	3,262	3,386	124	4%	8,097	10,032	1,935	24%	14,860	–	0.68
		PM	5,069	8,145	3,076	61%	1,269	1,349	80	6%	2,162	2,238	76	4%	8,500	11,732	3,232	38%	14,860	–	0.79
NB	Dartford Crossing*	AM	3,758	3,659	-99	-3%	1,625	1,183	-442	-27%	2,396	1,729	-667	-28%	7,778	6,571	-1,208	-16%	6,981	1.11	0.94
		IP	3,315	3,408	93	3%	1,064	815	-249	-23%	3,415	2,352	-1,062	-31%	7,794	6,576	-1,218	-16%	6,890	1.13	0.95
		PM	4,716	4,448	-268	-6%	1,138	942	-196	-17%	1,968	1,426	-542	-28%	7,821	6,816	-1,005	-13%	6,762	1.16	1.01
	Lower Thames Crossing	AM	0	3,376	–	–	0	696	–	–	0	1,114	–	–	0	5,186	–	–	6,360	–	0.82
		IP	0	2,627	–	–	0	416	–	–	0	1,453	–	–	0	4,495	–	–	6,360	–	0.71
		PM	0	3,250	–	–	0	297	–	–	0	727	–	–	0	4,274	–	–	6,360	–	0.67
	Total	AM	3,758	7,035	3,277	87%	1,625	1,879	254	16%	2,396	2,843	448	19%	7,778	11,757	3,979	51%	13,341	–	0.88
		IP	3,315	6,035	2,720	82%	1,064	1,231	167	16%	3,415	3,805	390	11%	7,794	11,071	3,277	42%	13,250	–	0.84
		PM	4,716	7,698	2,982	63%	1,138	1,240	102	9%	1,968	2,153	185	9%	7,821	11,090	3,269	42%	13,122	–	0.85

** Flows are extracted for the link approaching the TMC*

Note: Red text indicates a negative value

Table 8.75 Cross-river traffic flows (NB flows after TMC) – 2051 core DM vs DS (hourly flows in PCUs)

Direction	Crossing	Time period	Cars				LGV				HGV				Total				Effective capacity	Link V/C ratio	
			DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %	DM	DS	Diff.	Diff. %		DM	DS
SB	Dartford Crossing	AM	3,482	3,940	458	13%	1,885	1,878	-7	0%	3,133	2,682	-451	-14%	8,500	8,500	0	0%	8,500	1.00	1.00
		IP	3,825	3,418	-407	-11%	1,010	857	-154	-15%	3,262	2,348	-915	-28%	8,097	6,622	-1,475	-18%	8,500	0.95	0.78
		PM	5,069	4,511	-558	-11%	1,269	988	-281	-22%	2,162	1,453	-709	-33%	8,500	6,952	-1,548	-18%	8,500	1.00	0.82
	Lower Thames Crossing	AM	0	2,582	–	–	0	380	–	–	0	1,022	–	–	0	3,984	–	–	6,360	–	0.63
		IP	0	2,156	–	–	0	215	–	–	0	1,039	–	–	0	3,410	–	–	6,360	–	0.54
		PM	0	3,633	–	–	0	361	–	–	0	785	–	–	0	4,779	–	–	6,360	–	0.75
	Total	AM	3,482	6,522	3,040	87%	1,885	2,258	373	20%	3,133	3,704	571	18%	8,500	12,484	3,984	47%	14,860	–	0.84
		IP	3,825	5,574	1,749	46%	1,010	1,072	62	6%	3,262	3,386	124	4%	8,097	10,032	1,935	24%	14,860	–	0.68
		PM	5,069	8,145	3,076	61%	1,269	1,349	80	6%	2,162	2,238	76	4%	8,500	11,732	3,232	38%	14,860	–	0.79
NB	Dartford Crossing*	AM	3,377	3,659	282	8%	1,459	1,183	-277	-19%	2,145	1,729	-416	-19%	6,981	6,571	-410	-6%	6,981	1.00	0.94
		IP	2,932	3,408	476	16%	941	815	-126	-13%	3,017	2,352	-665	-22%	6,890	6,576	-315	-5%	6,890	1.00	0.95
		PM	4,076	4,413	337	8%	984	936	-49	-5%	1,701	1,413	-288	-17%	6,762	6,762	0	0%	6,762	1.00	1.00
	Lower Thames Crossing	AM	0	3,376	–	–	0	696	–	–	0	1,114	–	–	0	5,186	–	–	6,360	–	0.82
		IP	0	2,627	–	–	0	416	–	–	0	1,453	–	–	0	4,495	–	–	6,360	–	0.71
		PM	0	3,250	–	–	0	297	–	–	0	727	–	–	0	4,274	–	–	6,360	–	0.67
	Total	AM	3,377	7,035	3,658	108%	1,459	1,879	420	29%	2,145	2,843	698	33%	6,981	11,757	4,776	68%	13,341	–	0.88
		IP	2,932	6,035	3,103	106%	941	1,231	290	31%	3,017	3,805	788	26%	6,890	11,071	4,181	61%	13,250	–	0.84
		PM	4,076	7,663	3,586	88%	984	1,233	248	25%	1,701	2,140	439	26%	6,762	11,036	4,274	63%	13,122	–	0.84

** Flows are extracted for the link after the TMC*

Note: Red text indicates a negative value

8.5.8 The movements considered critical to understanding the impacts of the Project are the same as those described under Section 8.2 and previously illustrated in Plate 8.13. Table 8.76 provides a comparison of the flows at these strategic locations between the DM and DS in each time period. The V/C ratio is also presented, with green shading indicating a V/C below 0.85, orange between 0.85 and 0.95 and red if 0.95 or above.

Table 8.76 Key corridor traffic flows – 2051 core DM vs DS (hourly flows in PCUs)

Location	Location description	Time period	DM			DS			Flow differences	
			Flow	Effective capacity	V/C	Flow	Effective capacity	V/C	Diff.	Diff. %
A	M25 junctions 29 to M25 junctions 28 (NB)	AM	7,898	9,180	0.86	9,129	9,180	0.99	1,231	16%
		IP	7,230	9,180	0.79	8,485	9,180	0.92	1,255	17%
		PM	7,272	9,180	0.79	8,393	9,180	0.91	1,121	15%
	M25 junctions 28 to M25 junctions 29 (SB)	AM	7,966	9,115	0.87	8,143	9,180	0.89	177	2%
		IP	7,890	9,115	0.87	8,313	9,180	0.91	423	5%
		PM	8,190	9,115	0.90	8,547	9,180	0.93	357	4%
B	M25 junctions 4 to M25 junctions 3 (NB)	AM	5,819	6,850	0.85	6,009	6,850	0.88	190	3%
		IP	5,998	6,850	0.88	6,273	6,850	0.92	275	5%
		PM	6,545	6,850	0.96	6,697	6,850	0.98	152	2%
	M25 junctions 3 to M25 junctions 4 (SB)	AM	6,843	6,850	1.00	6,844	6,850	1.00	1	0%
		IP	5,850	6,850	0.85	6,009	6,850	0.88	158	3%
		PM	6,057	6,850	0.88	6,399	6,850	0.93	343	6%
C	A13 A126 to A1012 (EB)	AM	5,239	6,307	0.83	4,464	6,294	0.71	-775	-15%
		IP	5,329	6,298	0.85	4,649	6,279	0.74	-681	-13%
		PM	5,747	6,268	0.92	5,737	6,234	0.92	-10	0%
	A13 A1012 to A126 (WB)	AM	6,159	6,360	0.97	5,470	6,360	0.86	-690	-11%
		IP	5,779	6,360	0.91	4,869	6,360	0.77	-910	-16%
		PM	6,037	6,360	0.95	4,988	6,360	0.78	-1,049	-17%
D	A13 Orsett Cock to Manor Way (EB)	AM	5,225	6,370	0.82	5,787	6,370	0.91	563	11%
		IP	4,514	6,370	0.71	5,338	6,370	0.84	825	18%
		PM	5,109	6,370	0.80	6,009	6,370	0.94	901	18%
	A13 Manor Way to Orsett Cock (WB)	AM	5,353	6,220	0.86	5,873	6,220	0.94	520	10%
		IP	4,677	6,220	0.75	5,391	6,220	0.87	714	15%
		PM	5,115	6,220	0.82	5,870	6,220	0.94	756	15%

Location	Location description	Time period	DM			DS			Flow differences	
			Flow	Effective capacity	V/C	Flow	Effective capacity	V/C	Diff.	Diff. %
E	A2 A227 to Gravesend East (EB)	AM	6,659	9,230	0.72	5,723	9,224	0.62	-936	-14%
		IP	7,023	9,187	0.76	5,892	9,179	0.64	-1,131	-16%
		PM	9,077	9,186	0.99	8,811	9,166	0.96	-266	-3%
	A2 Gravesend East to A227 (WB)	AM	7,292	7,324	1.00	6,575	6,990	0.94	-716	-10%
		IP	6,279	7,053	0.89	5,473	6,886	0.79	-807	-13%
		PM	6,313	6,815	0.93	5,858	6,685	0.88	-455	-7%
F	M2 junction 1 to M2 junction 2 (EB)	AM	6,010	8,563	0.70	6,895	8,431	0.82	885	15%
		IP	5,284	8,704	0.61	6,084	8,635	0.70	800	15%
		PM	6,751	8,635	0.78	7,931	8,450	0.94	1,180	17%
	M2 junction 2 to M2 junction 1 (WB)	AM	6,526	8,824	0.74	7,807	8,575	0.91	1,281	20%
		IP	4,651	8,863	0.52	6,529	8,682	0.75	1,878	40%
		PM	5,754	8,937	0.64	6,774	8,769	0.77	1,021	18%
G	M20 junction 3 to M20 junction 4 (EB)	AM	6,674	9,115	0.73	6,281	9,115	0.69	-393	-6%
		IP	6,663	9,115	0.73	6,245	9,115	0.69	-418	-6%
		PM	8,830	9,115	0.97	8,664	9,115	0.95	-166	-2%
	M20 junction 4 to M20 junction 3 (WB)	AM	8,911	9,115	0.98	8,309	9,115	0.91	-602	-7%
		IP	6,520	9,115	0.72	5,331	9,115	0.58	-1,189	-18%
		PM	6,513	9,115	0.71	5,700	9,115	0.63	-813	-12%

Note: Red text indicates a negative value

DM vs DS journey time comparisons

8.5.9 The same link-based and route-based journey time comparisons introduced under Section 8.2 are repeated for this year scenario combination.

8.5.10 The link-based corridors analysed are as previously shown diagrammatically in Plate 8.14.

8.5.11 The link-based journey time comparisons for this scenario are presented in Table 8.77 to Table 8.79.

8.5.12 The route-based movements analysed are as previously shown diagrammatically in Plate 8.15.

8.5.13 Table 8.80 to Table 8.85 provide the With and Without Scheme journey distances, times and average speeds for a selection of these movements for southbound and northbound movements.

Table 8.77 Link based journey time scenario comparison (2051 core DM vs DS) AM peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	17.8	79.3	23.5	18.6	75.7	0.0	0.8	-3.6	-0.1%	4.7%	-4.6%
	B to D	M25 J29	M25 J2	18.8	22.4	50.3	18.9	17.2	65.9	0.1	-5.2	15.5	0.3%	-23.3%	30.8%
	D to F	M25 J2	M25 J7	37.7	32.7	69.3	37.7	35.0	64.7	0.0	2.3	-4.6	0.0%	7.1%	-6.7%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	27.5	83.1	38.0	27.9	81.8	0.0	0.4	-1.2	0.0%	1.5%	-1.5%
	D to B	M25 J2	M25 J29	18.7	22.1	50.7	18.8	15.3	73.6	0.1	-6.8	22.8	0.6%	-30.6%	45.0%
	B to A	M25 J29	M25 J26	23.2	18.1	77.1	23.1	21.6	64.3	-0.1	3.5	-12.8	-0.3%	19.6%	-16.6%
A13 EB	C to G	M25 J30	A1089	5.2	5.5	57.3	5.3	4.4	71.7	0.0	-1.1	14.3	0.9%	-19.3%	25.0%
	G to H	A1089	A130	15.7	13.8	68.3	15.7	15.0	62.7	-0.1	1.2	-5.6	-0.4%	8.4%	-8.1%
A13 WB	H to G	A130	A1089	15.3	15.4	59.6	15.2	18.0	50.6	-0.1	2.6	-9.0	-0.7%	17.0%	-15.1%
	G to C	A1089	M25 J30	5.5	9.5	34.7	5.6	6.0	55.8	0.1	-3.5	21.0	1.6%	-36.7%	60.6%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	9.6	95.3	15.3	9.1	100.8	0.1	-0.5	5.5	0.5%	-5.0%	5.8%
	I to J	M2 J1	M2 J4	14.7	8.7	100.9	14.7	9.4	93.9	0.0	0.7	-7.0	0.0%	7.4%	-6.9%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	9.6	95.2	15.1	10.7	84.2	-0.1	1.2	-10.9	-0.7%	12.2%	-11.5%
	I to D	M2 J1	M25 J2	14.8	21.0	42.2	14.8	14.1	63.3	0.1	-6.9	21.1	0.6%	-32.9%	50.0%
M20 EB	E to K	M25 J3	M20 J8	35.3	21.0	100.7	35.3	20.7	102.3	0.0	-0.3	1.5	0.0%	-1.5%	1.5%
M20 WB	K to E	M20 J8	M25 J3	35.3	27.3	77.5	35.3	25.0	84.8	0.0	-2.4	7.3	0.0%	-8.6%	9.4%

Note: Red text indicates a negative value

Table 8.78 Link based journey time scenario comparison (2051 core DM vs DS) inter-peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	17.7	79.9	23.5	18.5	76.3	0.0	0.8	-3.7	-0.1%	4.7%	-4.6%
	B to D	M25 J29	M25 J2	18.8	15.6	72.3	18.9	13.1	86.3	0.1	-2.5	13.9	0.3%	-15.9%	19.3%
	D to F	M25 J2	M25 J7	37.7	27.5	82.4	37.7	27.8	81.5	0.0	0.3	-0.9	0.0%	1.1%	-1.1%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	28.1	81.1	38.0	29.4	77.7	0.0	1.2	-3.4	0.0%	4.3%	-4.1%
	D to B	M25 J2	M25 J29	18.7	22.1	50.7	18.8	14.3	78.8	0.1	-7.8	28.2	0.6%	-35.3%	55.6%
	B to A	M25 J29	M25 J26	23.2	15.4	90.6	23.1	17.5	79.3	-0.1	2.1	-11.3	-0.3%	13.9%	-12.4%
A13 EB	C to G	M25 J30	A1089	5.2	5.8	54.3	5.3	4.7	67.6	0.0	-1.1	13.2	0.9%	-18.8%	24.4%
	G to H	A1089	A130	15.7	12.2	77.6	15.7	13.4	70.2	-0.1	1.2	-7.4	-0.4%	10.2%	-9.6%
A13 WB	H to G	A130	A1089	15.3	12.2	74.8	15.2	13.9	65.4	-0.1	1.7	-9.4	-0.7%	13.6%	-12.6%
	G to C	A1089	M25 J30	5.5	7.0	46.8	5.6	5.1	65.6	0.1	-1.9	18.8	1.6%	-27.5%	40.1%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	9.9	92.2	15.3	9.1	101.2	0.1	-0.8	8.9	0.5%	-8.4%	9.7%
	I to J	M2 J1	M2 J4	14.7	8.6	103.0	14.7	8.8	100.7	0.0	0.2	-2.4	0.0%	2.3%	-2.3%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	8.6	105.4	15.1	9.0	100.3	-0.1	0.4	-5.2	-0.7%	4.4%	-4.9%
	I to D	M2 J1	M25 J2	14.8	12.7	69.9	14.8	9.7	92.0	0.1	-3.0	22.1	0.6%	-23.6%	31.6%
M20 EB	E to K	M25 J3	M20 J8	35.3	20.8	102.0	35.3	20.5	103.3	0.0	-0.3	1.2	0.0%	-1.2%	1.2%
M20 WB	K to E	M20 J8	M25 J3	35.3	20.8	101.8	35.3	20.3	104.6	0.0	-0.6	2.8	0.0%	-2.6%	2.7%

Note: Red text indicates a negative value

Table 8.79 Link based journey time scenario comparison (2051 core DM vs DS) PM peak

Road	Movement	From	To	Do Minimum			Do Something			Difference			Difference (%)		
				Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance (km)	Time (mins)	Av. speed (kph)	Distance	Time	Av. speed
M25 clockwise	A to B	M25 J26	M25 J29	23.5	19.6	72.2	23.5	20.4	69.2	0.0	0.8	-3.0	-0.1%	4.2%	-4.1%
	B to D	M25 J29	M25 J2	18.8	18.3	61.8	18.9	14.1	80.5	0.1	-4.2	18.7	0.3%	-23.0%	30.3%
	D to F	M25 J2	M25 J7	37.7	25.6	88.5	37.7	26.5	85.6	0.0	0.9	-3.0	0.0%	3.5%	-3.3%
M25 anti-clockwise	F to D	M25 J7	M25 J2	38.0	33.5	68.0	38.0	34.3	66.5	0.0	0.8	-1.5	0.0%	2.3%	-2.2%
	D to B	M25 J2	M25 J29	18.7	20.7	54.3	18.8	15.0	75.4	0.1	-5.7	21.1	0.6%	-27.6%	38.9%
	B to A	M25 J29	M25 J26	23.2	15.0	92.7	23.1	16.7	83.0	-0.1	1.7	-9.8	-0.3%	11.4%	-10.5%
A13 EB	C to G	M25 J30	A1089	5.2	9.2	34.0	5.3	5.9	53.4	0.0	-3.3	19.5	0.9%	-35.9%	57.4%
	G to H	A1089	A130	15.7	13.4	70.5	15.7	15.2	61.7	-0.1	1.9	-8.8	-0.4%	13.8%	-12.5%
A13 WB	H to G	A130	A1089	15.3	13.2	69.5	15.2	15.1	60.2	-0.1	2.0	-9.4	-0.7%	14.8%	-13.5%
	G to C	A1089	M25 J30	5.5	8.2	40.2	5.6	5.4	62.4	0.1	-2.8	22.2	1.6%	-34.6%	55.2%
A2/M2 EB	D to I	M25 J2	M2 J1	15.3	15.5	59.0	15.3	11.7	78.7	0.1	-3.8	19.6	0.5%	-24.6%	33.3%
	I to J	M2 J1	M2 J4	14.7	10.0	88.2	14.7	13.1	67.3	0.0	3.1	-20.9	0.0%	31.1%	-23.7%
A2/M2 WB	J to I	M2 J4	M2 J1	15.2	9.1	100.6	15.1	9.4	96.2	-0.1	0.4	-4.4	-0.7%	3.9%	-4.4%
	I to D	M2 J1	M25 J2	14.8	16.1	54.9	14.8	11.8	75.3	0.1	-4.3	20.4	0.6%	-26.7%	37.2%
M20 EB	E to K	M25 J3	M20 J8	35.3	27.5	77.0	35.3	26.3	80.7	0.0	-1.3	3.8	0.0%	-4.7%	4.9%
M20 WB	K to E	M20 J8	M25 J3	35.3	21.2	100.0	35.3	20.7	102.5	0.0	-0.5	2.6	0.0%	-2.5%	2.6%

Note: Red text indicates a negative value

Table 8.80 Route based journey time comparison north to south movements (2051 core DM vs DS) AM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.9	68.2	54.5	61.9	66.2	56.1	0.0	-1.9	1.6	0.1%	-2.8%	3.0%
1 to 8	Cheshunt	Godstone	91.6	89.0	61.7	91.6	86.9	63.2	0.0	-2.1	1.5	0.0%	-2.3%	2.4%
1 to 9	Cheshunt	Southfleet	62.2	63.0	59.2	62.2	58.3	64.1	0.0	-4.7	4.8	0.1%	-7.5%	8.2%
1 to 10	Cheshunt	Maidstone	88.2	81.2	65.2	86.5	76.8	67.6	-1.7	-4.4	2.4	-1.9%	-5.4%	3.6%
1 to 11	Cheshunt	Rochester	74.6	80.9	55.3	70.5	68.7	61.6	-4.0	-12.2	6.3	-5.4%	-15.1%	11.4%
1 to 12	Cheshunt	Rainham	91.5	86.5	63.5	87.4	74.9	70.0	-4.1	-11.6	6.5	-4.5%	-13.4%	10.3%
2 to 7	Romford	Bexley	32.3	59.1	32.7	35.9	53.2	40.5	3.7	-5.9	7.8	11.4%	-10.0%	23.7%
2 to 8	Romford	Godstone	62.0	80.0	46.5	65.6	73.9	53.3	3.7	-6.0	6.8	5.9%	-7.6%	14.6%
2 to 9	Romford	Southfleet	32.6	54.0	36.2	36.3	45.3	48.1	3.7	-8.7	11.8	11.3%	-16.1%	32.7%
2 to 10	Romford	Maidstone	58.6	72.1	48.8	60.5	63.8	57.0	1.9	-8.4	8.2	3.3%	-11.6%	16.8%
2 to 11	Romford	Rochester	45.0	71.8	37.6	44.6	55.6	48.1	-0.4	-16.2	10.5	-0.9%	-22.5%	28.0%
2 to 12	Romford	Rainham	61.9	77.4	47.9	61.4	61.9	59.6	-0.5	-15.6	11.6	-0.7%	-20.1%	24.3%
3 to 7	Brentwood	Bexley	33.0	48.5	40.8	32.9	44.2	44.6	-0.1	-4.2	3.8	-0.2%	-8.8%	9.3%
3 to 8	Brentwood	Godstone	62.7	69.3	54.3	62.6	64.9	57.8	-0.1	-4.4	3.6	-0.1%	-6.3%	6.6%
3 to 9	Brentwood	Southfleet	33.3	43.3	46.1	33.2	36.3	55.0	-0.1	-7.0	8.8	-0.2%	-16.2%	19.1%
3 to 10	Brentwood	Maidstone	59.3	61.5	57.9	57.5	54.8	63.0	-1.8	-6.7	5.1	-3.1%	-10.9%	8.8%
3 to 11	Brentwood	Rochester	45.7	61.2	44.8	41.5	46.7	53.4	-4.2	-14.5	8.6	-9.1%	-23.7%	19.2%
3 to 12	Brentwood	Rainham	62.6	66.8	56.2	58.4	52.9	66.2	-4.2	-13.9	10.0	-6.7%	-20.8%	17.8%
4 to 7	Basildon	Bexley	39.7	61.1	39.0	39.6	56.8	41.9	-0.1	-4.3	2.9	-0.2%	-7.0%	7.4%
4 to 8	Basildon	Godstone	69.4	81.9	50.8	69.3	77.5	53.7	-0.1	-4.4	2.8	-0.1%	-5.4%	5.6%

Movement	**From**	**To**	**DM**			**DS**			**Difference**			**Difference %age**		
			Distance (km)	**Journey time (mins)**	**Average speed (km/h)**	**Distance (km)**	**Journey time (mins)**	**Average speed (km/h)**	**Distance (km)**	**Journey time (mins)**	**Average speed (km/h)**	**Distance**	**Journey time**	**Average speed**
4 to 9	Basildon	Southfleet	40.0	55.9	42.9	34.9	42.5	49.3	-5.1	-13.4	6.4	-12.7%	-24.0%	14.9%
4 to 10	Basildon	Maidstone	66.0	74.1	53.5	49.2	61.3	48.2	-16.8	-12.8	-5.3	-25.5%	-17.3%	-9.9%
4 to 11	Basildon	Rochester	52.4	73.8	42.6	36.8	52.5	42.0	-15.6	-21.3	-0.6	-29.8%	-28.9%	-1.3%
4 to 12	Basildon	Rainham	69.3	79.4	52.4	53.6	58.7	54.8	-15.7	-20.7	2.4	-22.6%	-26.1%	4.7%
5 to 7	Tilbury Port	Bexley	28.3	48.5	35.0	28.3	43.0	39.6	0.0	-5.5	4.5	0.0%	-11.4%	12.9%
5 to 8	Tilbury Port	Godstone	58.0	69.3	50.2	58.0	63.7	54.7	0.0	-5.6	4.5	0.0%	-8.1%	8.9%
5 to 9	Tilbury Port	Southfleet	28.6	43.3	39.7	27.7	28.7	58.0	-0.9	-14.6	18.4	-3.2%	-33.8%	46.3%
5 to 10	Tilbury Port	Maidstone	54.6	61.5	53.3	42.0	47.4	53.1	-12.7	-14.0	-0.2	-23.2%	-22.9%	-0.4%
5 to 11	Tilbury Port	Rochester	41.0	61.2	40.2	29.5	38.6	45.9	-11.5	-22.6	5.7	-28.0%	-36.9%	14.1%
5 to 12	Tilbury Port	Rainham	57.9	66.8	52.0	46.4	44.9	62.1	-11.5	-21.9	10.0	-19.9%	-32.8%	19.3%
6 to 7	DP World	Bexley	32.1	49.7	38.7	32.1	44.3	43.5	0.0	-5.5	4.8	0.0%	-11.0%	12.3%
6 to 8	DP World	Godstone	61.8	70.6	52.5	61.8	65.0	57.0	0.0	-5.6	4.5	0.0%	-7.9%	8.6%
6 to 9	DP World	Southfleet	32.4	44.6	43.6	29.0	27.5	63.5	-3.4	-17.1	19.8	-10.4%	-38.4%	45.4%
6 to 10	DP World	Maidstone	58.4	62.7	55.9	43.3	46.2	56.2	-15.1	-16.5	0.3	-25.9%	-26.3%	0.6%
6 to 11	DP World	Rochester	44.8	62.4	43.1	30.9	37.4	49.5	-13.9	-25.0	6.4	-31.1%	-40.1%	15.0%
6 to 12	DP World	Rainham	61.7	68.0	54.4	47.7	43.6	65.6	-14.0	-24.4	11.2	-22.7%	-35.9%	20.6%

Note: Red text indicates a negative value

Table 8.81 Route based journey time comparison north to south movements (2051 core DM vs DS) inter-peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.9	55.3	67.2	61.9	54.0	68.8	0.0	-1.3	1.6	0.0%	-2.3%	2.4%
1 to 8	Cheshunt	Godstone	91.6	73.6	74.6	91.6	72.3	76.0	0.0	-1.4	1.4	0.0%	-1.8%	1.9%
1 to 9	Cheshunt	Southfleet	62.2	52.9	70.5	62.2	50.6	73.8	0.0	-2.3	3.3	0.0%	-4.4%	4.6%
1 to 10	Cheshunt	Maidstone	88.2	69.9	75.7	82.9	65.5	75.9	-5.3	-4.4	0.2	-6.0%	-6.3%	0.3%
1 to 11	Cheshunt	Rochester	74.6	67.1	66.6	70.3	60.4	69.9	-4.2	-6.8	3.3	-5.7%	-10.1%	4.9%
1 to 12	Cheshunt	Rainham	91.5	75.4	72.8	87.4	68.7	76.3	-4.1	-6.7	3.5	-4.5%	-8.9%	4.8%
2 to 7	Romford	Bexley	35.6	44.2	48.3	35.6	40.3	52.9	0.0	-3.9	4.7	0.0%	-8.8%	9.7%
2 to 8	Romford	Godstone	65.2	62.6	62.5	65.3	58.6	66.8	0.0	-4.0	4.3	0.0%	-6.4%	6.8%
2 to 9	Romford	Southfleet	35.9	41.9	51.4	35.9	36.9	58.3	0.0	-5.0	6.9	0.0%	-11.9%	13.5%
2 to 10	Romford	Maidstone	61.9	58.9	63.1	56.6	51.8	65.5	-5.3	-7.0	2.4	-8.6%	-11.9%	3.8%
2 to 11	Romford	Rochester	48.2	56.1	51.6	44.0	46.7	56.5	-4.2	-9.4	5.0	-8.8%	-16.7%	9.6%
2 to 12	Romford	Rainham	65.2	64.4	60.7	61.0	55.1	66.5	-4.1	-9.3	5.8	-6.3%	-14.5%	9.6%
3 to 7	Brentwood	Bexley	33.0	36.1	54.9	32.9	33.6	58.8	-0.1	-2.5	3.9	-0.3%	-6.8%	7.1%
3 to 8	Brentwood	Godstone	62.7	54.4	69.1	62.6	51.9	72.4	-0.1	-2.6	3.3	-0.1%	-4.7%	4.8%
3 to 9	Brentwood	Southfleet	33.3	33.7	59.3	33.2	30.2	66.0	-0.1	-3.5	6.8	-0.3%	-10.5%	11.4%
3 to 10	Brentwood	Maidstone	59.3	50.7	70.2	53.9	45.1	71.7	-5.4	-5.6	1.5	-9.1%	-11.0%	2.1%
3 to 11	Brentwood	Rochester	45.7	47.9	57.1	41.3	40.0	62.0	-4.3	-8.0	4.9	-9.4%	-16.6%	8.6%
3 to 12	Brentwood	Rainham	62.6	56.2	66.8	58.4	48.3	72.5	-4.2	-7.9	5.7	-6.7%	-14.1%	8.5%
4 to 7	Basildon	Bexley	39.7	40.7	58.5	39.6	37.9	62.8	-0.1	-2.8	4.3	-0.2%	-7.0%	7.3%
4 to 8	Basildon	Godstone	69.4	59.1	70.5	69.3	56.2	74.1	-0.1	-2.9	3.6	-0.1%	-5.0%	5.1%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	40.0	38.4	62.6	33.8	30.0	67.6	-6.3	-8.4	5.0	-15.7%	-21.9%	8.0%
4 to 10	Basildon	Maidstone	66.1	55.3	71.6	48.0	43.2	66.6	-18.1	-12.1	-5.0	-27.4%	-21.9%	-7.0%
4 to 11	Basildon	Rochester	52.4	52.6	59.7	35.4	38.1	55.7	-17.0	-14.5	-4.0	-32.4%	-27.6%	-6.7%
4 to 12	Basildon	Rainham	69.3	60.9	68.3	52.4	46.5	67.7	-16.9	-14.4	-0.6	-24.4%	-23.7%	-0.8%
5 to 7	Tilbury Port	Bexley	28.3	32.3	52.6	28.3	28.6	59.4	0.0	-3.7	6.8	0.0%	-11.4%	12.9%
5 to 8	Tilbury Port	Godstone	58.0	50.7	68.7	58.0	46.9	74.2	0.0	-3.8	5.5	0.0%	-7.4%	8.0%
5 to 9	Tilbury Port	Southfleet	28.6	30.0	57.3	27.7	20.1	82.7	-0.9	-9.9	25.4	-3.2%	-32.9%	44.3%
5 to 10	Tilbury Port	Maidstone	54.6	46.9	69.8	41.9	33.4	75.4	-12.7	-13.6	5.5	-23.3%	-28.9%	7.9%
5 to 11	Tilbury Port	Rochester	41.0	44.2	55.6	29.3	28.2	62.4	-11.6	-16.0	6.7	-28.4%	-36.1%	12.1%
5 to 12	Tilbury Port	Rainham	57.9	52.5	66.2	46.4	36.6	76.1	-11.5	-15.9	9.9	-19.9%	-30.3%	14.9%
6 to 7	DP World	Bexley	32.1	35.9	53.7	32.1	32.7	58.9	0.0	-3.2	5.2	0.0%	-8.8%	9.6%
6 to 8	DP World	Godstone	61.8	54.3	68.3	61.8	51.0	72.7	0.0	-3.3	4.3	0.0%	-6.0%	6.4%
6 to 9	DP World	Southfleet	32.4	33.6	58.0	29.0	22.6	77.0	-3.4	-10.9	19.1	-10.4%	-32.6%	32.9%
6 to 10	DP World	Maidstone	58.4	50.5	69.4	43.2	35.9	72.3	-15.2	-14.6	2.9	-26.0%	-29.0%	4.2%
6 to 11	DP World	Rochester	44.8	47.8	56.2	30.7	30.7	59.8	-14.1	-17.0	3.6	-31.5%	-35.6%	6.4%
6 to 12	DP World	Rainham	61.7	56.1	66.0	47.7	39.1	73.2	-14.0	-17.0	7.2	-22.7%	-30.3%	10.9%

Note: Red text indicates a negative value

Table 8.82 Route based journey time comparison north to south movements (2051 core DM vs DS) PM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
1 to 7	Cheshunt	Bexley	61.8	65.7	56.5	61.9	63.3	58.6	0.0	-2.3	2.1	0.1%	-3.5%	3.7%
1 to 8	Cheshunt	Godstone	91.5	80.3	68.4	91.5	77.8	70.6	0.0	-2.5	2.2	0.0%	-3.1%	3.2%
1 to 9	Cheshunt	Southfleet	60.7	61.8	58.9	62.2	57.0	65.5	1.4	-4.8	6.5	2.4%	-7.8%	11.1%
1 to 10	Cheshunt	Maidstone	88.2	83.4	63.4	82.9	78.0	63.8	-5.3	-5.5	0.4	-6.0%	-6.5%	0.6%
1 to 11	Cheshunt	Rochester	74.8	83.2	53.9	70.6	72.2	58.7	-4.2	-11.0	4.8	-5.6%	-13.2%	8.8%
1 to 12	Cheshunt	Rainham	91.4	99.0	55.4	87.3	88.4	59.3	-4.1	-10.6	3.9	-4.5%	-10.7%	6.9%
2 to 7	Romford	Bexley	38.0	56.1	40.6	36.1	50.9	42.6	-1.8	-5.3	2.0	-4.8%	-9.4%	5.0%
2 to 8	Romford	Godstone	67.6	70.8	57.3	65.8	65.3	60.4	-1.8	-5.4	3.1	-2.7%	-7.7%	5.4%
2 to 9	Romford	Southfleet	36.9	52.3	42.3	36.4	44.5	49.1	-0.4	-7.8	6.8	-1.1%	-14.9%	16.2%
2 to 10	Romford	Maidstone	64.3	73.9	52.2	57.1	65.5	52.3	-7.2	-8.4	0.1	-11.1%	-11.4%	0.2%
2 to 11	Romford	Rochester	50.9	73.7	41.5	44.9	59.8	45.1	-6.0	-14.0	3.6	-11.9%	-18.9%	8.7%
2 to 12	Romford	Rainham	67.5	89.5	45.3	61.6	75.9	48.7	-6.0	-13.5	3.4	-8.8%	-15.1%	7.4%
3 to 7	Brentwood	Bexley	33.0	45.0	44.0	32.9	41.1	48.1	-0.1	-3.9	4.1	-0.3%	-8.7%	9.2%
3 to 8	Brentwood	Godstone	62.7	59.6	63.1	62.6	55.5	67.6	-0.1	-4.1	4.6	-0.1%	-6.9%	7.2%
3 to 9	Brentwood	Southfleet	31.9	41.1	46.5	33.2	34.7	57.5	1.3	-6.5	11.0	4.2%	-15.7%	23.6%
3 to 10	Brentwood	Maidstone	59.3	62.8	56.7	53.9	55.7	58.1	-5.4	-7.1	1.4	-9.1%	-11.2%	2.4%
3 to 11	Brentwood	Rochester	46.0	62.5	44.1	41.7	49.9	50.1	-4.3	-12.6	6.0	-9.3%	-20.2%	13.6%
3 to 12	Brentwood	Rainham	62.6	78.3	48.0	58.4	66.1	53.0	-4.2	-12.2	5.0	-6.7%	-15.6%	10.5%
4 to 7	Basildon	Bexley	36.8	49.6	44.5	39.6	47.7	49.9	2.8	-2.0	5.4	7.6%	-4.0%	12.1%
4 to 8	Basildon	Godstone	66.5	64.3	62.1	69.3	62.1	66.9	2.8	-2.1	4.9	4.2%	-3.3%	7.8%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
4 to 9	Basildon	Southfleet	35.7	45.8	46.8	33.8	33.9	59.7	-2.0	-11.8	12.9	-5.5%	-25.9%	27.5%
4 to 10	Basildon	Maidstone	63.2	67.4	56.2	48.0	53.2	54.1	-15.2	-14.2	-2.1	-24.1%	-21.1%	-3.7%
4 to 11	Basildon	Rochester	49.8	67.2	44.5	35.7	47.4	45.2	-14.1	-19.8	0.7	-28.3%	-29.4%	1.7%
4 to 12	Basildon	Rainham	66.4	82.9	48.0	52.4	63.6	49.5	-14.0	-19.4	1.4	-21.1%	-23.3%	3.0%
5 to 7	Tilbury Port	Bexley	28.3	38.8	43.8	28.3	33.8	50.3	0.0	-5.0	6.5	0.0%	-13.0%	14.9%
5 to 8	Tilbury Port	Godstone	58.0	53.4	65.1	58.0	48.2	72.2	0.0	-5.2	7.0	0.0%	-9.7%	10.8%
5 to 9	Tilbury Port	Southfleet	27.2	34.9	46.7	27.7	21.7	76.5	0.5	-13.2	29.8	1.8%	-37.8%	63.8%
5 to 10	Tilbury Port	Maidstone	54.6	56.6	58.0	41.9	41.0	61.4	-12.7	-15.6	3.4	-23.3%	-27.6%	5.9%
5 to 11	Tilbury Port	Rochester	41.3	56.4	44.0	29.7	35.2	50.6	-11.6	-21.2	6.6	-28.1%	-37.5%	15.1%
5 to 12	Tilbury Port	Rainham	57.9	72.1	48.2	46.4	51.4	54.2	-11.5	-20.7	6.0	-19.9%	-28.7%	12.4%
6 to 7	DP World	Bexley	32.1	42.9	44.9	32.1	40.9	47.1	0.0	-2.0	2.2	-0.1%	-4.6%	4.8%
6 to 8	DP World	Godstone	61.8	57.5	64.5	61.8	55.3	67.0	0.0	-2.2	2.5	0.0%	-3.7%	3.9%
6 to 9	DP World	Southfleet	31.0	39.0	47.7	29.0	27.3	63.9	-2.0	-11.7	16.2	-6.3%	-30.1%	34.0%
6 to 10	DP World	Maidstone	58.4	60.7	57.8	43.2	46.5	55.8	-15.2	-14.1	-2.0	-26.0%	-23.3%	-3.5%
6 to 11	DP World	Rochester	45.1	60.4	44.8	31.0	40.8	45.6	-14.1	-19.7	0.9	-31.2%	-32.6%	2.0%
6 to 12	DP World	Rainham	61.7	76.2	48.6	47.7	56.9	50.3	-14.0	-19.2	1.7	-22.7%	-25.3%	3.5%

Note: Red text indicates a negative value

Table 8.83 Route based journey time comparison south to north movements (2051 core DM vs DS) AM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	62.7	58.9	61.6	59.7	62.0	0.0	-3.1	3.1	0.1%	-4.9%	5.2%
7 to 2	Bexley	Romford	34.7	48.6	42.9	34.8	42.3	49.4	0.1	-6.4	6.6	0.2%	-13.1%	15.3%
7 to 3	Bexley	Brentwood	33.1	44.1	45.1	32.7	38.8	50.4	-0.5	-5.2	5.3	-1.5%	-11.9%	11.8%
7 to 4	Bexley	Basildon	36.8	45.8	48.3	36.8	38.0	58.1	0.0	-7.8	9.8	-0.1%	-17.0%	20.4%
7 to 5	Bexley	Tilbury Port	28.6	39.2	43.7	28.6	30.5	56.2	0.0	-8.7	12.5	-0.1%	-22.3%	28.6%
7 to 6	Bexley	DP World	32.4	41.5	46.9	32.4	33.9	57.2	0.0	-7.5	10.4	-0.1%	-18.2%	22.1%
8 to 1	Godstone	Cheshunt	91.8	85.6	64.3	91.8	83.0	66.4	0.0	-2.6	2.1	0.1%	-3.0%	3.2%
8 to 2	Godstone	Romford	64.9	71.5	54.5	65.0	65.6	59.5	0.1	-5.9	5.0	0.1%	-8.2%	9.1%
8 to 3	Godstone	Brentwood	63.3	66.9	56.8	62.8	62.2	60.6	-0.5	-4.8	3.9	-0.8%	-7.1%	6.9%
8 to 4	Godstone	Basildon	67.0	68.7	58.6	67.0	61.3	65.5	0.0	-7.3	7.0	0.0%	-10.7%	11.9%
8 to 5	Godstone	Tilbury Port	58.7	62.1	56.7	58.7	53.8	65.5	0.0	-8.3	8.7	0.0%	-13.3%	15.4%
8 to 6	Godstone	DP World	62.6	64.3	58.4	62.6	57.3	65.5	0.0	-7.1	7.2	0.0%	-11.0%	12.3%
9 to 1	Southfleet	Cheshunt	60.7	62.6	58.2	60.8	57.8	63.1	0.0	-4.8	4.9	0.1%	-7.7%	8.5%
9 to 2	Southfleet	Romford	33.9	48.5	41.9	34.0	40.4	50.4	0.1	-8.1	8.6	0.3%	-16.8%	20.5%
9 to 3	Southfleet	Brentwood	32.3	44.0	44.0	31.8	37.0	51.6	-0.5	-7.0	7.6	-1.5%	-15.9%	17.2%
9 to 4	Southfleet	Basildon	36.0	45.7	47.2	35.8	30.6	70.2	-0.1	-15.1	23.0	-0.4%	-33.0%	48.8%
9 to 5	Southfleet	Tilbury Port	27.7	39.2	42.4	31.4	26.8	70.4	3.7	-12.4	28.0	13.4%	-31.7%	66.0%
9 to 6	Southfleet	DP World	31.5	41.4	45.7	31.4	26.5	71.0	-0.1	-14.8	25.3	-0.4%	-35.8%	55.2%
10 to 1	Maidstone	Cheshunt	88.3	87.0	60.9	83.3	78.1	64.0	-5.0	-8.9	3.1	-5.6%	-10.3%	5.2%
10 to 2	Maidstone	Romford	61.4	72.9	50.5	56.5	60.3	56.2	-4.9	-12.6	5.6	-8.0%	-17.2%	11.1%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	68.4	52.5	54.3	56.9	57.2	-5.5	-11.4	4.7	-9.2%	-16.7%	9.0%
10 to 4	Maidstone	Basildon	63.5	70.1	54.4	50.3	48.2	62.6	-13.2	-21.9	8.3	-20.8%	-31.2%	15.2%
10 to 5	Maidstone	Tilbury Port	55.2	63.6	52.2	45.9	44.3	62.1	-9.4	-19.2	9.9	-16.9%	-30.2%	19.1%
10 to 6	Maidstone	DP World	59.1	65.8	53.9	45.9	44.1	62.4	-13.2	-21.6	8.5	-22.3%	-32.9%	15.8%
11 to 1	Rochester	Cheshunt	76.3	90.8	50.4	70.6	72.5	58.4	-5.7	-18.4	8.0	-7.5%	-20.2%	16.0%
11 to 2	Rochester	Romford	49.4	76.7	38.6	43.7	54.7	47.9	-5.6	-22.0	9.3	-11.4%	-28.7%	24.2%
11 to 3	Rochester	Brentwood	47.8	72.2	39.7	41.6	51.3	48.6	-6.2	-20.9	8.9	-13.0%	-28.9%	22.3%
11 to 4	Rochester	Basildon	51.5	73.9	41.8	37.6	42.6	52.9	-13.9	-31.3	11.1	-27.0%	-42.4%	26.6%
11 to 5	Rochester	Tilbury Port	43.2	67.4	38.5	33.1	38.7	51.3	-10.1	-28.6	12.8	-23.3%	-42.5%	33.4%
11 to 6	Rochester	DP World	47.1	69.6	40.6	33.1	38.5	51.6	-13.9	-31.1	11.0	-29.6%	-44.7%	27.2%
12 to 1	Rainham	Cheshunt	91.7	107.2	51.3	87.7	88.2	59.6	-4.0	-19.0	8.3	-4.4%	-17.7%	16.2%
12 to 2	Rainham	Romford	64.8	93.1	41.8	60.8	70.4	51.8	-4.0	-22.6	10.0	-6.2%	-24.3%	24.0%
12 to 3	Rainham	Brentwood	63.3	88.5	42.9	58.7	67.0	52.5	-4.6	-21.5	9.6	-7.2%	-24.3%	22.5%
12 to 4	Rainham	Basildon	67.0	90.2	44.5	54.7	58.3	56.3	-12.3	-31.9	11.8	-18.3%	-35.4%	26.4%
12 to 5	Rainham	Tilbury Port	58.7	83.7	42.1	50.2	54.4	55.4	-8.4	-29.3	13.3	-14.4%	-35.0%	31.7%
12 to 6	Rainham	DP World	62.5	85.9	43.7	50.2	54.2	55.6	-12.3	-31.7	11.9	-19.6%	-36.9%	27.3%

Note: Red text indicates a negative value

Table 8.84 Route based journey time comparison south to north movements (2051 core DM vs DS) inter-peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	60.1	61.5	61.6	55.7	66.4	0.0	-4.4	4.9	0.1%	-7.3%	8.0%
7 to 2	Bexley	Romford	35.8	45.0	47.8	35.8	38.0	56.6	0.0	-7.0	8.8	0.0%	-15.5%	18.3%
7 to 3	Bexley	Brentwood	33.1	42.8	46.5	33.2	36.1	55.2	0.0	-6.7	8.7	0.1%	-15.7%	18.7%
7 to 4	Bexley	Basildon	36.8	46.6	47.4	36.8	38.5	57.4	0.0	-8.1	10.0	0.0%	-17.4%	21.1%
7 to 5	Bexley	Tilbury Port	31.9	42.6	45.0	31.9	34.0	56.4	0.0	-8.6	11.4	0.0%	-20.3%	25.4%
7 to 6	Bexley	DP World	32.4	42.0	46.3	32.4	34.1	57.1	0.0	-8.0	10.8	0.0%	-19.0%	23.4%
8 to 1	Godstone	Cheshunt	91.8	81.6	67.4	91.8	77.7	70.9	0.0	-3.9	3.4	0.1%	-4.8%	5.1%
8 to 2	Godstone	Romford	66.0	66.5	59.5	66.0	60.0	66.0	0.0	-6.5	6.4	0.0%	-9.7%	10.8%
8 to 3	Godstone	Brentwood	63.3	64.4	59.0	63.4	58.2	65.4	0.0	-6.2	6.3	0.1%	-9.6%	10.7%
8 to 4	Godstone	Basildon	67.0	68.2	59.0	67.0	60.6	66.4	0.0	-7.6	7.4	0.0%	-11.2%	12.6%
8 to 5	Godstone	Tilbury Port	62.1	64.1	58.1	62.1	56.0	66.5	0.0	-8.1	8.4	0.0%	-12.7%	14.5%
8 to 6	Godstone	DP World	62.6	63.6	59.1	62.6	56.1	66.9	0.0	-7.5	7.9	0.0%	-11.8%	13.3%
9 to 1	Southfleet	Cheshunt	60.7	59.3	61.4	60.8	52.8	69.0	0.0	-6.5	7.6	0.1%	-10.9%	12.4%
9 to 2	Southfleet	Romford	35.0	44.2	47.5	35.0	35.1	59.7	0.0	-9.0	12.2	0.0%	-20.5%	25.8%
9 to 3	Southfleet	Brentwood	32.3	42.0	46.1	32.3	33.2	58.4	0.0	-8.8	12.3	0.2%	-20.9%	26.6%
9 to 4	Southfleet	Basildon	36.0	45.8	47.1	35.8	29.7	72.5	-0.1	-16.2	25.4	-0.4%	-35.3%	54.0%
9 to 5	Southfleet	Tilbury Port	31.1	41.8	44.6	34.8	28.7	72.8	3.7	-13.1	28.2	12.0%	-31.4%	63.1%
9 to 6	Southfleet	DP World	31.5	41.2	45.9	31.4	25.2	74.8	-0.1	-16.0	28.9	-0.4%	-38.9%	62.9%
10 to 1	Maidstone	Cheshunt	88.3	77.0	68.8	83.3	66.5	75.2	-5.0	-10.5	6.3	-5.6%	-13.6%	9.2%
10 to 2	Maidstone	Romford	62.5	61.8	60.6	57.5	48.7	70.8	-5.0	-13.1	10.2	-8.0%	-21.2%	16.7%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	59.7	60.1	54.9	46.0	71.6	-4.9	-13.7	11.4	-8.3%	-22.9%	19.0%
10 to 4	Maidstone	Basildon	63.5	63.5	60.0	50.3	41.3	73.1	-13.2	-22.2	13.1	-20.8%	-35.0%	21.8%
10 to 5	Maidstone	Tilbury Port	58.6	59.5	59.1	49.2	40.3	73.3	-9.4	-19.1	14.2	-16.0%	-32.2%	23.9%
10 to 6	Maidstone	DP World	59.1	58.9	60.2	45.9	36.8	74.7	-13.2	-22.1	14.5	-22.3%	-37.5%	24.2%
11 to 1	Rochester	Cheshunt	74.5	77.9	57.4	70.3	63.0	67.0	-4.2	-14.9	9.6	-5.6%	-19.2%	16.8%
11 to 2	Rochester	Romford	48.7	62.7	46.6	44.5	45.2	59.1	-4.2	-17.6	12.5	-8.7%	-28.0%	26.8%
11 to 3	Rochester	Brentwood	46.0	60.6	45.6	41.9	42.4	59.2	-4.2	-18.1	13.6	-9.0%	-29.9%	29.8%
11 to 4	Rochester	Basildon	49.7	64.4	46.3	37.3	37.7	59.3	-12.4	-26.7	13.0	-25.0%	-41.4%	28.0%
11 to 5	Rochester	Tilbury Port	44.8	60.4	44.5	36.2	36.8	59.1	-8.6	-23.6	14.6	-19.1%	-39.1%	32.8%
11 to 6	Rochester	DP World	45.3	59.8	45.4	32.9	33.3	59.2	-12.4	-26.5	13.8	-27.4%	-44.3%	30.4%
12 to 1	Rainham	Cheshunt	91.7	86.5	63.6	87.7	71.2	73.8	-4.0	-15.3	10.3	-4.4%	-17.7%	16.1%
12 to 2	Rainham	Romford	65.9	71.4	55.4	61.8	53.4	69.4	-4.1	-17.9	14.0	-6.2%	-25.1%	25.3%
12 to 3	Rainham	Brentwood	63.3	69.2	54.8	59.2	50.7	70.1	-4.0	-18.5	15.2	-6.4%	-26.7%	27.8%
12 to 4	Rainham	Basildon	67.0	73.1	55.0	54.7	46.0	71.3	-12.3	-27.0	16.3	-18.3%	-37.0%	29.7%
12 to 5	Rainham	Tilbury Port	62.0	69.0	53.9	53.6	45.0	71.4	-8.4	-24.0	17.5	-13.6%	-34.7%	32.4%
12 to 6	Rainham	DP World	62.5	68.5	54.8	50.2	41.6	72.5	-12.3	-26.9	17.7	-19.6%	-39.3%	32.4%

Note: Red text indicates a negative value

Table 8.85 Route based journey time comparison south to north movements (2051 core DM vs DS) PM peak

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
7 to 1	Bexley	Cheshunt	61.6	64.8	57.0	61.6	61.3	60.3	0.0	-3.5	3.3	0.1%	-5.5%	5.8%
7 to 2	Bexley	Romford	34.8	50.6	41.2	34.8	44.7	46.6	0.0	-5.9	5.4	-0.1%	-11.6%	13.0%
7 to 3	Bexley	Brentwood	33.1	43.3	46.0	33.2	38.4	51.8	0.0	-4.8	5.8	0.1%	-11.2%	12.7%
7 to 4	Bexley	Basildon	36.8	52.9	41.8	36.8	45.3	48.8	0.0	-7.6	7.0	-0.1%	-14.3%	16.7%
7 to 5	Bexley	Tilbury Port	28.6	42.2	40.6	28.6	33.7	50.9	0.0	-8.5	10.3	0.0%	-20.2%	25.3%
7 to 6	Bexley	DP World	32.4	46.5	41.8	32.4	39.0	49.8	0.0	-7.5	8.1	-0.1%	-16.2%	19.3%
8 to 1	Godstone	Cheshunt	91.2	89.6	61.1	91.3	86.9	63.0	0.1	-2.7	1.9	0.1%	-3.0%	3.1%
8 to 2	Godstone	Romford	64.4	75.4	51.3	64.4	70.4	54.9	0.0	-5.0	3.6	0.0%	-6.6%	7.1%
8 to 3	Godstone	Brentwood	62.8	68.0	55.4	62.8	64.1	58.9	0.0	-4.0	3.5	0.1%	-5.8%	6.2%
8 to 4	Godstone	Basildon	66.5	77.7	51.4	66.5	70.9	56.2	0.0	-6.7	4.8	0.0%	-8.6%	9.4%
8 to 5	Godstone	Tilbury Port	58.2	67.0	52.2	58.2	59.3	58.9	0.0	-7.7	6.7	0.0%	-11.4%	12.9%
8 to 6	Godstone	DP World	62.0	71.3	52.2	62.0	64.6	57.6	0.0	-6.7	5.4	0.0%	-9.4%	10.3%
9 to 1	Southfleet	Cheshunt	60.7	62.3	58.5	60.8	57.5	63.4	0.0	-4.7	4.9	0.1%	-7.6%	8.3%
9 to 2	Southfleet	Romford	33.9	48.0	42.4	33.9	41.0	49.6	0.0	-7.0	7.3	0.0%	-14.7%	17.1%
9 to 3	Southfleet	Brentwood	32.3	40.7	47.6	32.3	34.7	55.9	0.0	-6.0	8.3	0.1%	-14.8%	17.5%
9 to 4	Southfleet	Basildon	36.0	50.3	42.9	35.9	36.1	59.6	-0.1	-14.2	16.7	-0.3%	-28.2%	38.9%
9 to 5	Southfleet	Tilbury Port	27.7	39.6	41.9	31.4	28.8	65.3	3.7	-10.8	23.4	13.4%	-27.2%	55.9%
9 to 6	Southfleet	DP World	31.5	44.0	43.0	31.4	29.8	63.3	-0.1	-14.2	20.2	-0.3%	-32.2%	47.0%
10 to 1	Maidstone	Cheshunt	88.3	82.1	64.5	83.3	76.7	65.2	-5.0	-5.4	0.7	-5.6%	-6.6%	1.1%
10 to 2	Maidstone	Romford	61.5	67.9	54.3	56.4	60.1	56.3	-5.0	-7.8	2.0	-8.2%	-11.5%	3.7%

Movement	From	To	DM			DS			Difference			Difference %age		
			Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance (km)	Journey time (mins)	Average speed (km/h)	Distance	Journey time	Average speed
10 to 3	Maidstone	Brentwood	59.8	60.6	59.3	54.9	53.6	61.4	-4.9	-7.0	2.2	-8.3%	-11.5%	3.7%
10 to 4	Maidstone	Basildon	63.5	70.2	54.3	50.3	51.1	59.1	-13.2	-19.1	4.8	-20.8%	-27.2%	8.8%
10 to 5	Maidstone	Tilbury Port	55.2	59.5	55.7	45.9	43.8	62.8	-9.4	-15.7	7.2	-16.9%	-26.4%	12.8%
10 to 6	Maidstone	DP World	59.1	63.8	55.5	45.9	44.8	61.5	-13.2	-19.1	6.0	-22.3%	-29.9%	10.7%
11 to 1	Rochester	Cheshunt	74.5	90.7	49.3	70.3	74.4	56.7	-4.2	-16.3	7.4	-5.6%	-18.0%	15.1%
11 to 2	Rochester	Romford	47.7	76.4	37.4	43.4	57.8	45.1	-4.2	-18.7	7.7	-8.9%	-24.4%	20.5%
11 to 3	Rochester	Brentwood	46.0	69.1	40.0	41.9	51.3	49.0	-4.2	-17.8	9.0	-9.0%	-25.8%	22.6%
11 to 4	Rochester	Basildon	49.7	78.7	37.9	37.3	48.8	45.9	-12.4	-30.0	8.0	-25.0%	-38.1%	21.2%
11 to 5	Rochester	Tilbury Port	41.4	68.1	36.5	32.9	41.5	47.6	-8.6	-26.6	11.0	-20.7%	-39.1%	30.2%
11 to 6	Rochester	DP World	45.3	72.4	37.5	32.9	42.4	46.5	-12.4	-30.0	8.9	-27.4%	-41.4%	23.8%
12 to 1	Rainham	Cheshunt	91.7	95.9	57.4	87.7	78.9	66.7	-4.0	-17.0	9.3	-4.4%	-17.8%	16.2%
12 to 2	Rainham	Romford	64.9	81.7	47.7	60.8	62.3	58.5	-4.1	-19.4	10.9	-6.3%	-23.7%	22.8%
12 to 3	Rainham	Brentwood	63.2	74.3	51.0	59.2	55.8	63.7	-4.0	-18.6	12.7	-6.4%	-25.0%	24.8%
12 to 4	Rainham	Basildon	66.9	84.0	47.8	54.7	53.3	61.6	-12.3	-30.7	13.7	-18.3%	-36.6%	28.7%
12 to 5	Rainham	Tilbury Port	58.7	73.3	48.0	50.2	46.0	65.5	-8.4	-27.3	17.5	-14.4%	-37.3%	36.5%
12 to 6	Rainham	DP World	62.5	77.6	48.3	50.2	46.9	64.2	-12.3	-30.7	15.9	-19.6%	-39.5%	32.9%

Note: Red text indicates a negative value

Commentary on the results

8.5.14 Table 8.65 to Table 8.70 demonstrate that the highway assignment models for each time period in the Do Minimum and Do Something scenarios have converged well within the TAG recommended convergence limits.

8.5.15 The select link analysis presented in Plate 8.40 to Plate 8.48 and associated Table 8.71 to Table 8.73 shows that the introduction of the Project has a significant impact on the patterns of movement using the Dartford Crossing. In particular, there is a substantial reduction in traffic to/from east Kent using the Dartford Crossing with the Project. As would be expected, in the Do Something situation the majority of this traffic uses the Project. There is also a substantial reduction north of the River Thames in trips to/from M25 north.

8.5.16 There is a large relative increase in the number of trips using the Dartford Crossing from within London both north and south of the River Thames. This is likely due to route switching of travellers from using Silvertown/Blackwall in the Do Minimum scenario to using the Dartford Crossing in the Do Something scenario due to the newly available capacity. This will also be caused by an increase in shorter distance trips switching destinations to cross the River Thames in the Do Something scenario. These movements are suppressed in the Do Minimum scenario due to the lack of available capacity at the Dartford Crossing.

8.5.17 Movements using the Project are predominantly from/to east Kent, M25 north and the A13 east of the junction with the Project. In the south there is some local traffic (approximately 910–1,360 PCU/hr in the peak hours) and relatively few trips to/from Kent west of the Project's junction with the A2 using the Project (approximately 670–820 PCU/hr in the peak hours) and zero trips from M25 south of the A2 junction using the Project. These movements will continue to use the Dartford Crossing as to use the Project requires a considerable detour. In the north there is traffic to/from the A1089 using the Project (up to 980 PCU/hr in the peak hours). These patterns of movement are consistent across all time periods and accord well with *a priori* expectations.

8.5.18 Comparisons of traffic flows in the Do Minimum and Do Something scenarios are presented in Plate 8.49 to Plate 8.51 and in Table 8.74 to Table 8.76. Initially focussing on the impact of the Project on flows at the Dartford Crossing, it can be observed that the model is predicting a substantial reduction in flow. In the southbound direction, in the Do Minimum scenario, the AM and PM peaks are at capacity (V/C ratio of 1.0) and the inter-peak is approaching capacity (V/C ratio of 0.95). In the Do Something scenario, the model predicted flows at the Dartford Crossing are reduced by between 0% and 18%. There is no reduction in flow in the AM peak which leads to operating conditions at capacity (V/C ratio of 1.00). The PM peak and inter-peak experience under capacity conditions with V/C ratios 0.82 and 0.78 respectively.

8.5.19 In the northbound direction, in the Do Minimum scenario, the flows at the Dartford Crossing exceed the capacity of the TMC in all time periods with V/C ratios of between 1.11 and 1.16. In the AM and PM peaks the flows approaching the TMC exceed the capacity by between 800 and 1,060 PCU/hr. In the Do Something scenario these flows are significantly reduced by between 13% and 16%. In the PM peak the flow approaching the TMC exceeds the capacity of the TMC by a small amount (approximately 50 PCU/hr). In the inter-peak and AM peak the flows approaching the TMC are slightly below its capacity leading to V/C ratios of 0.95 and 0.94 respectively.

8.5.20 In particular, there is a substantial reduction in HGVs using the Dartford Crossing both northbound and southbound in all time periods, in the Do Something scenario compared to the Do Minimum scenario. This is due to the alignment of the Project making it a very favourable route for HGVs accessing the ports in Kent and Essex. The reduction in HGV flow in the Do Something scenario frees up additional capacity at the Dartford Crossing for car users, this is particularly evident when viewing the northbound flows after the TMC, where car flow is predicted to increase by between 8% and 16% across the different time periods with the introduction of the Project.

8.5.21 The Project tunnel is operating well under capacity in both directions with V/C ratios of between 0.54 and 0.75 in the southbound direction and 0.67 to 0.82 in the northbound direction. It can also be observed that in 2051, the flow on the Project is significantly over two full lanes worth of traffic southbound in the PM peak and northbound in all periods. More detailed information on the flows along the different sections of the Project and at its junctions is provided in Chapter 10.

8.5.22 When looking at both crossings combined, it can be seen that in the Do Something scenario there is sufficient cross-river capacity with V/C ratios of between 0.68 and 0.84 in the southbound direction and 0.84 to 0.88 in the northbound direction. This is in stark contrast to the Do Minimum situation where the Dartford Crossing is heavily congested in all time periods, likely leading to long queues, unreliable journey times and a higher rate of incidents.

8.5.23 The analysis shows that there are associated reductions in traffic flows along the A2 and A13 west of their junctions with the Project and also on the M20. These reductions in flow lead to reductions in congestion along these corridors. This is one of the major benefits of the Project and is from which a significant proportion of the economic benefits of the Project are derived.

8.5.24 There are also some increases in flow in the Do Something scenario compared to the Do Minimum scenario on the A2/M2 corridor east of the Project, the A13 east of the Project and on M25 north of the Project. This is caused by the Project drawing more traffic to cross the River Thames than in the constrained Do Minimum scenario. This increase in flow leads to additional congestion in these corridors and leads to disbenefits of introducing the Project. Some of these increases in flow increase congestion in these corridors. In particular, M25 junctions 28–29 and A13 Orsett Cock to Manor Way (and the reverse directions) are significantly worse in the Do Something scenario when compared with the Do Minimum scenario. M2 junctions 1–2 is also significantly worse in the Do Something scenario and is congested westbound in the AM peak and eastbound in the PM peak.

8.5.25 These benefits and disbenefits are further illustrated by the link-based journey time analysis presented in Table 8.77 to Table 8.79. It can be observed that there are substantial increases in speed in the Dartford Crossing corridor between M25 junction 29 and M25 junction 2 in both directions (up to a 23km/h increase in all periods in the northbound direction). There are also significant journey time savings on the A2 between the junction with the Project and the M25 and on the A13 between the junction with the Project and the M25. There are also some predicted reductions in speed on the A2 and A13 east of their junctions with the Project and on the wider M25 both north and south of the River Thames. This is in line with the increases in flows predicted in those corridors. This pattern is relatively consistent across all time periods.

8.5.26 There is additional detailed link-based journey time analysis presented in Annex C.

8.5.27 The route-based journey times presented in Table 8.80 to Table 8.85 show cross-river movements. As expected, all cross-river movements experience improved journey times in the Do Something scenario when compared to the Do Minimum. Some cross-river movements also benefit substantially from a reduced journey distance. Using the Project rather than the Dartford Crossing provides a significant distance saving for movements to/from east Kent to/from east Essex.

8.5.28 It is for this reason that it is considered necessary to undertake a full 24 hours per day, 365 days per year economic assessment of the Project. Some movements will benefit significantly from the introduction of the Project even during the night when flow is predicted to be low. It is important that the associated benefits, and disbenefits, of this are captured in the economic analysis.

8.5.29 Most movements also experience an increase in average speed in the Do Something scenario. Some movements do not however, primarily due to using different parts of the network with different speed limits and links with higher congestion in the Do Something scenario as described above. Overall though the balance is substantially positive.

8.6 LTAM low and high growth scenarios

8.6.1 The TAG high and low growth increment is defined according to TAG guidance (Unit M4 Section 4.2 (DfT, 2019)). This involves adding/subtracting a proportion of the base year traffic to/from the demand from the core scenario.

8.6.2 For highway trips the formula applied is as follows:

$$2.5\% \times \sqrt{(Forecast\ Year - Base\ Year)}$$

8.6.3 For rail trips the formula applied is as follows:

$$2.0\% \times \sqrt{(Forecast\ Year - Base\ Year)}$$

8.6.4 After these increments have been applied to the VDM input reference matrices for both low and high growth, the resultant matrices are then run through the VDM process to convergence and the outputs extracted to inform the economic and operational assessments. The low and high growth outputs for economic assessment are provided in Annex D. Comparisons of forecast flows between the core, low and high growth scenarios are presented in Annex E.

9 Assignment results for environmental assessment

9.1 Introduction

9.1.1 Outputs from the LTAM are used to inform the environmental assessment of the Project. This section of the report provides summary information on those forecasts provided. Current guidance requires that this is provided for the core scenario only, for all forecast years.

9.1.2 Data provided to the environmental teams covers the model periods but is also aggregated to form Annual Average Daily Traffic (AADT) and Annual Average Weekday Traffic (AAWT). It is therefore necessary to initially present the methodologies used in undertaking these aggregations.

9.1.3 Traffic datasets are produced as outputs from the LTAM, which includes data on traffic flows and speeds. The environmental assessments and TAG worksheets undertaken are based on traffic datasets CM45 (Core Do Minimum) and CS67 (Core Do Something). These traffic datasets are different to those used in the traffic and transport assessments, which are based on datasets CM49 and CS72 that were updated to include the correct value of time in the variable demand model for low income commuting trips.

9.1.4 A review of traffic datasets CM49 and CS72 concluded that the difference between the two sets of traffic flows were minimal. The environmental assessments and TAG worksheets undertaken are therefore considered to be robust for air quality as the changes in flows would not change the conclusions of the assessment in relation to the impacts on human health being not significant, or change the conclusion that the Project would not delay compliance with Limit Values. The impacts on ecological receptors would also remain the same which has identified significant air quality effects on a number of sites.

9.2 AADT and AAWT calculation methodology

9.2.1 The LTAM represent neutral weekday conditions within three distinct peak hours as defined below:

a. AM peak = 07:00 to 08:00

b. Inter-peak = 09:00 to 15:00 (average hour)

c. PM peak = 17:00 to 18:00

9.2.2 In order to support environmental assessment activities, data from these model time periods needs to be factored to represent broader time periods. These requirements were discussed and agreed with the environmental consultants at a collaborative planning workshop at an early stage of the work. It was agreed that some of the standard environmental time periods would be shifted so as to better match the LTAM modelled hours and periods as defined under Chapter 3. The time periods required in order to support environmental assessment activities are provided in Table 9.1.

Table 9.1 Environmental assessment time period definitions

Time period name	Description	Hours included
AADT24	24hr annual average all days	00:00 – 24:00
AADTAM	AM peak annual average all days	06:00 – 09:00
AADTIP	Inter-peak annual average all days	09:00 – 15:00
AADTPM	PM peak annual average all days	15:00 – 18:00
AADTOP	Off peak annual average all days	18:00 – 06:00
AAWT24	24hr annual average weekdays	00:00 – 24:00
AAWTAM	AM peak annual average weekdays	06:00 – 09:00
AAWTIP	Inter-peak annual average weekdays	09:00 – 15:00
AAWTPM	PM peak annual average weekdays	15:00 – 18:00
AAWTOP	Off peak annual average weekdays	18.00 – 06:00
AAWT18	18hr annual average weekdays	06:00 – 24:00
AAWTNighttime	Night-time annual average weekdays	23:00 – 07:00

9.2.3 In order to derive the factors to enable the transposition, a series of annual traffic counts were required. As discussed in Chapter 3, previous work had been undertaken to identify the Project's potential area of impact. This led to the development of the FMA as shown in Plate 3.3.

9.2.4 A range of traffic count data sources were reviewed. National Highways traffic flow data presented in the TRIS database was identified as the primary data source for generating the factors as this is a continuous dataset where data is collected 365 days of the year. Additional data sources were not included because they did not provide 24 hour counts for a full year.

9.2.5 TRIS data within the LTAM FMA was processed to ensure that the count sites used provided high quality data. Two layers of data processing were performed:

a. Data quality index score – a quality index (QI) score is provided with TRIS data. A score of 15 indicates that 15 valid one-minute counting records were used to generate a 15-minute interval flow. Only sites where over 95% of data records for the year have a QI score of 15 were used, and sites with less than 70% of data records with QI scores of 15 in any particular month were excluded.

b. Spatial and Road Type analysis – the data sites used were mapped in GIS software to show their spatial dispersion. Trip flow data and the spatial analysis were reviewed in conjunction to ensure that the resultant annualisation factors are not influenced by site clustering. This analysis suggested that spatial disaggregation of factors or calculating factors by different road types did not significantly impact the factors and that single factors across the area and across road types were appropriate.

9.2.6 Applying these criteria results in 440 TRIS count sites being used for the annualisation factor calculation. A map showing the spatial locations of these sites is provided in Plate 9.1.

Plate 9.1 TRIS sites used in environmental factor calculations

9.2.7 The equations used to generate the time period flow values are presented in Table 9.2. The factors derived from analysis of this data are provided in Table 9.3. These have been disaggregated by vehicle type.

Table 9.2 Environmental assessment time period equations

Time period	Equation
AADT24	((LTAM AM x AADTAMFac) + (LTAM IP x AADTIPFac) + (LTAM PM x AADTPMFac)) x AADT24Fac
AADTAM	LTAM AM x AADTAMFac
AADTIP	LTAM IP x AADTIPFac
AADTPM	LTAM PM x AADTPMFac
AADTOP	((LTAM AM x AADTAMFac) + (LTAM IP x AADTIPFac) + (LTAM PM x AADTPMFac)) x AADTOPFac
AAWT24	((LTAM AM x AAWTAMFac) + (LTAM IP x AAWTIPFac) + (LTAM PM x AAWTPMFac)) x AAWT24Fac
AAWTAM	LTAM AM x AAWTAMFac
AAWTIP	LTAM IP x AAWTIPFac
AAWTPM	LTAM PM x AAWTPMFac
AAWTOP	((LTAM AM x AAWTAMFac) + (LTAM IP x AAWTIPFac) + (LTAM PM x AAWTPMFac)) x AAWTOPFac

Time period	Equation
AAWT18	((LTAM AM x AAWTAMFac) + (LTAM IP x AAWTIPFac) + (LTAM PM x AAWTPMFac)) x AAWT18Fac
AAWTNighttime	((LTAM AM x AAWTAMFac) + (LTAM IP x AAWTIPFac) + (LTAM PM x AAWTPMFac)) x AAWTNighttimeFac

9.2.8 For AADT24 and AAWT24 the total flow through the period is provided. For the different time periods the flow values are divided by the length of the time period in order to obtain the average flow within the time period.

Table 9.3 Environmental assessment time period factors

Factor name	All vehicles factor	Car/LGV factor	HGV factor
AADT24Fac	1.367	1.354	1.368
AADTAMFac	2.338	2.298	2.307
AADTIPFac	6.022	6.216	4.843
AADTPMFac	2.715	2.687	2.928
AADTOPFac	0.367	0.354	0.368
AAWT24Fac	1.348	1.342	1.340
AAWTAMFac	2.762	2.740	2.853
AAWTIPFac	6.000	6.000	6.000
AAWTPMFac	2.898	2.831	3.646
AAWTOPFac	0.348	0.342	0.340
AAWT18Fac	1.264	1.272	1.186
AAWTNightimeFac	0.179	0.159	0.264

9.2.9 In order to support the environmental assessment, it is also necessary to provide average speeds for each of the above time periods. The procedure adopted essentially provides a flow weighted average speed using the relative weights associated with each of the time periods as described above.

9.3 LTAM 2030 core – outputs to environmental assessment

9.3.1 Plate 9.2 to Plate 9.4 present the flow difference plots comparing the DM and DS for the 2030 core scenario. Plots are provided for AADT all vehicles, AADT non-HGV and AADT HGV. Blue colours show reductions in traffic, green colours show increases in traffic.

9.3.2 As can be seen these figures accord well with results presented in other sections of this report and with *a priori* expectations. Generally, flows reduce across the Dartford Crossing, on the A13 and A2 west of their junctions with the Project and on the M20. Flows increase obviously on the Project, which does not exist in the Do Minimum scenario, and also on the M25 north of the junction with the Project and on the A2/M2 and A13 east of their junctions with the Project.

Plate 9.2 AADT all vehicles flow difference plot – 2030 core DM vs DS

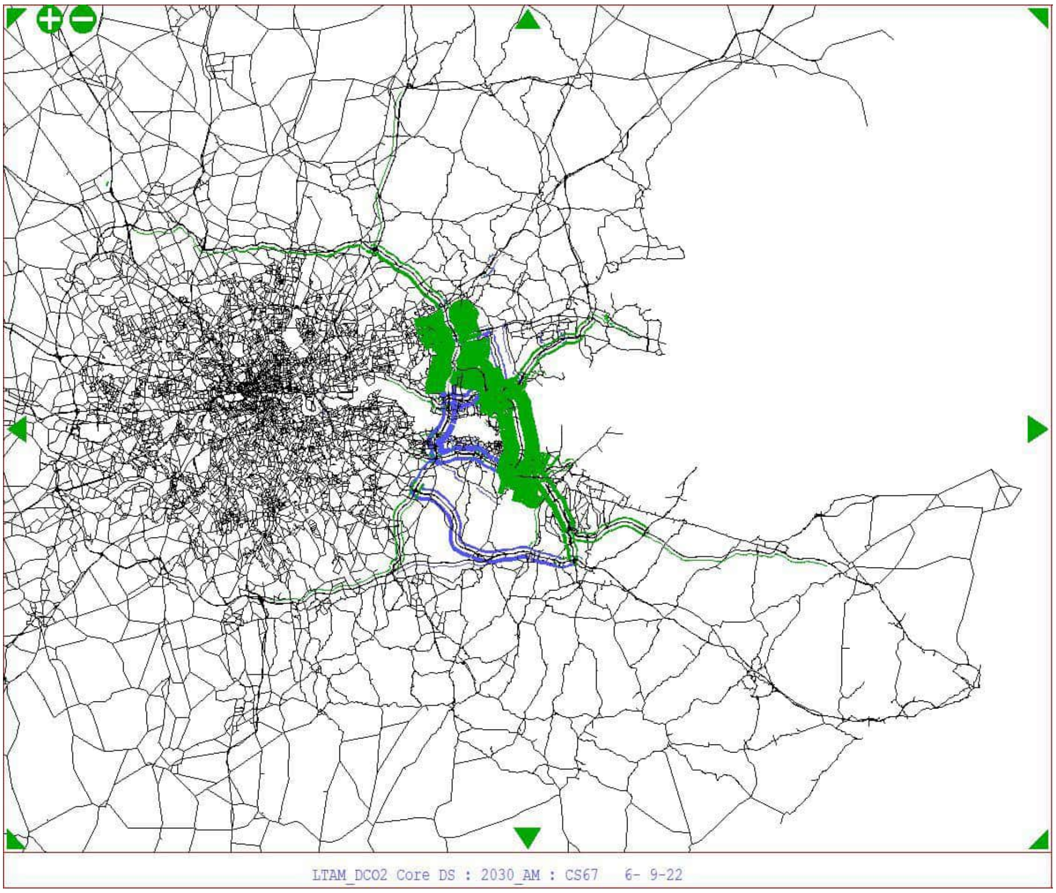


Plate 9.3 AADT non-HGV vehicles flow difference plot – 2030 core DM vs DS

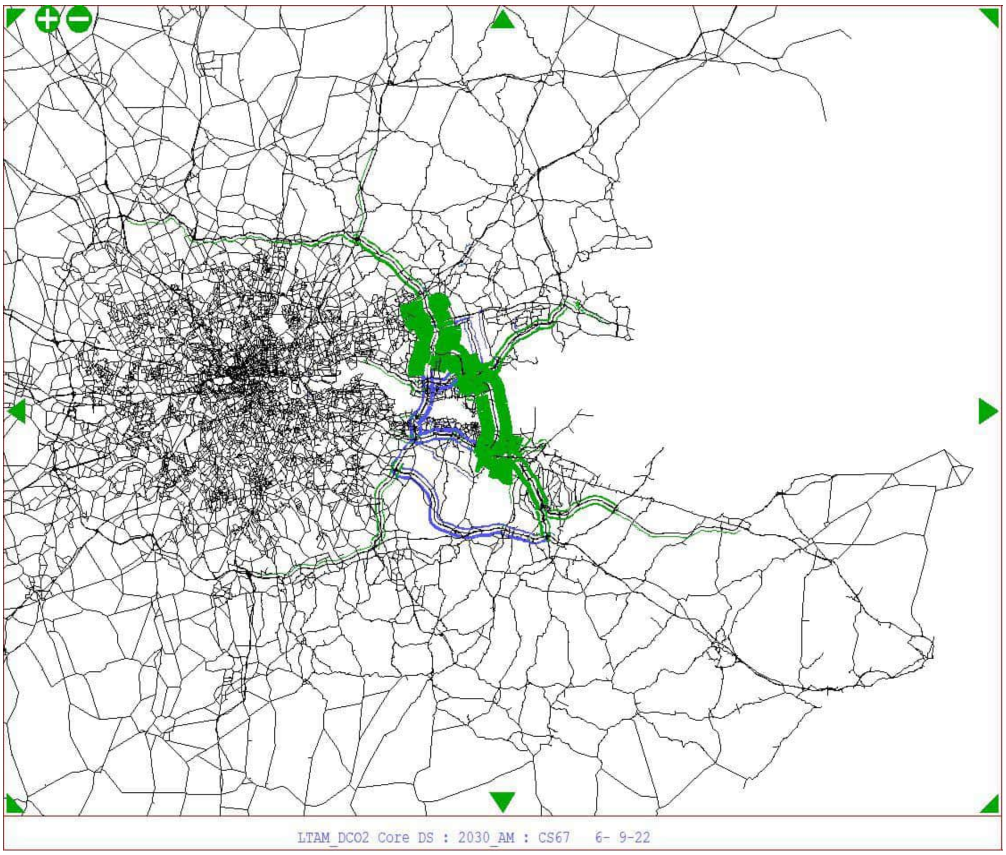
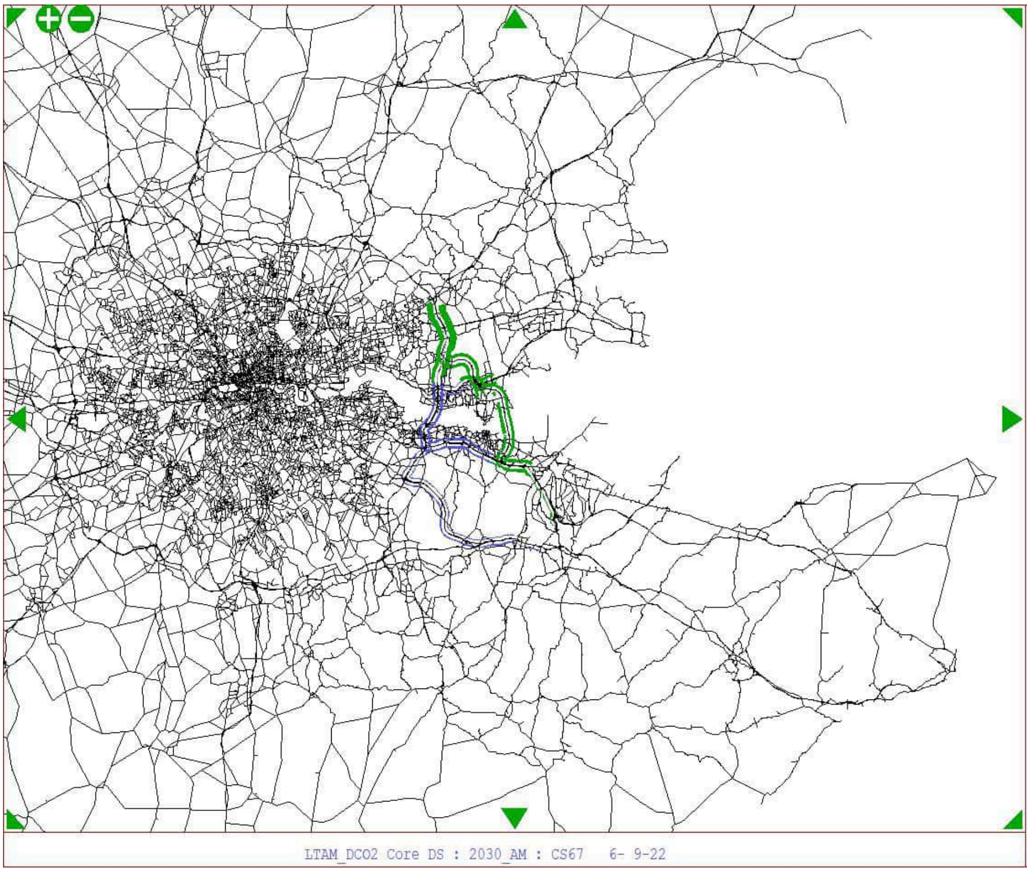


Plate 9.4 AADT HGV vehicles flow difference plot – 2030 core DM vs DS



9.4 LTAM 2037 core – outputs to environmental assessment

9.4.1 Plate 9.5 to Plate 9.7 present the flow difference plots comparing the DM and DS for the 2037 core scenario. Plots are provided for AADT all vehicles, AADT non-HGV and AADT HGV. Blue colours show reductions in traffic, green colours show increases in traffic.

9.4.2 As can be seen these figures accord well with results presented in other sections of this report and with *a priori* expectations. Generally, flows reduce across the Dartford Crossing, on the A13 and A2 west of their junctions with the Project and on the M20. Flows increase obviously on the Project, which does not exist in the Do Minimum scenario, and also on the M25 north of the junction with the Project and on the A2/M2 and A13 east of their junctions with the Project.

Plate 9.5 AADT all vehicles flow difference plot – 2037 core DM vs DS

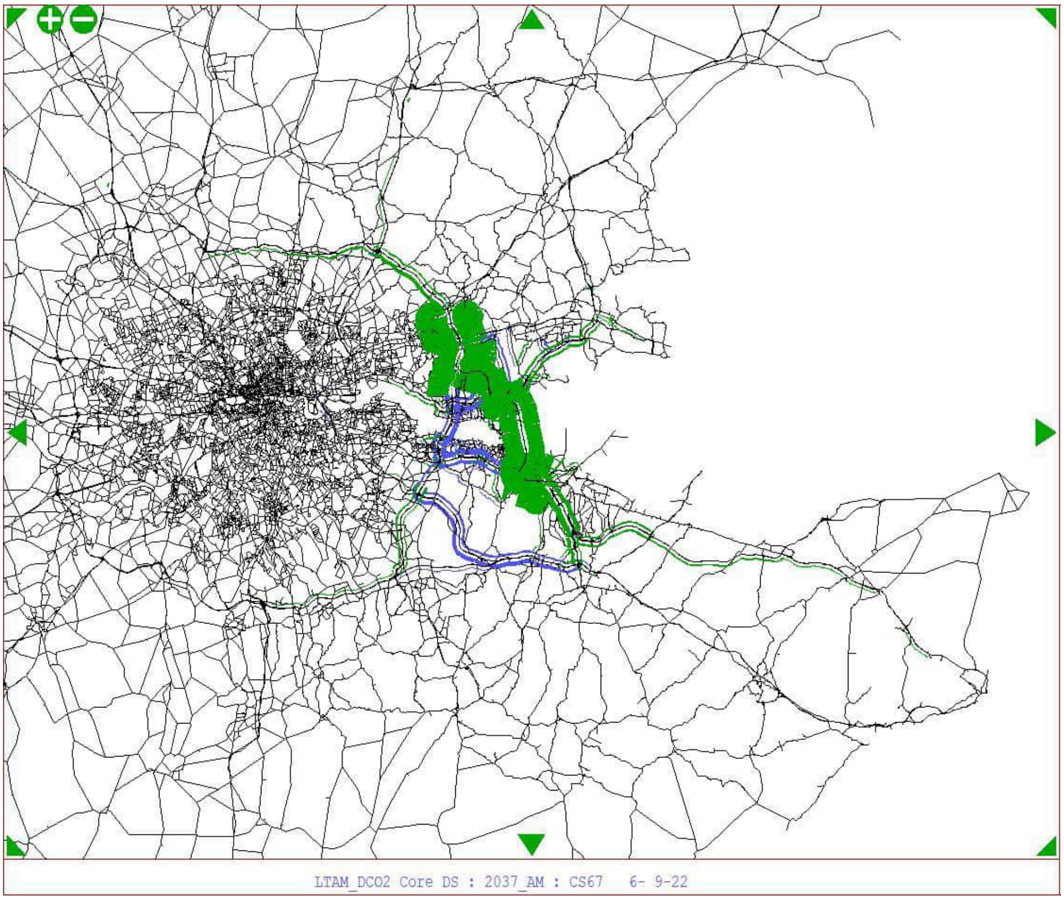


Plate 9.6 AADT non-HGV vehicles flow difference plot – 2037 core DM vs DS

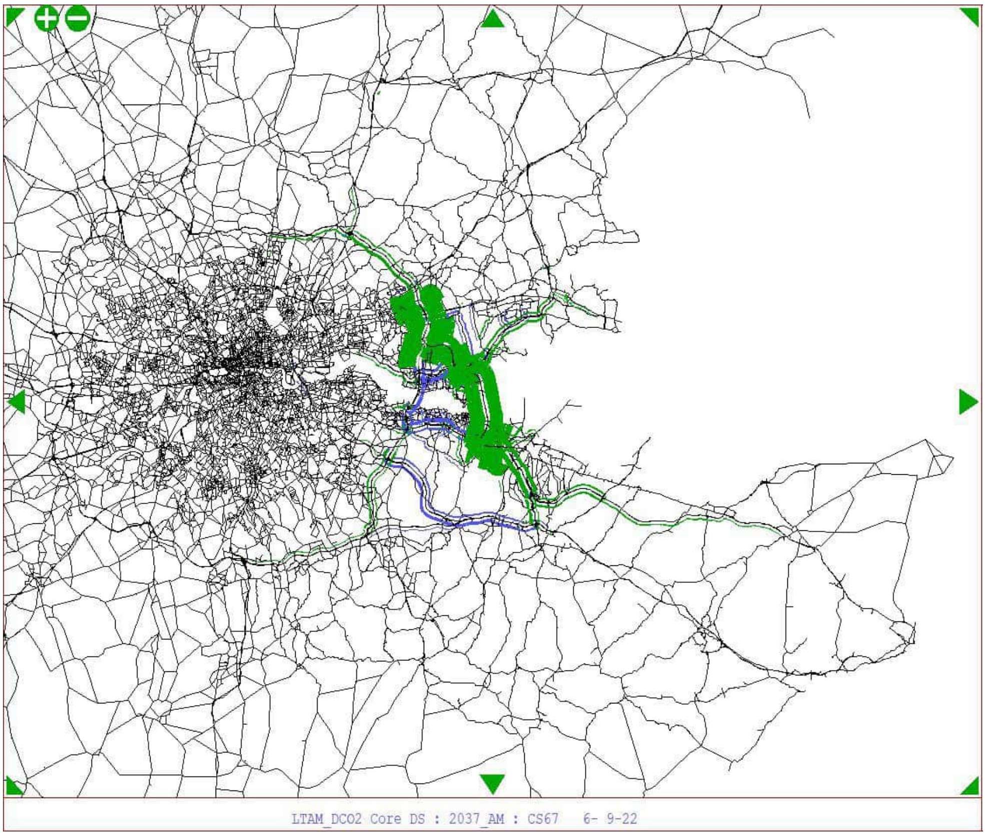
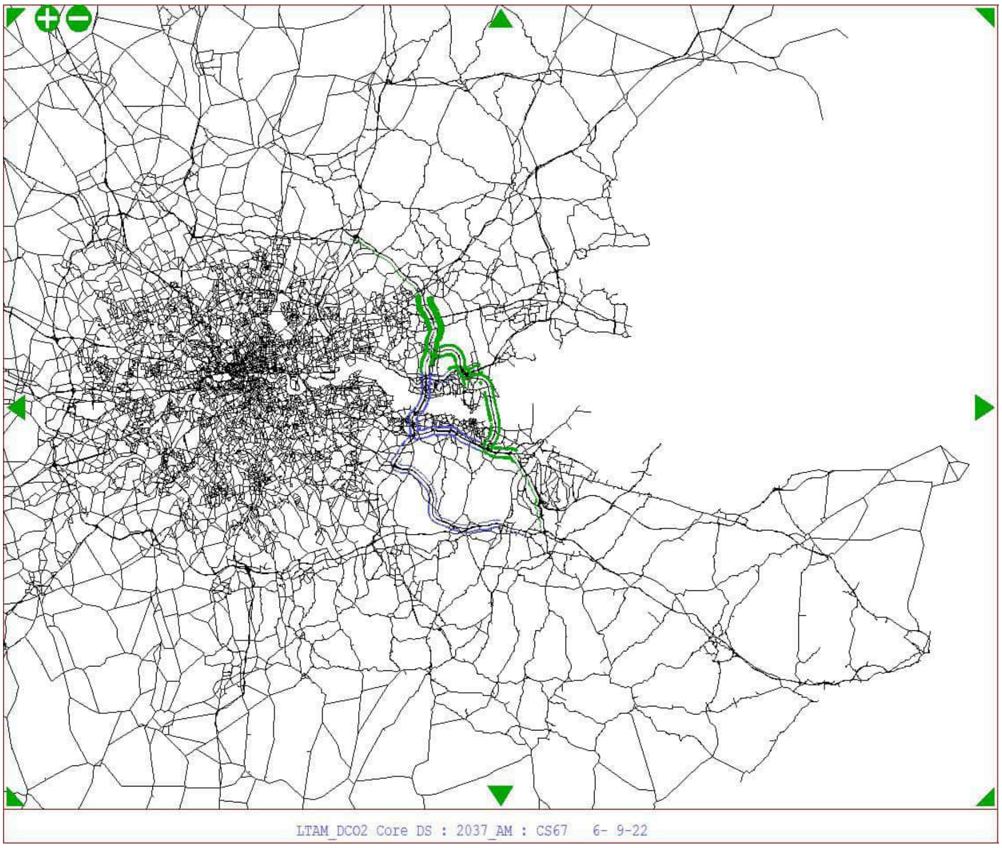


Plate 9.7 AADT HGV vehicles flow difference plot – 2037 core DM vs DS



9.5 LTAM 2045 core – outputs to environmental assessment

9.5.1 Plate 9.8 to Plate 9.10 present the flow difference plots comparing the DM and DS for the 2045 core scenario. Plots are provided for AADT all vehicles, AADT non-HGV and AADT HGV. Blue colours show reductions in traffic, green colours show increases in traffic.

9.5.2 As can be seen these figures accord well with results presented in other sections of this report and with *a priori* expectations. Generally, flows reduce across the Dartford Crossing, on the A13 and A2 west of their junctions with the Project and on the M20. Flows increase obviously on the Project, which does not exist in the Do Minimum scenario, and also on the M25 north of the junction with the Project and on the A2/M2 and A13 east of their junctions with the Project.

Plate 9.8 AADT all vehicles flow difference plot – 2045 core DM vs DS

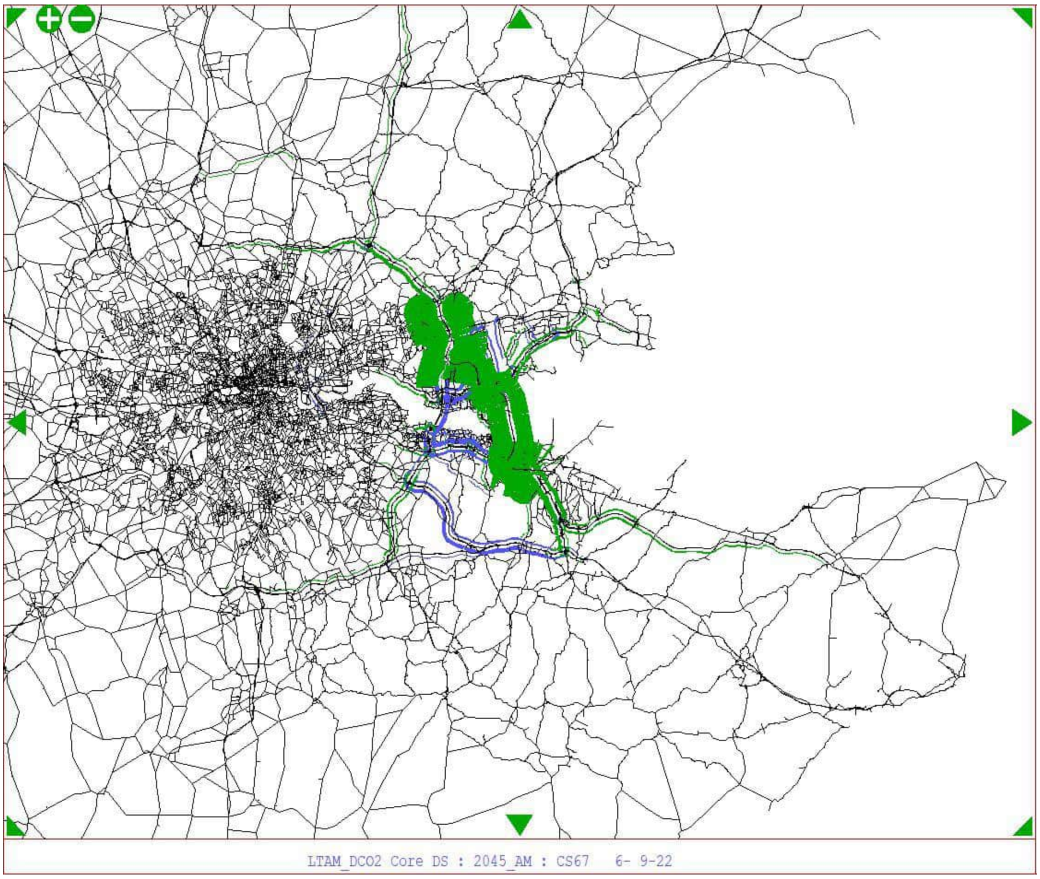


Plate 9.9 AADT non-HGV vehicles flow difference plot – 2045 core DM vs DS

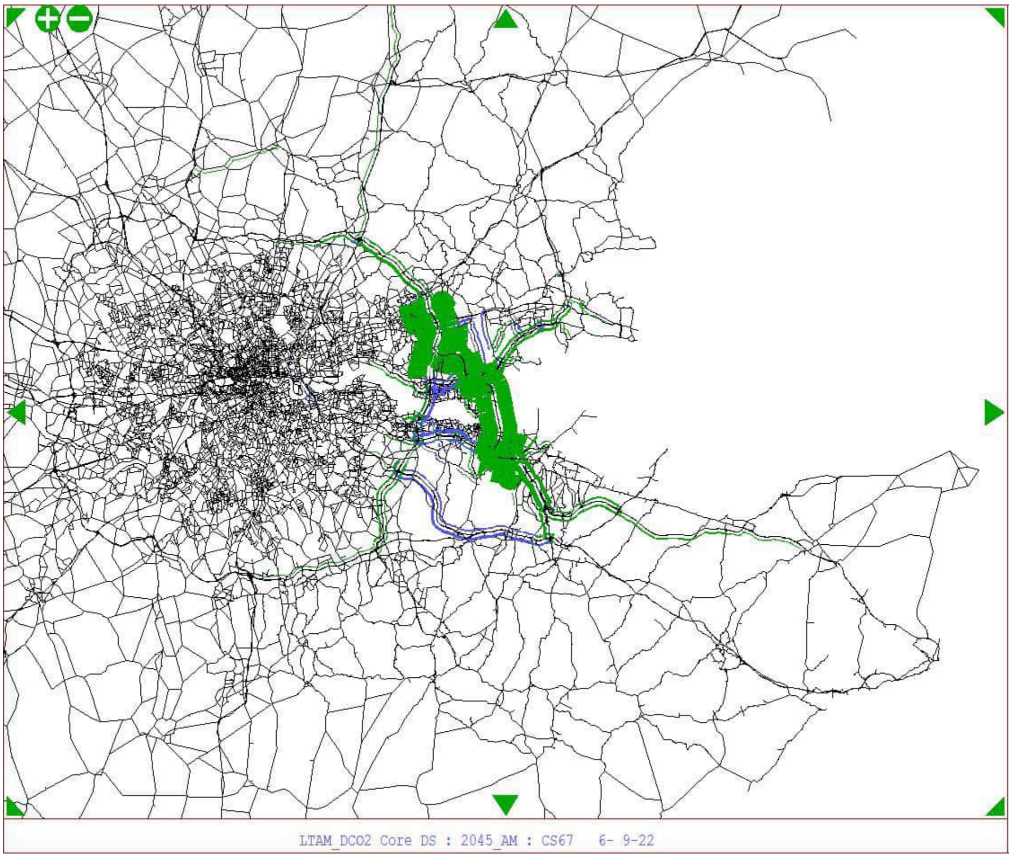
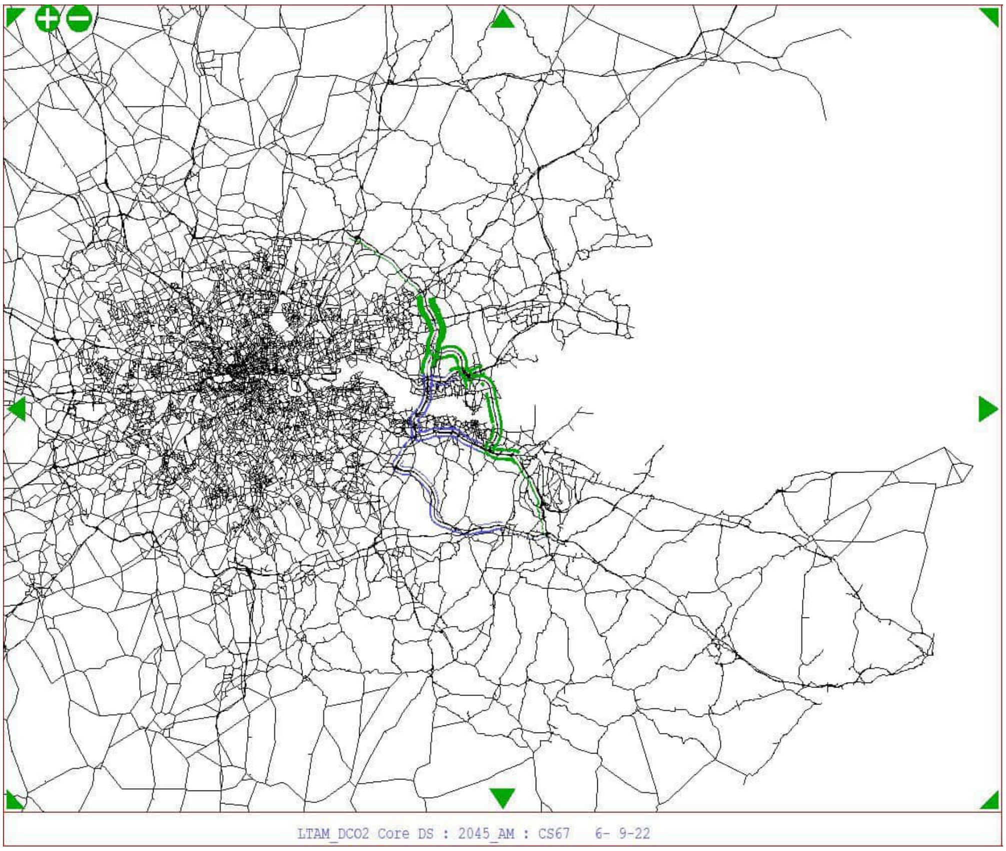


Plate 9.10 AADT HGV vehicles flow difference plot – 2045 core DM vs DS



9.6 LTAM 2051 core – outputs to environmental assessment

9.6.1 Plate 9.11 to Plate 9.13 present the flow difference plots comparing the DM and DS for the 2051 core scenario. Plots are provided for AADT all vehicles, AADT non-HGV and AADT HGV. Blue colours show reductions in traffic, green colours show increases in traffic.

9.6.2 As can be seen these figures accord well with results presented in other sections of this report and with *a priori* expectations. Generally, flows reduce across the Dartford Crossing, on the A13 and A2 west of their junctions with the Project and on the M20. Flows increase obviously on the Project, which does not exist in the Do Minimum scenario, and also on the M25 north of the junction with the Project and on the A2/M2 and A13 east of their junctions with the Project.

Plate 9.11 AADT all vehicles flow difference plot – 2051 core DM vs DS

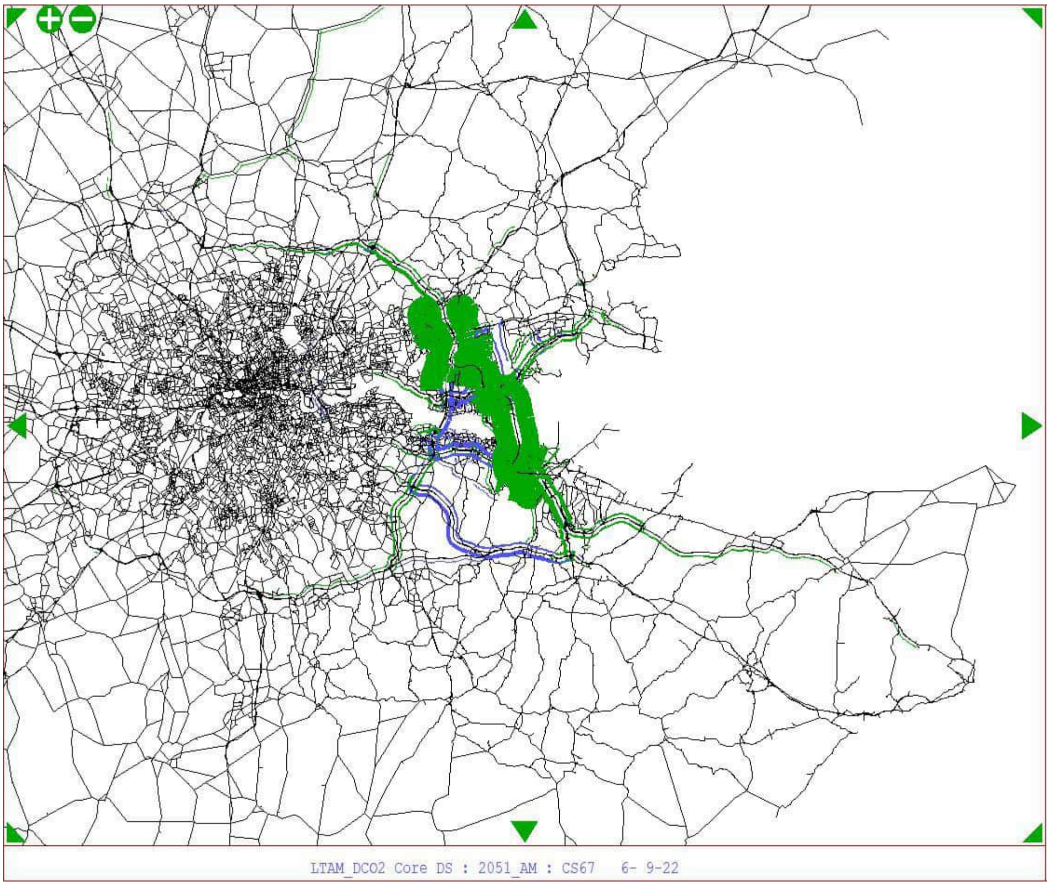


Plate 9.12 AADT non-HGV vehicles flow difference plot – 2051 core DM vs DS

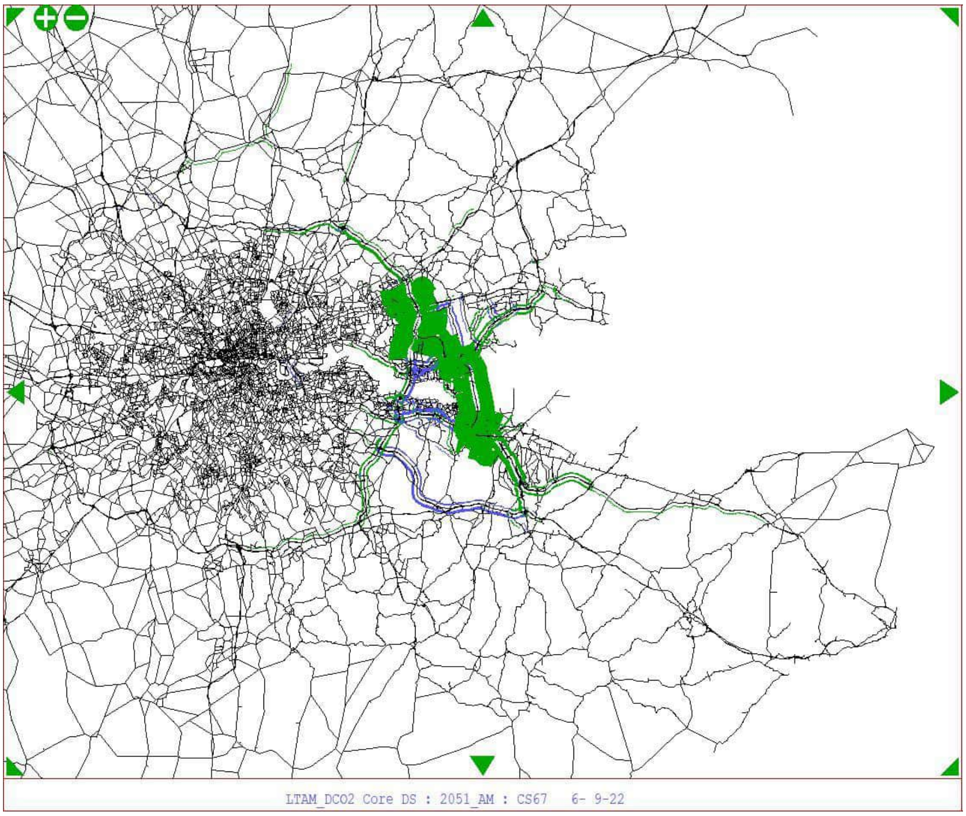
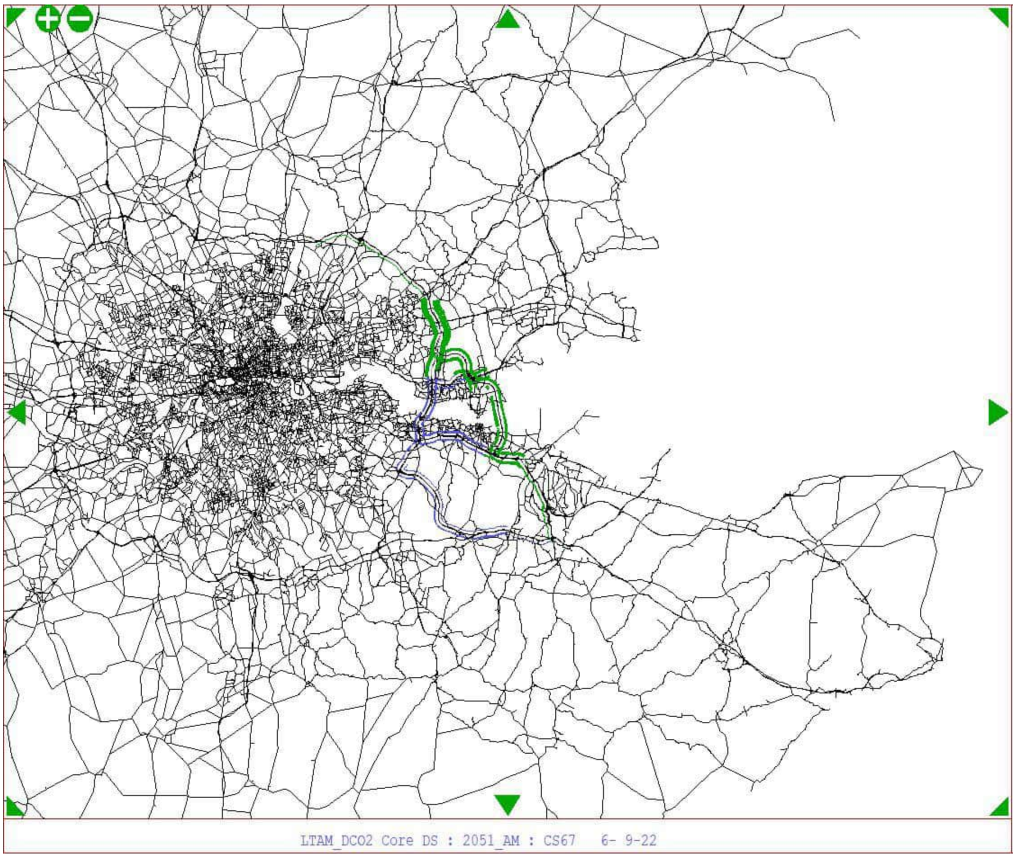


Plate 9.13 AADT HGV vehicles flow difference plot – 2051 core DM vs DS



9.7 DMRB speed banding exercise

9.7.1 DMRB LA105 Air Quality (National Highways, 2019) provides guidance on how speeds extracted from a traffic model should be processed in order for them to be used for detailed air quality modelling processes. DMRB LA111 Noise and Vibration (National Highways, 2020) provides guidance on how speeds extracted from a traffic model should be processed in order for them to be used for detailed noise modelling processes.

9.7.2 Strategic traffic models such as the LTAM are calibrated and validated so as to reproduce observed speeds along strategic routes. They are not calibrated to speeds at the individual link level. This means that at the individual link level speeds predicted by the model can vary from real world speeds.

9.7.3 The DMRB seeks to address this with the following methodology, which involves three key steps:

a. Calculating a speed pivot factor

b. Applying the speed pivot factor to model forecast speeds

c. Allocation of links into speed bands

Calculating a speed pivot factor

9.7.4 The methodology operates by using observed vehicle speeds from the base year. This allows for a comparison with the modelled base year speeds and provides an indication of the performance of the speeds from the traffic model.

This information can then be used to adjust the individual base year link speeds output from the traffic model, where required. As it is not possible to measure forecast traffic speeds, the adjustments applied to the base year model are applied to the opening and design year forecasts in the same way.

9.7.5 During the development of the LTAM a correspondence was generated between the LTAM highway network node and link structure in the FMA and the Integrated Transport Network (ITN) GIS file network structure. Teletrac journey time data provides observed speeds across all links in the ITN where there is a sample of records. It is therefore possible to generate an observed speed from the Teletrac dataset for every link in the LTAM FMA. Where there was no direct correspondence between the ITN network and the SATURN node and link structure a distance weighted average process was taken to derive the observed speed.

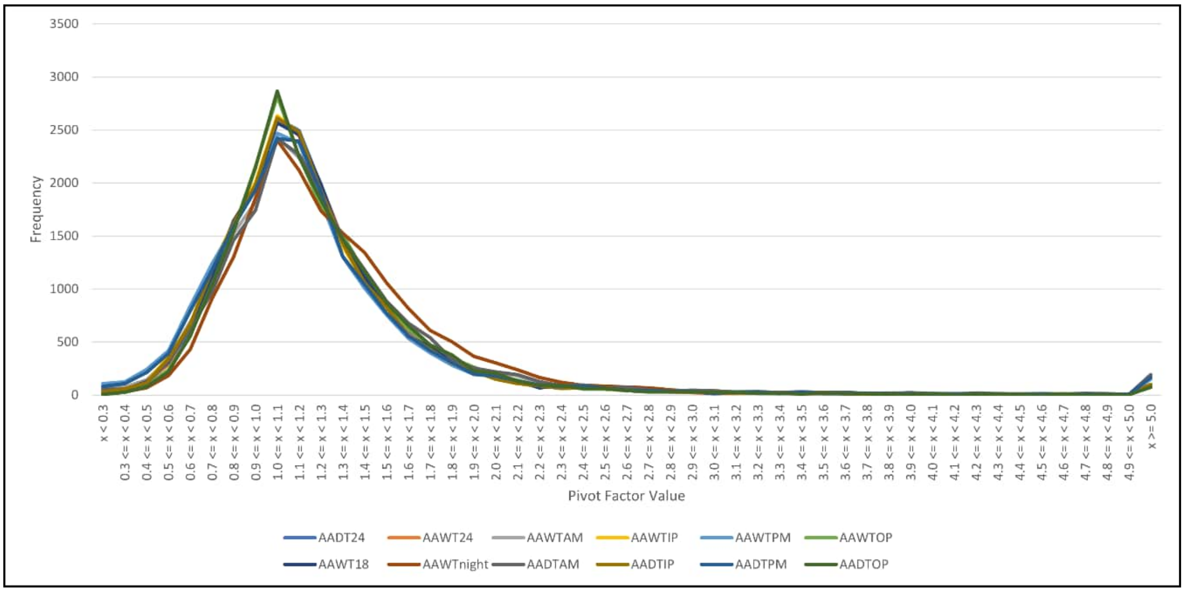
9.7.6 The pivot factor is therefore a simple ratio of:

$$Speed\ Pivot\ Factor = \frac{Observed\ Speed}{Modelled\ Speed}$$

9.7.7 It is important to note that the observed speed used in this calculation could be from a different time period than the individual model hour. This means that the pivot factor not only adjusts the modelled speed to reflect observed conditions but also adjusts the model speed to reflect a different time period. For example, taking an AM weekday modelled hour speed (07:00–08:00) and converting that into an AADT (7-day) AM peak period average speed (06:00–09:00).

9.7.8 Plate 9.14 shows the distribution of pivot factors calculated using this process for each of the environmental time periods as defined in Table 9.1. As can be seen the majority of the pivot factors are clustered around one as would be expected. There are some outliers with large or small pivot factors. In some instances, this can lead to unrealistic pivoted speeds being predicted when the pivot is applied in the forecast years. Where this occurs the unpivoted speed is generally used across all scenarios. This is as per DMRB guidance. Additional analysis is also undertaken to assess where large pivot factors have led to speed band changes. If this occurs the affected link was discussed with the environment team and an approach agreed for which speed to use for the analysis. Again, this is as per DMRB guidance.

Plate 9.14 Distribution of pivot factors by environmental time period



Applying the speed pivot factor to model forecast speeds

9.7.9 Once the speed pivot factor has been calculated it can then be applied to forecast year model speeds. This is done in exactly the same way between the DM and DS scenarios as follows:

$$Do\ Minimum\ Speed = Do\ Minimum\ Model\ Speed\ \times Speed\ Pivot\ Factor$$

$$Do\ Something\ Speed = Do\ Something\ Model\ Speed\ \times Speed\ Pivot\ Factor$$

9.7.10 In certain locations there may not have been a Teletrac speed sample on a particular link, or it was a very small sample. In these locations an average speed has been derived from links with similar characteristics within the local area. This is as per the DMRB guidance.

Allocation of links into speed bands

9.7.11 For the Air Quality assessment, once the speed pivot factors have been applied it is then necessary to allocate each link into a speed band category. For noise assessment, speed bands are not used and the noise modelling is based purely on the pivoted speed value.

9.7.12 Table 9.4 and (Source: DMRB LA 105 Table A.1 (National Highways, 2019))

9.7.13 Table 9.5 provide the Air Quality speed band categories to be used for motorway and urban/rural (non-motorway) roads respectively. The primary criteria used to distinguish which speed band each link is in is the pivoted speed.

Table 9.4 Motorway speed bands

Category	Speed range (kph)	General description
Heavy congestion	5–48	Traffic with a high degree of congestion and stop: start driving behaviour, junction merges, slip roads with queuing traffic.
Light congestion	48–80	Traffic with some degree of flow breakdown, typical V/C >80%. Normal operation on slip roads.
Free flow	80–96	Motorway generally free flow driving conditions with little or no flow breakdown. Motorway busy but not congested, V/C <80%.
High speed	96–140	Motorway unconstrained, typical of overnight conditions when traffic is light.

(Source: DMRB LA 105 Table A.1 (National Highways, 2019))

Table 9.5 Urban speed bands

Category	Speed range (kph)	General description
Heavy congestion	5–20	Traffic with a high degree of congestion. Within a 100m radius of road junction with a high degree of congestion.
Light congestion	20–45	Typical urban traffic with a reasonable degree of congestion. Within a 100m radius of road junction.
Free flow	45–80	Typical urban traffic with limited or no congestion.
High speed	80–112	High speed urban single or dual carriageway.

(Source: DMRB LA 105 Table A.2 (National Highways, 2019))

9.7.14 Once each link within the LTAM FMA has been allocated to a particular speed band based upon its pivoted speed, more detailed analysis is then undertaken on links that are defined as high risk within the Affected Road Network (ARN) as defined by the Air Quality team. This focusses on those links that are close to the boundary of one of the speed ranges, in particular, if the link is predicted to change speed band between base year and forecast year DM and DS scenarios.

9.7.15 The speed banding exercise has focussed on the AADT 24, AADTAM, AADTIP, AADTPM and AADTOP. In accordance with the requirements of the environmental assessment team, this has only been undertaken for the Project opening year of 2030. The analysis presented in Plate 9.15 to Plate 9.24 show links where speed bands have changed between the actual base versus the DM and the DM versus the DS.

9.7.16 As can be seen in the actual base vs DM analysis there are a number of links across the network that have changed speed band. This is as a result of a combination of changes in demand in these locations and the introduction of new transport infrastructure schemes in the DM. The comparisons between the DM and DS show only links associated with or clustered around the proposed Project have changed speed band. This accords well with analysis shown in other sections of this report and with *a priori* expectations.

Plate 9.15 Link speed band changes actual base vs 2030 core DM AADT24

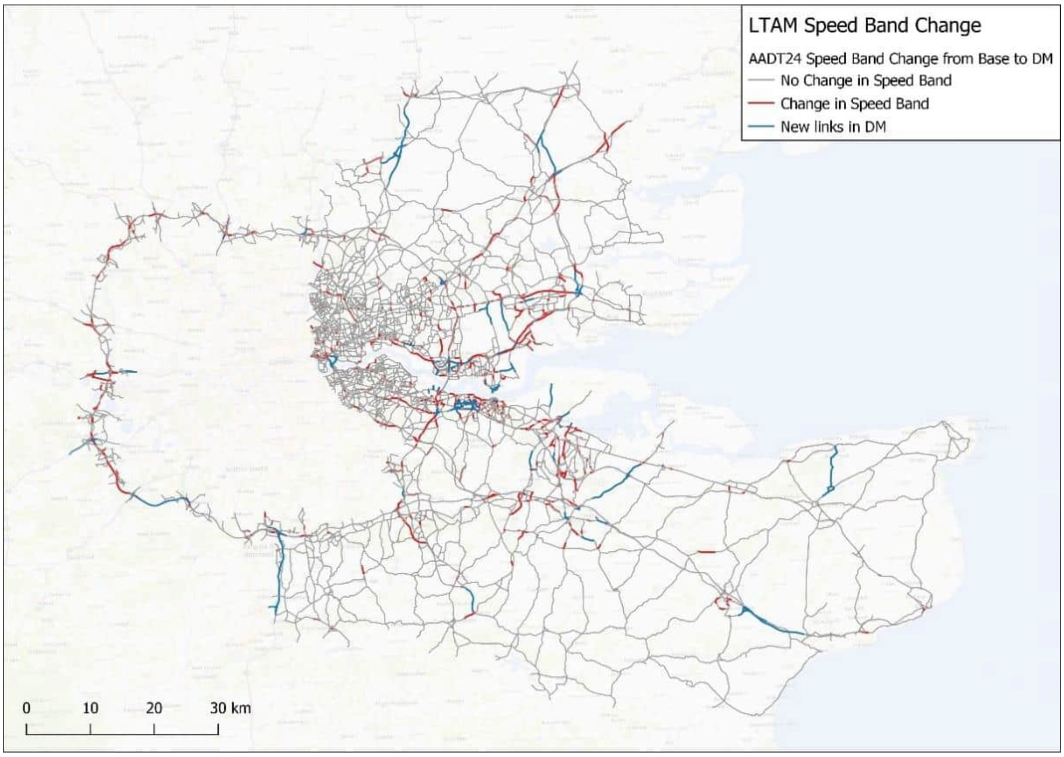


Plate 9.16 Link speed band changes actual base vs 2030 core DM AM peak

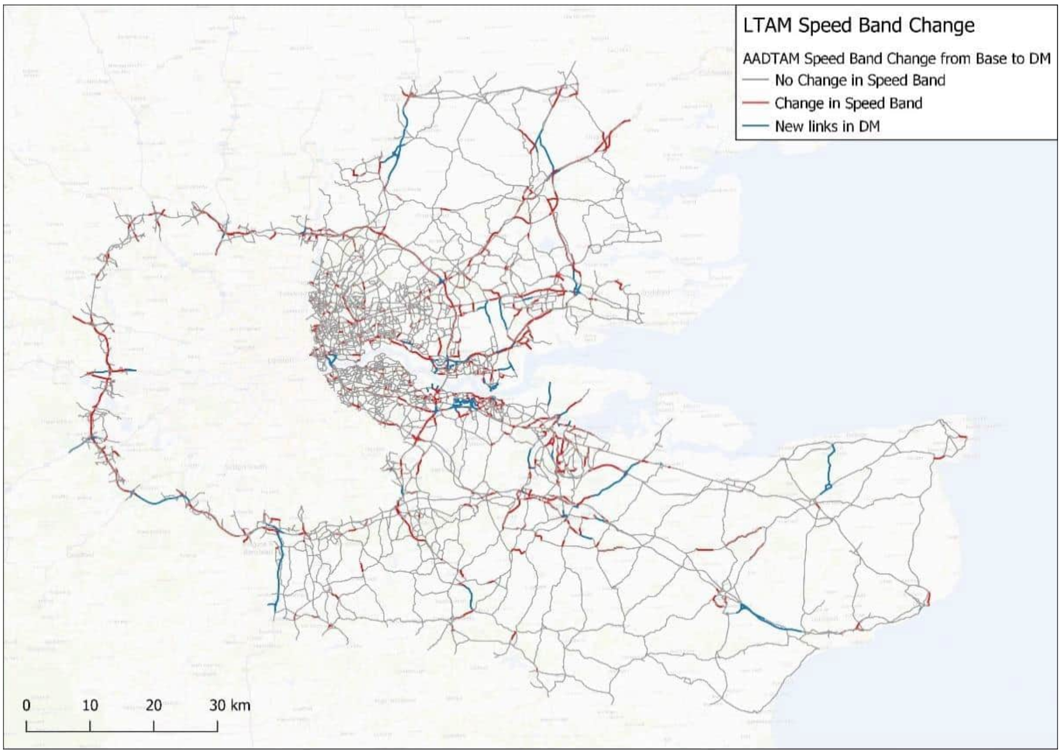


Plate 9.17 Link speed band changes actual base vs 2030 core DM inter-peak

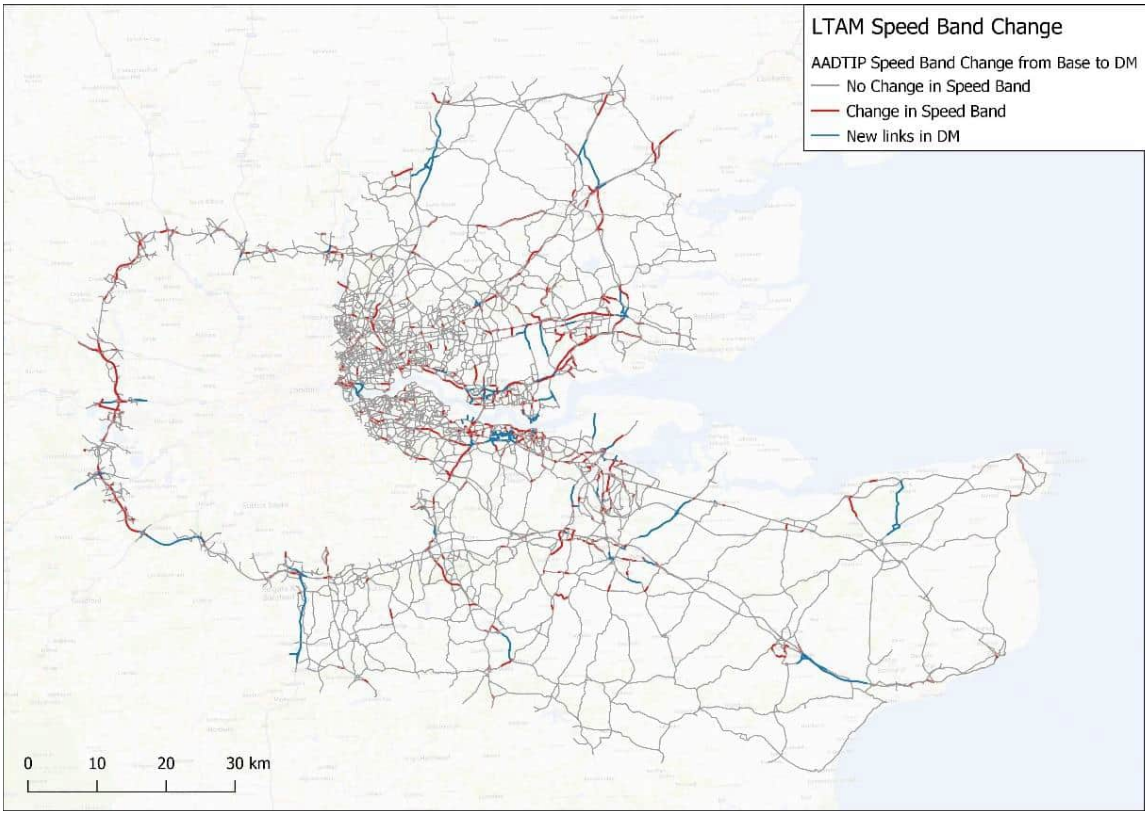


Plate 9.18 Link speed band changes actual base vs 2030 core DM PM peak

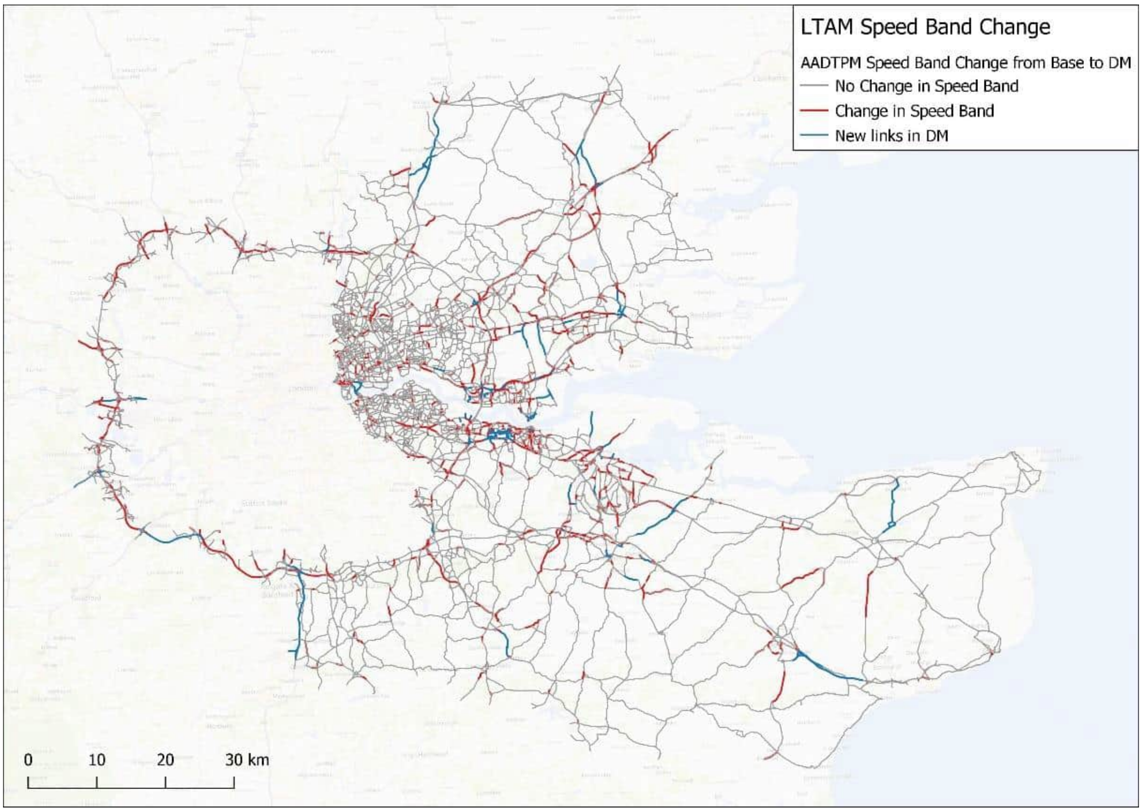


Plate 9.19 Link speed band changes actual base vs 2030 core DM off peak

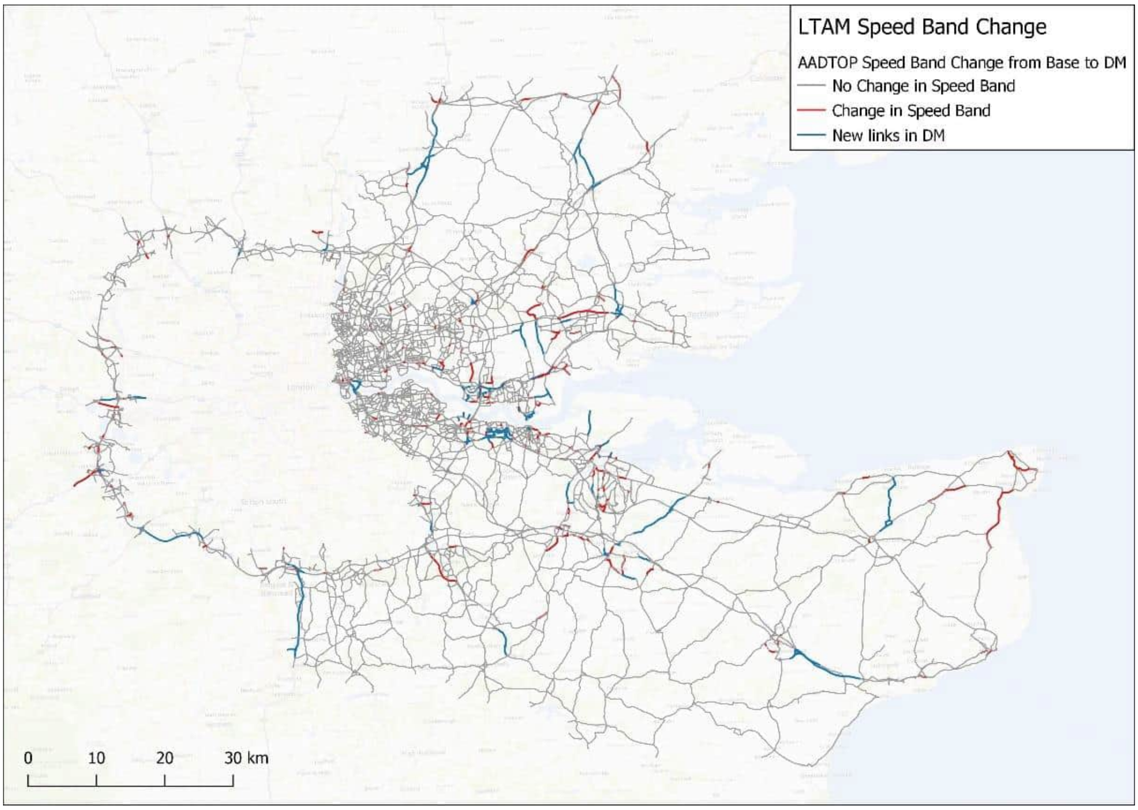


Plate 9.20 Link speed band changes 2030 core DM vs 2030 core DS AADT24

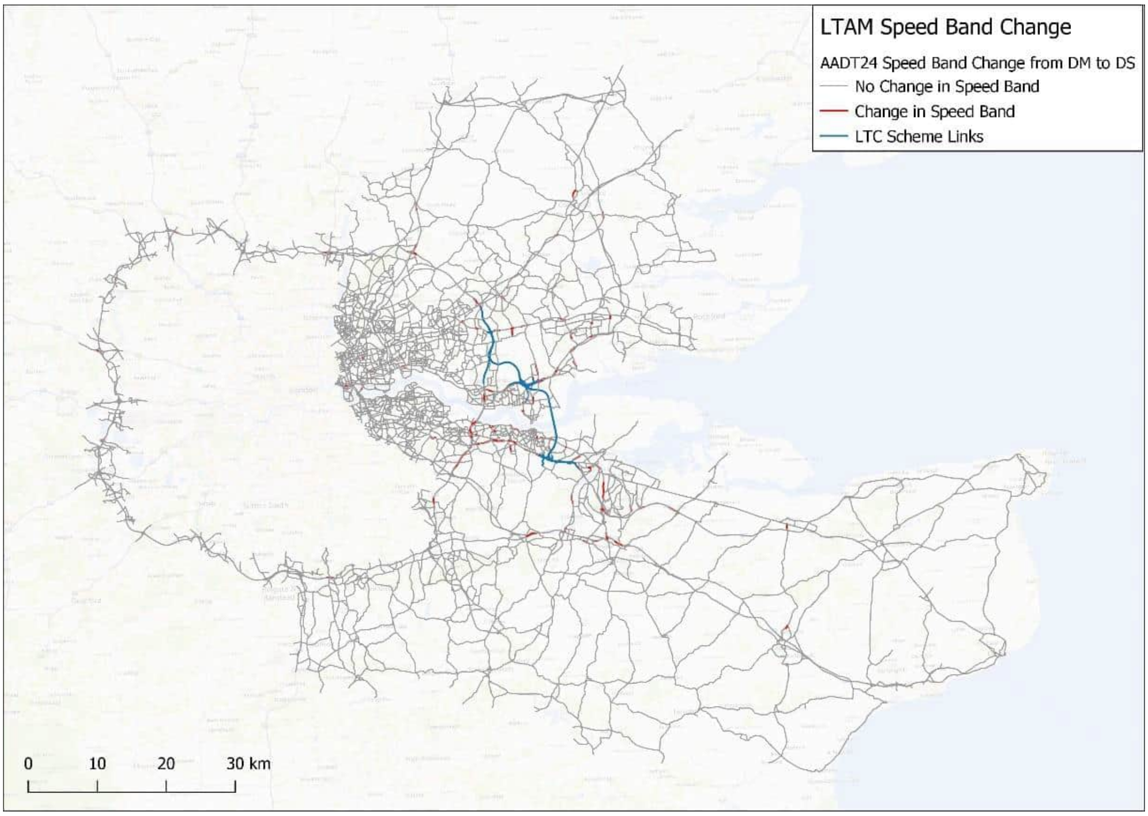


Plate 9.21 Link speed band changes 2030 core DM vs 2030 core DS AM peak

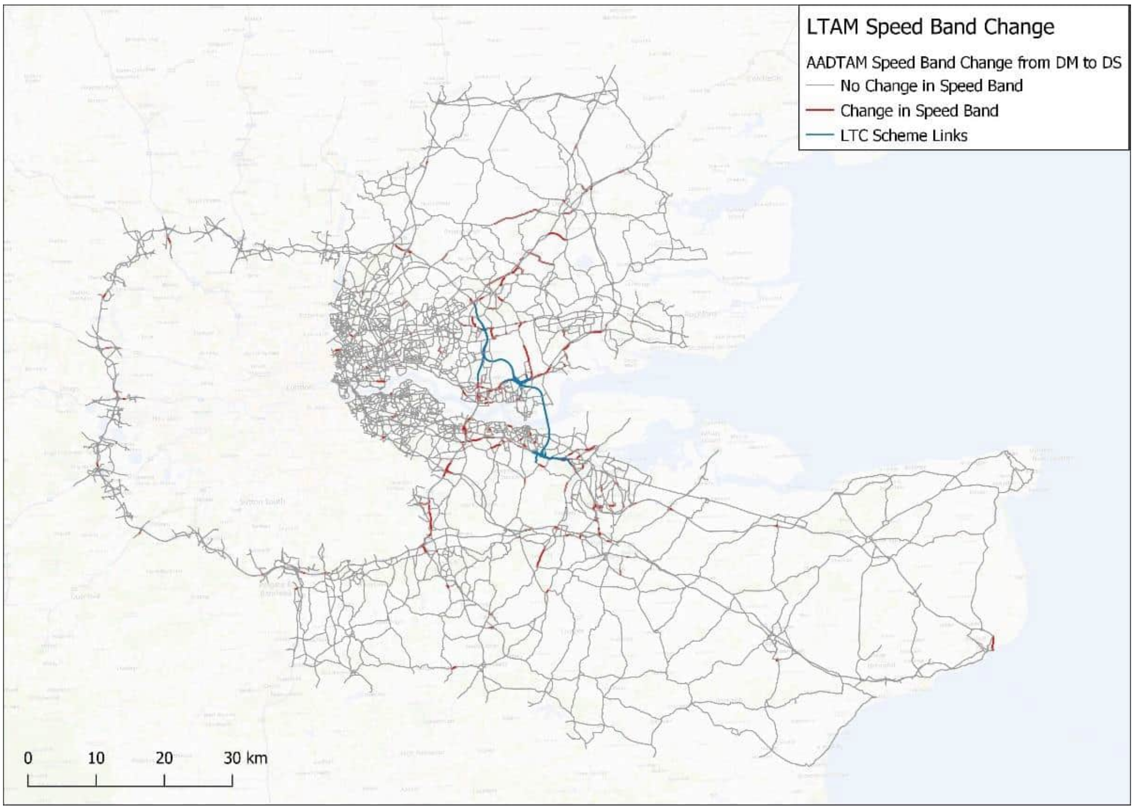


Plate 9.22 Link speed band changes 2030 core DM vs 2030 core DS inter-peak

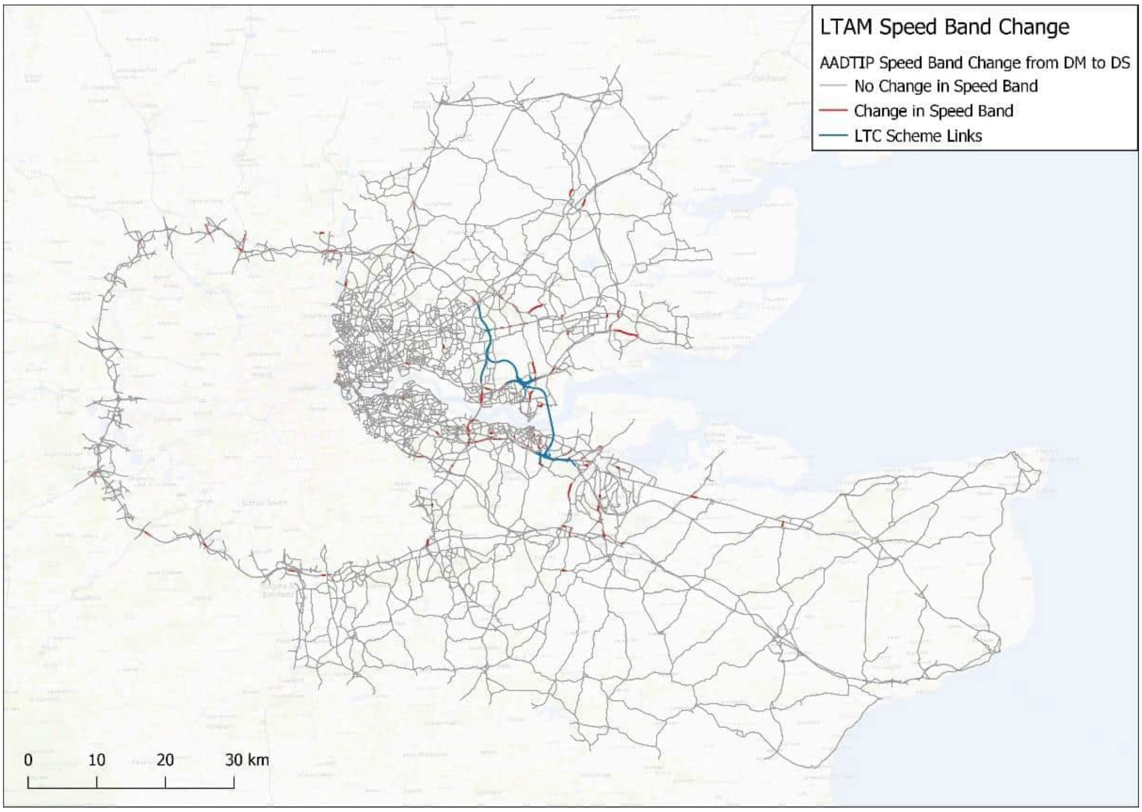


Plate 9.23 Link speed band changes 2030 core DM vs 2030 core DS PM peak

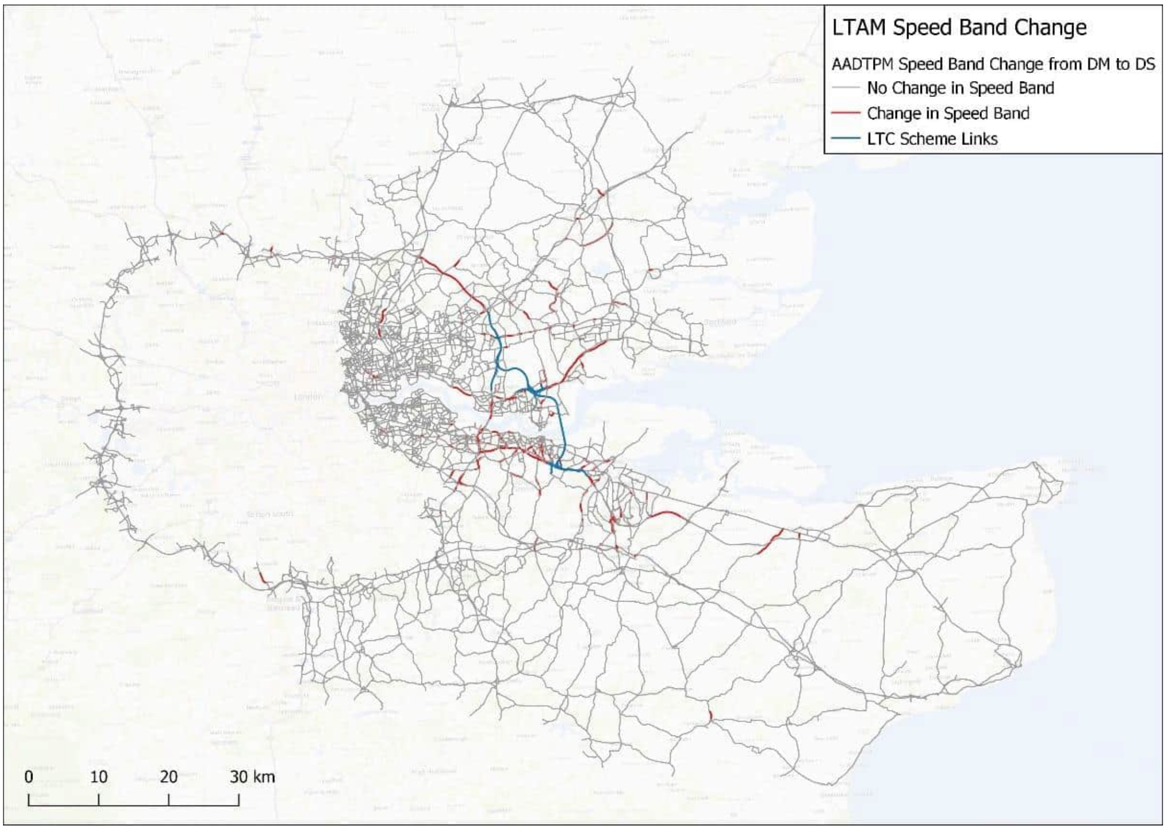
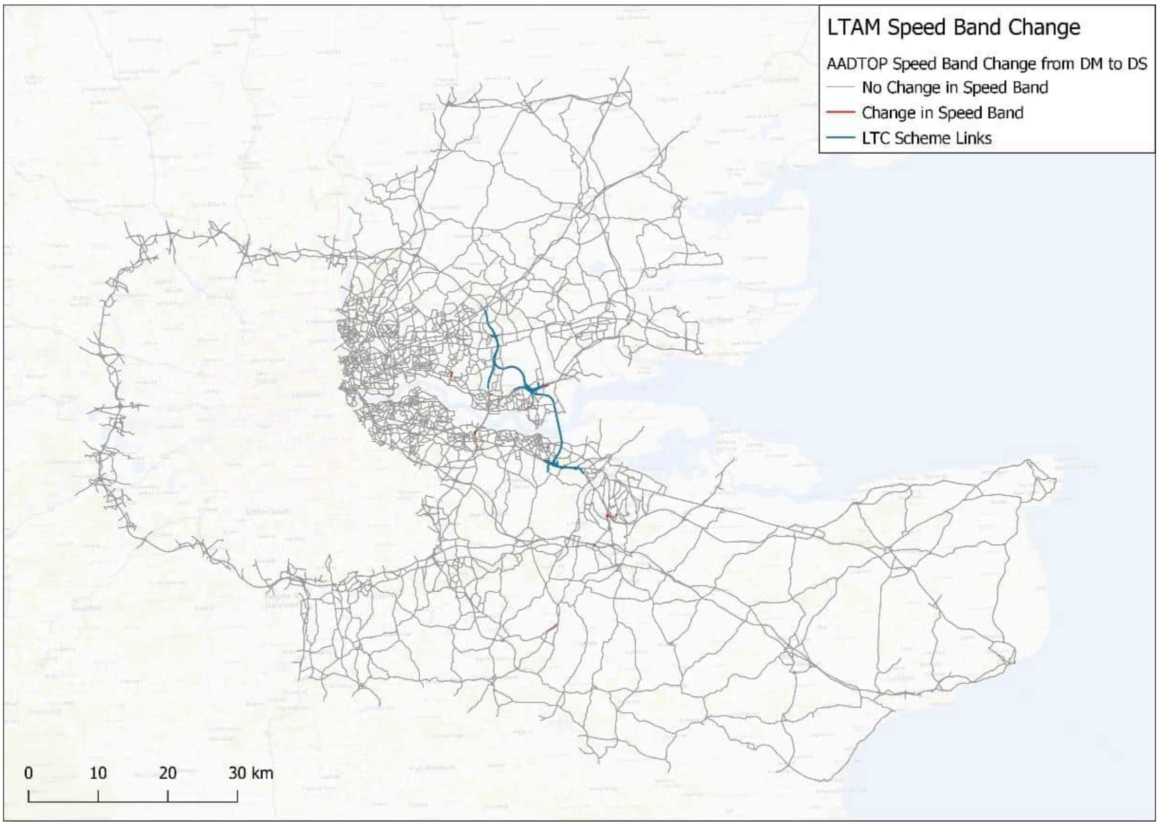


Plate 9.24 Link speed band changes 2030 core DM vs 2030 core DS off peak



10 Assignment results for operational performance assessment

10.1 Introduction

10.1.1 The LTAM forecasts have been produced in order to predict traffic flows and speeds along the proposed Project, which have then been fed to the design team in order to test the operation of the different elements of the design.

10.1.2 The analysis below is presented for the morning and evening peaks, for all model years for the core scenario for the Do Something only. The low and high growth scenario results are presented in Annex F.

10.2 LTAM 2030 core – outputs to operational assessment

10.2.1 Plate 10.1 to Plate 10.12 provide traffic flow information at the three Project junctions for all vehicles and HGV for the morning and evening peak for the 2030 core scenario. The figures show a simplified representation of the junction layouts.

10.2.2 Plate 10.1 shows the total vehicle flows for the 2030 core scenario in the AM peak at the proposed A2 junction with the Project and highlights the low proportion of west-to-north and north-to-west traffic on the Project (attributed to the significant relief provided by the Project to the existing A2/A282/Dartford Crossing route). The traffic on the Project northbound consists of:

a. 83% (3,793 of 4,566 PCUs) comes from the east

b. 10% (465 PCUs) accesses from Gravesend East

c. 7% (308 PCUs) comes from the A2 to the west

10.2.3 Similar proportions can be seen for southbound traffic on the Project:

a. 87% (3,029 of 3,472 PCUs) travels east

b. 8% (273 PCUs) exits at Gravesend East

c. 5% (169 PCUs) continues on the A2 to the west

10.2.4 Plate 10.1 also shows the high 'weaving' flows that necessitated the design of separate carriageways at the A2 junction with the Project. These are the movements that would have been in conflict (i.e. 'weaving' flows) in a single carriageway configuration. For westbound traffic these flows are:

a. 2,897 PCUs (i.e. well over one lane worth) from the M2 to the Project northbound

b. 2,312 PCUs (over one lane worth) from the A2/A289 to the A2 westbound

10.2.5 For eastbound traffic the 'weaving' flows are:

a. 2,654 PCUs from the Project to the M2 eastbound

b. 1,862 PCUs from the A2 eastbound to the A2/A289 in the east

10.2.6 Plate 10.2 shows the HGV (PCUs) flows for the 2030 core scenario in the AM peak at the proposed A2 junction with the Project and shows the very high proportions of east-to-north and north-to-east HGV traffic using the Project. Very few HGVs west of the Gravesend East junction will use the Project because HGVs have a much higher cost per km than other vehicles so will favour the shorter, Lower Thames Crossing-relieved, existing route. This is shown by the following HGV flows using the Project northbound:

a. 91% (937 of 1,035 PCUs) of HGVs on the Project northbound come from the east

b. 7% (73 PCUs) access the Project from Gravesend East

c. 2% (21 PCUs) comes from the A2 to the west

10.2.7 Similar proportions can be seen for southbound traffic on the Project:

a. 89% (950 of 1,063 PCUs) travels east

b. 8% (89 PCUs) exits at Gravesend East

c. 2% (23 PCUs) continues on the A2 to the west

10.2.8 Plate 10.3 and Plate 10.4 show the total vehicle and HGV flows respectively for the 2030 core scenario in the AM peak at the proposed A13/A1089 junction with the Project. As the A2 junction with the Project is designed to minimise the impact of weaving, in this case, the westbound on-slip from Orsett Cock has been extended so that it joins the A13 after the A13 westbound to the Project southbound link road. Access to the A1089 from the A13 eastbound would remain unchanged, as would access from the A1089 to the A13 westbound. The current access from the A13 westbound to the A1089 would be re-routed via the Orsett Cock junction. Access from the A122 north and southbound, as well as to local roads, would also be via the Orsett Cock junction.

10.2.9 The key junction movements are as follows:

a. The traffic travelling north across the River Thames on the Project consists of:

i. 53% (2,438 PCUs) of total traffic and 80% (823 PCUs) of HGVs continuing north towards the M25

ii. 47% (2,128 PCUs) of total traffic and 20% (211 PCUs) of HGVs turning east on to the A13

b. The traffic travelling south across the River Thames on the Project consists of:

i. 44% (1,544 PCUs) of total traffic and 71% (752 PCUs) of HGVs from the M25

ii. 43% (1,479 PCUs) of total traffic and 18% (196 PCUs) of HGVs from the A13 westbound

iii. 13% (449 PCUs) of total traffic and 10% (111 PCUs) of HGVs from the A1089 northbound

10.2.10 The Project design does not provide for all possible movements at the A13 junction either due to lack of demand (e.g. A13 eastbound to the Project northbound) or because the Project has provided significant relief to an existing route (e.g. the Project northbound to the A13 westbound relieves traffic that would otherwise continue west on the A13 to reach the M25 northbound).

10.2.11 Another key feature of this junction is the retention of all key existing connections between the A13 and A1089 (which will include Tilbury Port traffic), and the addition of the following new connections:

a. A1089 northbound to the Project southbound (total flow of 449 PCUs)

b. A1089 northbound to the Project northbound (total flow of 1,272 PCUs)

10.2.12 These two connections provide a significant benefit to 56% (1,721 of 3,064 PCUs) of the traffic on the A1089 which otherwise would have been forced to access their eventual destinations via M25 junction 30 (or via a lengthy U-turn at the Manor Way junction on the A13 to access the Project to the south).

10.2.13 Plate 10.5 and Plate 10.6 show the total vehicle and HGV flows respectively for the 2030 core scenario in the AM peak at the proposed M25 junction. As with the proposed A2 and A13 junctions, the Project is designed to minimise the impact of weaving. In this case the M25 northbound off-slip to junction 29 has been greatly extended so that it is now located south of the M25 northbound merge from the Project. This results in the following total flow movements not having to weave through each other:

a. 3,271 PCUs of total traffic from the Project northbound to the M25 northbound

b. 1,422 PCUs of total traffic from the M25 northbound to junction 29

10.2.14 Weaving was considered much less of an issue southbound as the distance between the merge (end of the on-slip from junction 29) and the diverge (start of the Project) is much longer than it would have been northbound. As such, it was considered that widening from the existing four lanes to five lanes would be sufficient to accommodate the additional demand generated by the Project as well as any weaving.

10.2.15 The key junction movements are as follows:

a. The traffic travelling north on the Project consists of:

i. 79% (3,271 PCUs) of total traffic and 91% (1,208 PCUs) of HGVs continuing north towards the M25

ii. 21% (888 PCUs) of total traffic and 9% (120 PCUs) of HGVs taking the slip/link road to M25 junction 29

b. The traffic travelling north on the M25 consists of:

i. 72% (3,694 PCUs) of total traffic and 84% (1,237 PCUs) of HGVs continuing north on the M25

ii. 28% (1,422 PCUs) of total traffic and 16% (240 PCUs) of HGVs taking the slip/link road to M25 junction 29

c. The traffic travelling south on the M25 consists of:

i. 73% (6,307 PCUs) of total traffic and 71% (2,420 PCUs) of HGVs continuing south on the M25

ii. 27% (2,274 PCUs) of total traffic and 29% (1,008 PCUs) of HGVs take the Project towards A13

10.2.16 Plate 10.7 shows the total vehicle flows for the 2030 core scenario in the PM peak at the proposed A2 junction and highlights similar flow composition to the AM. The traffic on the Project northbound consists of:

a. 75% (2,680 of 3,573 PCUs) comes from the east

b. 13% (456 PCUs) accesses from Gravesend East

c. 12% (437 PCUs) comes from the A2 to the west

10.2.17 Similar proportions can be seen for southbound traffic on the Project:

a. 83% (3,652 of 4,415 PCUs) travels east

b. 13% (574 PCUs) exits at Gravesend East

c. 4% (188 PCUs) continues on the A2 to the west

10.2.18 Plate 10.7 also shows the high 'weaving' flows that necessitated the design of separate carriageways. These are the movements that would have been in conflict (i.e. 'weaving' flows) in a single carriageway configuration. For westbound traffic these flows are:

a. 2,035 PCUs (approx. one lane worth) from the M2 to the Project northbound

b. 1,817 PCUs (approx. one lane worth) from the A2/A289 to the A2 westbound

10.2.19 For eastbound traffic the 'weaving' flows are:

a. 2,732 PCUs from the Project to the M2 eastbound

b. 2,897 PCUs from A2 eastbound to A2/A289 in the east

10.2.20 Plate 10.8 shows the HGV (PCUs) flows for the 2030 core scenario in the PM peak at the proposed A2 junction and shows the very high proportions of east-to-north and north-to-east HGV traffic using the Project. Very few HGVs west of the Gravesend East junction will use the Project because HGVs have a much higher cost per km than other vehicles so will favour the shorter, Lower Thames

Crossing-relieved, existing route. This is shown by the following HGV flows using the Project northbound:

a. 93% (705 of 755 PCUs) of HGVs on the Project northbound comes from the east

b. 6% (42 PCUs) access the Project from Gravesend East

c. <1% (5 PCUs) comes from the A2 to the west

10.2.21 Similar proportions can be seen for southbound traffic on the Project:

a. 95% (751 of 794 PCUs) travels east

b. 5% (43 PCUs) exits at Gravesend East

c. <1% (2 PCUs) continues on the A2 to the west

10.2.22 Plate 10.9 and Plate 10.10 show the total vehicle and HGV flows respectively for the 2030 core scenario in the PM peak at the proposed A13/A1089 junction.

10.2.23 The key junction movements are as follows:

a. The traffic travelling north across the River Thames on the Project consists of:

   i. 44% (1,563 PCUs) of total traffic and 81% (608 PCUs) of HGVs continuing north towards the M25

   ii. 56% (2,010 PCUs) of total traffic and 19% (147 PCUs) of HGVs turning east on to the A13

b. The traffic travelling south across the River Thames on the Project consists of:

   i. 45% (1,993 PCUs) of total traffic and 94% (745 PCUs) of HGVs from the M25

   ii. 43% (1,906 PCUs) of total traffic and 4% (29 PCUs) of HGVs from A13 westbound

   iii. 12% (515 PCUs) of total traffic and 2% (16 PCUs) of HGVs from the A1089 northbound

10.2.24 As noted for the AM, the Project design does not provide for all possible movements at the A13 junction with the Project either due to lack of demand (e.g. A13 eastbound to the Project northbound) or because the Project has provided significant relief to an existing route (e.g. the Project northbound to A13 westbound relieves traffic that would otherwise continue west on the A13 to reach the M25 northbound).

10.2.25 Another key feature of this junction is the retention of all key existing connections between the A13 and A1089 (which will include Tilbury Port traffic), and the addition of the following new connections:

c. A1089 northbound to the Project southbound (total flow of 515 PCUs)

d. A1089 northbound to the Project northbound (total flow of 940 PCUs)

10.2.26 These two connections provide a significant benefit to 50% (1,455 of 2,917 PCUs) of the traffic on the A1089 which otherwise would have been forced to access their eventual destinations via M25 junction 30 (or via a lengthy U-turn at the Manor Way junction on the A13 to access the Project to the south).

10.2.27 Plate 10.11 and Plate 10.12 show the total vehicle and HGV flows respectively for the 2030 core scenario in the PM peak at the proposed M25 junction. As with the proposed A2 and A13 junctions, the Project is designed to minimise the impact of weaving. In this case the M25 northbound off-slip to junction 29 has been greatly extended so that it is now located south of the M25 northbound merge from the Project. This results in the following total flow movements not having to weave through each other:

a. 2,145 PCUs of total traffic from the Project northbound to the M25 northbound

b. 1,354 PCUs of total traffic from the M25 northbound to junction 29

10.2.28 Other key junction movements are as follows:

a. The traffic travelling north on the Project consists of:

i. 77% (2,145 PCUs) of total traffic and 94% (873 PCUs) of HGVs continuing north towards the M25

ii. 23% (647 PCUs) of total traffic and 6% (52 PCUs) of HGVs taking the slip/link road to M25 junction 29

b. The traffic travelling north on the M25 consists of:

i. 74% (3,807 PCUs) of total traffic and 84% (969 PCUs) of HGVs continuing north on the M25

ii. 26% (1,354 PCUs) of total traffic and 16% (186 PCUs) of HGVs taking the slip/link road to M25 junction 29

c. The traffic travelling south on the M25 consists of:

i. 62% (5,346 PCUs) of total traffic and 64% (1,842 PCUs) of HGVs continuing south on the M25

ii. 38% (3,212 PCUs) of total traffic and 36% (1,033 PCUs) of HGVs take the Project towards the A13

Plate 10.1 The Project junction with A2/M2 – LTAM predicted traffic lows 2030 core AM peak all vehicles (PCUs)

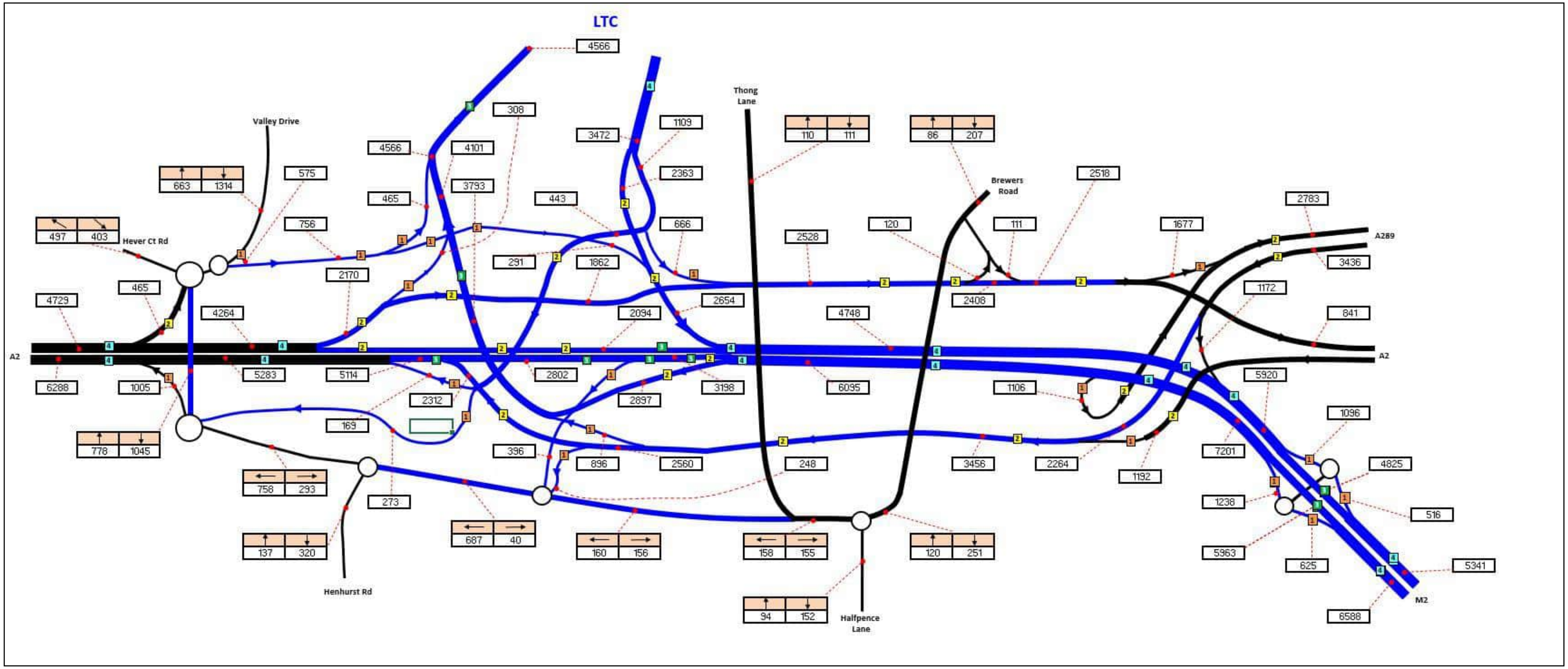


Plate 10.2 The Project junction with A2/M2 – LTAM predicted traffic flows 2030 core AM peak HGV (PCUs)

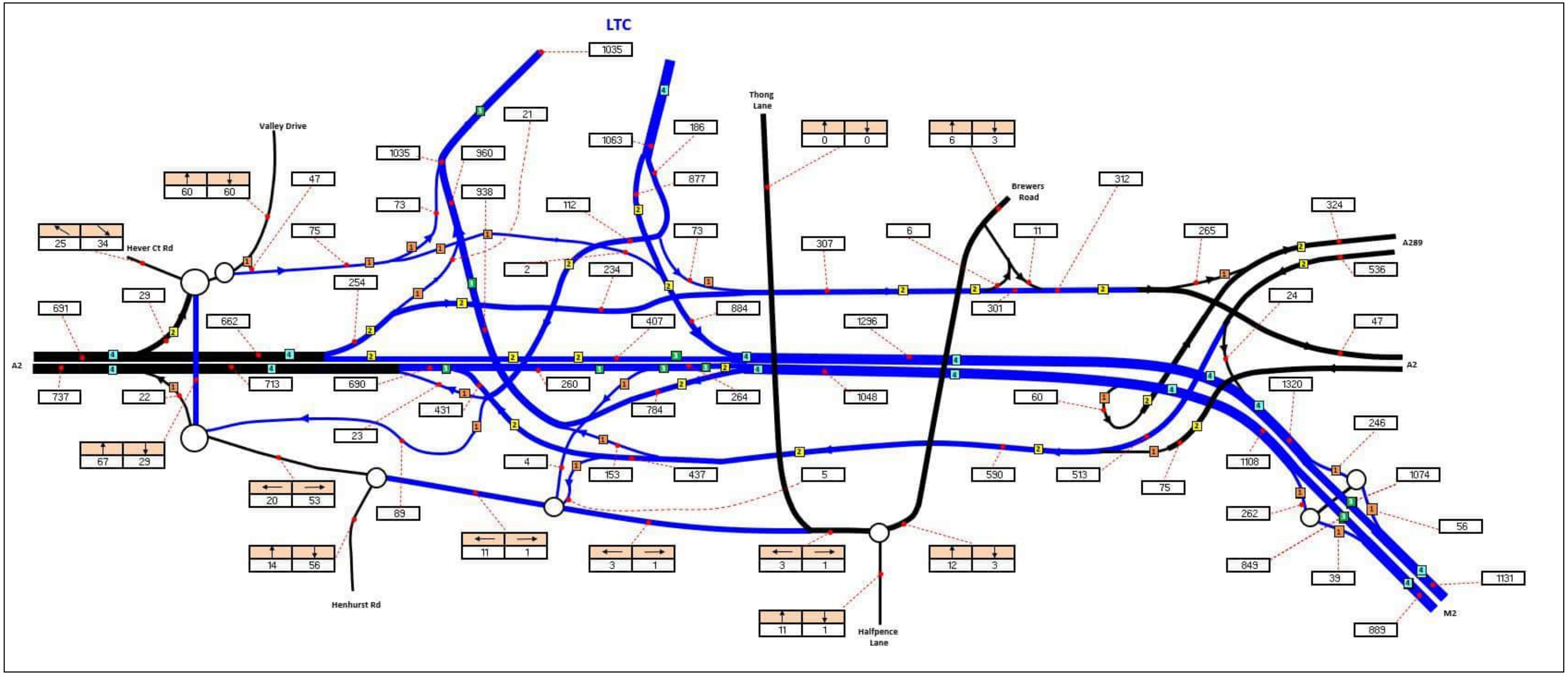


Plate 10.3 The Project junction with A13 – LTAM predicted traffic flows 2030 core AM peak all vehicles (PCUs)

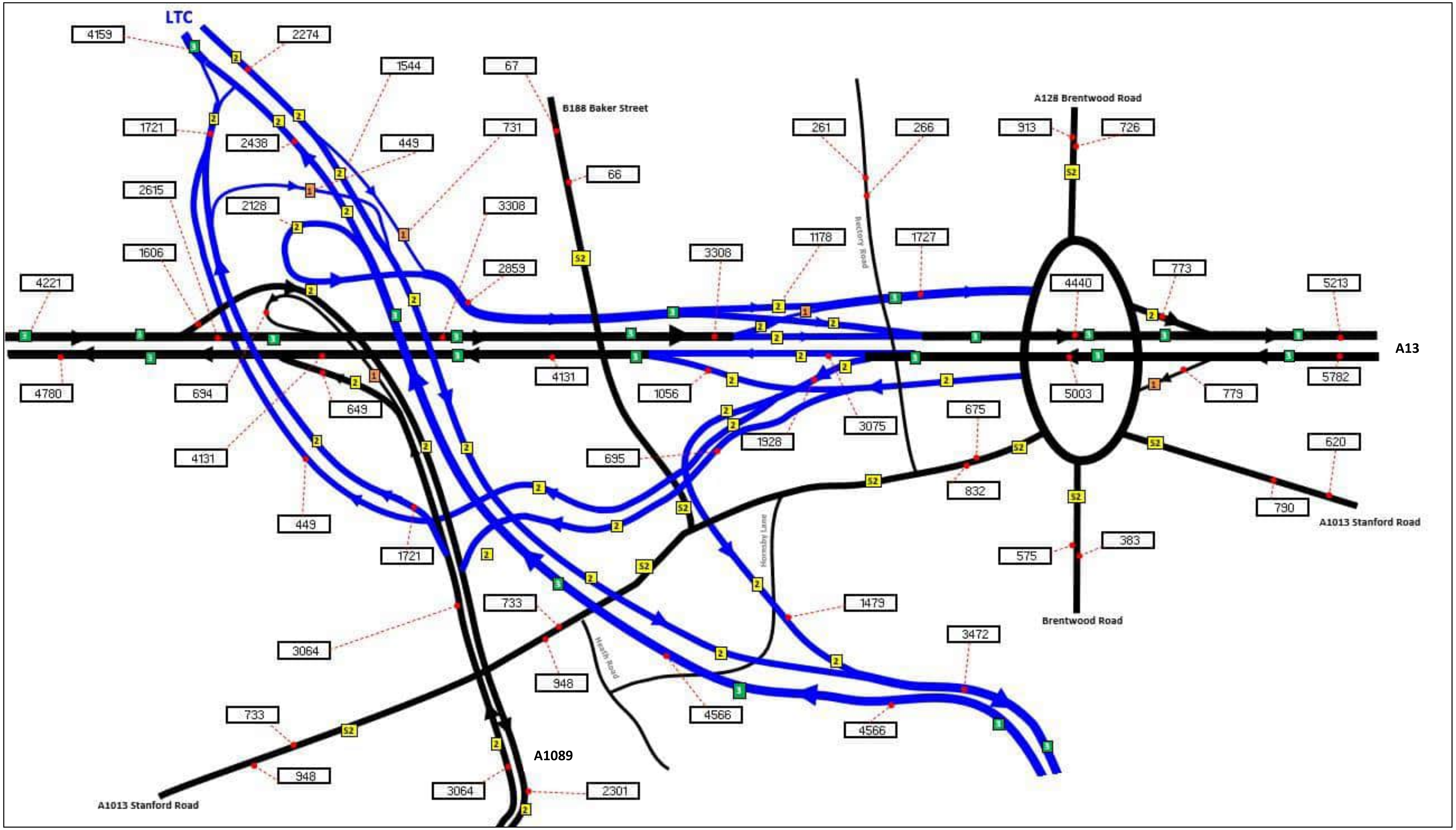


Plate 10.4 The Project junction with A13 – LTAM predicted traffic flows 2030 core AM peak HGV (PCUs)

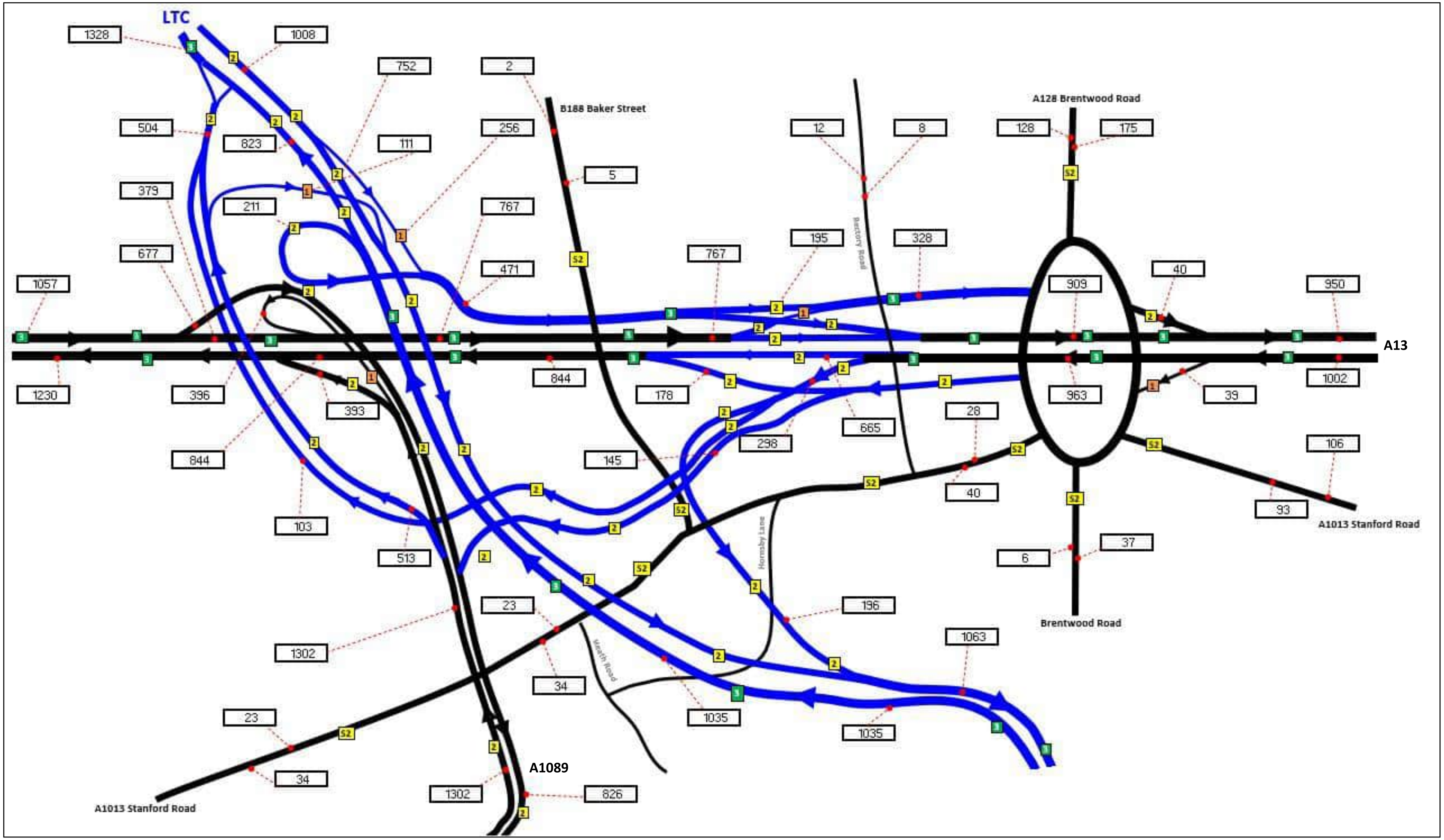


Plate 10.5 The Project junction with M25 – LTAM predicted traffic flows 2030 core AM peak all vehicles (PCUs)

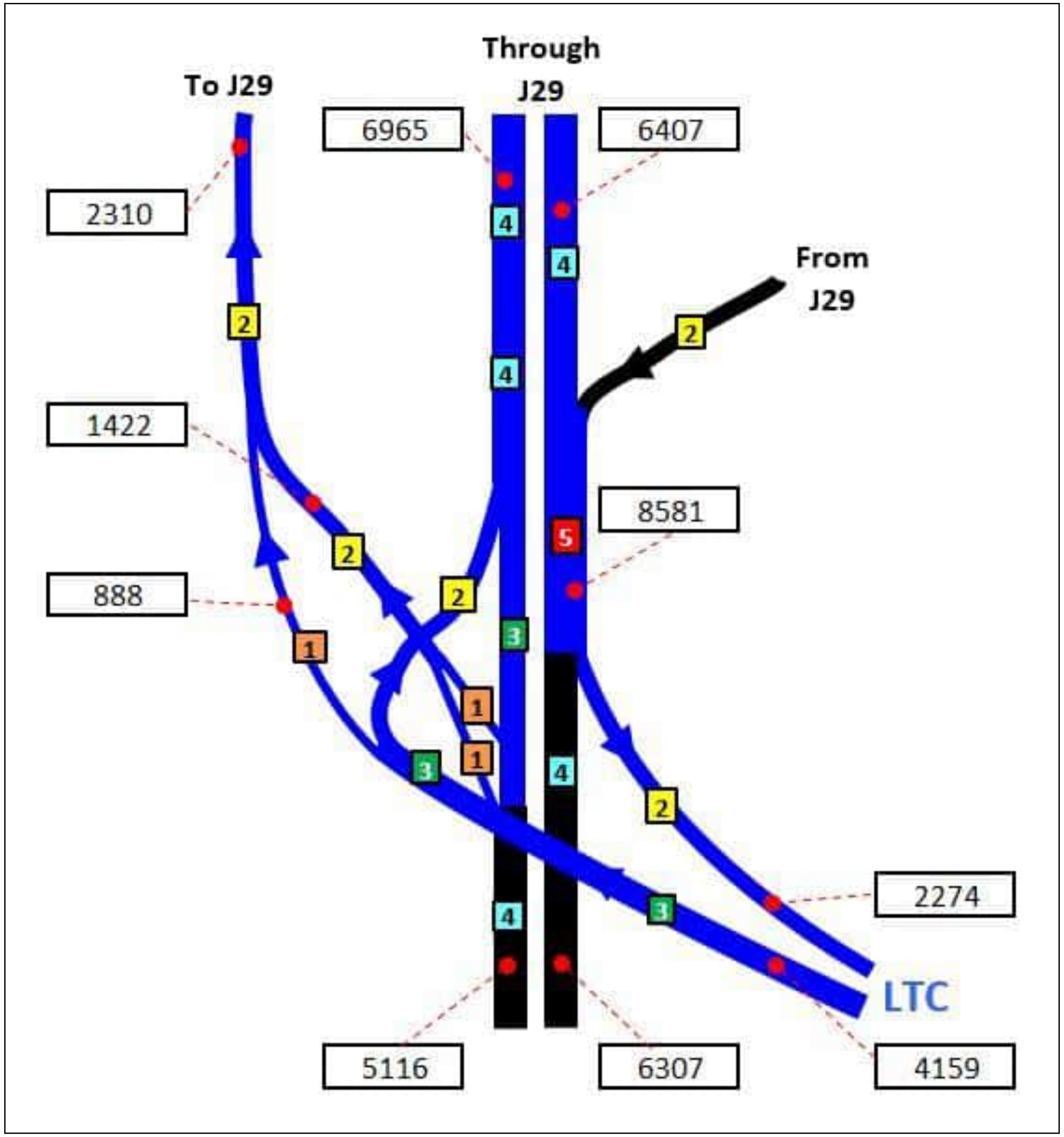


Plate 10.6 The Project junction with M25 – LTAM predicted traffic flows 2030 core AM peak HGV (PCUs)

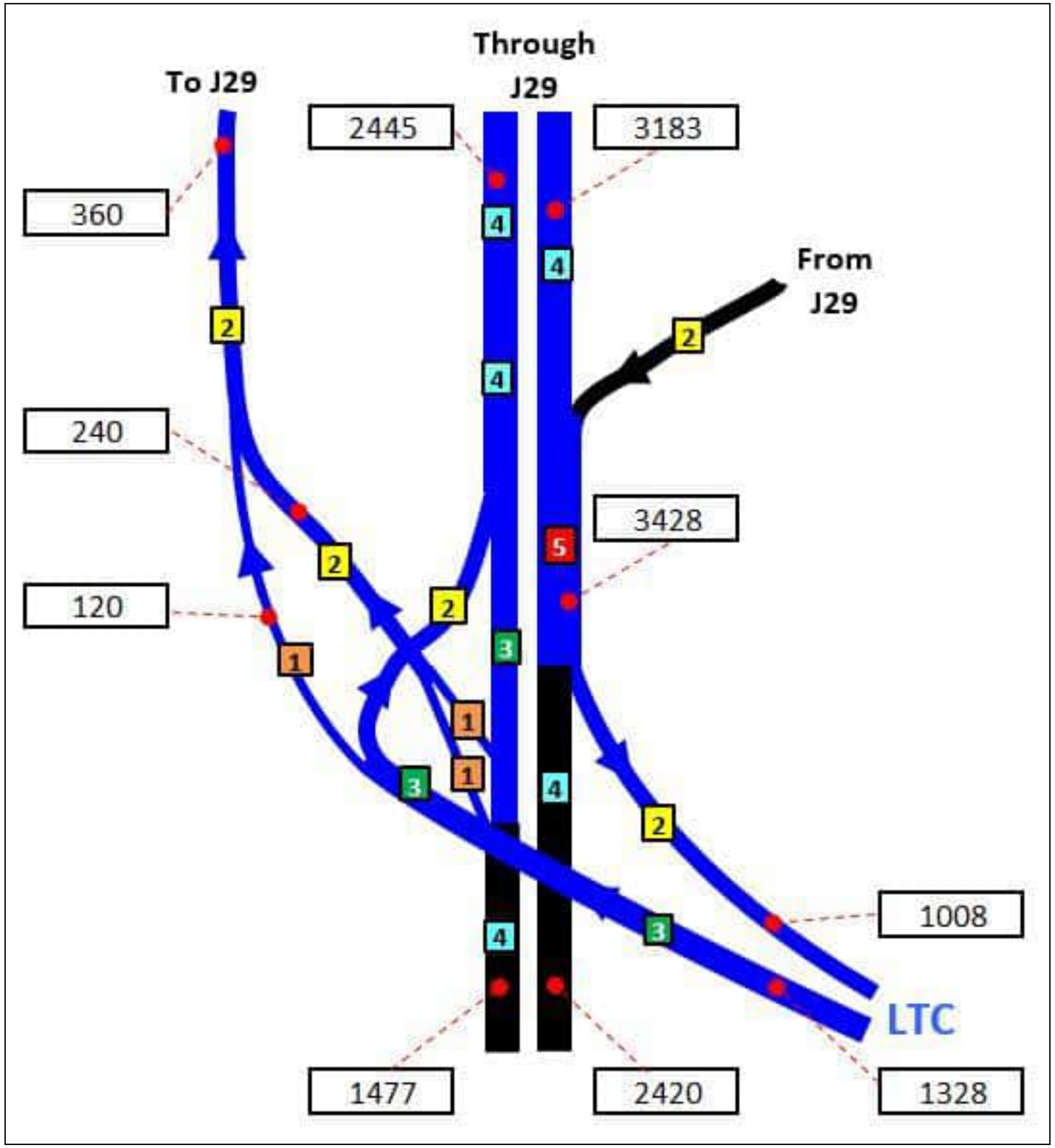


Plate 10.7 The Project junction with A2/M2 – LTAM predicted traffic flows 2030 core PM peak all vehicles (PCUs)

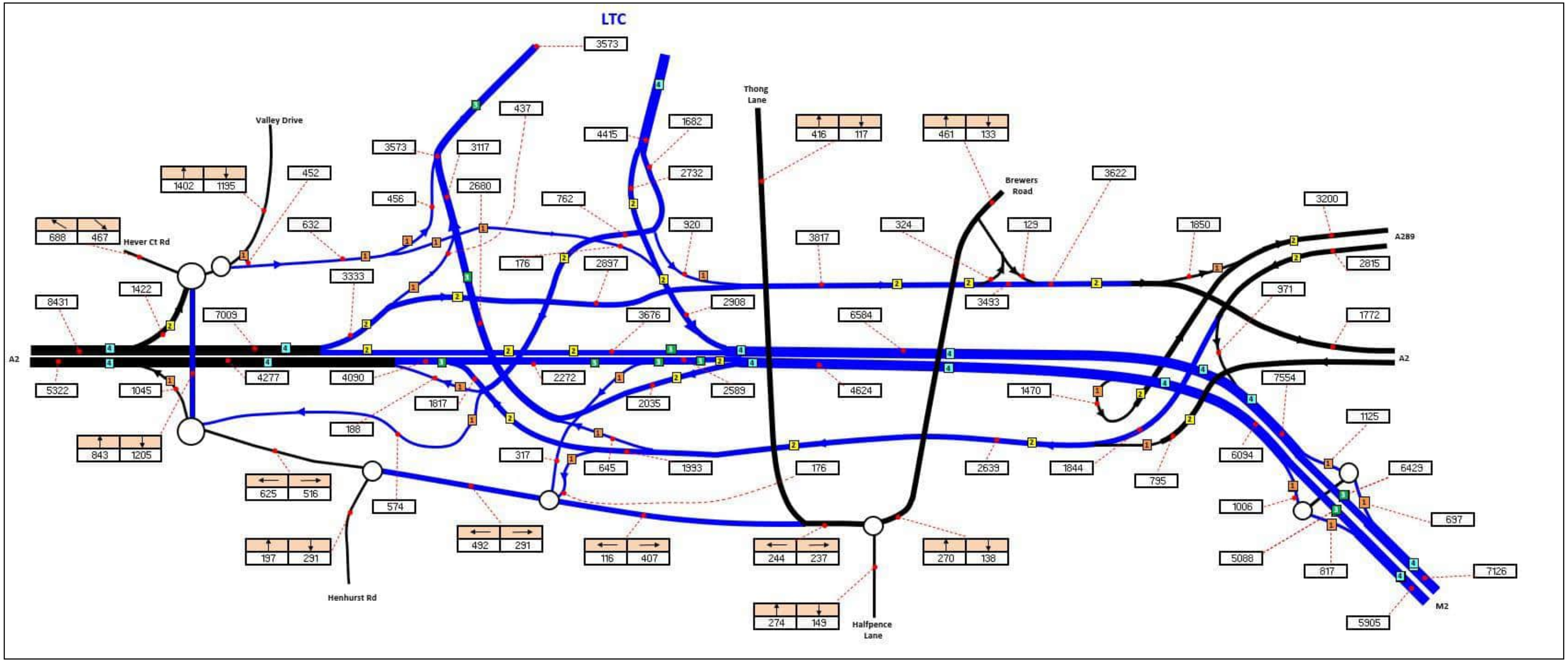


Plate 10.8 The Project junction with A2/M2 – LTAM predicted traffic flows 2030 core PM peak HGV (PCUs)

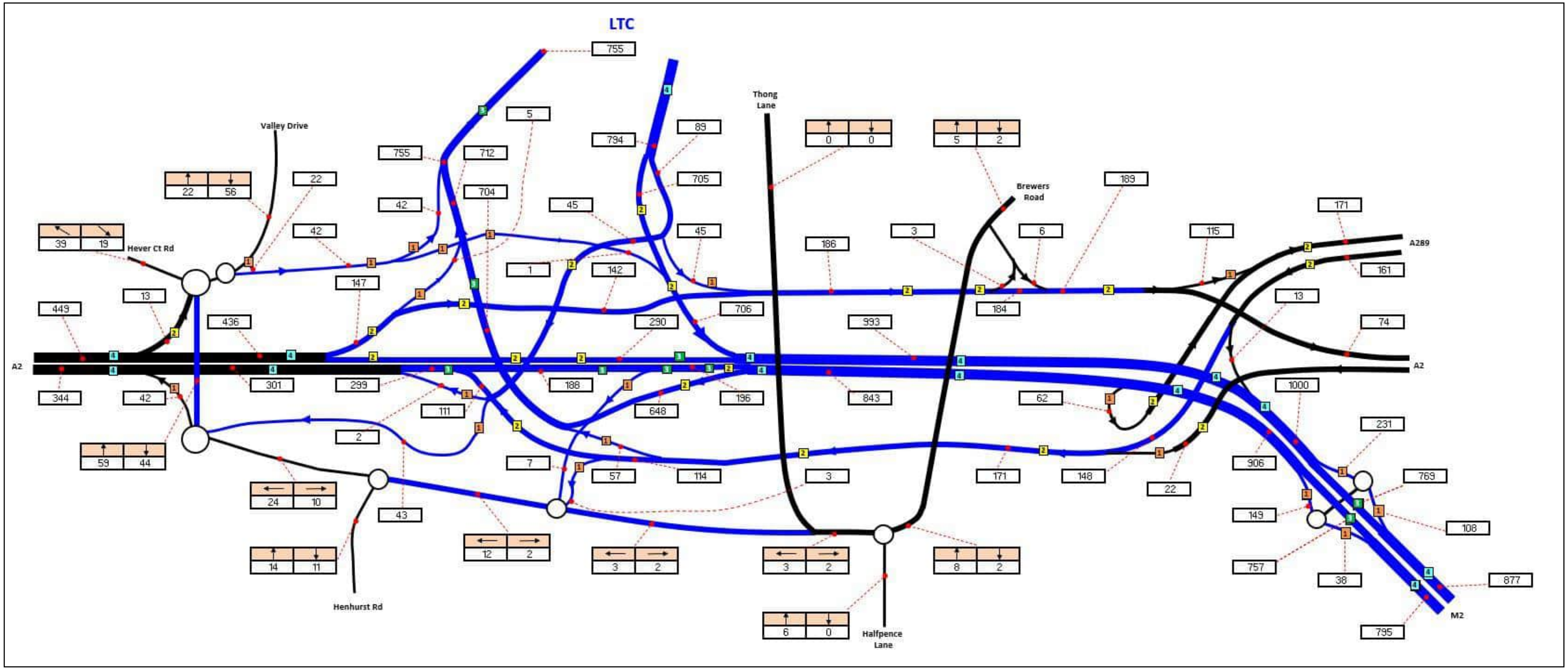


Plate 10.9 The Project junction with A13 – LTAM predicted traffic flows 2030 core PM peak all vehicles (PCUs)

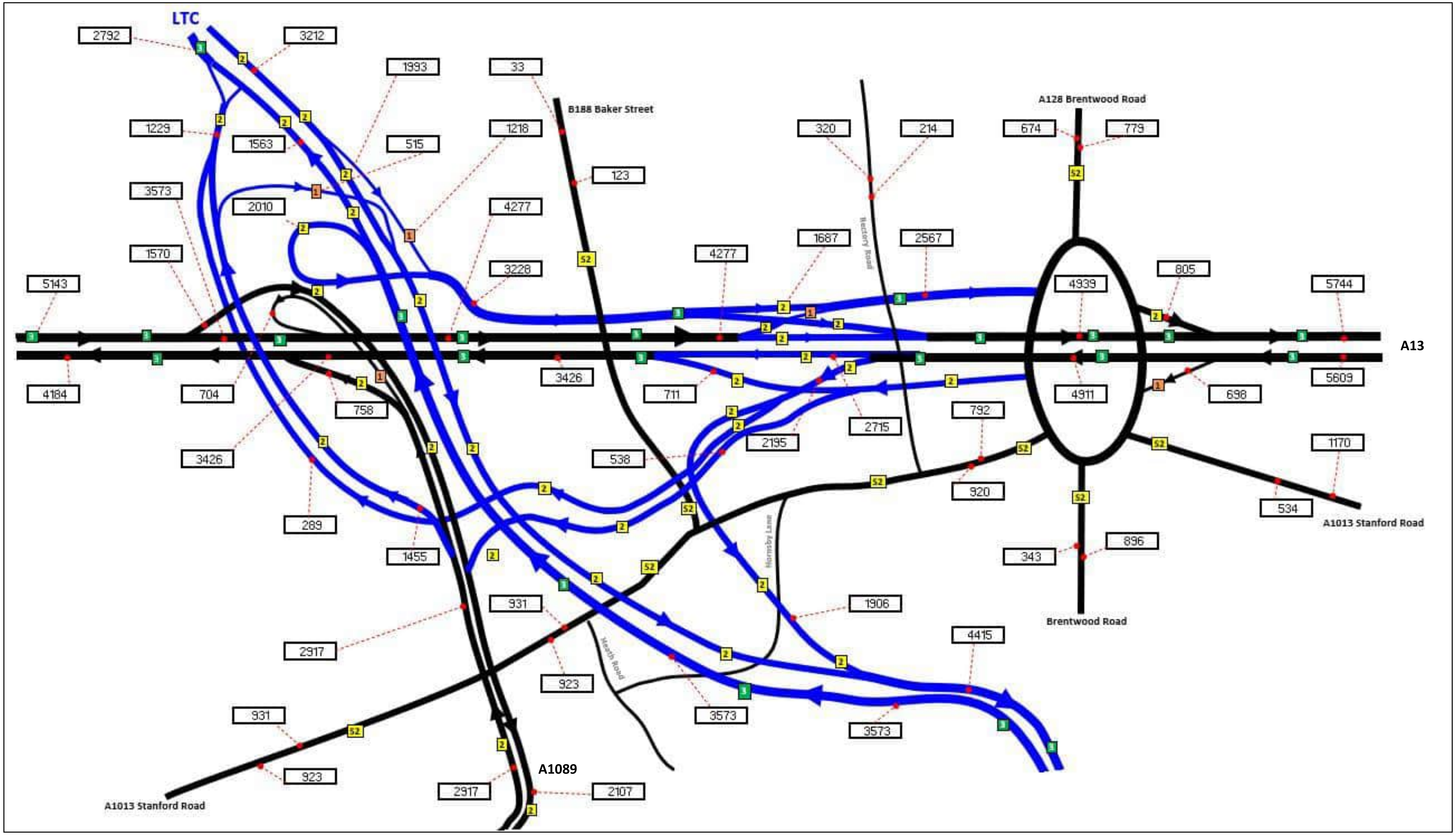


Plate 10.10 The Project junction with A13 – LTAM predicted traffic flows 2030 core PM peak HGV (PCUs)

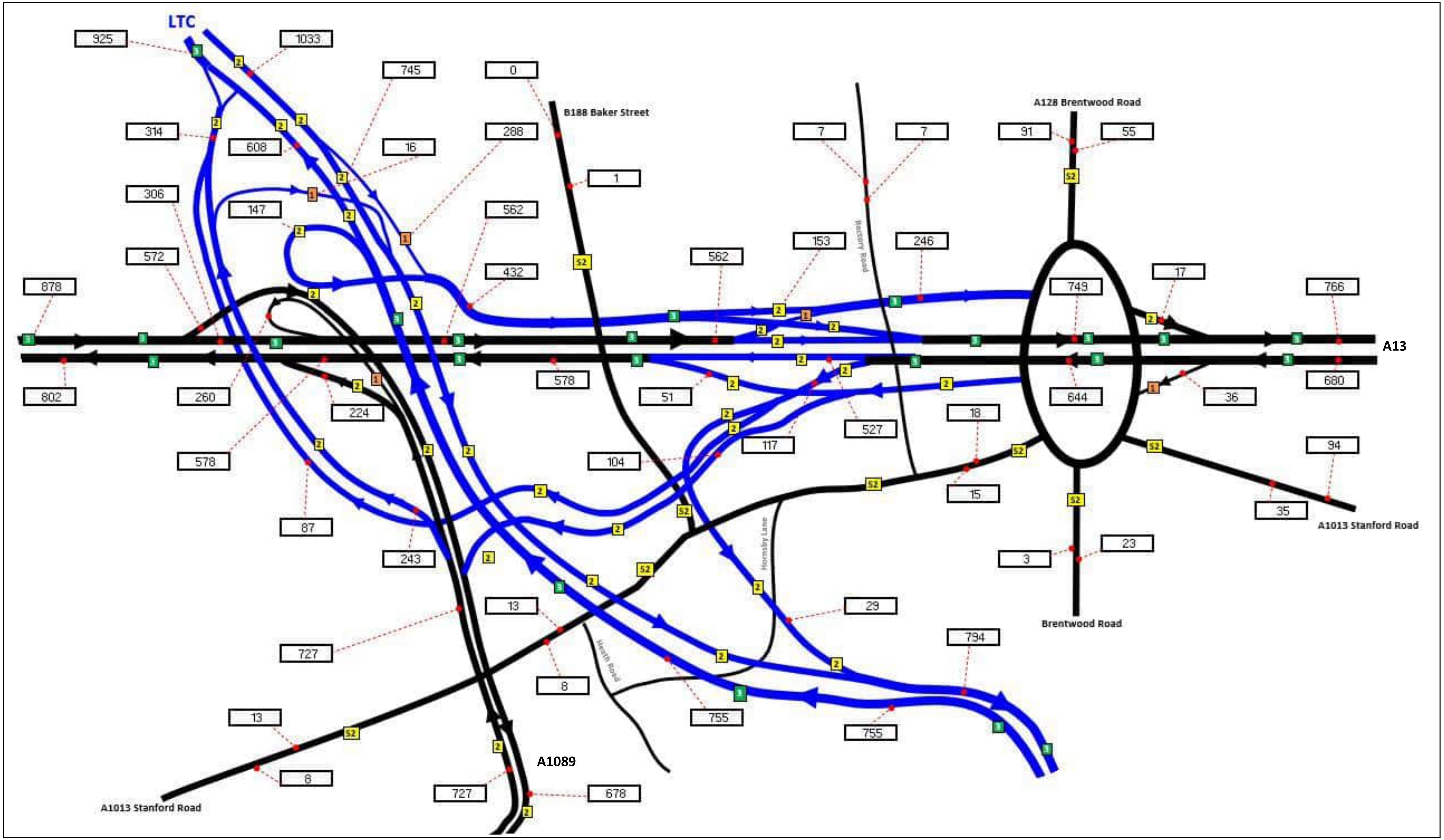


Plate 10.11 The Project junction with M25 – LTAM predicted traffic flows 2030 core PM peak all vehicles (PCUs)

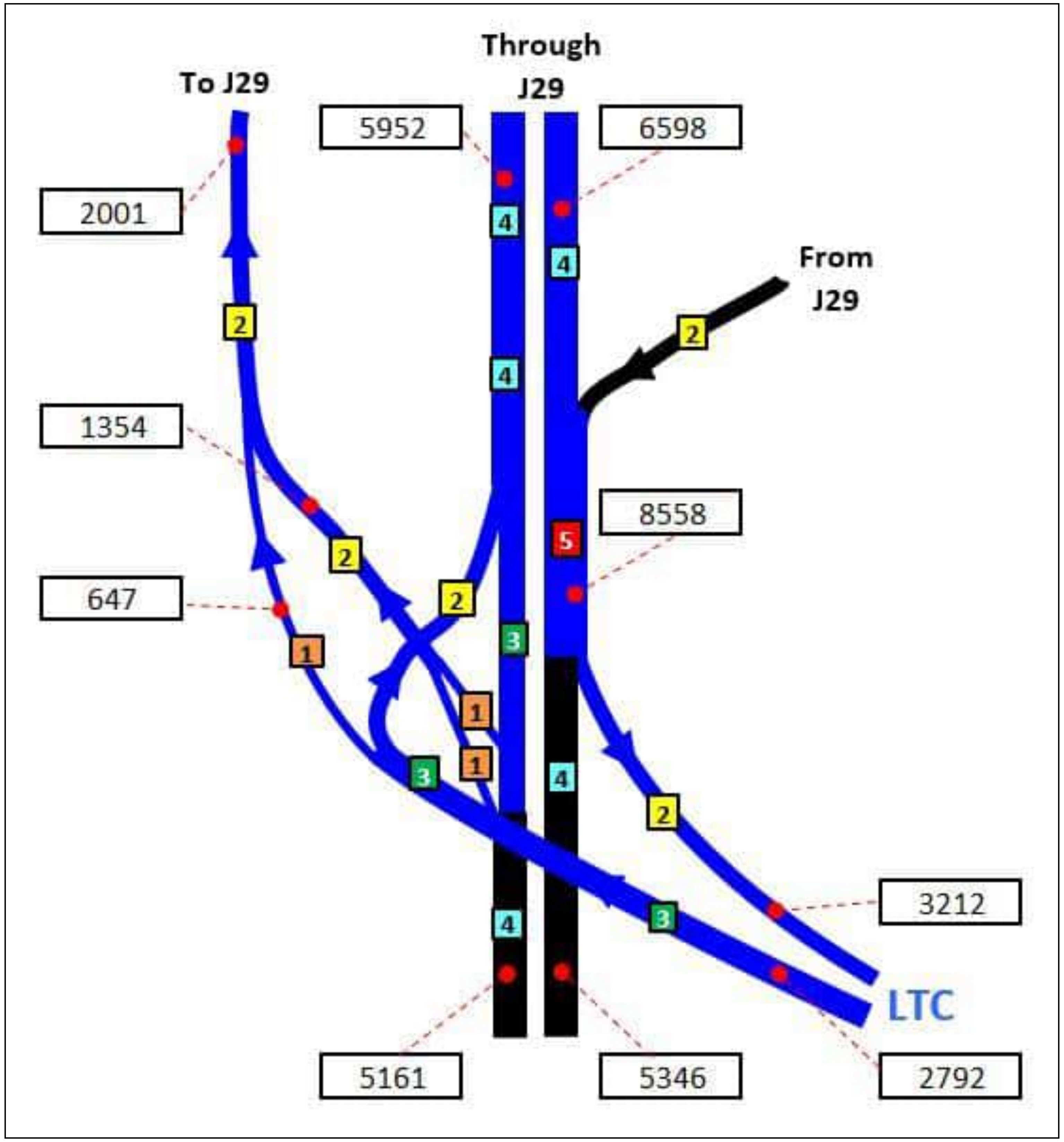
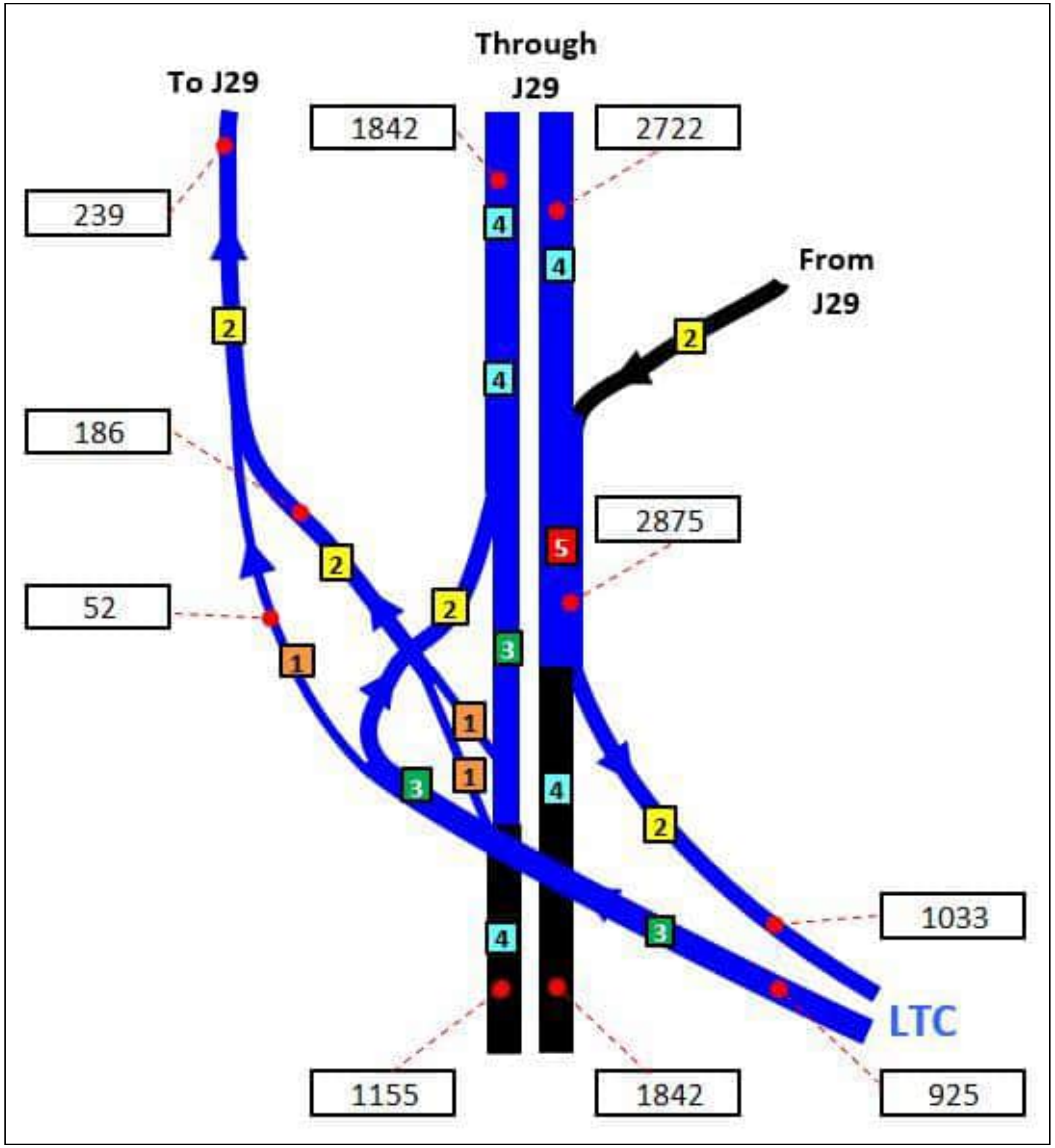


Plate 10.12 The Project junction with M25 – LTAM predicted traffic flows 2030 core PM peak HGV (PCUs)



10.3 LTAM 2037 core – outputs to operational assessment

10.3.1 Plate 10.13 to Plate 10.24 provide traffic flow information at the three junctions with the Project for all vehicles and HGVs for the morning and evening peak for the 2037 core scenario. The figures show a simplified representation of the junction layouts.

10.3.2 Plate 10.13 shows the total vehicle flows for the 2037 core scenario in the AM peak at the proposed A2 junction and highlights the low proportion of west-to-north and north-to-west traffic on the Project (attributed to the significant relief provided by the Project to the existing A2/A282/Dartford Crossing route). The traffic on the Project northbound consists of:

a. 82% (3,945 of 4,819 PCUs) comes from the east

b. 11% (508 PCUs) accesses from Gravesend East

c. 8% (364 PCUs) comes from the A2 to the west

10.3.3 Similar proportions can be seen for southbound traffic on the Project:

a. 86% (3,186 of 3,684 PCUs) travels east

b. 8% (303 PCUs) exits at Gravesend East

c. 5% (195 PCUs) continues on the A2 to the west

10.3.4 Plate 10.13 also shows the high 'weaving' flows that necessitated the design of separate carriageways at the A2 junction with the Project. These are the movements that would have been in conflict (i.e. 'weaving' flows) in a single carriageway configuration. For westbound traffic these flows are:

a. 3,008 PCUs (well over one lane worth) from the M2 to the Project northbound

b. 2,375 PCUs (over one lane worth) from A2/A289 to A2 westbound

10.3.5 For eastbound traffic the 'weaving' flows are:

a. 2,778 PCUs from the Project to M2 eastbound

b. 1,985 PCUs from A2 eastbound to A2/A289 in the east

10.3.6 Plate 10.14 shows the HGV (PCUs) flows for the 2037 core scenario in the AM peak at the proposed A2 junction and shows the very high proportions of east-to-north and north-to-east HGV traffic using the Project. Very few HGVs west of the Gravesend East junction will use the Project because HGVs have a much higher cost per km than other vehicles so will favour the shorter, Lower Thames Crossing-relieved, existing route. This is shown by the following HGV flows using the Project northbound:

a. 90% (954 PCUs) of HGVs on the Project northbound comes from the east

b. 7% (76 PCUs) accesses the Project from Gravesend East

c. 2% (22 PCUs) comes from the A2 to the west

10.3.7 Similar proportions can be seen for southbound traffic on the Project:

a. 88% (892 of 1,011 PCUs) travels east

b. 9% (93 PCUs) exits at Gravesend East

c. 3% (26 PCUs) continues on the A2 to the west

10.3.8 Plate 10.15 and Plate 10.16 show the total vehicle and HGV flows respectively for the 2037 core scenario in the AM peak at the proposed A13/A1089 junction. As with the proposed A2 junction the Project is designed to minimise the impact of weaving; in this case the westbound on-slip from Orsett Cock has been extended so that it joins the A13 after the A13 westbound to the Project southbound link road. Access to the A1089 from the A13 eastbound would remain unchanged, as would access from the A1089 to the A13 westbound. The current access from the A13 westbound to the A1089 would be re-routed via the Orsett Cock junction. Access from the A122 north and southbound, as well as to local roads, would also be via the Orsett Cock junction.

10.3.9 The key junction movements are as follows:

a. The traffic travelling north across the River Thames on the Project consists of:

   i. 54% (2,583 PCUs) of total traffic and 80% (844 PCUs) of HGVs continuing north towards the M25

   ii. 46% (2,235 PCUs) of total traffic and 20% (212 PCUs) of HGVs turning east on to the A13

b. The traffic travelling south across the River Thames on the Project consists of:

   i. 43% (1,584 PCUs) of total traffic and 69% (697 PCUs) of HGVs from the M25

   ii. 42% (1,562 PCUs) of total traffic and 19% (196 PCUs) of HGVs from the A13 westbound

   iii. 15% (537 PCUs) of total traffic and 11% (115 PCUs) of HGVs from the A1089 northbound

10.3.10 The Project design does not provide for all possible movements at the proposed A13 junction either due to lack of demand (e.g. A13 eastbound to the Project northbound) or because the Project has provided significant relief to an existing route (e.g. the Project northbound to the A13 westbound relieves traffic that would otherwise continue west on the A13 to reach the M25 northbound).

10.3.11 Another key feature of this junction is the retention of all key existing connections between the A13 and A1089 (which will include Tilbury Port traffic), and the addition of the following new connections:

c. A1089 northbound to the Project southbound (total flow of 537 PCUs)

d. A1089 northbound to the Project northbound (total flow of 1,367 PCUs)

10.3.12 These two connections provide a significant benefit to 58% (1,904 of 3,281 PCUs) of the traffic on the A1089 which otherwise would have been forced to access their eventual destinations via M25 junction 30 (or via a lengthy U-turn at the Manor Way junction on the A13 to access the Project to the south).

10.3.13 Plate 10.17 and Plate 10.18 show the total vehicle and HGV flows respectively for the 2037 core scenario in the AM peak at the proposed M25 junction. As with the proposed A2 and A13 junctions, the Project is designed to minimise the impact of weaving. In this case the M25 northbound off-slip to junction 29 has been greatly extended so that it is now located south of the M25 northbound merge from the Project. This results in the following total flow movements not having to weave through each other:

a. 3,455 PCUs from the Project northbound to M25 northbound

b. 1,516 PCUs from M25 northbound to junction 29

10.3.14 Weaving was considered much less of an issue southbound as the distance between the merge (end of the on-slip from junction 29) to the diverge (start of the Project) is much longer than it would have been northbound. As such, it was considered that widening from the existing four lanes to five lanes would be sufficient to accommodate the additional demand generated by the Project as well as any weaving.

10.3.15 The key junction movements are as follows:

a. The traffic travelling north on the Project consists of:

   i. 77% (3,455 PCUs) of total traffic and 91% (1,228 PCUs) of HGVs continuing north towards the M25

   ii. 23% (1,004 PCUs) of total traffic and 9% (124 PCUs) of HGVs taking the slip/link road to M25 junction 29

b. The traffic travelling north on the M25 consists of:

   i. 72% (3,914 PCUs) of total traffic and 84% (1,278 PCUs) of HGVs continuing north on the M25

   ii. 28% (1,516 PCUs) of total traffic and 16% (245 PCUs) of HGVs taking the slip/link road to M25 junction 29

c. The traffic travelling south on M25 consists of:

   i. 74% (6,739 PCUs) of total traffic and 73% (2,553 PCUs) of HGVs continuing south on M25

   ii. 26% (2,383 PCUs) of total traffic and 27% (964 PCUs) of HGVs take the Project towards A13

10.3.16 Plate 10.19 shows the total vehicle flows for the 2037 core scenario in the PM peak at the proposed A2 junction and highlights similar flow composition to the AM. The traffic on the Project northbound consists of:

a. 73% (2,811 of 3,846 PCUs) comes from the east

b. 14% (540 PCUs) accesses from Gravesend East

c. 13% (494 PCUs) comes from the A2 to the west

10.3.17 Similar proportions can be seen for southbound traffic on the Project:

a. 82% (3,724 of 4,568 PCUs) travels east

b. 14% (638 PCUs) exits at Gravesend East

c. 5% (207 PCUs) continues on the A2 to the west

10.3.18 Plate 10.19 also shows the high ‘weaving’ flows that necessitated the design of separate carriageways. These are the movements that would have been in conflict (i.e. ‘weaving’ flows) in a single carriageway configuration. For westbound traffic these flows are:

a. 2,105 PCUs (approx. one lane worth) from the M2 to the Project northbound

b. 1,924 PCUs (approx. one lane worth) from A2/A289 to A2 westbound

10.3.19 For eastbound traffic the ‘weaving’ flows are:

a. 2,946 PCUs from the Project to M2 eastbound

b. 2,925 PCUs from A2 eastbound to A2/A289 in the east

10.3.20 Plate 10.20 shows the HGV (PCUs) flows for the 2037 core scenario in the PM peak at the proposed A2 junction and shows the very high proportions of east-to-north and north-to-east HGV traffic using the Project. Very few HGVs west of the Gravesend East junction will use the Project because HGVs have a much higher cost per km than other vehicles so will favour the shorter, Lower Thames Crossing-relieved, existing route. This is shown by the following HGV flows using the Project northbound:

a. 92% (652 PCUs) of HGVs on the Project northbound comes from the east

b. 6% (44 PCUs) access the Project from Gravesend East

c. 1% (5 PCUs) comes from the A2 to the west

10.3.21 Similar proportions can be seen for southbound traffic on the Project:

a. 94% (738 of 783 PCUs) travels east

b. 6% (45 PCUs) exits at Gravesend East

c. <1% (1 PCU) continues on the A2 to the west

10.3.22 Plate 10.21 and Plate 10.22 show the total vehicle and HGV flows respectively for the 2037 core scenario in the PM peak at the proposed A13/A1089 junction.

10.3.23 The key junction movements are as follows:

a. The traffic travelling north across the River Thames on the Project consists of:

   i. 42% (1,627 PCUs) of total traffic and 79% (558 PCUs) of HGVs continuing north towards the M25

   ii. 58% (2,219 PCUs) of total traffic and 21% (148 PCUs) of HGVs turning east on to the A13

b. The traffic travelling south across the River Thames on the Project consists of:

   i. 44% (1,997 PCUs) of total traffic and 93% (730 PCUs) of HGVs from the M25

   ii. 43% (1,985 PCUs) of total traffic and 4% (30 PCUs) of HGVs from A13 westbound

   iii. 13% (586 PCUs) of total traffic and 2% (17 PCUs) of HGVs from the A1089 northbound

10.3.24 As noted for the AM, the Project design does not provide for all possible movements at the proposed A13 junction either due to lack of demand (e.g. A13 eastbound to the Project northbound) or because the Project has provided significant relief to an existing route (e.g. the Project northbound to the A13 westbound relieves traffic that would otherwise continue west on the A13 to reach the M25 northbound).

10.3.25 Another key feature of this junction is the retention of all key existing connections between the A13 and A1089 (which will include Tilbury Port traffic), and the addition of the following new connections:

a. A1089 northbound to the Project southbound (total flow of 586 PCUs)

b. A1089 northbound to the Project northbound (total flow of 1,033 PCUs)

10.3.26 These two connections provide a significant benefit to 52% (1,619 of 3,116 PCUs) of the traffic on the A1089 which otherwise would have been forced to access their eventual destinations via M25 junction 30 (or via a lengthy U-turn at the Manor Way junction on the A13 to access the Project to the south).

10.3.27 Plate 10.23 and Plate 10.24 show the total vehicle and HGV flows respectively for the 2037 core scenario in the PM peak at the M25 junction with the Project. As with the proposed A2 and A13 junctions, the Project is designed to minimise the impact of weaving. In this case the M25 northbound off-slip to junction 29 has been greatly extended so that it is now located south of the M25 northbound merge from the Project. This results in the following total flow movements not having to weave through each other:

a. 2,278 PCUs from the Project northbound to M25 northbound

b. 1,417 PCUs from the M25 northbound to junction 29

10.3.28 Other key junction movements are as follows:

a. The traffic travelling north on the Project consists of:

   i. 77% (2,278 PCUs) of total traffic and 94% (833 PCUs) of HGVs continuing north towards the M25

   ii. 23% (697 PCUs) of total traffic and 6% (52 PCUs) of HGVs taking the slip/link road to M25 junction 29

b. The traffic travelling north on M25 consists of:

   i. 74% (4,110 PCUs) of total traffic and 85% (1,059 PCUs) of HGVs continuing north on M25

   ii. 26% (1,417 PCUs) of total traffic and 15% (190 PCUs) of HGVs taking the slip/link road to M25 junction 29

c. The traffic travelling south on M25 consists of:

   i. 64% (5,783 PCUs) of total traffic and 65% (1,937 PCUs) of HGVs continuing south on M25

   ii. 36% (3,304 PCUs) of total traffic and 35% (1,024 PCUs) of HGVs take the Project towards A13

Plate 10.13 The Project junction with A2/M2 – LTAM predicted traffic flows 2037 core AM peak all vehicles (PCUs)

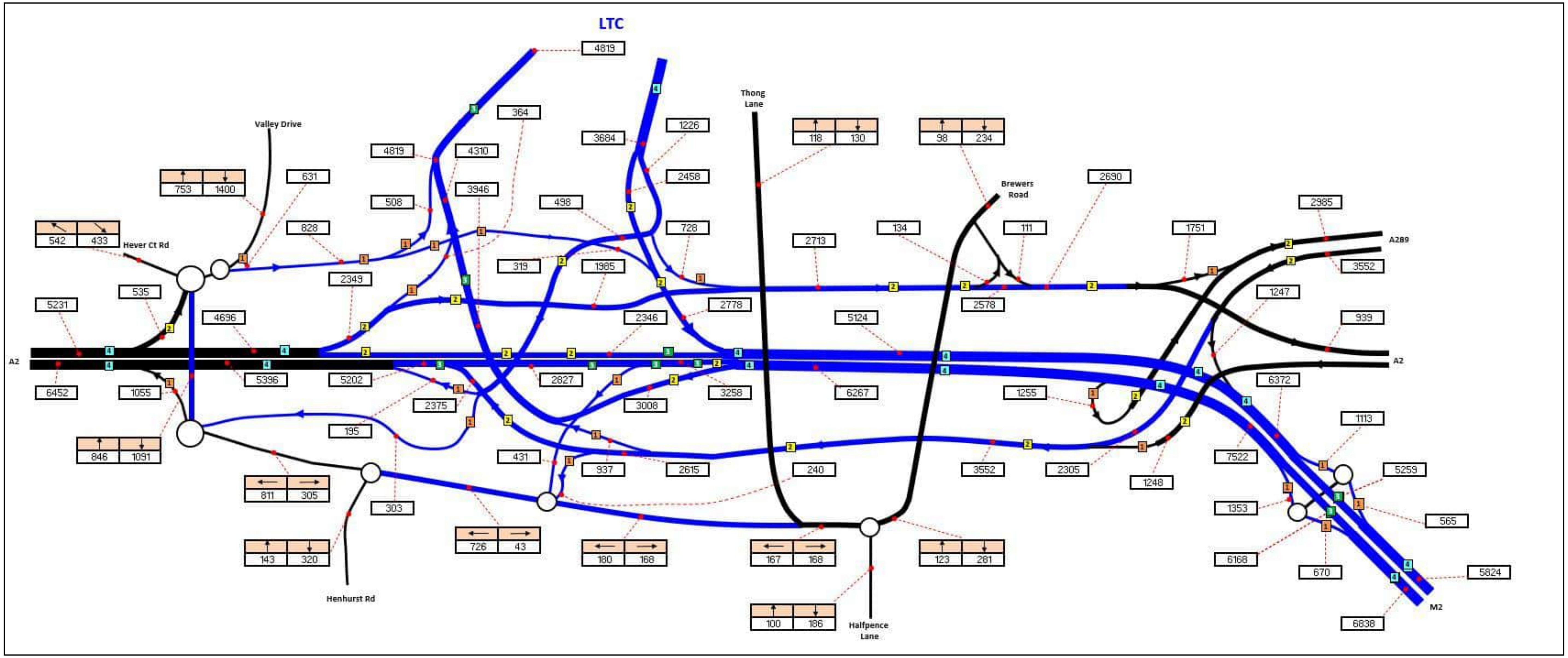


Plate 10.14 The Project junction with A2/M2 – LTAM predicted traffic flows 2037 core AM peak HGV (PCUs)

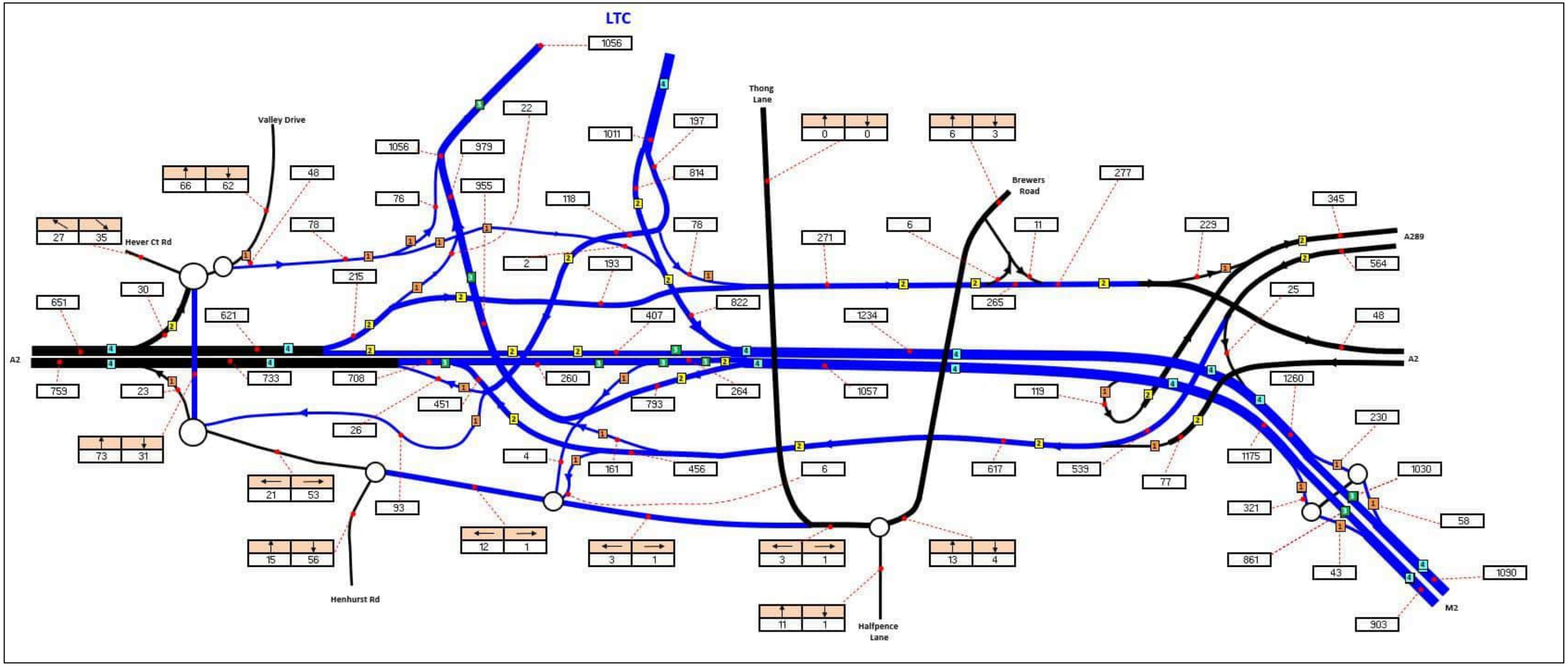


Plate 10.15 The Project junction with A13 – LTAM predicted traffic flows 2037 core AM peak all vehicles (PCUs)

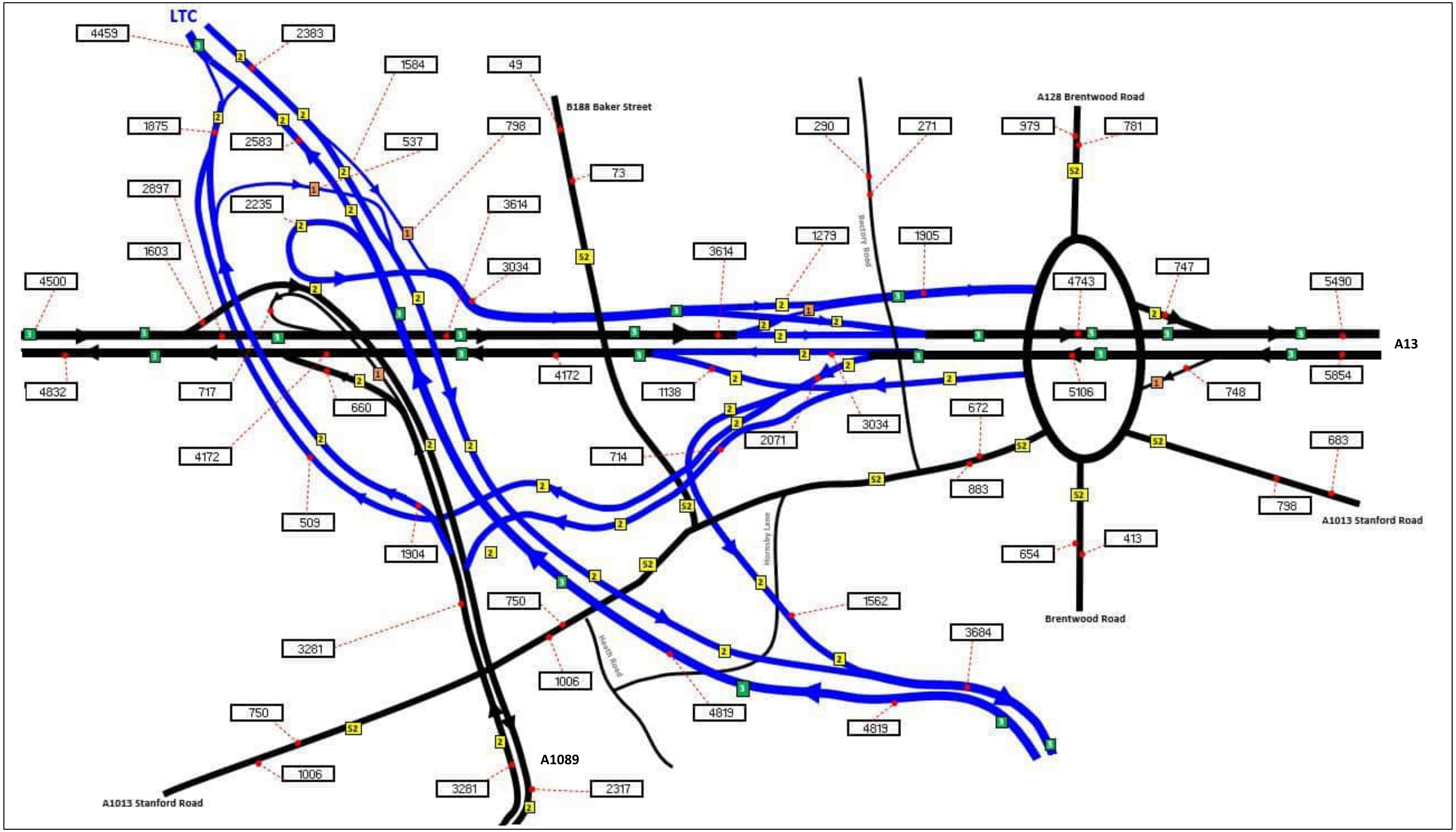


Plate 10.16 The Project junction with A13 – LTAM predicted traffic flows 2037 core AM peak HGV (PCUs)

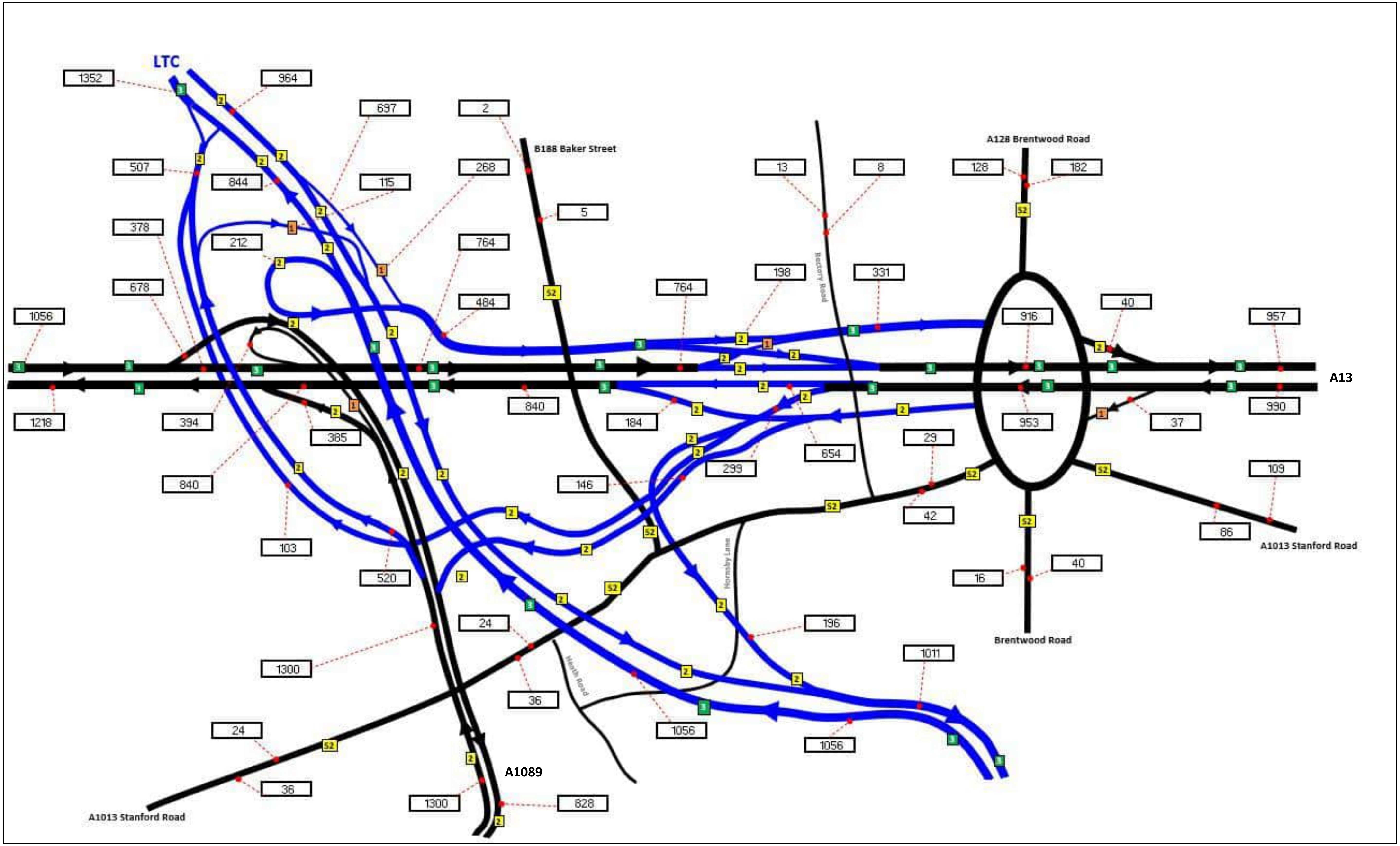


Plate 10.17 The Project junction with M25 – LTAM predicted traffic flows 2037 core AM peak all vehicles (PCUs)

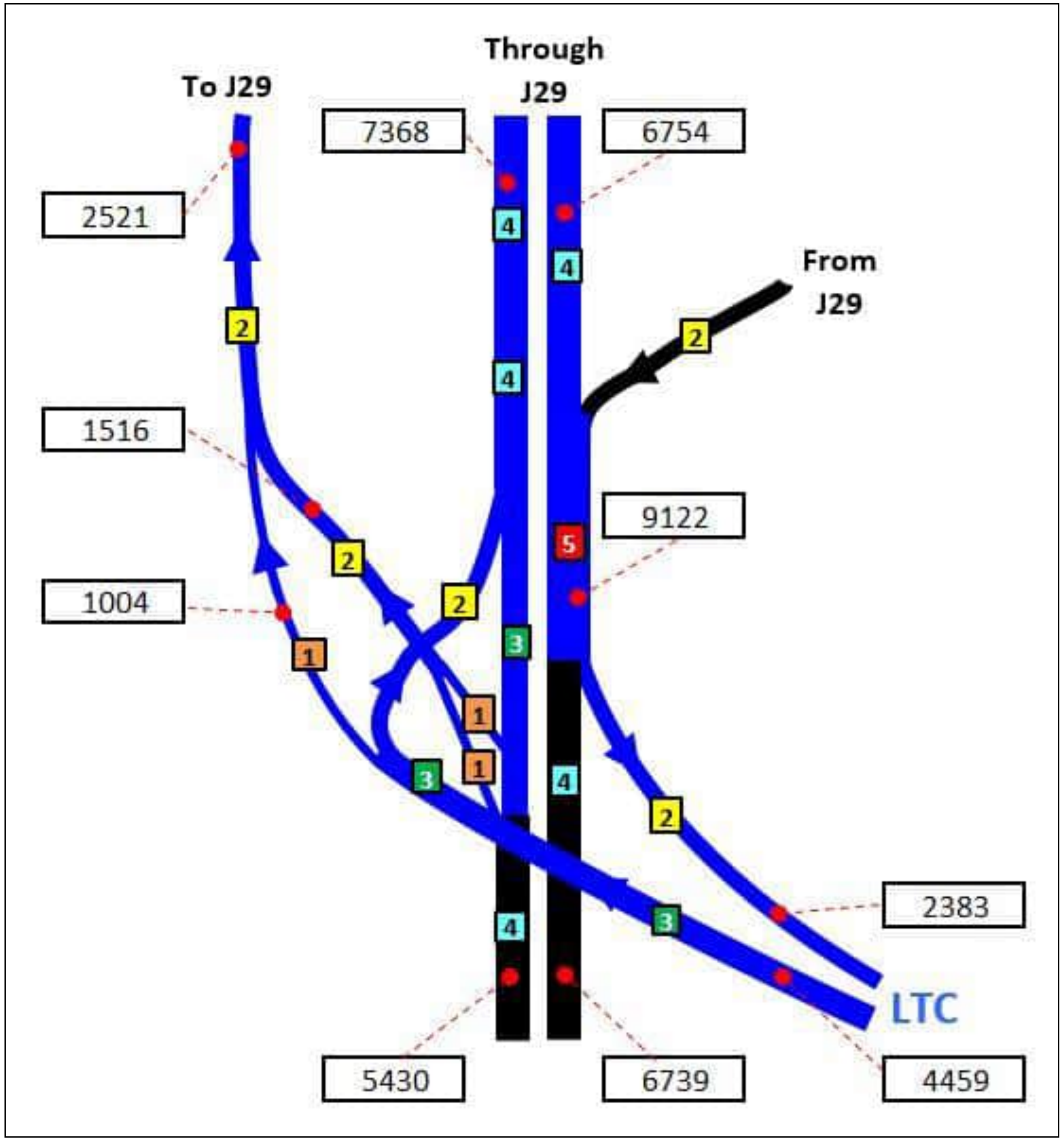


Plate 10.18 The Project junction with M25 – LTAM predicted traffic flows 2037 core AM peak HGV (PCUs)

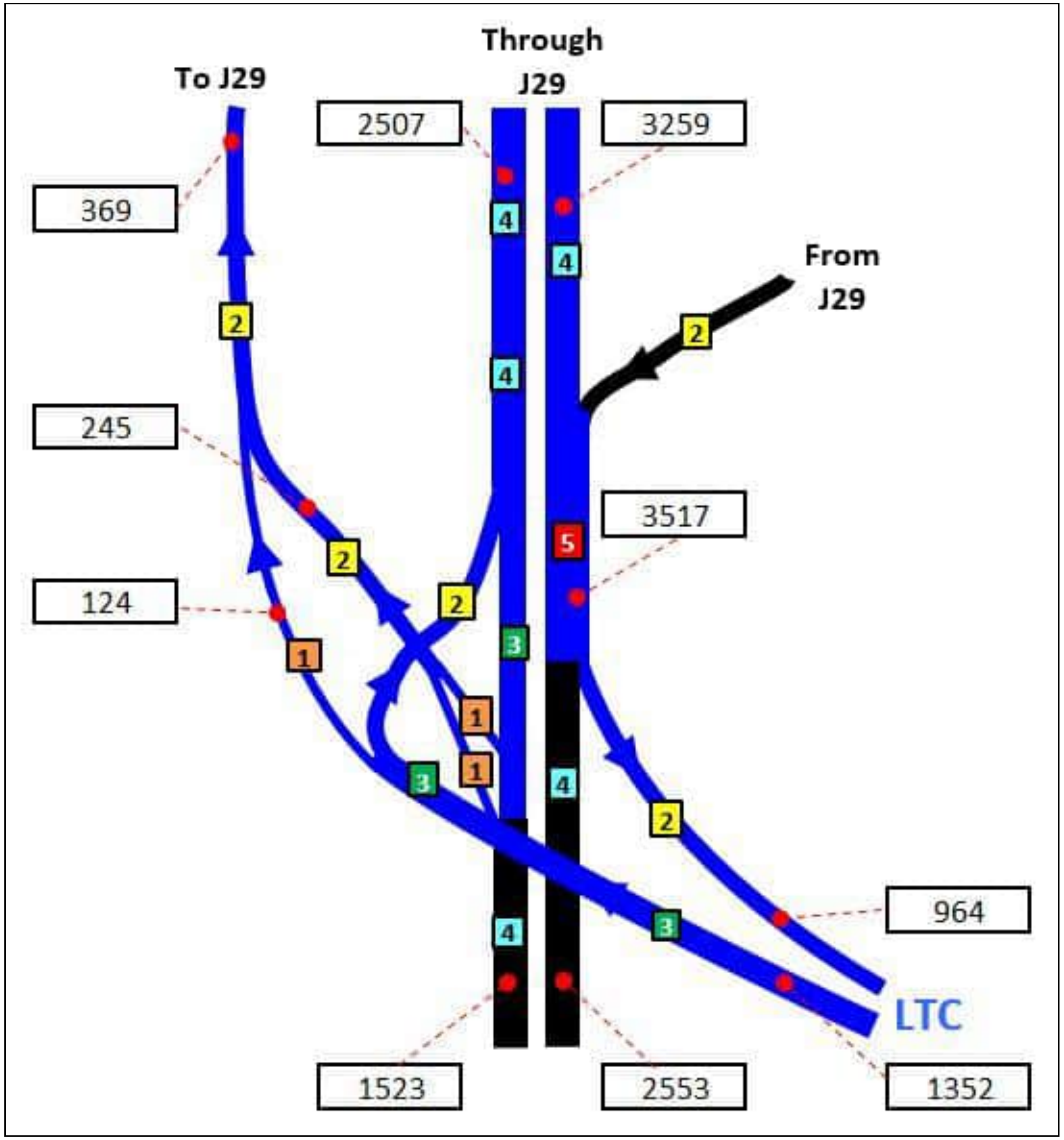


Plate 10.19 The Project junction with A2/M2 – LTAM predicted traffic flows 2037 core PM peak all vehicles (PCUs)

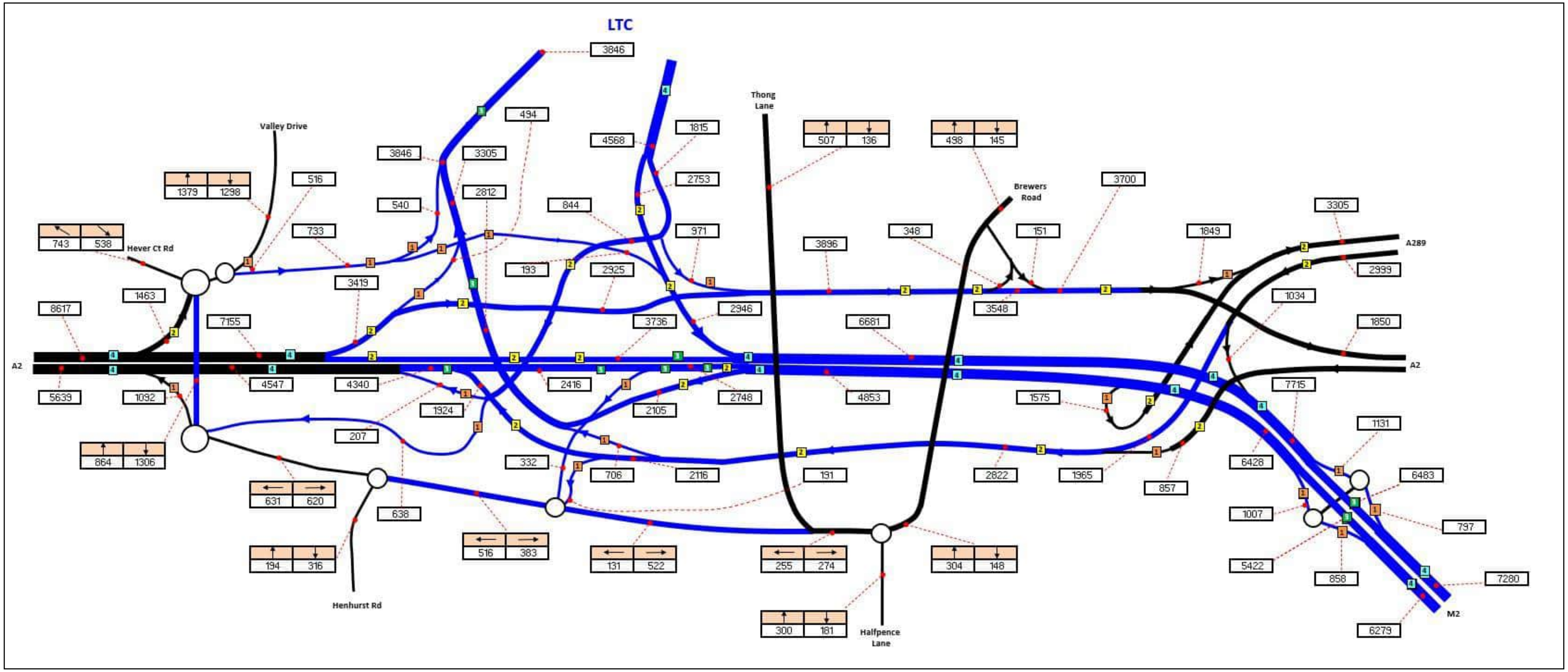


Plate 10.20 The Project junction with A2/M2 – LTAM predicted traffic flows 2037 core PM peak HGV (PCUs)

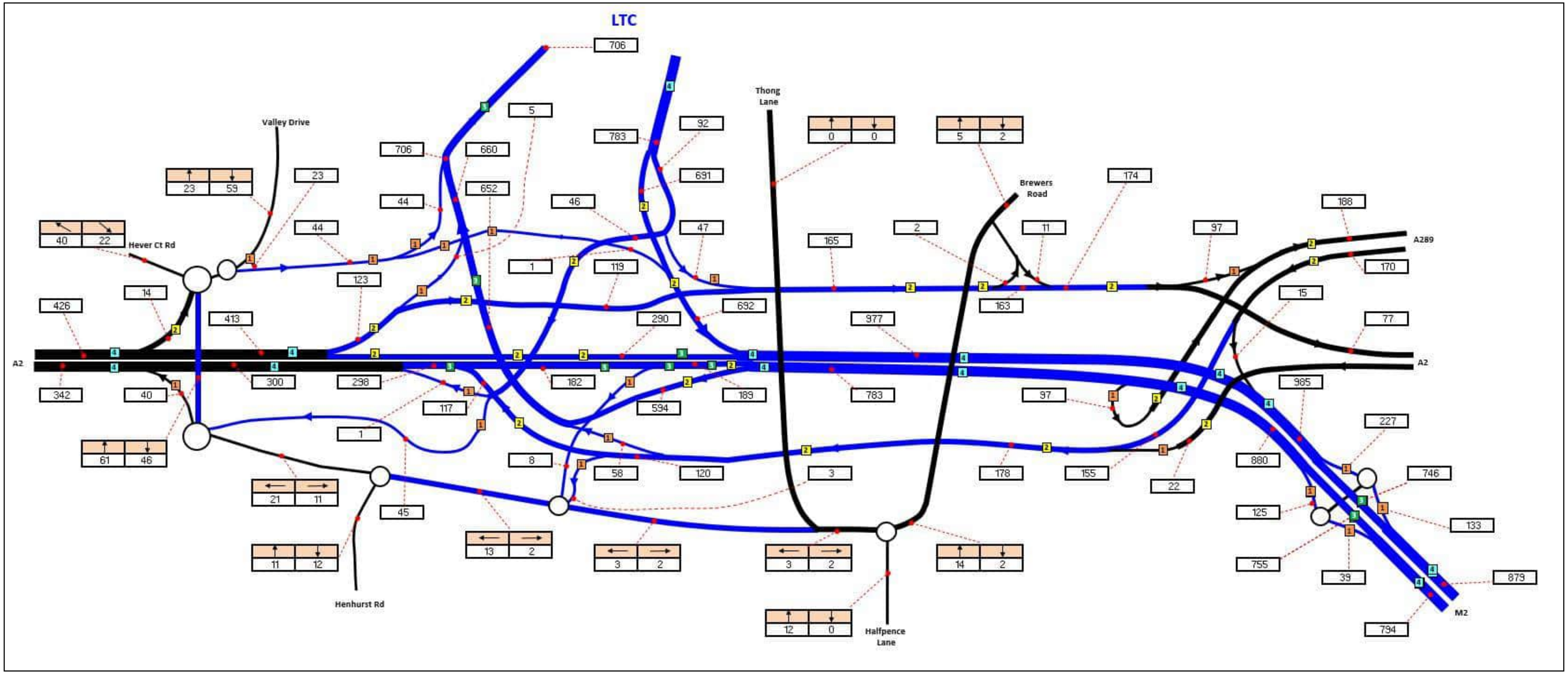


Plate 10.21 The Project junction with A13 – LTAM predicted traffic flows 2037 core PM peak all vehicles (PCUs)

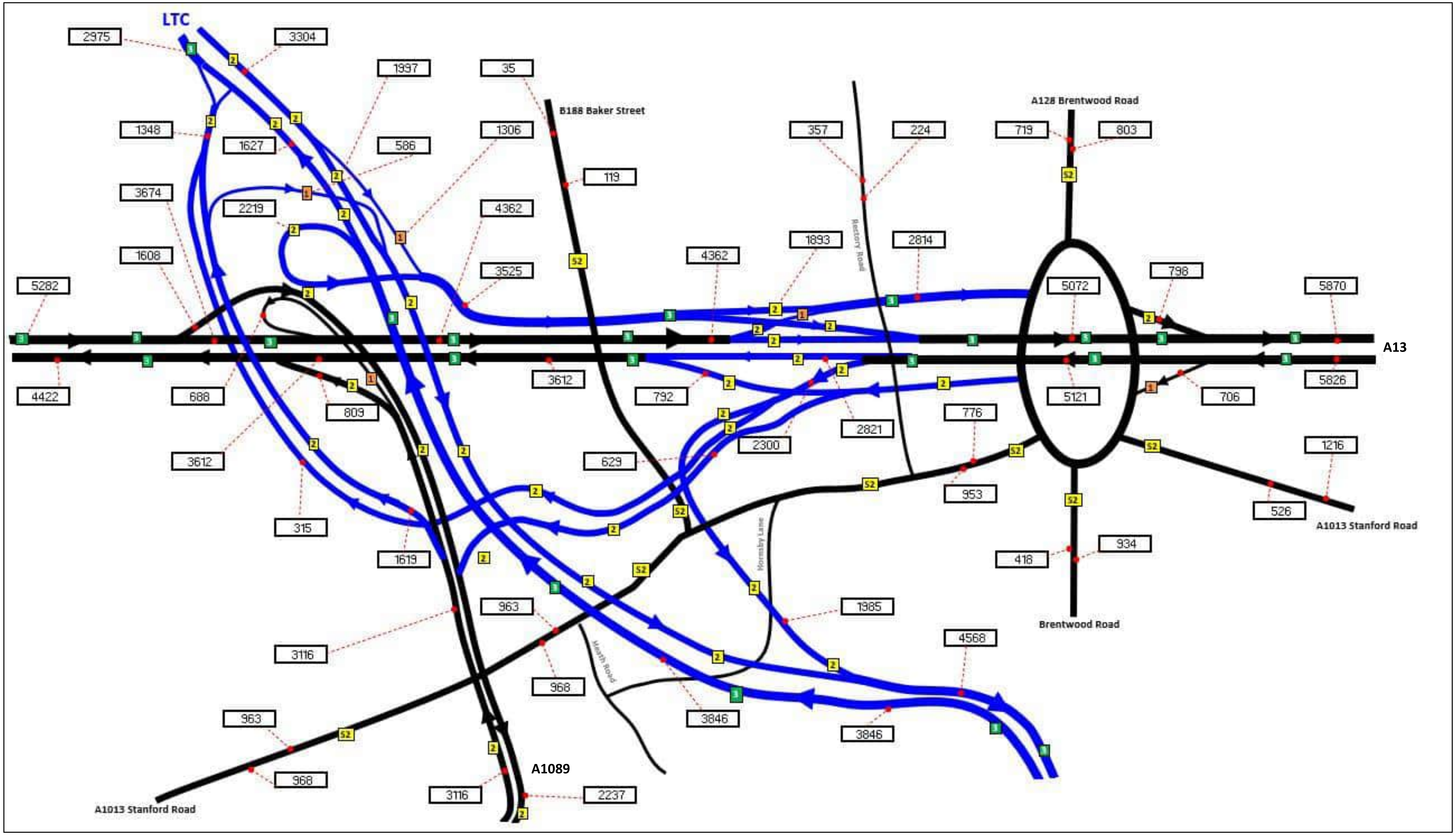


Plate 10.22 The Project junction with A13 – LTAM predicted traffic flows 2037 core PM peak HGV (PCUs)

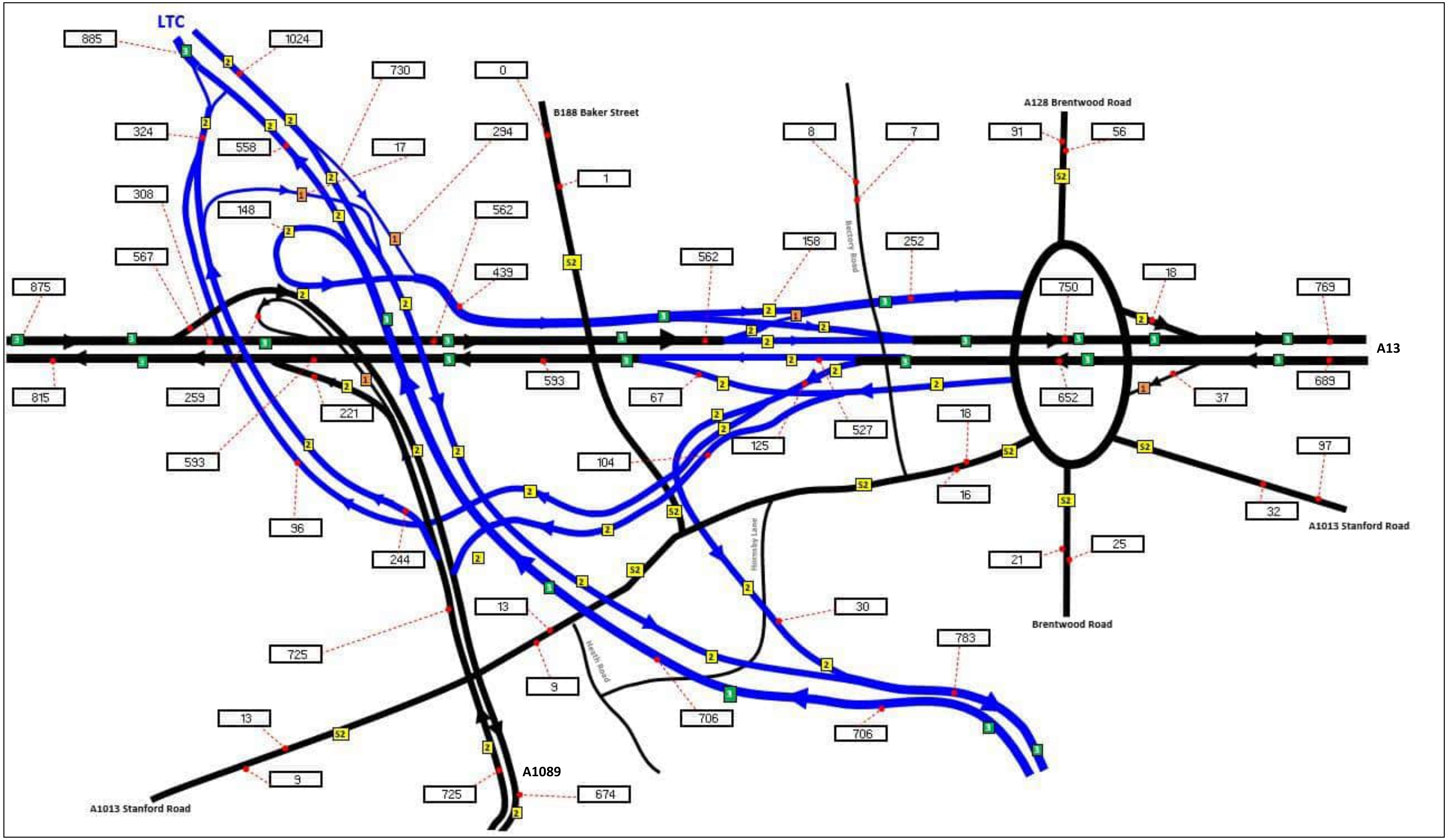


Plate 10.23 The Project junction with M25 – LTAM predicted traffic flows 2037 core PM peak all vehicles (PCUs)

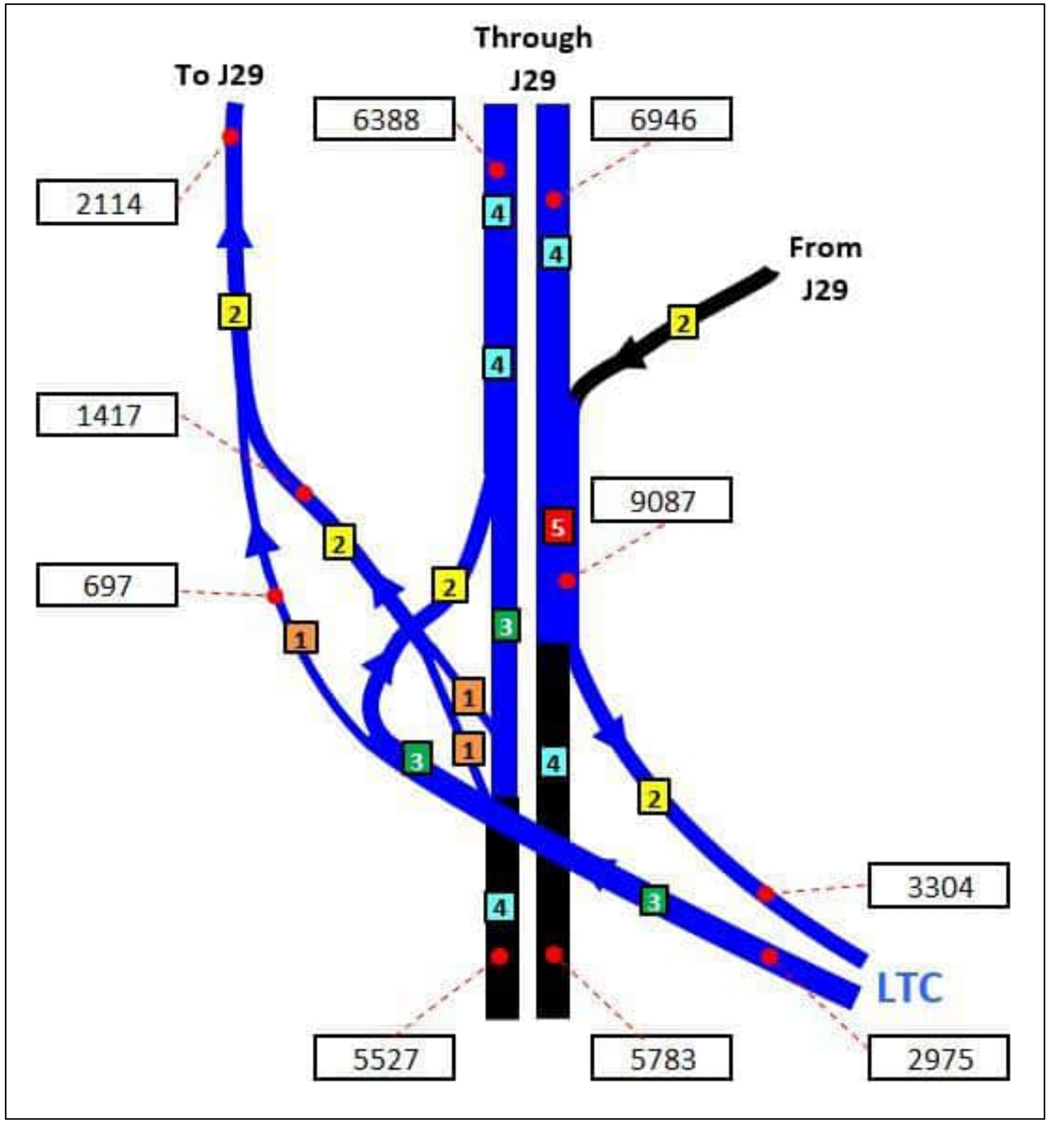
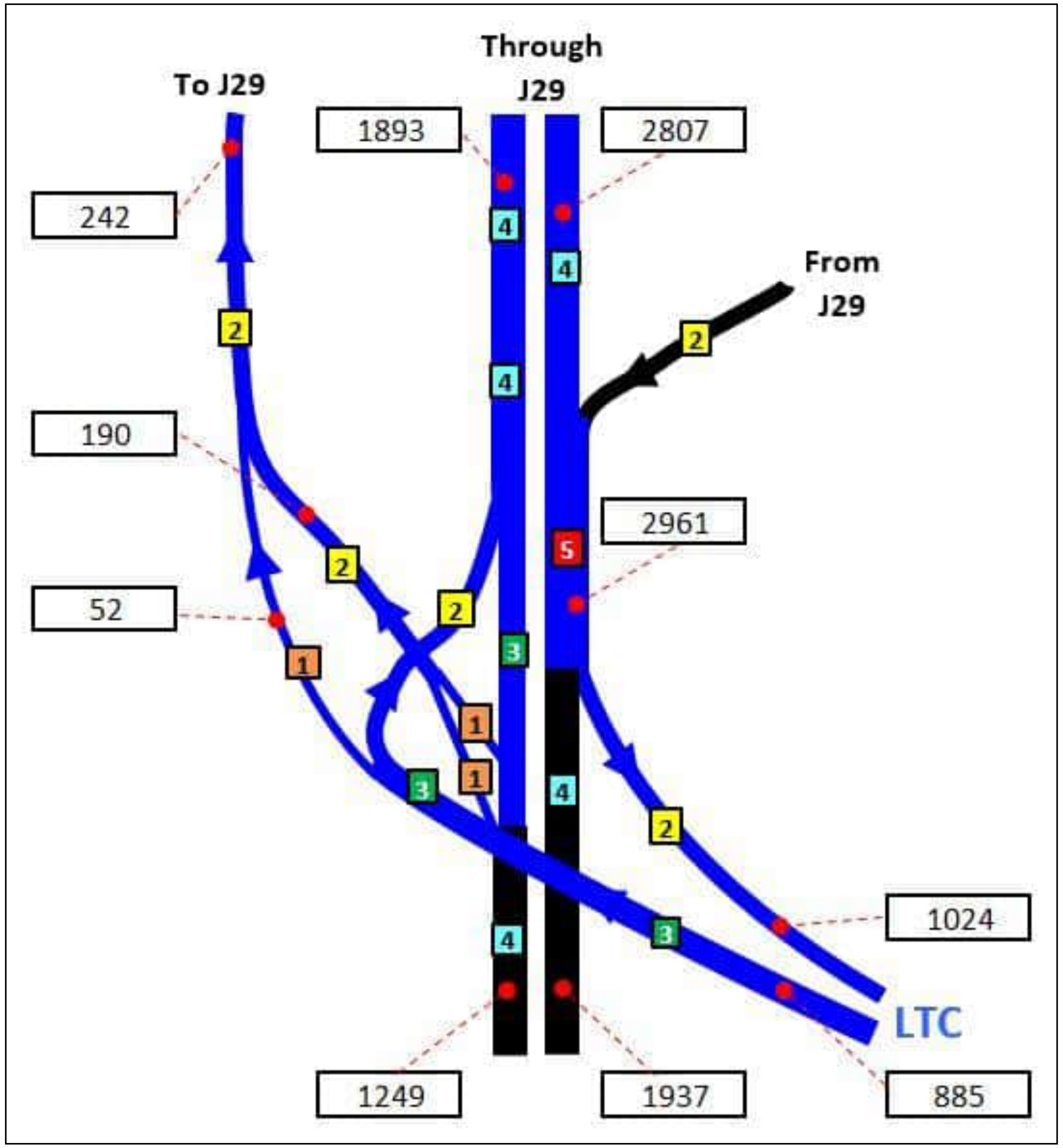


Plate 10.24 The Project junction with M25 – LTAM predicted traffic flows 2037 core PM peak HGV (PCUs)



10.4 LTAM 2045 core – outputs to operational assessment

10.4.1 Plate 10.25 to Plate 10.36 provide traffic flow information at the three junctions with the Project for all vehicles and HGV for the morning and evening peak for the 2045 core scenario. The figures show a simplified representation of the junction layouts.

10.4.2 Plate 10.25 shows the total vehicle flows for the 2045 core scenario in the AM peak at the proposed A2 junction and highlights the low proportion of west-to-north and north-to-west traffic on the Project (attributed to the significant relief provided by the Project to the existing A2/A282/Dartford Crossing route). The traffic on the Project northbound consists of:

a. 81% (4,109 of 5,077 PCUs) comes from the east

b. 11% (565 PCUs) accesses from Gravesend East

c. 8% (402 PCUs) comes from the A2 to the west

10.4.3 Similar proportions can be seen for southbound traffic on the Project:

a. 86% (3,324 of 3,867 PCUs) travels east

b. 8% (328 PCUs) exits at Gravesend East

c. 6% (216 PCUs) continues on the A2 to the west

10.4.4 Plate 10.25 also shows the high ‘weaving’ flows that necessitated the design of separate carriageways at the A2 junction the Project. These are the movements that would have been in conflict (i.e. ‘weaving’ flows) in a single carriageway configuration. For westbound traffic these flows are:

a. 3,117 PCUs (i.e. well over one lane worth) from the M2 to the Project northbound

b. 2,388 PCUs (over one lane worth) from A2/A289 to A2 westbound

10.4.5 For eastbound traffic the ‘weaving’ flows are:

a. 2,889 PCUs from the Project to M2 eastbound

b. 2,042 PCUs from A2 eastbound to A2/A289 in the east

10.4.6 Plate 10.26 shows the HGV (PCUs) flows for the 2045 core scenario in the AM peak at the proposed A2 junction and shows the very high proportions of east-to-north and north-to-east HGV traffic using the Project. Very few HGVs west of the Gravesend East junction will use the Project because HGVs have a much higher cost per km than other vehicles so will favour the shorter, Lower Thames Crossing-relieved, existing route. This is shown by the following HGV flows using the Project northbound:

a. 90% (985 PCUs) of HGVs on the Project northbound comes from the east

b. 7% (80 PCUs) access the Project from Gravesend East

c. 2% (22 PCUs) come from the A2 to the west

10.4.7 Similar proportions can be seen for southbound traffic on the Project:

a. 88% (890 of 1,012 PCUs) travels east

b. 9% (94 PCUs) exits at Gravesend East

c. 3% (28 PCUs) continues on the A2 to the west

10.4.8 Plate 10.27 and Plate 10.28 show the total vehicle and HGV flows respectively for the 2045 core scenario in the AM peak at the proposed A13/A1089 junction with the Project. As with the proposed A2 junction, the Project is designed to minimise the impact of weaving; in this case the westbound on-slip from Orsett Cock has been extended so that it joins the A13 after the A13 westbound to the Project southbound link road. Access to the A1089 from the A13 eastbound would remain unchanged, as would access from the A1089 to the A13 westbound. The current access from the A13 westbound to the A1089 would be re-routed via the Orsett Cock junction. Access from the A122 north and southbound, as well as to local roads, would also be via the Orsett Cock junction.

10.4.9 The key junction movements are as follows:

a. The traffic travelling north across the River Thames on the Project consists of:

   i. 53% (2,716 PCUs) of total traffic and 79% (869 PCUs) of HGVs continuing north towards the M25

   ii. 47% (2,361 PCUs) of total traffic and 21% (226 PCUs) of HGVs turning east on to the A13

b. The traffic travelling south across the River Thames on the Project consists of:

   i. 43% (1,655 PCUs) of total traffic and 69% (702 PCUs) of HGVs from the M25

   ii. 42% (1,637 PCUs) of total traffic and 19% (190 PCUs) of HGVs from the A13 westbound

   iii. 15% (575 PCUs) of total traffic and 12% (121 PCUs) of HGVs from the A1089 northbound

10.4.10 The Project design does not provide for all possible movements at the A13 junction with the Project either due to lack of demand (e.g. A13 eastbound to the Project northbound) or because the Project has provided significant relief to an existing route (e.g. the Project northbound to the A13 westbound relieves traffic that would otherwise continue west on the A13 to reach the M25 northbound).

10.4.11 Another key feature of this junction is the retention of all key existing connections between the A13 and A1089 (which will include Tilbury Port traffic), and the addition of the following new connections:

a. A1089 northbound to the Project southbound (total flow of 575 PCUs)

b. A1089 northbound to the Project northbound (total flow of 1,355 PCUs)

10.4.12 These two connections provide a significant benefit to 57% (1,930 of 3,392 PCUs) of the traffic on the A1089 which otherwise would have been forced to access their eventual destinations via M25 junction 30 (or via a lengthy U-turn at the Manor Way junction on the A13 to access the Project to the south).

10.4.13 Plate 10.29 and Plate 10.30 show the total vehicle and HGV flows respectively for the 2045 core scenario in the AM peak at the proposed M25 junction. As with the proposed A2 and A13 junctions, the Project is designed to minimise the impact of weaving. In this case the M25 northbound off-slip to junction 29 has been greatly extended so that it is now located south of the M25 northbound merge from the Project. This results in the following total flow movements not having to weave through each other:

a. 3,476 PCUs from the Project northbound to the M25 northbound

b. 1,654 PCUs from the M25 northbound to junction 29

10.4.14 Weaving was considered much less of an issue southbound as the distance between the merge (end of on-slip from junction 29) and the diverge (start of the Project) is much longer than it would have been northbound. As such it was considered that widening from the existing four lanes to five lanes would be sufficient to accommodate the additional demand generated by the Project as well as any weaving.

10.4.15 The key junction movements are as follows:

a. The traffic travelling north on the Project consists of:

  i. 75% (3,476 PCUs) of total traffic and 91% (1,239 PCUs) of HGVs continuing north towards the M25

  ii. 25% (1,163 PCUs) of total traffic and 9% (128 PCUs) of HGVs taking the slip/link road to M25 junction 29

b. The traffic travelling north on the M25 consists of:

  i. 71% (3,998 PCUs) of total traffic and 84% (1,320 PCUs) of HGVs continuing north on the M25

  ii. 29% (1,654 PCUs) of total traffic and 16% (252 PCUs) of HGVs taking the slip/link road to M25 junction 29

c. The traffic travelling south on the M25 consists of:

  i. 73% (6,947 PCUs) of total traffic and 73% (2,641 PCUs) of HGVs continuing south on the M25

  ii. 27% (2,543 PCUs) of total traffic and 27% (990 PCUs) of HGVs take the Project towards the A13

10.4.16 Plate 10.31 shows the total vehicle flows for the 2045 core scenario in the PM peak at the proposed A2 junction and highlights similar flow composition to the AM. The traffic on the Project northbound consists of:

a. 72% (2,959 of 4,114 PCUs) comes from the east

b. 15% (603 PCUs) accesses from Gravesend East

c. 13% (552 PCUs) comes from the A2 to the west

10.4.17 Similar proportions can be seen for southbound traffic on the Project:

a. 81% (3,797 of 4,715 PCUs) travels east

b. 15% (693 PCUs) exits at Gravesend East

c. 5% (225 PCUs) continues on the A2 to the west

10.4.18 Plate 10.31 also shows the high ‘weaving’ flows that necessitated the design of separate carriageways. These are the movements that would have been in conflict (i.e. ‘weaving’ flows) in a single carriageway configuration. For westbound traffic these flows are:

a. 2,200 PCUs (over one lane worth) from the M2 to the Project northbound

b. 1,975 PCUs (approx. one lane worth) from A2/A289 to A2 westbound

10.4.19 For eastbound traffic the ‘weaving’ flows are:

a. 2,993 PCUs from the Project to M2 eastbound

b. 2,914 PCUs from A2 eastbound to A2/A289 in the east

10.4.20 Plate 10.32 shows the HGV (PCUs) flows for the 2045 core scenario in the PM peak at the proposed A2 junction and shows the very high proportions of east-to-north and north-to-east HGV traffic using the Project. Very few HGVs west of the Gravesend East junction will use the Project because HGVs have a much higher cost per km than other vehicles so will favour the shorter, Lower Thames Crossing-relieved, existing route. This is shown by the following HGV flows using the Project northbound:

a. 92% (655 PCUs) of HGVs on the Project northbound comes from the east

b. 6% (45 PCUs) access the Project from Gravesend East

c. 1% (5 PCUs) come from the A2 to the west

10.4.21 Similar proportions can be seen for southbound traffic on the Project:

a. 94% (740 of 787 PCUs) travels east

b. 6% (45 PCUs) exits at Gravesend East

c. <1% (1 PCU) continues on the A2 to the west

10.4.22 Plate 10.33 and Plate 10.34 show the total vehicle and HGV flows respectively for the 2045 core scenario in the PM peak at the proposed A13/A1089 junction with the Project.

10.4.23 The key junction movements are as follows:

a. The traffic travelling north across the River Thames on the Project consists of:

   i. 42% (1,733 PCUs) of total traffic and 79% (563 PCUs) of HGVs continuing north towards the M25

   ii. 58% (2,380 PCUs) of total traffic and 21% (151 PCUs) of HGVs turning east on to the A13

b. The traffic travelling south across the River Thames on the Project consists of:

   i. 43% (2,016 PCUs) of total traffic and 93% (730 PCUs) of HGVs from the M25

   ii. 44% (2,055 PCUs) of total traffic and 4% (29 PCUs) of HGVs from the A13 westbound

   iii. 14% (644 PCUs) of total traffic and 2% (18 PCUs) of HGVs from the A1089 northbound

10.4.24 As noted for the AM, the Project design does not provide for all possible movements at the proposed A13 junction either due to lack of demand (e.g. A13 eastbound to the Project northbound) or because the Project has provided significant relief to an existing route (e.g. the Project northbound to the A13 westbound relieves traffic that would otherwise continue west on the A13 to reach the M25 northbound).

10.4.25 Another key feature of this junction is the retention of all key existing connections between the A13 and A1089 (which will include Tilbury Port traffic), and the addition of the following new connections:

a. A1089 northbound to the Project southbound (total flow of 644 PCUs)

b. A1089 northbound to the Project northbound (total flow of 1,139 PCUs)

10.4.26 These two connections provide a significant benefit to 54% (1,783 of 3,287 PCUs) of the traffic on the A1089 which otherwise would have been forced to access their eventual destinations via M25 junction 30 (or via a lengthy U-turn at the Manor Way junction on the A13 to access the Project to the south).

10.4.27 Plate 10.35 and Plate 10.36 show the total vehicle and HGV flows respectively for the 2045 core scenario in the PM peak at the proposed M25 junction. As with the proposed A2 and A13 junctions, the Project is designed to minimise the impact of weaving. In this case the M25 northbound off-slip to junction 29 has been greatly extended so that it is now located south of the M25 northbound merge from the Project. This results in the following total flow movements not having to weave through each other:

a. 2,447 PCUs from the Project northbound to M25 northbound

b. 1,443 PCUs from M25 northbound to junction 29

10.4.28 Other key junction movements are as follows:

a. The traffic travelling north on the Project consists of:

   i. 77% (2,447 PCUs) of total traffic and 94% (841 PCUs) of HGVs continuing north towards the M25

   ii. 23% (731 PCUs) of total traffic and 6% (51 PCUs) of HGVs taking the slip/link road to M25 junction 29

b. The traffic travelling north on M25 consists of:

   i. 75% (4,274 PCUs) of total traffic and 85% (1,111 PCUs) of HGVs continuing north on the M25

   ii. 25% (1,443 PCUs) of total traffic and 15% (194 PCUs) of HGVs taking the slip/link road to M25 junction 29

c. The traffic travelling south on M25 consists of:

   i. 64% (6,069 PCUs) of total traffic and 66% (1,981 PCUs) of HGVs continuing south on the M25

   ii. 36% (3,383 PCUs) of total traffic and 34% (1,024 PCUs) of HGVs take the Project towards the A13

Plate 10.25 The Project junction with A2/M2 – LTAM predicted traffic flows 2045 core AM peak all vehicles (PCUs)

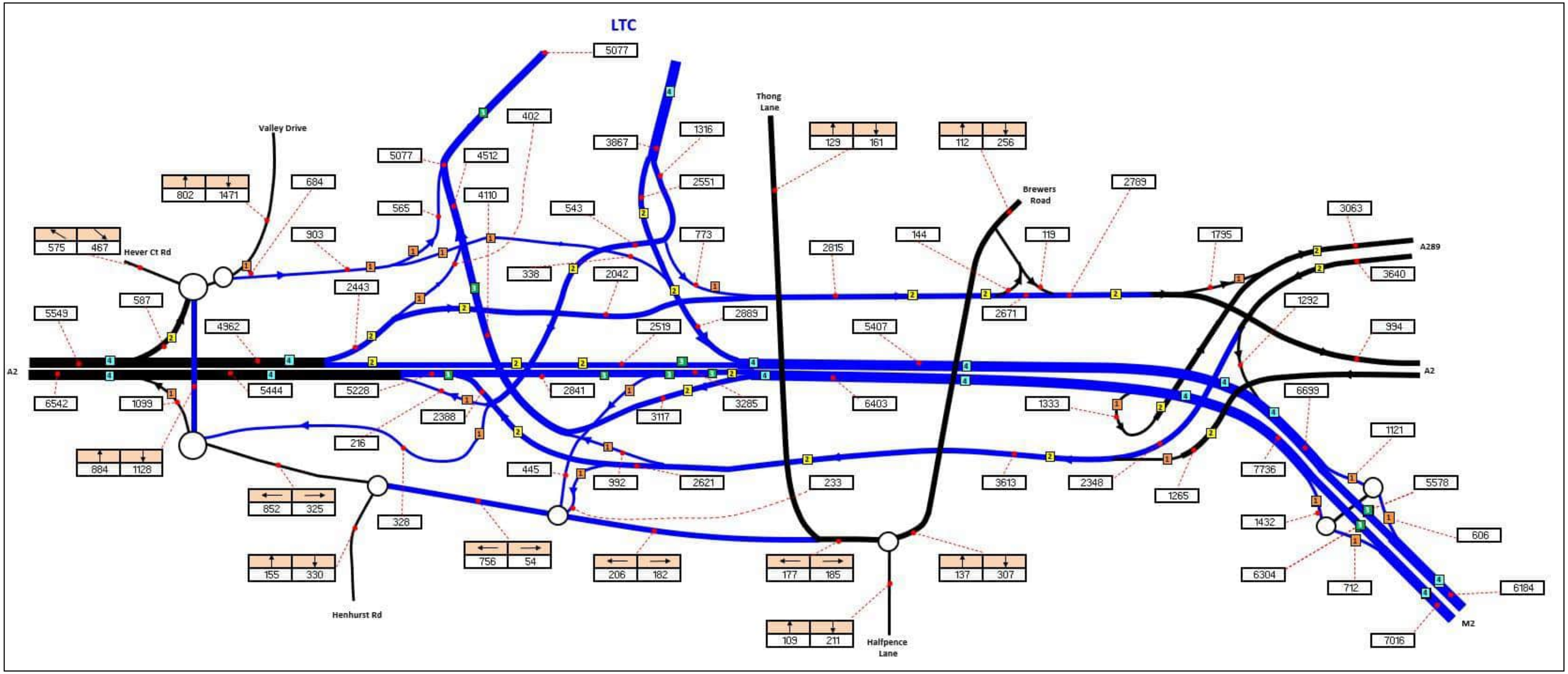


Plate 10.26 The Project junction with A2/M2 – LTAM predicted traffic flows 2045 core AM peak HGV (PCUs)

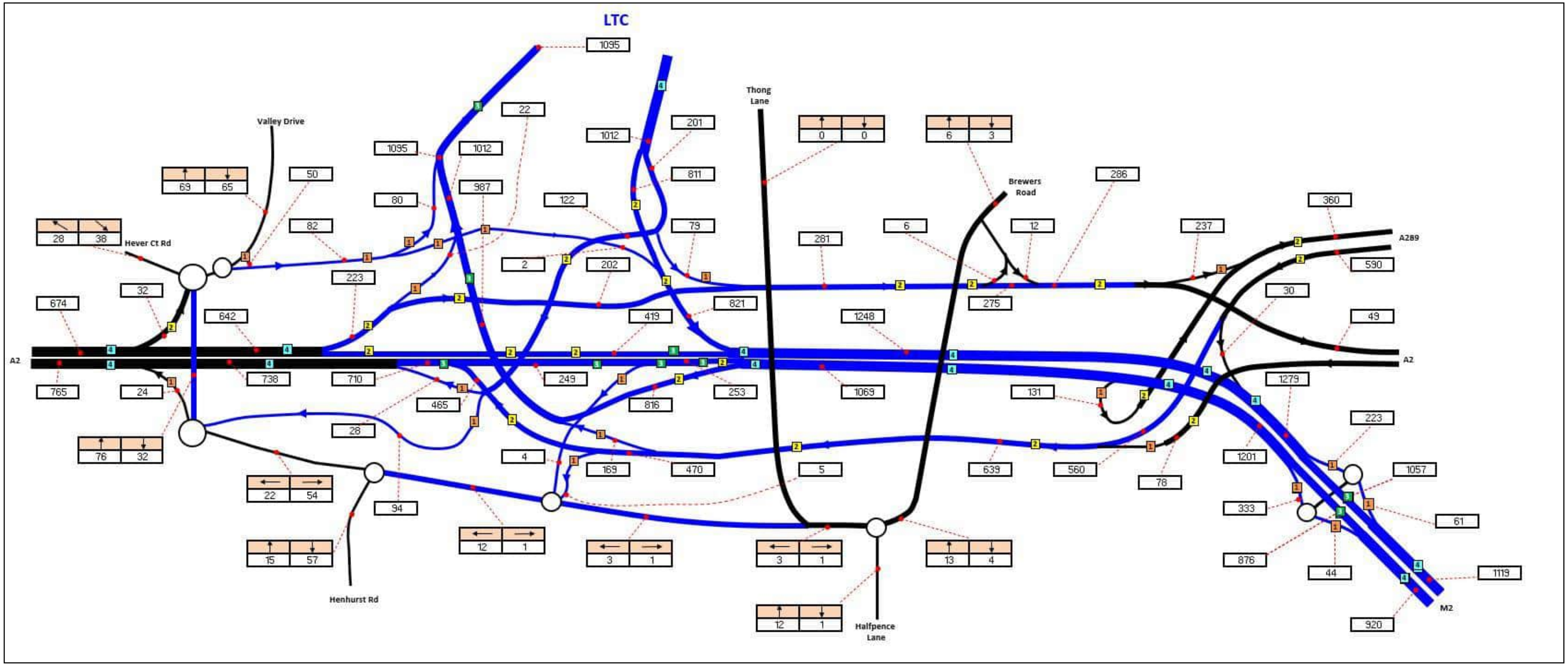


Plate 10.27 The Project junction with A13 – LTAM predicted traffic flows 2045 core AM peak all vehicles (PCUs)

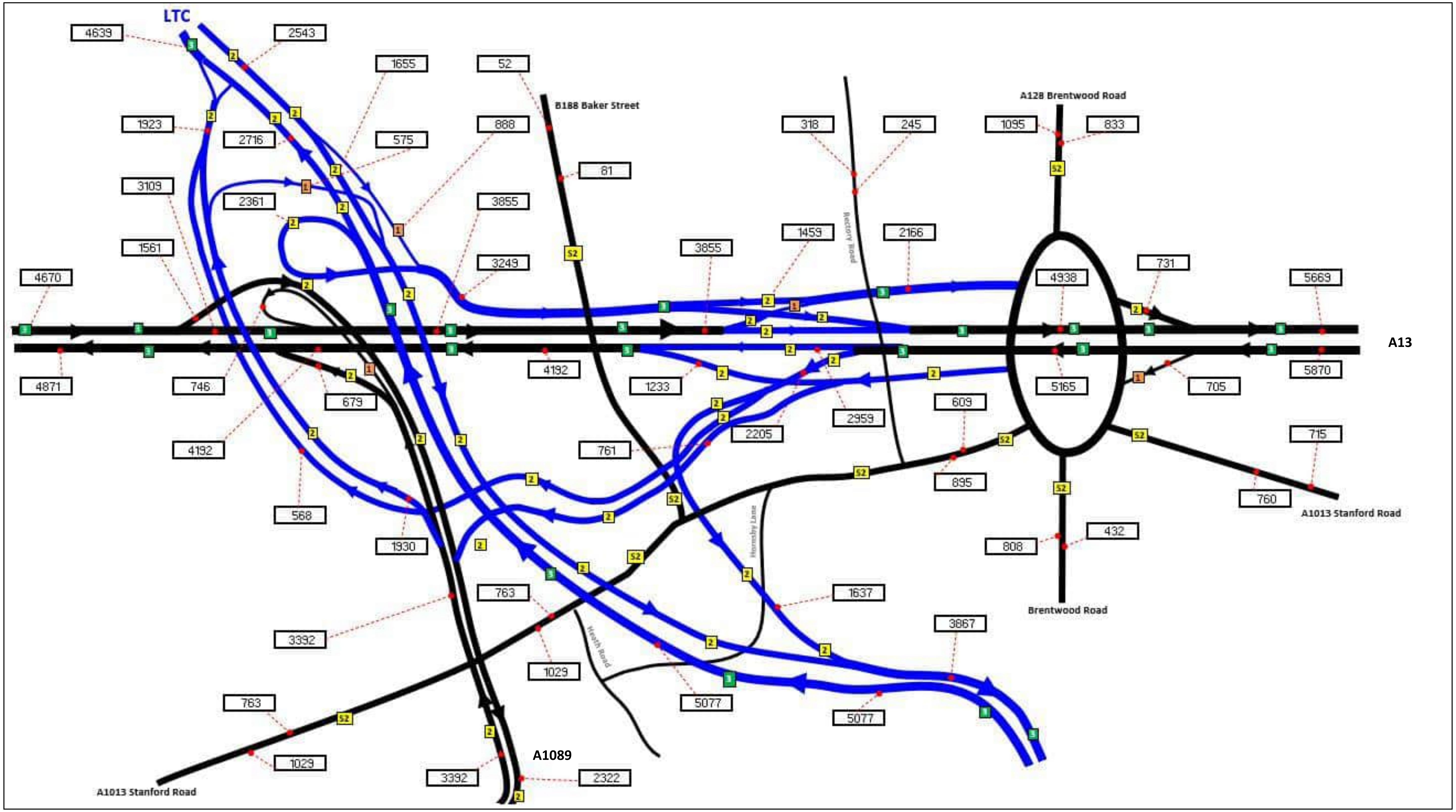


Plate 10.28 The Project junction with A13 – LTAM predicted traffic flows 2045 core AM peak HGV (PCUs)

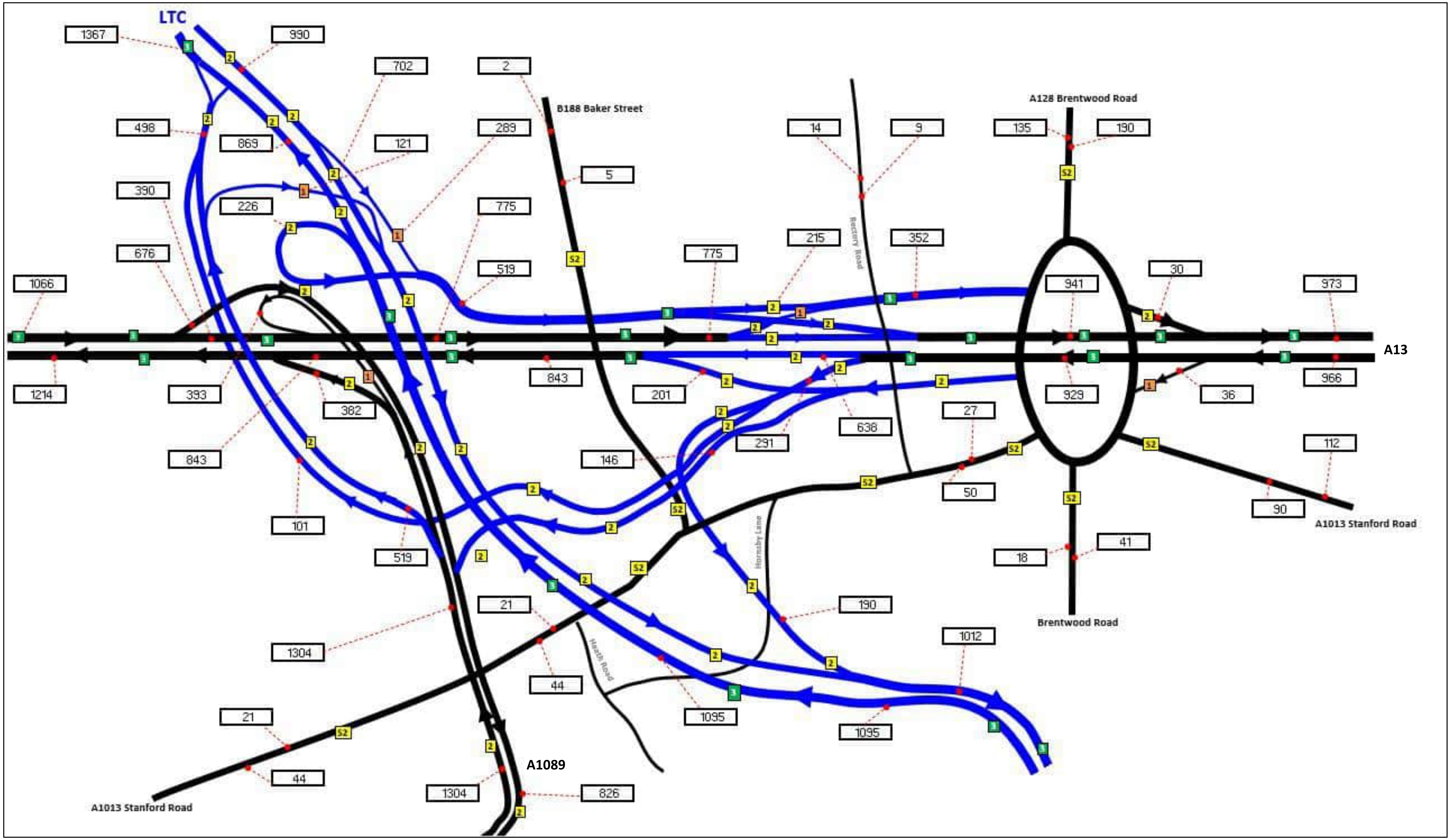


Plate 10.29 The Project junction with M25 – LTAM predicted traffic flows 2045 core AM peak all vehicles (PCUs)

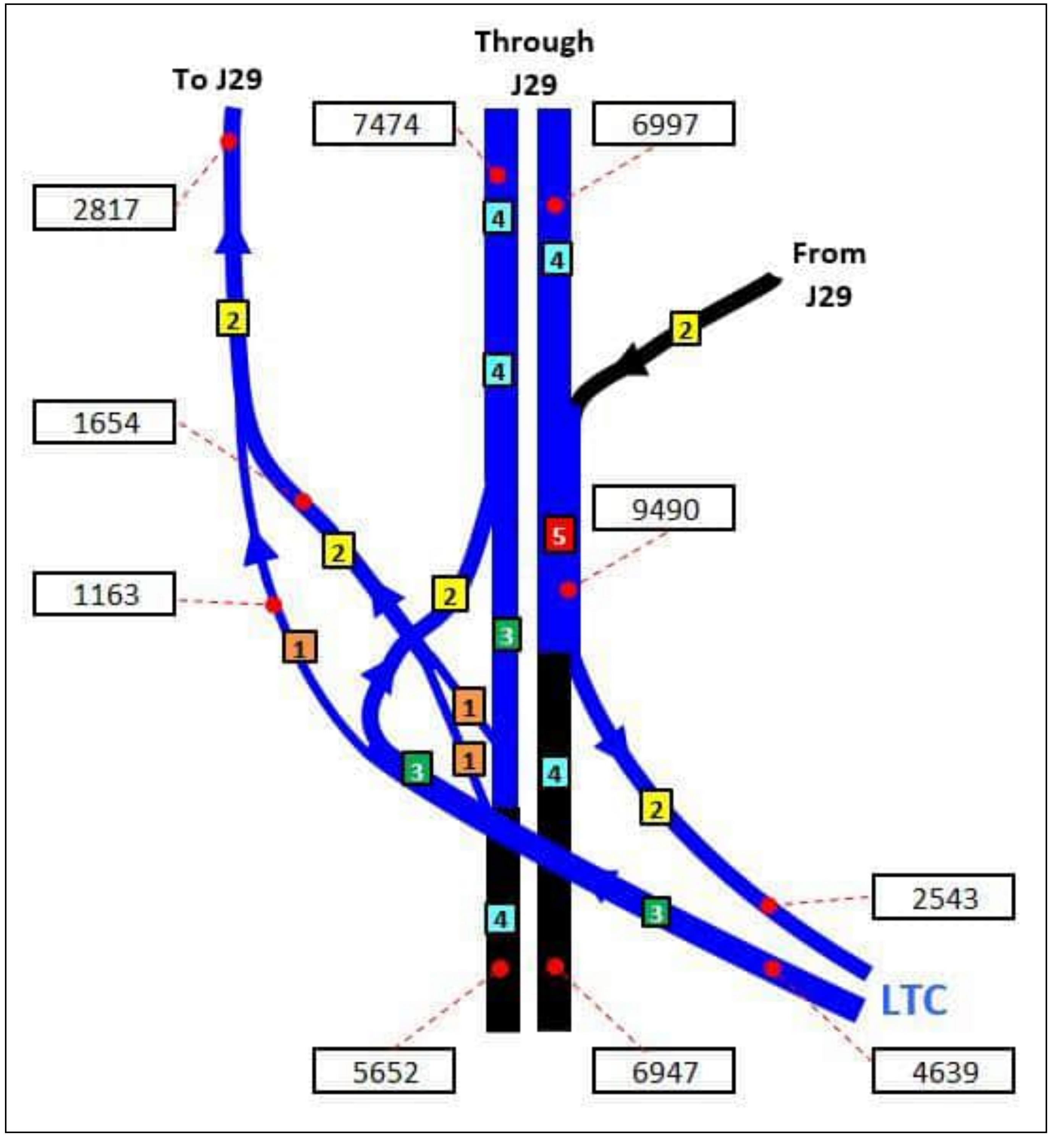


Plate 10.30 The Project junction with M25 – LTAM predicted traffic flows 2045 core AM peak HGV (PCUs)

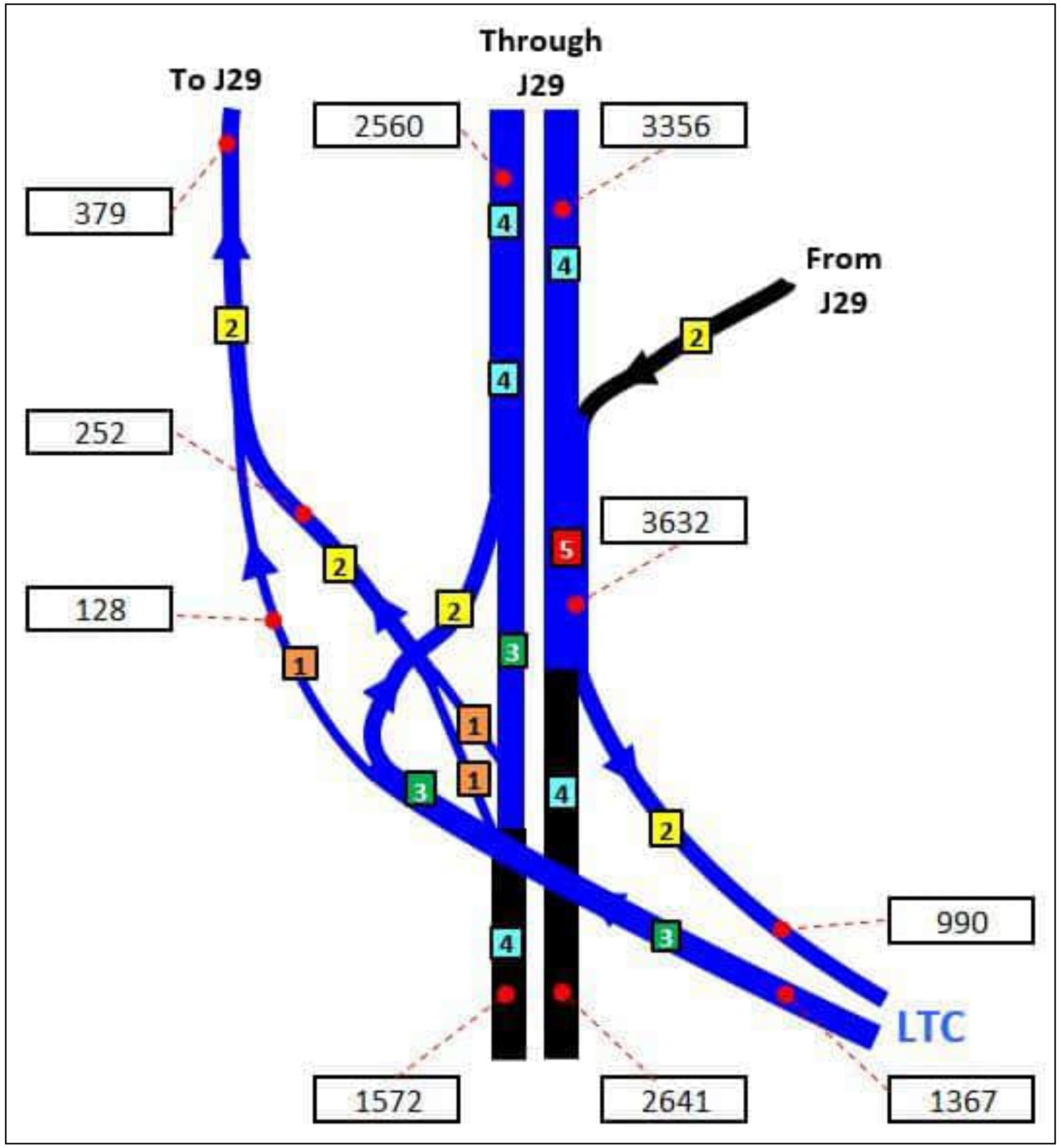


Plate 10.31 The Project junction with A2/M2 – LTAM predicted traffic flows 2045 core PM peak all vehicles (PCUs)

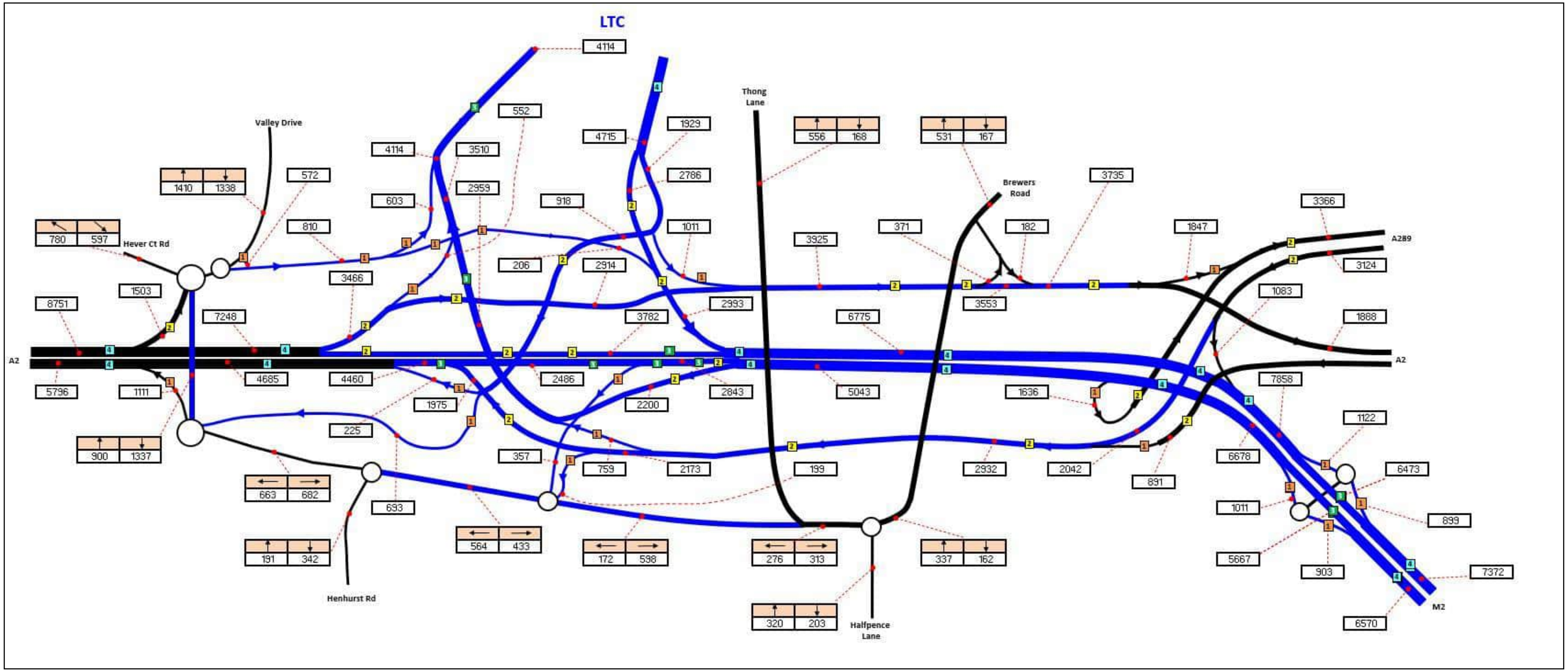


Plate 10.32 The Project junction with A2/M2 – LTAM predicted traffic flows 2045 core PM peak HGV (PCUs)

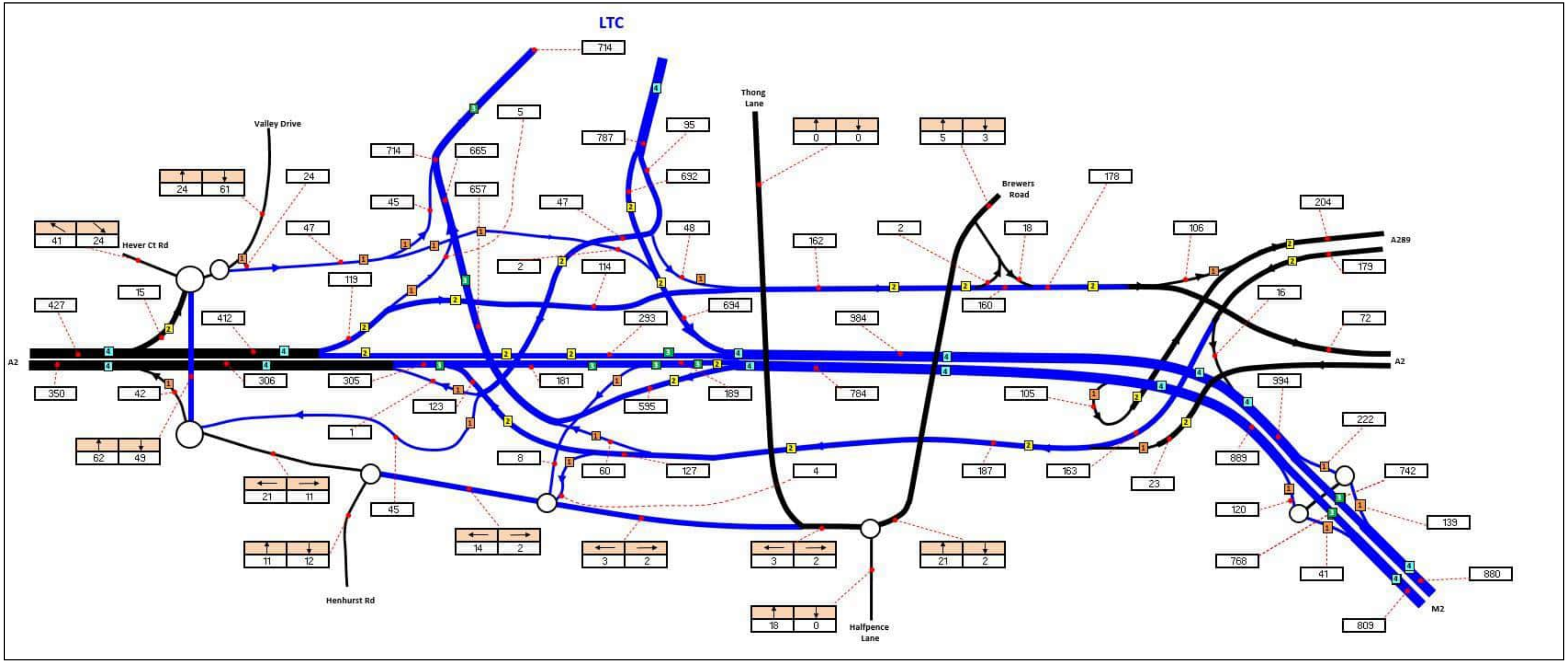


Plate 10.33 The Project junction with A13 – LTAM predicted traffic flows 2045 core PM peak all vehicles (PCUs)

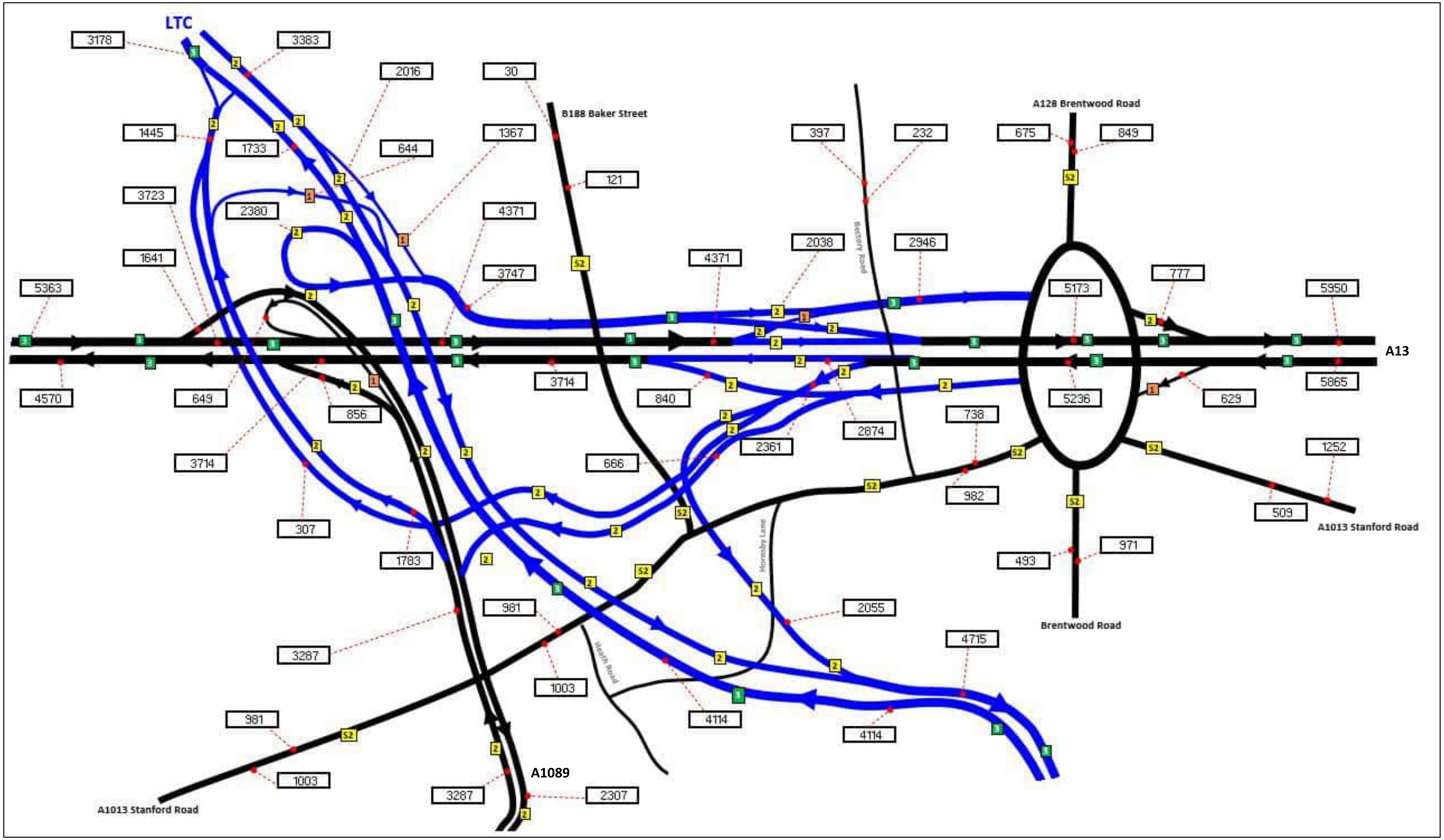


Plate 10.34 The Project junction with A13 – LTAM predicted traffic flows 2045 core PM peak HGV (PCUs)

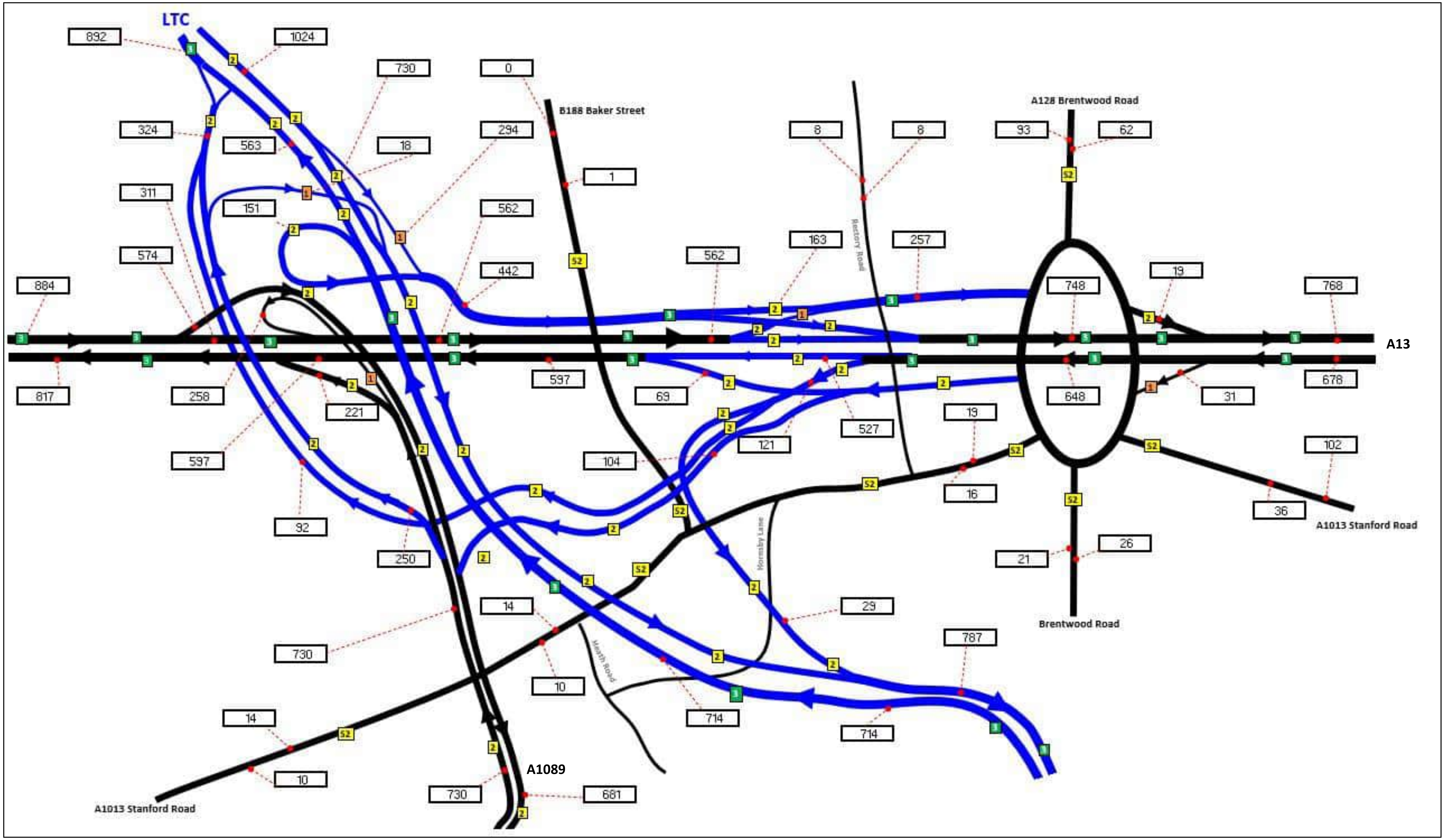


Plate 10.35 The Project junction with M25 – LTAM predicted traffic flows 2045 core PM peak all vehicles (PCUs)

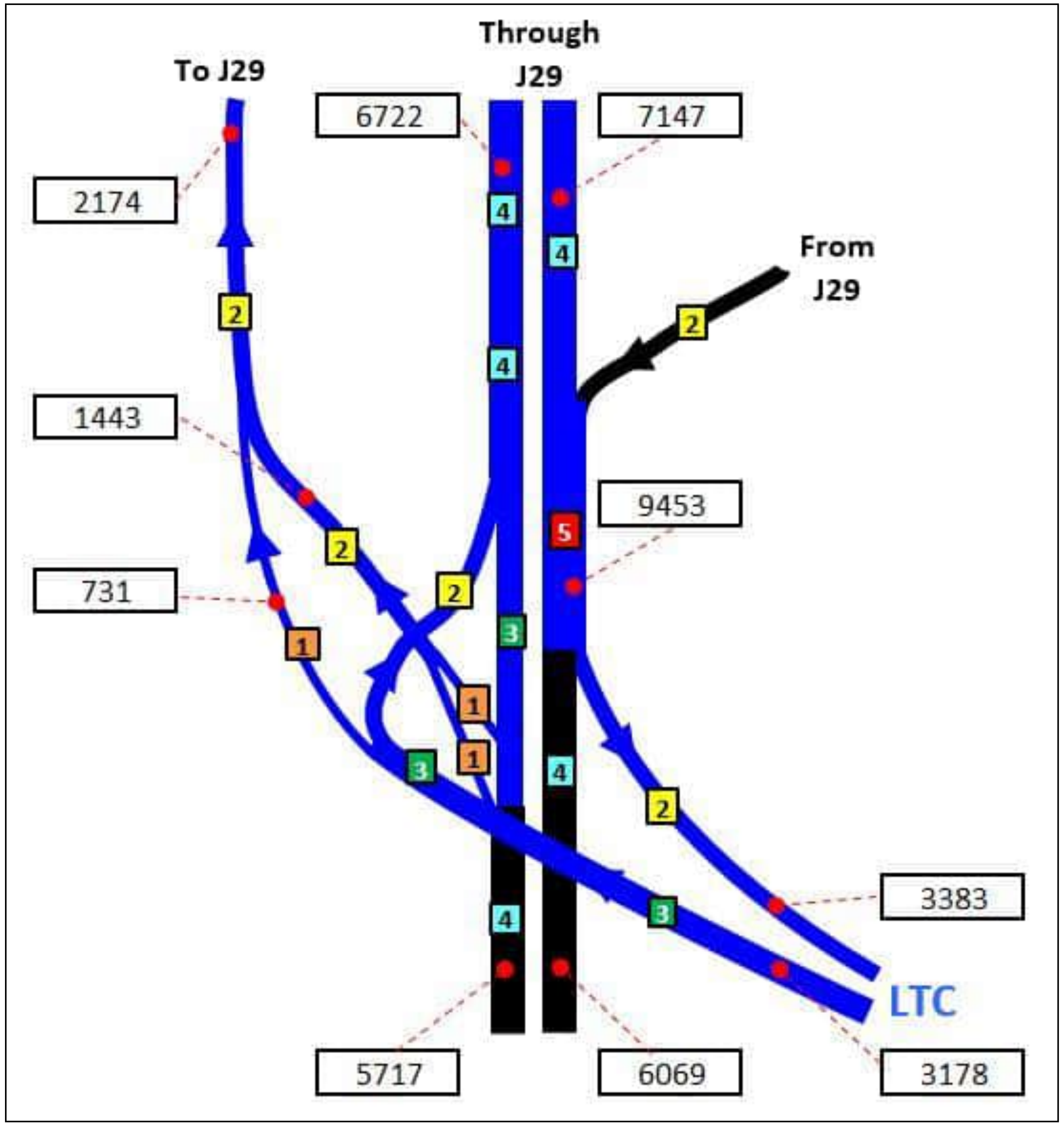
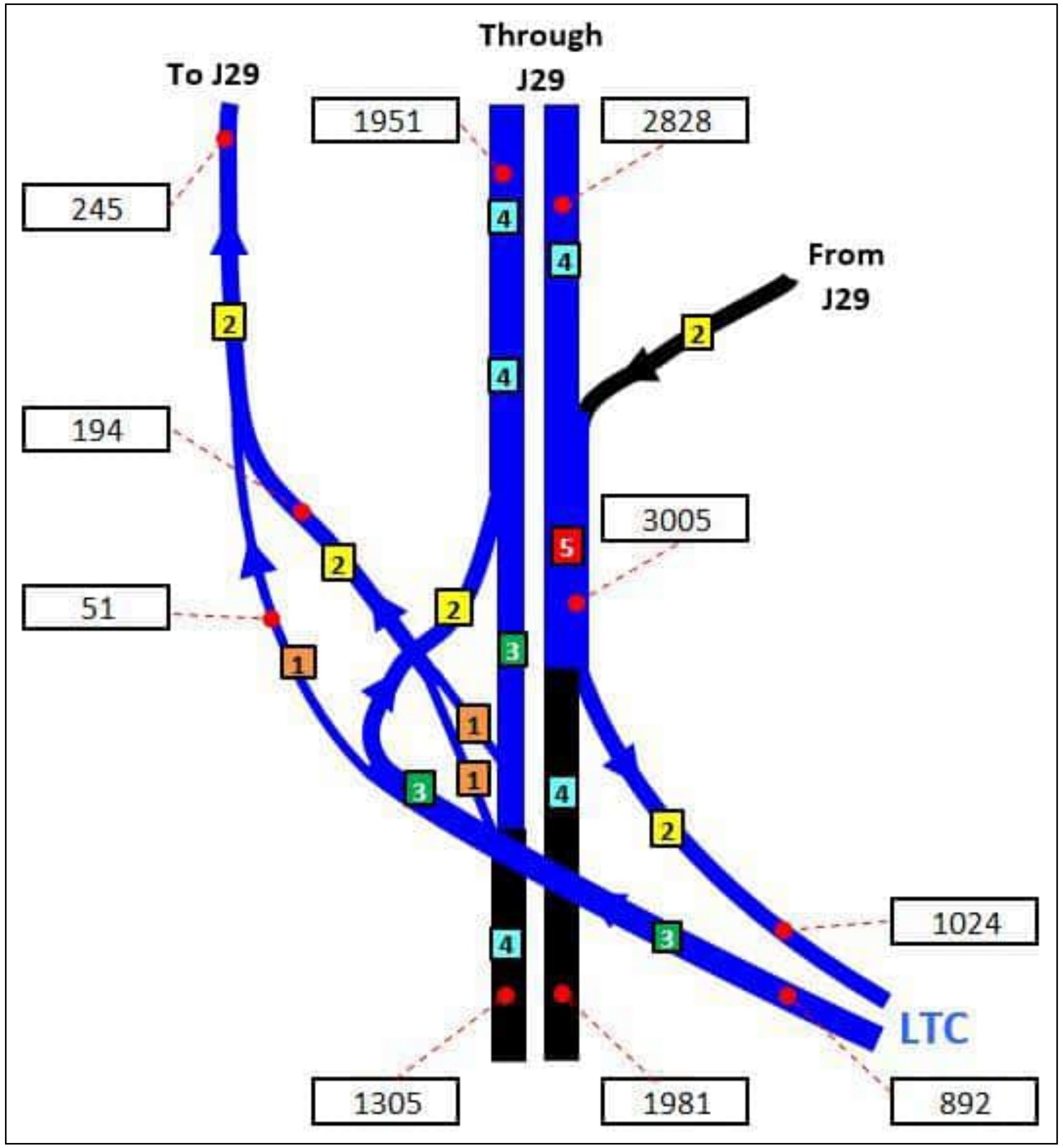


Plate 10.36 The Project junction with M25 – LTAM predicted traffic flows 2045 core PM peak HGV (PCUs)



10.5 LTAM 2051 core – outputs to operational assessment

10.5.1 Plate 10.37 to Plate 10.48 provide traffic flow information at the three junctions with the Project for all vehicles and HGVs for the morning and evening peak for the 2051 core scenario. The figures show a simplified representation of the junction layouts.

10.5.2 Plate 10.37 shows the total vehicle flows for the 2051 core scenario in the AM peak at the proposed A2 junction and highlights the low proportion of west-to-north and north-to-west traffic on the Project (attributed to the significant relief provided by the Project to the existing A2/A282/Dartford Crossing route). The traffic on the Project northbound consists of:

a. 80% (4,171 of 5,186 PCUs) comes from the east

b. 11% (590 PCUs) accesses from Gravesend East

c. 8% (426 PCUs) comes from the A2 to the west

10.5.3 Similar proportions can be seen for southbound traffic on the Project:

a. 86% (3,416 of 3,984 PCUs) travels east

b. 8% (337 PCUs) exits at Gravesend East

c. 6% (231 PCUs) continues on the A2 to the west

10.5.4 Plate 10.37 also shows the high 'weaving' flows that necessitated the design of separate carriageways at the proposed A2 junction. These are the movements that would have been in conflict (i.e. 'weaving' flows) in a single carriageway configuration. For westbound traffic these flows are:

a. 3,168 PCUs (well over one lane worth) from the M2 to the Project northbound

b. 2,407 PCUs (over one lane worth) from A2/A289 to A2 westbound

10.5.5 For eastbound traffic the 'weaving' flows are:

a. 2,964 PCUs from the Project to M2 eastbound

b. 2,064 PCUs from A2 eastbound to A2/A289 in the east

10.5.6 Plate 10.38 shows the HGV (PCUs) flows for the 2051 core scenario in the AM peak at the proposed A2 junction and shows the very high proportions of east-to-north and north-to-east HGV traffic using the Project. Very few HGVs west of the Gravesend East junction will use the Project because HGVs have a much higher cost per km than other vehicles so will favour the shorter, Lower Thames Crossing-relieved, existing route. This is shown by the following HGV flows using the Project northbound:

a. 90% (1,000 PCUs) of HGVs on the Project northbound comes from the east

b. 7% (81 PCUs) access the Project from Gravesend East

c. 2% (22 PCUs) come from the A2 to the west

10.5.7 Similar proportions can be seen for southbound traffic on the Project:

a. 88% (897 of 1,022 PCUs) travels east

b. 9% (96 PCUs) exits at Gravesend East

c. 3% (29 PCUs) continues on the A2 to the west

10.5.8 Plate 10.39 and Plate 10.40 show the total vehicle and HGV flows respectively for the 2051 core scenario in the AM peak at the proposed A13/A1089 junction. As with the proposed A2 junction the Project is designed to minimise the impact of weaving; in this case the westbound on-slip from Orsett Cock has been extended so that it joins the A13 after the A13 westbound to the Project southbound link road. Access to the A1089 from the A13 eastbound would remain unchanged, as would access from the A1089 to the A13 westbound. The current access from the A13 westbound to the A1089 would be re-routed via the Orsett Cock junction. Access from the A122 north and southbound, as well as to local roads, would also be via the Orsett Cock junction.

10.5.9 The key junction movements are as follows:

a. The traffic travelling north across the River Thames on the Project consists of:

   i. 53% (2,767 PCUs) of total traffic and 79% (885 PCUs) of HGVs continuing north towards the M25

   ii. 47% (2,420 PCUs) of total traffic and 21% (229 PCUs) of HGVs turning east on to the A13

b. The traffic travelling south across the River Thames on the Project consists of:

   i. 43% (1,706 PCUs) of total traffic and 70% (714 PCUs) of HGVs from the M25

   ii. 42% (1,680 PCUs) of total traffic and 19% (191 PCUs) of HGVs from the A13 westbound

   iii. 15% (597 PCUs) of total traffic and 12% (120 PCUs) of HGVs from the A1089 northbound

10.5.10 The Project design does not provide for all possible movements at the proposed A13 junction either due to lack of demand (e.g. A13 eastbound to the Project northbound) or because the Project has provided significant relief to an existing route (e.g. the Project northbound to the A13 westbound relieves traffic that would otherwise continue west on the A13 to reach the M25 northbound).

10.5.11 Another key feature of this junction is the retention of all key existing connections between the A13 and A1089 (which will include Tilbury Port traffic), and the addition of the following new connections:

a. A1089 northbound to the Project southbound (total flow of 597 PCUs)

b. A1089 northbound to the Project northbound (total flow of 1,333 PCUs)

10.5.12 These two connections provide a significant benefit to 56% (1,930 of 3,457 PCUs) of the traffic on the A1089 which otherwise would have been forced to access their eventual destinations via M25 junction 30 (or via a lengthy U-turn at the Manor Way junction on the A13 to access the Project to the south).

10.5.13 Plate 10.41 and Plate 10.42 show the total vehicle and HGV flows respectively for the 2051 core scenario in the AM peak at the proposed M25 junction. As with the proposed A2 and A13 junctions, the Project is designed to minimise the impact of weaving. In this case the M25 northbound off-slip to junction 29 has been greatly extended so that it is now located south of the M25 northbound merge from the Project. This results in the following total flow movements not having to weave through each other:

a. 3,751 PCUs from the Project northbound to the M25 northbound

b. 1,714 PCUs from the M25 northbound to junction 29

10.5.14 Weaving was considered much less of an issue southbound as the distance between the merge (end of on-slip from junction 29) and the diverge (start of the Project) is much longer than it would have been northbound. As such it was considered that widening from the existing four lanes to five lanes would be sufficient to accommodate the additional demand generated by the Project as well as any weaving.

10.5.15 The key junction movements are as follows:

a. The traffic travelling north on the Project consists of:

   i. 79% (3,751 PCUs) of total traffic and 90% (1,240 PCUs) of HGVs continuing north towards the M25

   ii. 21% (1,008 PCUs) of total traffic and 10% (135 PCUs) of HGVs taking the slip/link road to M25 junction 29

b. The traffic travelling north on the M25 consists of:

   i. 70% (4,070 PCUs) of total traffic and 84% (1,329 PCUs) of HGVs continuing north on M25

   ii. 30% (1,714 PCUs) of total traffic and 16% (255 PCUs) of HGVs taking the slip/link road to M25 junction 29

c. The traffic travelling south on the M25 consists of:

   i. 73% (7,033 PCUs) of total traffic and 72% (2,623 PCUs) of HGVs continuing south on the M25

   ii. 27% (2,643 PCUs) of total traffic and 28% (1,017 PCUs) of HGVs take the Project towards the A13

10.5.16 Plate 10.43 shows the total vehicle flows for the 2051 core scenario in the PM peak at the proposed A2 junction and highlights similar flow composition to the AM. The traffic on the Project northbound consists of:

a. 71% (3,041 of 4,274 PCUs) comes from the east

b. 15% (648 PCUs) accesses from Gravesend East

c. 14% (584 PCUs) comes from the A2 to the west

10.5.17 Similar proportions can be seen for southbound traffic on the Project:

a. 80% (3,832 of 4,779 PCUs) travels east

b. 15% (716 PCUs) exits at Gravesend East

c. 5% (232 PCUs) continues on the A2 to the west

10.5.18 Plate 10.43 also shows the high 'weaving' flows that necessitated the design of separate carriageways. These are the movements that would have been in conflict (i.e. 'weaving' flows) in a single carriageway configuration. For westbound traffic these flows are:

a. 2,245 PCUs (over one lane worth) from the M2 to the Project northbound

b. 1,993 PCUs (approx. one lane worth) from the A2/A289 to the A2 westbound

10.5.19 For eastbound traffic the 'weaving' flows are:

a. 3,018 PCUs from the Project to the M2 eastbound

b. 2,895 PCUs from the A2 eastbound to the A2/A289 in the east

10.5.20 Plate 10.44 shows the HGV (PCUs) flows for the 2051 core scenario in the PM peak at the proposed A2 junction and shows the very high proportions of east-to-north and north-to-east HGV traffic using the Project. Very few HGVs west of the Gravesend East junction will use the Project because HGVs have a much higher cost per km than other vehicles so will favour the shorter, Lower Thames Crossing-relieved, existing route. This is shown by the following HGV flows using the Project northbound:

a. 91% (665 PCUs) of HGVs on the Project northbound comes from the east

b. 6% (46 PCUs) access the Project from Gravesend East

c. 1% (5 PCUs) come from the A2 to the west

10.5.21 Similar proportions can be seen for southbound traffic on the Project:

a. 94% (735 of 785 PCUs) travels east

b. 6% (46 PCUs) exits at Gravesend East

c. 1% (4 PCUs) continues on the A2 to the west

10.5.22 Plate 10.45 and Plate 10.46 show the total vehicle and HGV flows respectively for the 2051 core scenario in the PM peak at the proposed A13/A1089 junction.

10.5.23 The key junction movements are as follows:

a. The traffic travelling north across the River Thames on the Project consists of:

   i. 42% (1,784 PCUs) of total traffic and 79% (573 PCUs) of HGVs continuing north towards the M25

   ii. 58% (2,489 PCUs) of total traffic and 21% (154 PCUs) of HGVs turning east on to the A13

b. The traffic travelling south across the River Thames on the Project consists of:

   i. 42% (2,030 PCUs) of total traffic and 93% (728 PCUs) of HGVs from the M25

   ii. 43% (2,073 PCUs) of total traffic and 4% (29 PCUs) of HGVs from the A13 westbound

   iii. 14% (676 PCUs) of total traffic and 2% (18 PCUs) of HGVs from the A1089 northbound

10.5.24 As noted for the AM, the Project design does not provide for all possible movements at the proposed A13 junction either due to lack of demand (e.g. A13 eastbound to the Project northbound) or because the Project has provided significant relief to an existing route (e.g. the Project northbound to the A13 westbound relieves traffic that would otherwise continue west on the A13 to reach the M25 northbound).

10.5.25 Another key feature of this junction is the retention of all key existing connections between the A13 and A1089 (which will include Tilbury Port traffic), and the addition of the following new connections:

a. A1089 northbound to the Project southbound (total flow of 676 PCUs)

b. A1089 northbound to the Project northbound (total flow of 1,184 PCUs)

10.5.26 These two connections provide a significant benefit to 55% (1,860 of 3,365 PCUs) of the traffic on the A1089 which otherwise would have been forced to access their eventual destinations via M25 junction 30 (or via a lengthy U-turn at the Manor Way junction on the A13 to access the Project to the south).

10.5.27 Plate 10.47 and Plate 10.48 show the total vehicle and HGV flows respectively for the 2051 core scenario in the PM peak at the proposed M25 junction with the Project. As with the proposed A2 and A13 junctions, the Project is designed to minimise the impact of weaving. In this case the M25 northbound off-slip to junction 29 has been greatly extended so that it is now located south of the M25 northbound merge from the Project. This results in the following total flow movements not having to weave through each other:

a. 2,521 PCUs from the Project northbound to the M25 northbound

b. 1,450 PCUs from the M25 northbound to junction 29

10.5.28 Other key junction movements are as follows:

a. The traffic travelling north on the Project consists of:

   i. 77% (2,521 PCUs) of total traffic and 94% (855 PCUs) of HGVs continuing north towards the M25

   ii. 23% (756 PCUs) of total traffic and 6% (52 PCUs) of HGVs taking the slip/link road to M25 junction 29

b. The traffic travelling north on the M25 consists of:

   i. 75% (4,317 PCUs) of total traffic and 85% (1,136 PCUs) of HGVs continuing north on M25

   ii. 25% (1,450 PCUs) of total traffic and 15% (199 PCUs) of HGVs taking the slip/link road to M25 junction 29

c. The traffic travelling south on the M25 consists of:

   i. 65% (6,215 PCUs) of total traffic and 66% (2,020 PCUs) of HGVs continuing south on M25

   ii. 35% (3,416 PCUs) of total traffic and 34% (1,021 PCUs) of HGVs take the Project towards A13

Plate 10.37 The Project junction with A2/M2 – LTAM predicted traffic flows 2051 core AM peak all vehicles (PCUs)

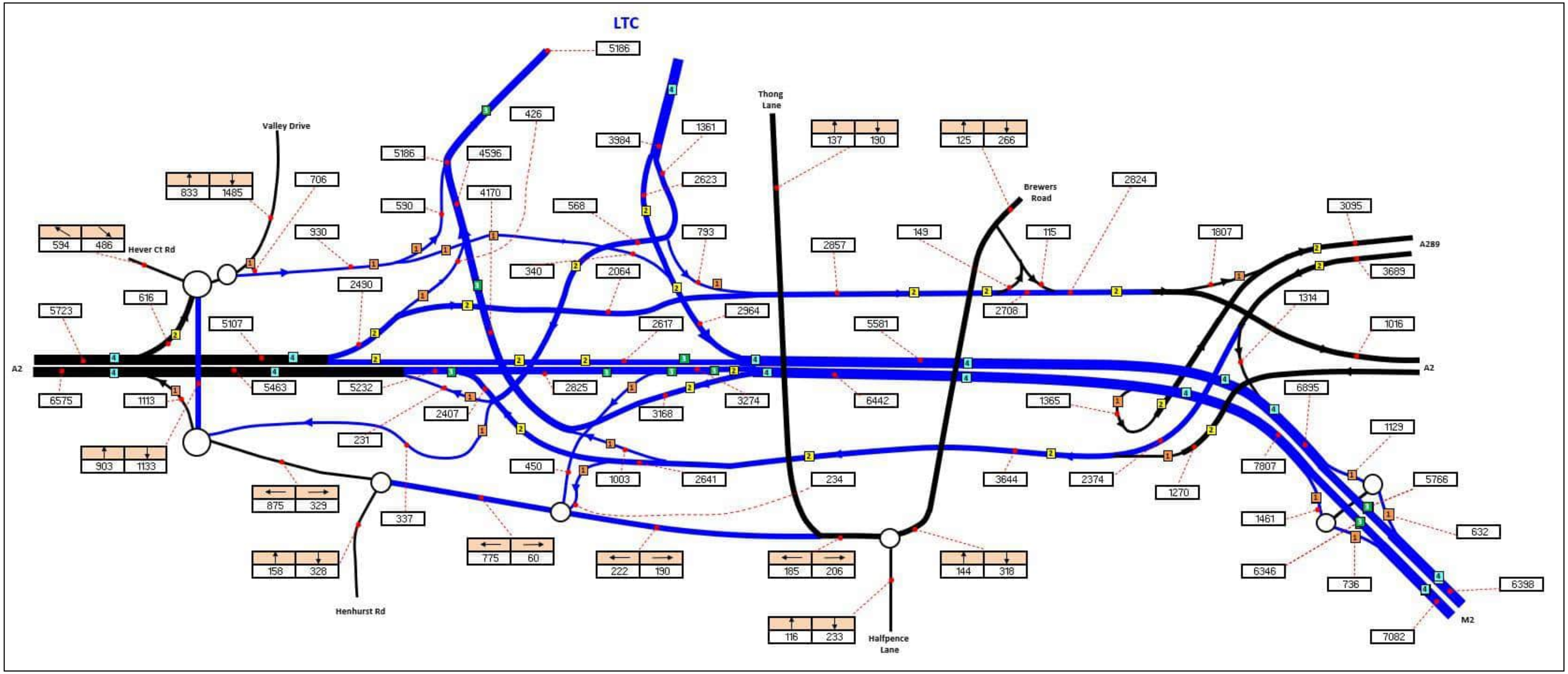


Plate 10.38 The Project junction with A2/M2 – LTAM predicted traffic flows 2051 core AM peak HGV (PCUs)

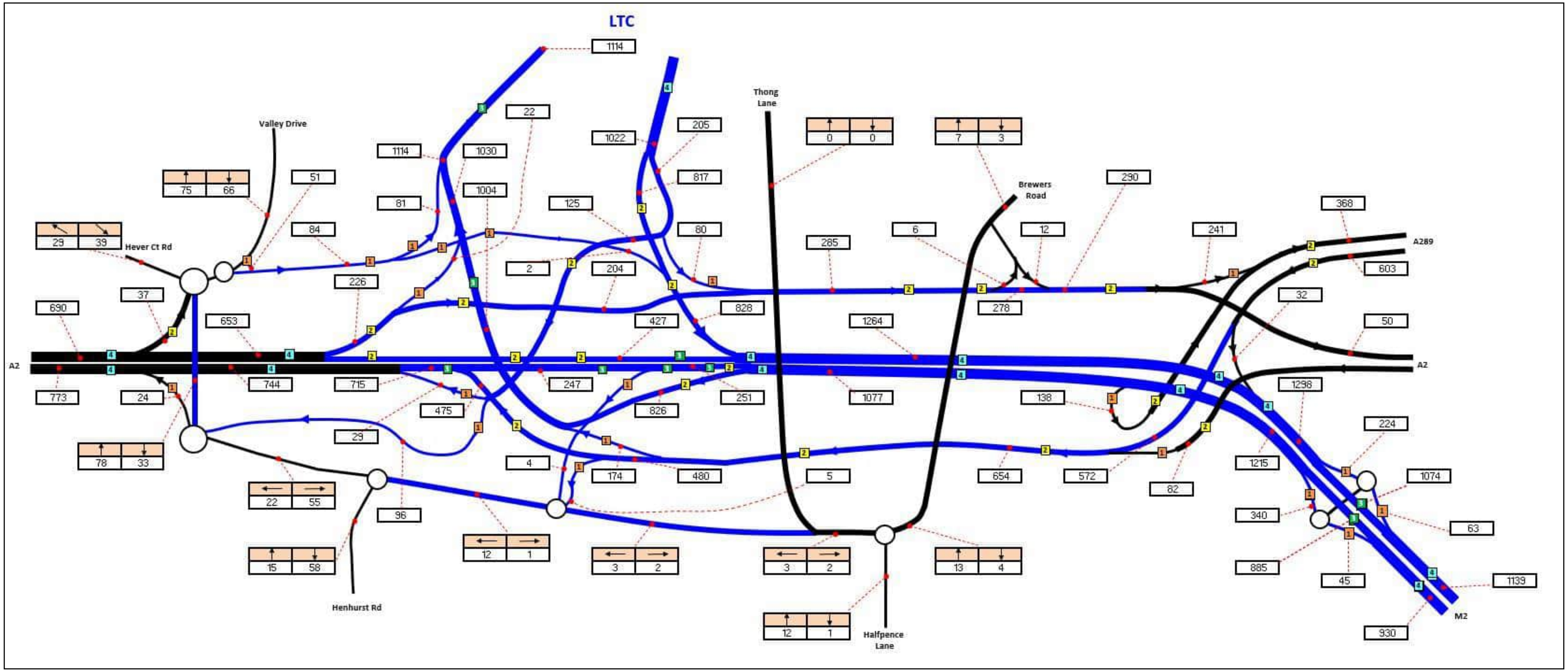


Plate 10.39 The Project junction with A13 – LTAM predicted traffic flows 2051 core AM peak all vehicles (PCUs)

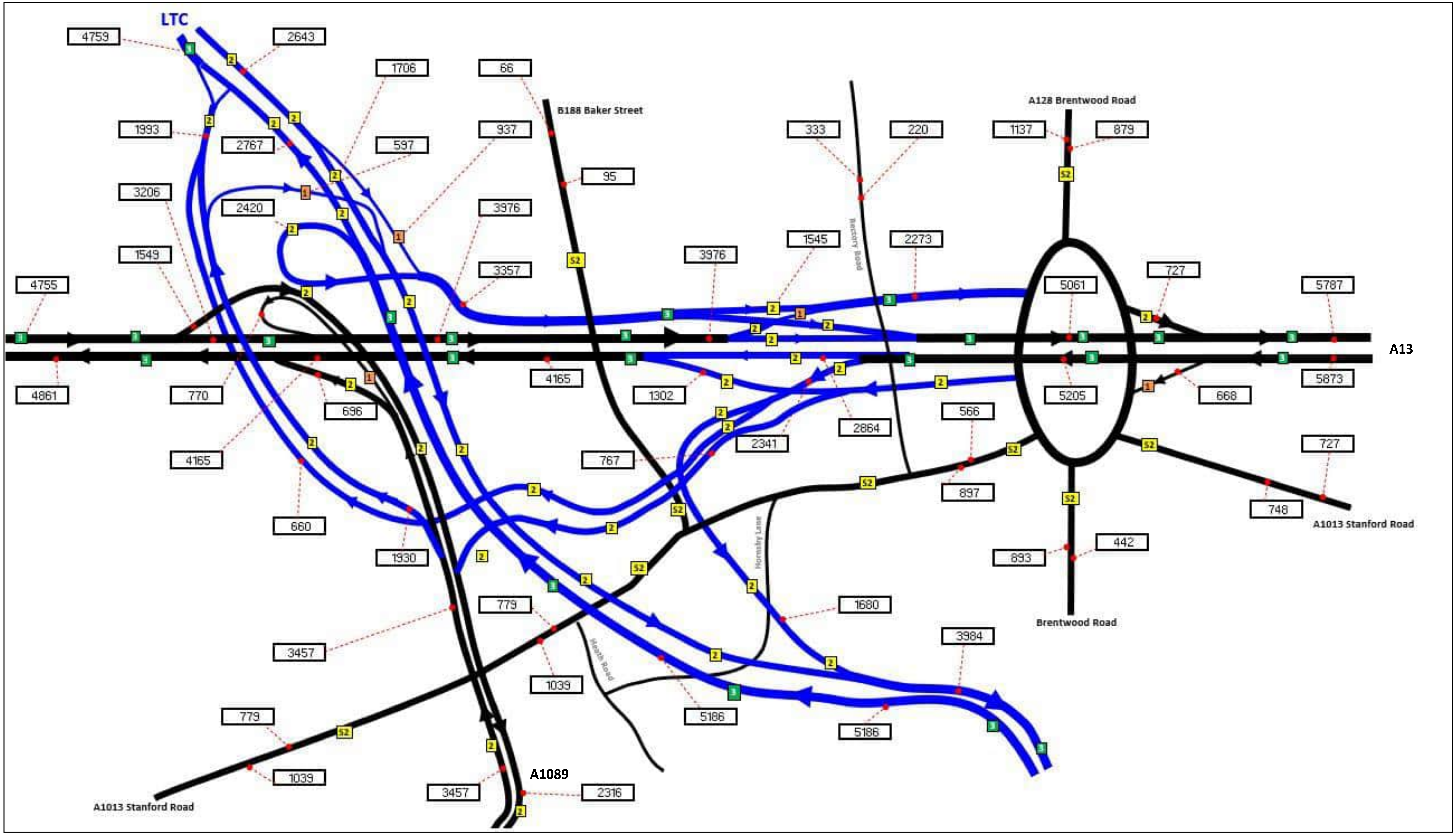


Plate 10.40 The Project junction with A13 – LTAM predicted traffic flows 2051 core AM peak HGV (PCUs)

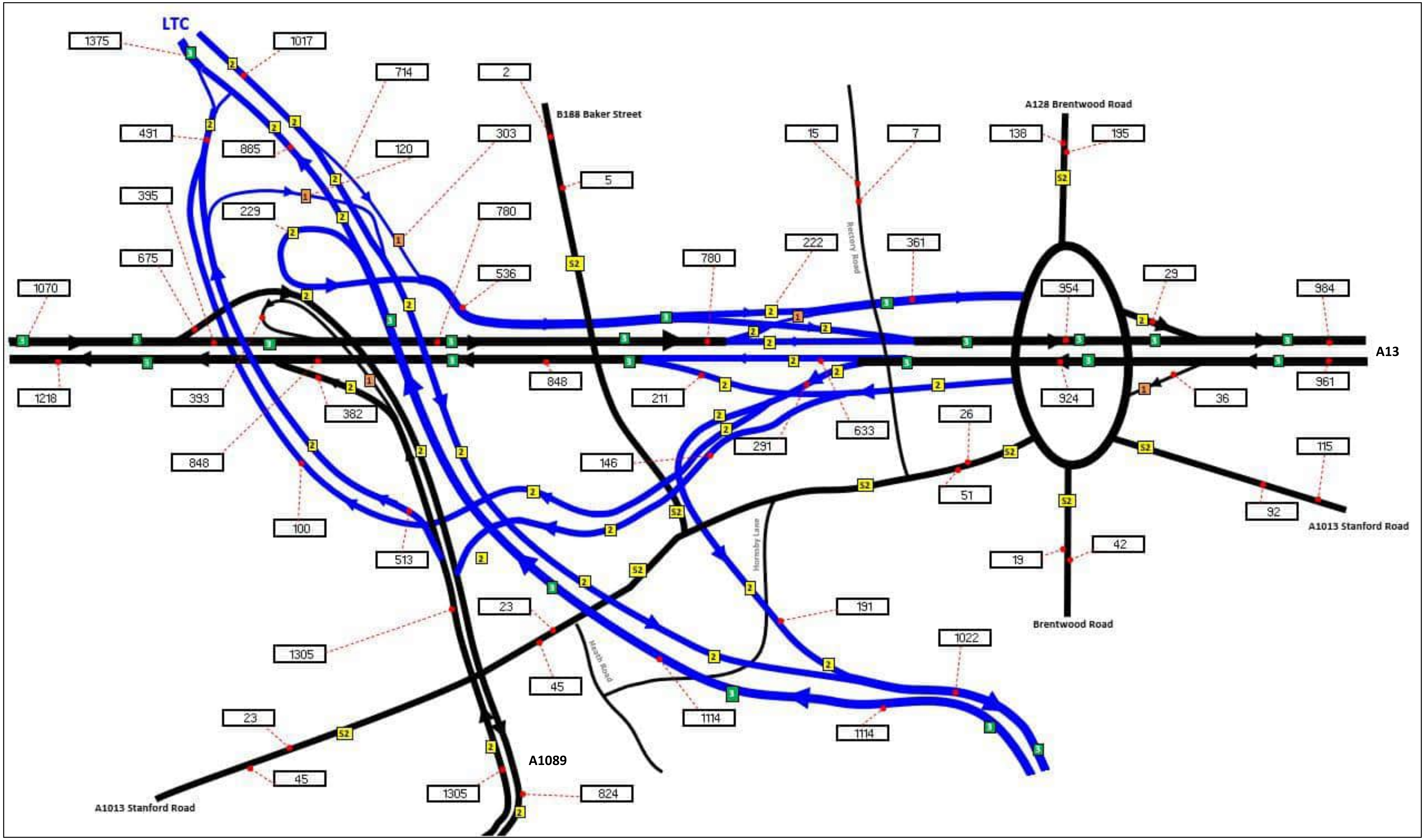


Plate 10.41 The Project junction with M25 – LTAM predicted traffic flows 2051 core AM peak all vehicles (PCUs)

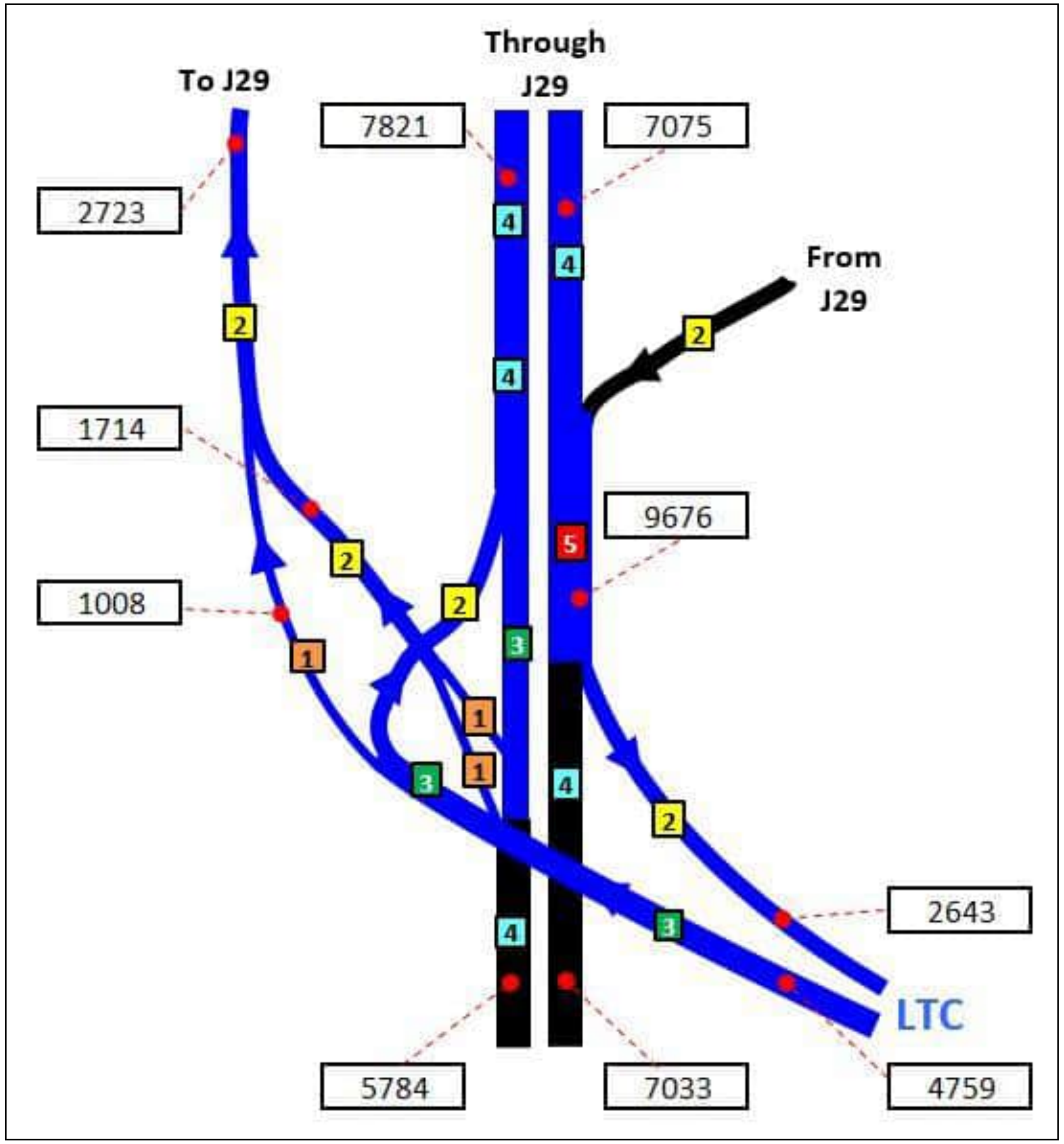


Plate 10.42 The Project junction with M25 – LTAM predicted traffic flows 2051 core AM peak HGV (PCUs)

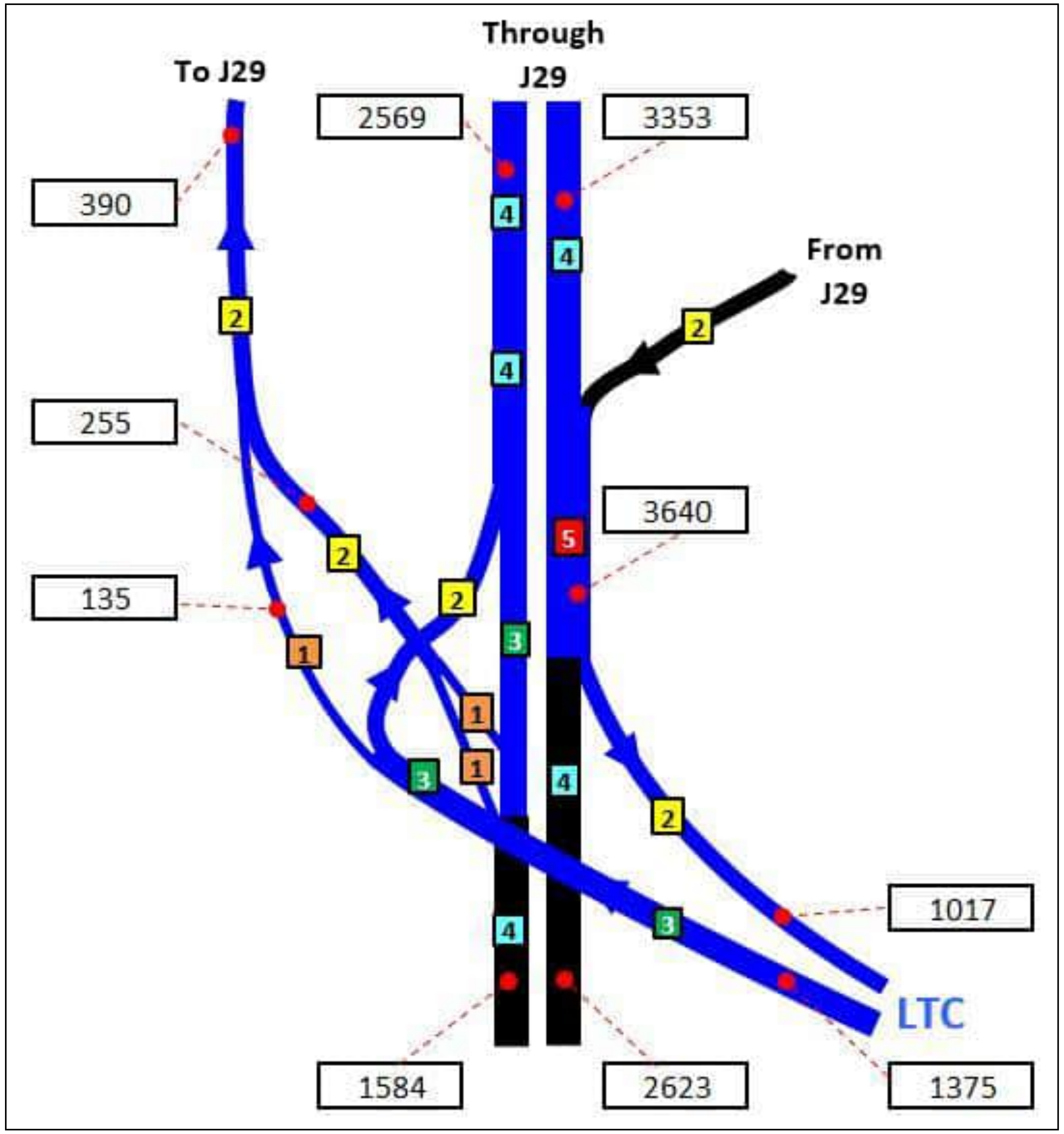


Plate 10.43 The Project junction with A2/M2 – LTAM predicted traffic flows 2051 core PM peak all vehicles (PCUs)

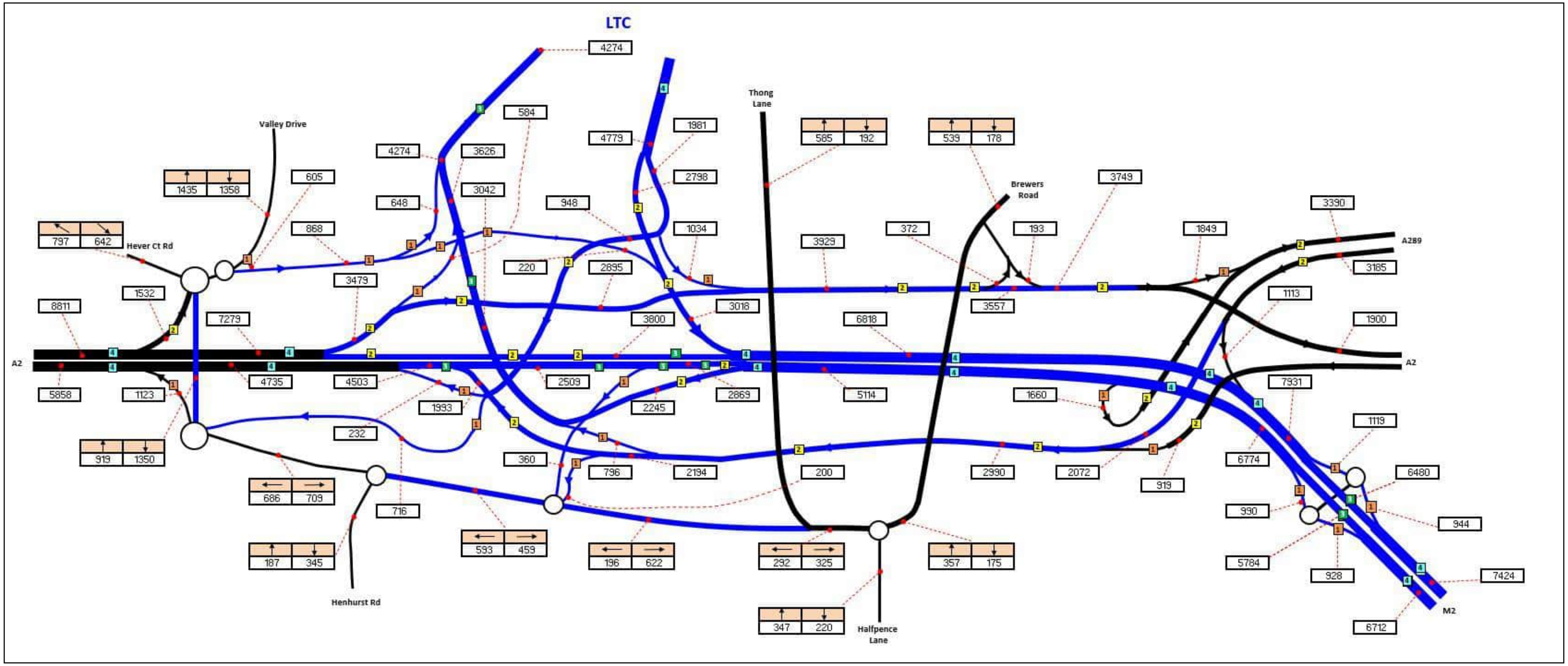


Plate 10.44 The Project junction with A2/M2 – LTAM predicted traffic flows 2051 core PM peak HGV (PCUs)

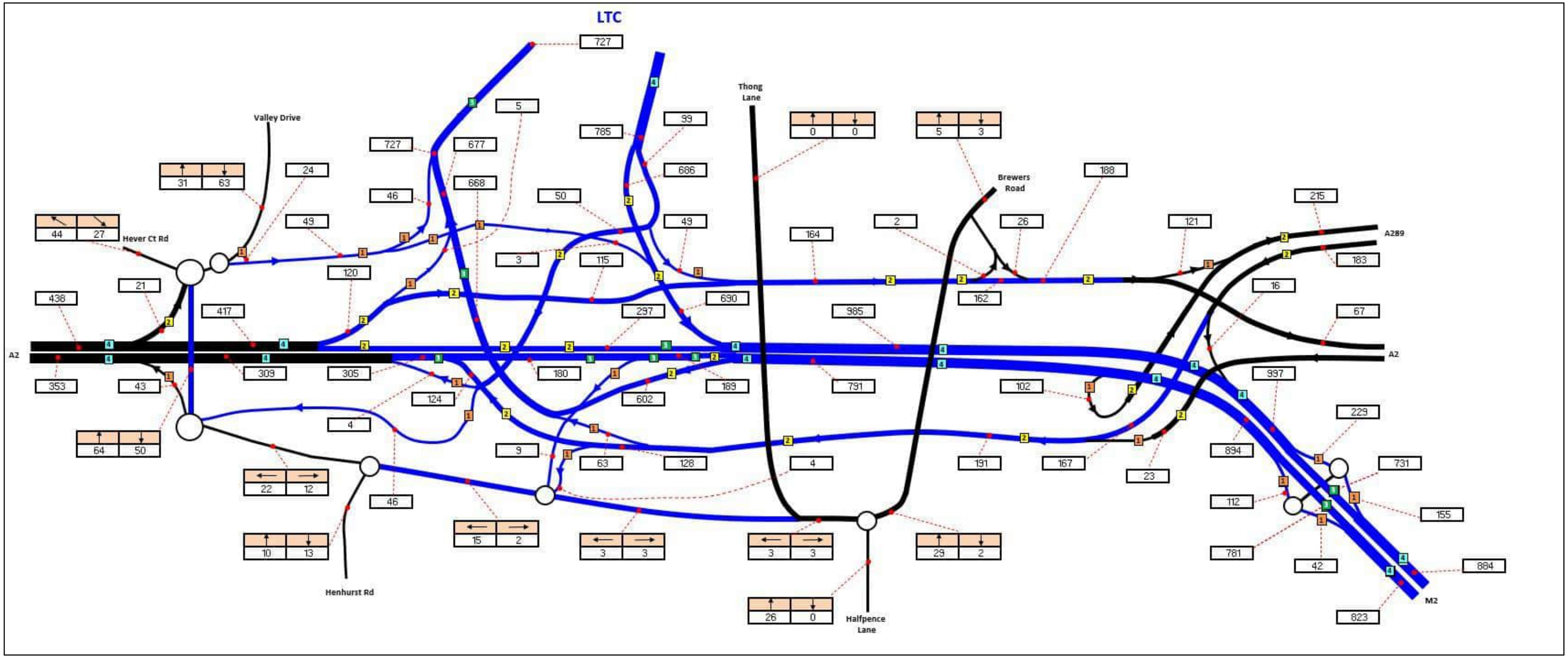


Plate 10.45 The Project junction with A13 – LTAM predicted traffic flows 2051 core PM peak all vehicles (PCUs)

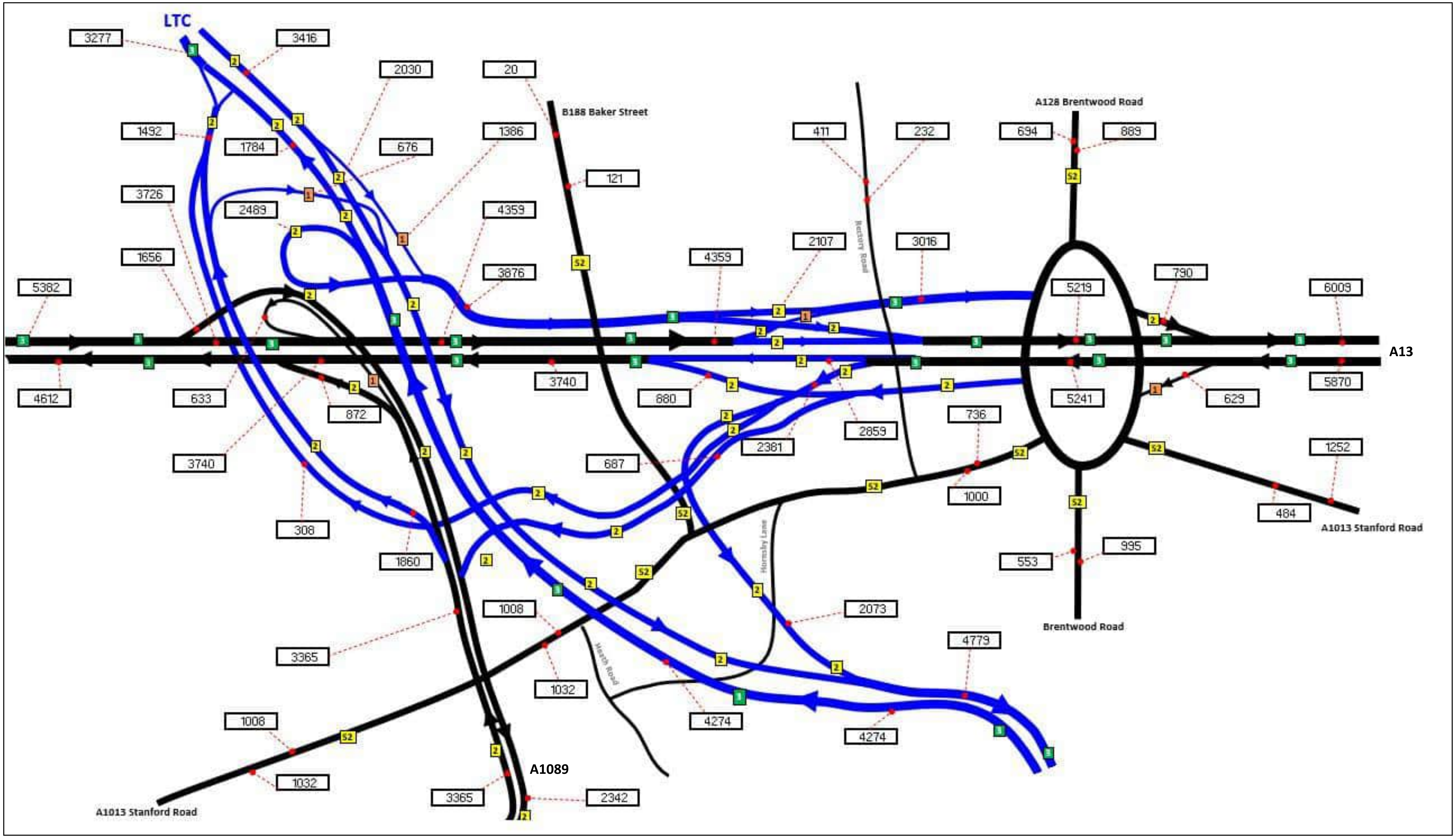


Plate 10.46 The Project junction with A13 – LTAM predicted traffic flows 2051 core PM peak HGV (PCUs)

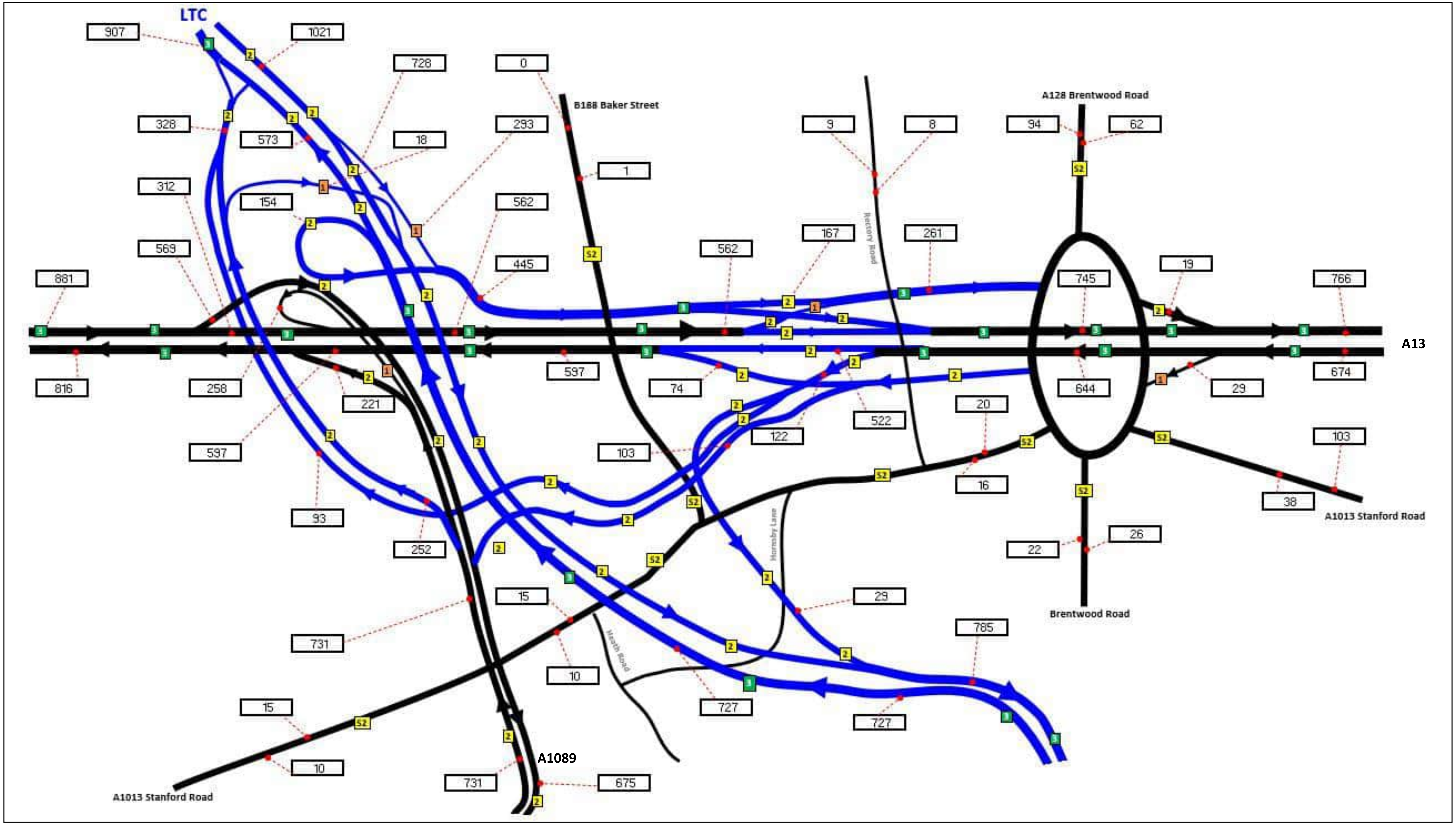


Plate 10.47 The Project junction with M25 – LTAM predicted traffic flows 2051 core PM peak all vehicles (PCUs)

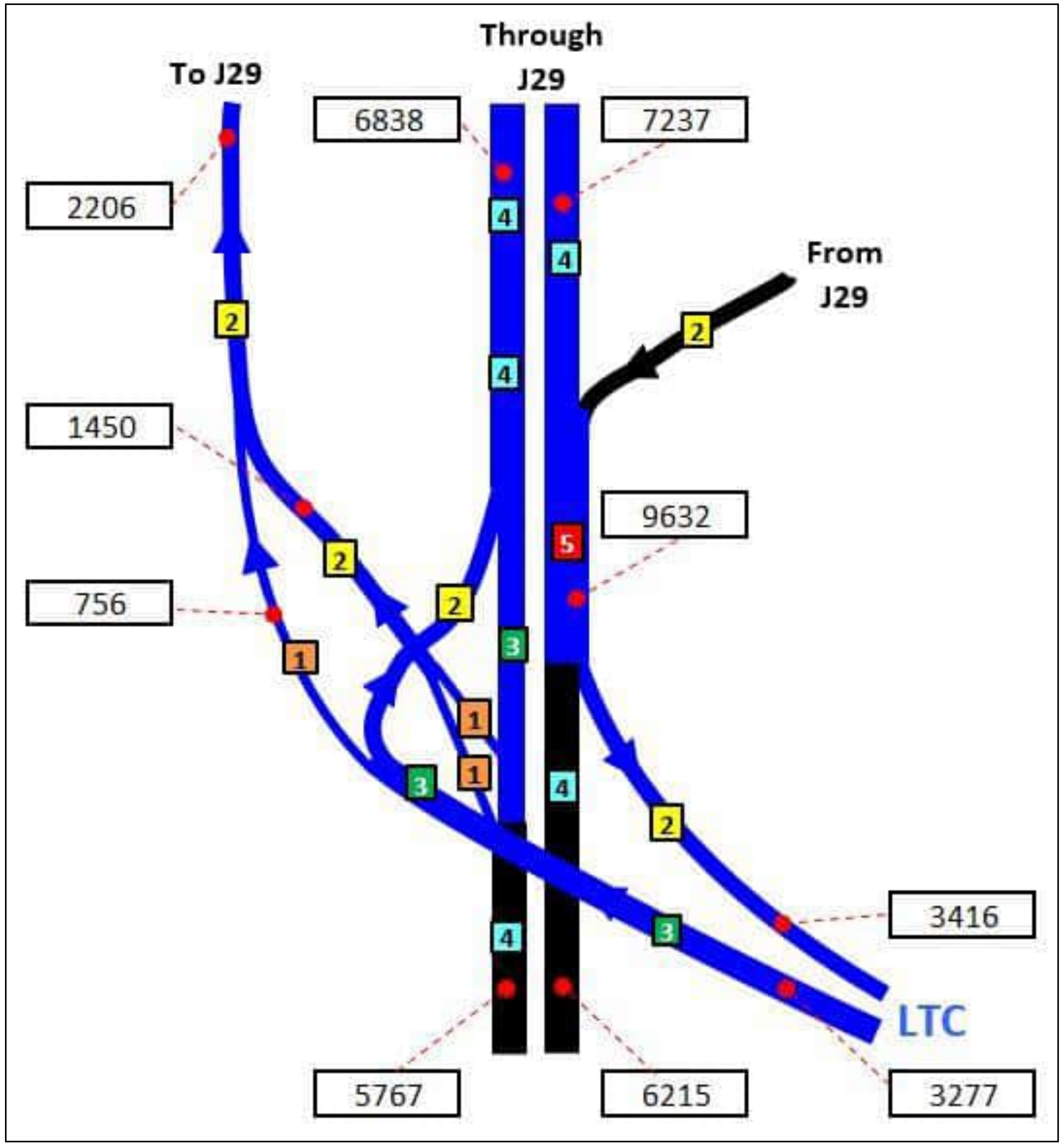
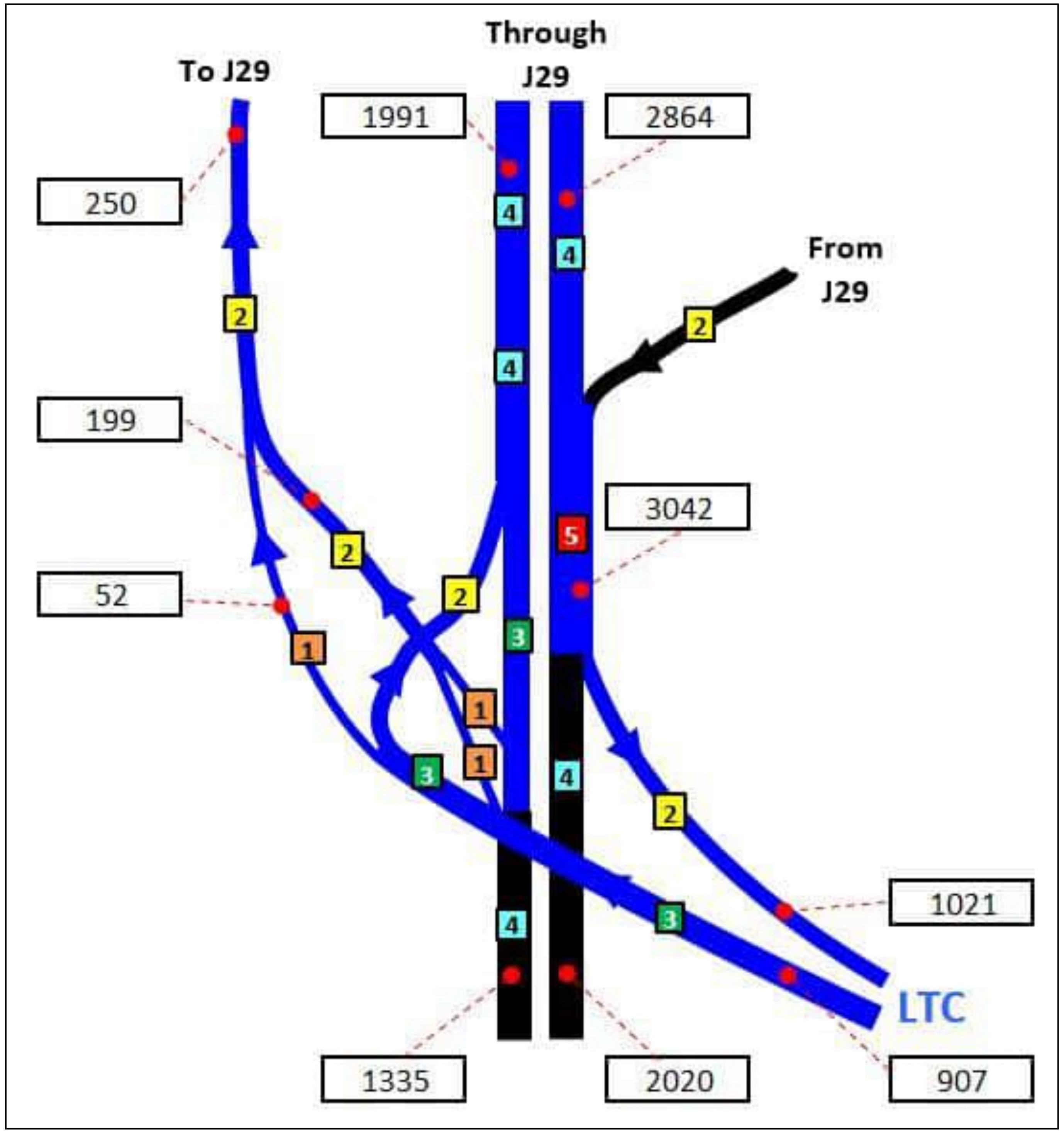


Plate 10.48 The Project junction with M25 – LTAM predicted traffic flows 2051 core PM peak HGV (PCUs)



11 Overall conclusion

11.1.1 This Transport Forecasting Package provides a comprehensive description of the methodologies used and the forecasts provided by the LTAM in order to support appraisal activities associated with the Project. The report demonstrates that the methodologies used are in line with current best practice as set out in the TAG.

11.1.2 This report initially provides some background information on the Project. It then summarises the work undertaken to calibrate and validate the LTAM base year models.

11.1.3 Planned land use developments and highway schemes were identified through contacting relevant local authorities. These developments were presented in an Uncertainty Log which sets out the relative scale of each development and the current level of certainty as to whether it would happen. Those developments considered near certain, or more than likely were incorporated within the core growth scenario for these forecasts.

11.1.4 Having agreed the Uncertainty Log, trip rates were identified from the TRICS database and these were used to determine the number of trips likely to be produced from each of the new developments in each of the model forecast years. The forecast years are 2030, 2037, 2045 and 2051. Some locations were treated differently, including the DP World London Gateway and Tilbury2 ports where predicted demand was taken from reports associated with those specific developments.

11.1.5 Overall car growth is then constrained to that contained within the National Trip End Model. Growth in goods vehicle traffic is constrained to that contained within the Road Traffic Forecasts 2018. The National Highways Interactive DIADEM Interface (HEIDI) is then used to develop reference matrices for each of the forecast years for each of the different segments included within the model. Low and high growth demand matrices were also derived to represent the uncertainty associated with national growth figures.

11.1.6 Forecast networks were defined for each of the forecast years by adding proposed highway schemes considered near certain or more than likely to the base year LTAM networks. These are called the Do Minimum networks. The Project is then added to the Do Minimum networks to produce the Do Something networks. Behavioural parameters such as values of time and vehicle operating costs were also derived for each of the forecast years using data provided in the TAG Databook V1.17 (DfT, 2021).

11.1.7 The LTAM is a variable demand model. For each model year the model is used to forecast how travellers would change their behaviour as a result of changes in the levels of congestion, the cost of fuel, the fuel efficiency of the fleet and incomes. The modelled behavioural responses included in the LTAM include changes to the frequency with which people make the same trip, the possibility of switching to/from rail, changes in the time of day they travel, changing where they travel to/from and the routes they use to make the journey. The model is run for both the Do Minimum and Do Something scenarios.

11.1.8 A series of outputs are then extracted from the Do Minimum and Do Something forecasts and the comparison between them is used to determine the level of impact that the proposed Project is predicted to have. These outputs are used to inform economic, environmental and operational appraisal activities and this report presents key findings for each of these areas.

11.1.9 The forecasts show that the Project is predicted to significantly reduce traffic along the A282 and across the Dartford Crossing, along the A2 between the proposed junction with the Project and the M25, and on the A13 between its proposed junction with the Project and the M25. These reductions in traffic lead to speed improvements on these sections of road. These locations are predicted to be heavily congested in the Do Minimum scenario therefore these reductions in congestion would lead to substantial economic benefits for the Project.

11.1.10 Other locations on the network are predicted to experience increased congestion as a result of introducing the Project. This is due to the increased capacity to cross the River Thames drawing more traffic into the corridor. These locations, such as on the M25 between junctions 29 and 28, on the A13 east of its proposed junction with the Project and on the A2/M2 east of its proposed junction with the Project, experience speed reductions which would lead to economic disbenefits of the Project but these do not outweigh the significant benefits of the Project as demonstrated by the overall positive Present Value of Benefits (PVB) which is provided in the Economic Appraisal Package as Appendix D of the Combined Modelling and Appraisal Report (Application Document 7.7).

11.1.11 A detailed 'speed banding' exercise was undertaken in line with the methodology set out in DMRB. Data from this process has been passed to the environmental assessment teams for them to undertake a full environmental assessment of the Project. The analysis showed that from an environmental perspective, the impact of the Project is largely contained within the local area of influence of the Project.

11.1.12 Outputs from the forecasts have been used to determine the levels of demand for various different movements and these have been used to inform the design decision making process. Outputs from the model have also been used to inform microsimulation models used to further refine the design.

11.1.13 The proposed Project is a transformational project. It is predicted to have a wide ranging overall beneficial impact on large areas of the heavily congested road network in the south-east. Its main impact is, as expected, at the Dartford Crossing and on the A2 and A13. There are also some locations which are predicted to be worse in the future with the Project but, overall, the balance of these benefits substantially outweigh the disbenefits.

References

Department for Transport (2013). Review of Lower Thames Crossing Options: Final Review Report. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/210625/final-review-report.pdf

Department for Transport (2013a). Transport Analysis Guidance [various access dates] https://www.gov.uk/guidance/transport-analysis-guidance-tag

Department for Transport (2014). National Policy Statement for National Networks. https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

Department for Transport (2015). Road Investment Strategy: 2015 to 2020. https://www.gov.uk/government/collections/road-investment-strategy

Department for Transport (2017). National Trip End Model NTEM. https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem

Department for Transport (2018). Road Traffic Forecasts 2018. https://www.gov.uk/government/publications/road-traffic-forecasts-2018

Department for Transport (2019). TAG unit M4 forecasting and uncertainty. https://www.gov.uk/government/publications/tag-unit-m4-forecasting-and-uncertainty

Department for Transport (2021). TAG Data Book [release version 1.17]. https://www.gov.uk/government/publications/tag-data-book

Department for Transport (2020a). Road Investment Strategy2: 2020 to 2025. https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025

Department for Transport (2020b). TAG unit M2-1 variable demand modelling. https://www.gov.uk/government/publications/tag-unit-m2-1-variable-demand-modelling

Department for Transport (2020c). TAG unit M3-1 highway assignment modelling. https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling

Department for Transport (2020d). TAG unit A2-2 induced investment. https://www.gov.uk/government/publications/tag-unit-a2-2-induced-investment

National Highways (2019). Design Manual for Roads and Bridges LA 105 - Air quality. [redacted]

National Highways (2020). Design Manual for Roads and Bridges LA 111 - Noise and vibration. [redacted]

National Highways (2022). Junction Improvement Progamme. [redacted]

Port of Tilbury London Limited (2017). Tilbury2 ES Appendix 13.A:Transport Assessment. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030003/TR030003-000254-ES%20Appendix%2013.A%20Transport%20Assessment.pdf

Transport for London (2016). Silvertown Tunnel Charging Statement. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010021/TR010021-000232-7.5%20Charging%20Statement.pdf

Glossary

Term	Abbreviation	Explanation
	AADT	Annual Average Daily Traffic
	AAWT	Annual Average Weekday Traffic
	ADT	Average Daily Traffic
AM peak hour		The hour between 07:00–08:00 in LTAM
AM peak period		The period between 06:00–09:00 in LTAM
Appraisal		The process of defining objectives, examining options and weighing up the relevant costs, benefits, risks and uncertainties
Appraisal period		The period of time over which benefits, costs and revenues are appraised. For a road scheme this includes benefits and costs before scheme opening and all impacts for 60 years from scheme opening.
	ARN	Affected Roa Network - All roads that trigger the traffic screening criteria and adjoining roads within 200m
Dart Charge		The Dartford Crossing free-flow electronic number plate recognition charging system
	DCO	Development Consent Order - Means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIPs)
	DfT	Department for Transport
DfT Value for Money Framework		DfT's approach to Value for Money assessments
	DGV	Dangerous Goods Vehicle
DIADEM		Dynamic Integrated Assignment and DEmand Model - DfT software for finding equilibrium between demand and supply in a transport model
Disbenefit		A negative benefit
	DMRB	Design Manual for Roads and Bridges: A comprehensive manual which contains requirements, advice and other published documents relating to works on motorway and all-purpose trunk roads for which one of the Overseeing Organisations (National Highways, Transport Scotland, the Welsh Government or the Department for Regional Development (Northern Ireland)) is the highway authority. For the Lower Thames Crossing, the Overseeing Organisation is National Highways.
Do Minimum		A future year scenario in LTAM which includes changes to the road network and planned development that is forecast to go ahead, but not the Lower Thames Crossing.
Do Something		A future year scenario in LTAM which includes changes to the road network and planned development that is forecast to go ahead, and the Lower Thames Crossing.

Term	Abbreviation	Explanation
	EA	External Area
	FMA	Fully Modelled Area
	GBFM	Great Britain Freight Model
	GDP	Gross Domestic Product - Total value of all goods and services produced within an economy in one year
	GEH	A formula used to compare two traffic volumes, named after its originator, Geoff E. Havers. It is similar to a chi-squared test.
	HAM	Highway Assignment Model
	HBEB	Home-Based Employers Business
	HBO	Home-Based Other
	HBW	Home-Based Work (Commute)
	HDV	Heavy Duty Vehicle
	HEIDI	National Highways Integrated Demand Interface - HEIDI is a bespoke DIADEM interface developed by National Highways
	HGV	Heavy Goods Vehicle
High traffic growth		A scenario that reflects high traffic levels
	IP	Inter-peak - An average hour within LTAM to represent an hour within the period 09:00–15:00
	ITN	Integrated Transport Network
	LGV	Light Goods Vehicle
Low traffic growth		A scenario that reflects low traffic levels
	LTAM	Lower Thames Area Model
	LTC	Lower Thames Crossing
	ME	Matrix Estimation
	NB	Northbound
	NHBEB	Non-Home-Based Employers Business
	NHBO	Non-Home-Based Other
	NTEM	National Trip End Model
	NTS	National Travel Survey
	OD	Origin Destination
	OGV1	Other Goods Vehicle 1 - all rigid vehicles over 3.5 tonnes gross vehicle weight including all large vehicles on a single frame: trucks, tow trucks, campers, motor homes, large ambulances, etc

Term	Abbreviation	Explanation
	OGV2	Other Goods Vehicle 2 - all articulated vehicles including multi-unit goods-carrying vehicles with a tractor or straight truck power unit, including goods-carrying rigid trucks pulling trailers
	OS	Ordnance Survey
	PA	Production Attraction
	PCF	Project Control Framework
	PCU	Passenger car unit - A metric to allow different vehicle types within a traffic model to be assessed in a consistent manner.
PM peak hour		The hour between 17:00–18:00 within LTAM
PM peak period		The hours between 15:00–18:00 within LTAM
	PRA	Preferred Route Announcement
	PT	Public transport
	PV	Present Value - The result of discounting a stream of benefits or costs
	PVB	Present Value of Benefits - The discounted value of benefits
	PVC	Present Value of Costs - The discounted value of costs
	RIS	Road Investment Strategy
	RIS2	Road Investment Strategy 2
	RPI	Retail Price Index - a measure of inflation published monthly by the Office for National Statistics. It measures the change in the cost of a representative sample of retail goods and services.
	RTF	Road Traffic Forecasts
	RTM	National Highways Regional Traffic Model
	RUC	Road user charging
	RXHAM	TfL's River Crossing Highway Assignment Model
	SATURN	Simulation and Assignment of Traffic to Urban Road Networks, software used to build transport models
	SB	Southbound
Scheme design		The design of the Project being submitted for development consent
	SERTM	National Highways South East Regional Traffic Model
	SLA	Select Link Analysis
Smart motorway		Term for a range of types of actively controlled motorway, using technology to optimise use of the carriageway including the hard shoulder

Term	Abbreviation	Explanation
	SRN	Strategic road network - The core road network in England managed by National Highways England
Static clustering		Benefits that come when firms and/or people locate near one another in geographical clusters but do not change their spatial location
	TAG	Transport Analysis Guidance published by DfT
Teletrac		DfT traffic dataset
TEMPro		Trip End Model Program - DfT software for viewing data from DfT's National Trip End Model
	TfL	Transport for London - The integrated body responsible for London's transport system
	TFR	Traffic Forecasting Report
	TIS	National Highways England Trip Information System
	TMC	Traffic Management Cell - the area at the Dartford Crossing used when extracting overheight vehicles
	TRIS	National Highways England Traffic Count Database
User charging		Charges paid by road users for the use of a road, tunnel or bridge
	V/C	Volume Over Capacity ratio
	VDM	Variable Demand Model
	VOC	Vehicle Operating Costs
	VOT	Value of Time
	VPD	Vehicles per Day

If you need help accessing this or any other National Highways information, please call **0300 123 5000** and we will help you.

If you have any enquiries about this publication email
info@nationalhighways.co.uk
or call **0300 123 5000***.

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.

These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone. Calls may be recorded or monitored.

Printed on paper from well-managed forests and other controlled sources when issued directly by National Highways.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ

National Highways Company Limited registered in England and Wales number 09346363