highways england

A14
Cambridge to Huntingdon improvement scheme
Development Consent Order Application

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Borrow Pits - Alternative sources of fill, and breakdown of types of material

September 2015

The Infrastructure Planning (Examination Procedure) Rules 2010

A14 Cambridge to Huntingdon improvement scheme

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1 Introduction

1.1 Introduction

1.1.1 At the Compulsory Acquisition Hearings on 4 September, the Examining Authority requested that Highways England undertake an assessment of alternative sources of material for the Scheme. At the same hearing, the Examining Authority also requested to be provided with a break down of the types of material expected to be extracted from each of the borrow pits. This paper has been produced in response to these requests.

2 Alternative Sources of Fill

2.1 Introduction

2.1.1 As noted in Highways England's response to question 1.14.1 (Applicant reference HE/A14/EX/41, PINS reference REP2-015), the A14 Cambridge to Huntingdon improvement scheme design requires approximately five million cubic metres additional fill material than is available from the cuttings and other excavations along the route. Highway schemes generally aim to balance the cut and fill requirements along a route; however, this is not possible with the proposed scheme, due to the flat topography of the area. There is a need to raise the alignment of the A14 and side roads on embankments, to construct the grade separated junctions, avoid flood plains and enable drainage, as well as providing mitigation embankments to help screen the highway from local residents. The scheme therefore has a large net deficit of fill material.

2.1.2 In the location of the Scheme, the following options for addressing this deficit are noted:

- Borrow pits adjacent to or near the route
- Disused airfields near the route
- Imported fill

2.2 Options for sourcing fill

Borrow *pits adjacent to or near the route*

2.2.1 The use of borrow pits to source material locally would provide flexibility in supply, minimise additional traffic on the local road system and keep haulage distance down. The local geology has a number of

strata that could be suitable for use as both embankment fill and capping material.

2.2.2 The Cambridgeshire and Peterborough Minerals and Waste Development Plan (Cambridgeshire County Council ('CCC') and Peterborough City Council, 2011) identifies a number of areas adjacent and near to the route corridor that are potential sources of minerals. Several of these have been historically earmarked for the A14 improvement works and as such any material excavated from them can only be used for the A14 scheme.

Disused airfields near the route

2.2.3 Several disused airfields exist near the proposed route, including former RAF Alconbury and RAF Oakington. CCC has advised that these sites are earmarked for redevelopment in the near future and so the structures and runways would need to be removed. The pavement and sub-layers of the runways could well be suitable as a sustainable source of recycled earthworks fill or capping. The volume available is estimated to be of the order of 0.5 million m^3.

2.2.4 At this stage the use of recycled airfield pavement material is identified as an opportunity, but the preliminary earthworks strategy has been designed not to rely on it for the following reasons:

- whilst near the route, the airfields are still several kilometres offline and so the mass haul arrangements would outweigh the advantage of the recycled fill source, particularly as haulage along the existing A14/A1 or local roads is to be avoided;
- to include one or both airfield sites in the A14 DCO submission would prevent development of the airfield sites independently of the A14 project, which may effectively "sterilise" the sites for redevelopment. Furthermore, there is not sufficient certainty over the timings of either project to guarantee they will be aligned to provide the fill for the DCO Scheme.

Imported fill/Commercial Quarries

2.2.5 Other sources of fill may be available at the time of construction, including surplus materials from other construction projects, industrial by-products such as PFA or commercial clay pits or quarries.

2.2.6 Depending on the location of these sources, importing fill would be likely to increase the traffic movements on the local roads and would involve additional transportation costs compared to sourcing material locally from borrow pits.

2.2.7 While there are a lot of site specific variables, the following information gives an indication of the relative costs of road transport (by road vehicles) versus on site transport (by site dump truck) and numbers of movements:

- Transporting 12km by road in 8 wheel road wagons: approximately £10.80 per m^3
- Transporting 3km on site by Site dump truck: approximately £4.50 per m^3

2.2.8 For 1 million cubic metres this transport element would therefore add £6.3 million of cost.

2.2.9 To achieve the same daily output, the road operation is likely to need nearly four times as many vehicles to account for the longer travel distance and reduced volume per vehicle. Consequently an operation involving 8 dumptrucks hauling 3km is approximately equivalent in output to 30 road wagons hauling 12km.

2.2.10 This would also result in 240 additional HGV journeys (loaded) and 240 additional return journeys (unloaded) per day on the road network.

2.3 Preferred option for sourcing fill

2.3.1 The principal factors influencing the decision to use borrow pits were:

- Shortest possible haulage distance. Hauling fill over a long distance takes time, needs more dump trucks and haul roads, produces greater emissions and can add significant cost. The borrow pits have been designed to limit bulk haul distance to about 4km at most.
- Minimise traffic on local and major roads by using haul roads. Fill hauled using public roads would need to be transported in tipper trucks rather than large dump trucks, which have a much smaller payload and therefore more journeys/trucks are needed. As identified by the Case for the Scheme (Applicant reference 7.1, PINS reference APP-755), the A1 and A14 are already congested. In addition, hundreds of additional trucks per day using local minor roads would be a significant nuisance to residents.
- Certainty of supply. Commercial quarries may not be able to reserve material for the project at the time that they are needed for the purposes of the Scheme, which would affect its deliverability and provide insufficient uncertainty to the Secretary of State in determining whether the Scheme should gain consent to proceed.
- Precedent – a number of these borrow pits are already identified as sources of engineering clay for the A14 in the Cambridgeshire and Peterborough Minerals and Waste Core Strategy Development Plan (2011).

- Lack of alternative sources. Whilst there are a number of local operators quarrying sand and gravel in the region, there are no engineering clay sites in a reasonable distance, as discussed below. As noted above, to keep haulage distances down, the sites would need to be as near as possible to the route of the Scheme.

2.4 Response to Wardell Armstrong report prepared for NFU

2.4.1 Highways England have considered the report on “Existing Sources of Construction Material” prepared in June 2015 by Wardell Armstrong (WA) for NFU, included within the Wilderspin family written representation (PINS reference REP2-157).

2.4.2 The report considers possible sources of construction material, dividing them into "sand and gravel" and "engineering clay". WA assume, based on the A14 Environmental Statement, that the A14 project requires about 3M tonnes of sand and gravel for roadbase, capping, concrete and 5.8 M m^3 of engineering clay for general earthworks fill. These appear to be broadly correct for the purpose of this discussion.

2.4.3 Approximately 80% of the fill import required for the A14 is general earthworks fill, typically (although not necessarily) clays. The earthworks slopes have been designed by Highways England to use locally available clays.

2.4.4 In paragraph 2.1.2 WA state that they have reviewed transport distances for construction aggregates and that 40 miles is typical in the industry). This may be reasonable for higher value graded/special aggregates that are quarried commercially. However it is important to understand the difference between aggregates, and general fill. Ordinary general fill is of much lower value than aggregate. It is not typically transported over a distance of more than 5km on large earthworks projects, is almost universally site won, and transported on dedicated haulage routes to provide enough transport capacity. This is normally the most practical approach given the very large volumes involved.

2.4.5 In paragraph 2.1.4 WA state that there is no evidence to suggest that material in the proposed borrow pits has any particular qualities that differ from alternative sources suggested in the report. For the engineering clay, this is not true. Some clays, such as those quarried for landfill capping (examples of which are referred to within WA's report such as Waterbeach Depot), can be too high in plasticity and low in shear strength to be suitable for highway earthworks and would be prone to slope stability problems. The proposed borrow pits have been carefully sited to target only geologies that are suitable for highway fill. Furthermore, the WA report does not give specific details of the clays at each of their identified sources.

2.4.6 In paragraph 3.1.3. WA comment that local sand/gravel reserves have been identified with a much greater reserve than the 3M tonnes estimated for the A14. We agree there will be numerous sources of sand/gravel in Cambridgeshire where quarrying is a widespread industry. However the proposed borrow pits would win both sand/gravel and clay from the same pits, making the scheme self-sufficient in most materials. It is still likely that some particular special aggregates (such as crushed rock and drainage bedding) would need to be imported from commercial quarries as they are specialist fills in small quantities but this would be a very small proportion of the total.

2.4.7 In paragraph 3.1.4 WA state that they have identified 12 possible sources of clay and shale, but none of the sources identified in Table 1 of their report (obtained from BGS "Britpits" data) are shown to have known reserves. WA indicate that identifying the source of the balance of the 5.8m million m^3 of engineering clay is unclear. Highways England agree with this, and consider this is because engineering clay for general earthworks fill is not commonly quarried commercially, (see 2.1.4 above). The sites identified in the CPMWCS only exist as potential A14 borrow pits. The nearest sites from the Britpits database are in Whittlesey and Wellingborough - they may not still be active or of suitable quality, and are 14 and 17 miles from the nearest part of the A14 site respectively. It is Highways England's position therefore that other sources do not have sufficient clay reserves for the purposes of the Scheme and that therefore the borrow pits are necessary to ensure the required clay reserves are available for the purposes of the Scheme.

2.4.8 Also in paragraph 3.1.4 WA mention a clay source at Waterbeach Waste Management (landfill) site; understood to be "Waterbeach Depot" in Table 1, which is a source of secondary aggregate, sand/gravel and clay. An appended letter from the operator AmeyCespa confirms stockpiles of about 0.5M m^3 Kimmeridge Clay available over the next few years. Section 2.4 below considers the viability of this source of fill.

2.4.9 In 4.2.1 WA again state (correctly) that the supply of engineering clay from existing sources is less clear than for sand/gravel. They further state that clay and fill materials from a number of existing sources are likely to be available to meet a significant proportion of the Scheme's requirement. However, WA provide no evidence at all for this statement. No site within a feasible distance has been identified. No evidence is presented that any of the sites in Table 1 have available reserves of suitable clay, and all are too far away to be feasible for general fill. We consider that borrow pits within the scheme are the only reliable and practicable way of obtaining the quantities of fill needed, at a reasonable distance.

2.4.10 In paragraph 4.2.1 WA also state that extracting fill from borrow pits to fill in other borrow pits, is not sustainable. This is a misunderstanding of the proposals. Some unsuitable material will have to be dug from borrow pits to expose the better material below it. This will normally be stockpiled in adjacent soil storage areas and finally re-used in its site of origin for landscaping/restoration. A minor proportion might be redistributed between the borrow pits to improve the overall restoration design.

2.4.11 In conclusion: WA/NFU have not identified any viable sources of general/clay fill, which comprises at least 80% of the A14 fill demand and is uneconomic to transport large distances. We agree with WA that there are alternative local sources for sand/gravel and special aggregate, but A14 borrow pits will provide most of the scheme's requirements for sand/gravel as well as clay.

2.5 Waterbeach Depot

2.5.1 Waterbeach Depot is a landfill and waste management site operated by AmeyCespa. It is located just off the A10 north of Cambridge. It is about 9 miles or 15km from the nearest part of the Scheme where significant embankment construction is proposed (Girton Interchange).

2.5.2 2.4.2 In response to a request from Highways England, Amey Cespa, have forwarded a package of geotechnical information typical of the Kimmeridge Clay at their site. The results on 14 samples date from July 2014 and comprise:

- 14 x moisture content
- 14 x density
- 5 x liquid/plastic limit
- 5 x particle size distribution
- 4 x particle density
- 4 x triaxial permeability

2.5.3 From a review of the liquid limit and particle size distribution, Highways England can conclude that the samples are clay with high/very high plasticity and low silt content. Although from the Kimmeridge Clay formation, the material appears more similar in character to the Ampthill Clay which Highways England have assessed as being unsuitable for bulk fill due to its low shear strength. We therefore conclude that this material would not be a suitable source of fill for constructing embankments on the A14 improvement scheme. Even if the 1.2m cu m of material were to be used for the A14 improvement scheme, this would introduce an additional 150,000 vehicle movements from the A10 onto the A14 through Milton Junction, which, as set out in the Traffic Modelling Update Report (Applicant reference

HE/A14/EX/44, PINS reference REP2-018) is already recognised as being heavily congested.

3 Breakdown of Types of Material

3.1 Breakdown of Types of Material

3.1.1 Table 1-1.below breaks down the different materials expected to be extracted from each borrow pit and the overall total for the six borrow pits. These are preliminary estimates of the quantities based on data available prior to the 2014/15 ground investigation. A subsequent check of the results of the recent ground investigation indicates they are broadly consistent, with a tolerance of around +/- 10% expected. The categories of material referred to in Table 1-1 are as follows:

3.1.2 Topsoil: This is the quantity of topsoil generated from the excavation area at each borrow pit site. Some of this will be used in restoration, however topsoil will not be required in areas expected to be under water, therefore much of this will be surplus and will be re-used off-site (at locations as local to the scheme as possible). At borrow pit 5 topsoil and subsoil will be stripped for re-use in restoring the site back to agriculture

3.1.3 Superficial Clay comprises several geologies:

- Alluvium,
- a firm clay within the flood plain we have called “River Terrace Deposits – Undifferentiated”
- Glacial till (“boulder clay”)

3.1.4 Bedrock clay in Borrow Pit 6 comprises Gault Clay, a stiff to hard clay.

3.1.5 Terrace Gravel comprises the sand and gravel units encountered in the flood plain. Ground Investigation surveys have revealed a complex geological sequence in this formation including clayey layers and lenses. While it cannot be assumed that this unit is a consistently clean sand/gravel, it could be screened and processed to generate particular selected fill materials.

3.1.6 The amount of fill required to build the scheme has been estimated at 6.7million m^3 of general fill and 1.03 million m^3 of selected fill (sand/gravel). Some of the general fill requirement is met by excavation from cuttings and flood compensation areas, the remainder will be sourced from the borrow pits, as will the selected fill as far as possible. Some selected fills may still need to be imported.

3.1.7 The estimated minimum requirement of selected fill for earthworks, i.e. sand/gravel, from the borrow pits is 0.8 million m^3 or about 15% of the total acceptable material. This excludes other potential uses of the

sands and gravels in the scheme such as use in pavement construction or as a concrete aggregate. These uses have not been included as they are not normally considered as 'earthworks' quantities and it is suspected that the engineering properties of the sands and gravels may not be suitable for these applications.

3.1.8 Table 1-1 shows that about 39% of the available acceptable material is expected to be Terrace Gravel, i.e. there is more than the minimum needed. This surplus provides a contingency in case the Terrace Gravel formation turns out to be not as thick as initially estimated, or not to yield quite as much selected fill. Any residual surplus sand/gravel material would still meet the specification for general fill and would be effectively used in the works.

Table 1-1: Borrow Pit materials by type (Preliminary estimated volumes)

			Material acceptable as fill				
Borrow Pit	**Gross volume (m^3)**	**Surplus topsoil (m^3)**	**Superficial Clay (m^3)**	**Bedrock Clay(m^3)**	**Terrace Gravel (m^3)**	**Total Acceptable (m^3)**	**Un-acceptable (m^3)**
Borrow Pit 1	1,870,000	130,000	700,000	-	700,000	**1,400,000**	340,000
Borrow Pit 2	890,000	70,000	220,000	-	480,000	**700,000**	120,000
Borrow Pit 3	1,080,000	80,000	130,000	-	780,000	**910,000**	90,000
Borrow Pit 5	1,120,000	(110,000)	990,000	-	-	**990,000**	130,000
Borrow Pit 6	1,230,000	80,000	90,000	970,000	-	**1,060,000**	90,000
Borrow Pit 7	390,000	40,000	160,000	-	120,000	**280,000**	70,000
TOTAL	**6,580,000**	**400,000**	**2,290,000**	**970,000**	**2,080,000**	**5,340,000**	**840,000**
PERCENTAGE OF ACCEPTABLE VOLUME	**-**	**-**	**43%**	**18%**	**39%**	**100%**	**-**

* The topsoil quantity for borrow pit 5 includes a 0.3m depth of topsoil strip and replacement. The topsoil quantity is therefore not included in the total excavation volume at borrow pit 5.