In Parliament – Session 2022 - 2023

HS2

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement

Volume 5: Appendix CT-008-00000

Borrow pit report

Q40

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Department for Transport

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Contents

Tables

Figures

1 Introduction

1.1 Background

1.1.1 The High Speed Two (HS2) High Speed Rail (Crewe – Manchester) Bill was submitted to Parliament together with an Environmental Statement (the main ES)[1] in January 2022. The main ES provided the assessment of the 'original scheme', that is the Bill scheme submitted to Parliament in January 2022.

1.1.2 Since submission of the Bill, a number of updates or changes to environmental baseline information, the design, and construction assumptions have occurred which may lead to new or different significant environmental effects. If enacted by Parliament, the Bill will provide the powers to construct, operate and maintain the HS2 Phase 2b Western Leg.

1.1.3 Following the deposit of the Bill, the need for a number of changes which do not require amendments to the Bill, including design changes, changes to construction programme and assumptions, new environmental baseline information and corrections to the main ES, have been identified. Any new or different significant effects that are likely to result from these changes, where these do not require amendments to the Bill, are reported in a Supplementary Environmental Statement (SES). This report covers Supplementary Environmental Statement 1 (SES1).

1.1.4 There is also a requirement for amendments to the Bill to make changes to the original scheme and these require the submission of an Additional Provision Environmental Statement (AP1 ES). This Additional Provision 1 Environmental Statement (AP1 ES) reports the likely significant environmental effects of these amendments, having taken into account the environmental information in the SES1.

1.1.5 These design changes and amendments have arisen through ongoing discussions with stakeholders and as a result of design refinements.

1.1.6 The following terms are used to differentiate between changes included in the SES1 and those included in the AP1 ES:

- 'SES1 design changes' – changes to the scheme design reported in the SES1 that do not require additional powers;
- 'SES1 changes' – all changes reported in the SES1 that do not require additional powers. This may include new baseline information, changes to the design and construction assumptions, and corrections; and

[1] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement*. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

- 'AP1 amendments' – changes to the scheme reported in the AP1 ES that include requirements for additional powers in the Bill.

1.1.7 In addition, the following terms are used to differentiate between the original scheme described in the main ES and subsequent changes and amendments:

- 'the SES1 scheme' – the original scheme with any changes described in the SES1 that are within the existing powers of the Bill; and
- 'the AP1 revised scheme' – the original scheme as amended by the SES1 changes and AP1 amendments.

1.1.8 This report is an appendix that forms part of Volume 5 of the SES1 and AP1 ES, which the Government has submitted to Parliament in support of the Bill. This appendix provides an update to the Borrow pit report[2] presented in the main ES and primarily concerns the SES1 design changes of: removal of MA02 Borrow Pit D, north of Moss Lane (SES1-002-002) as a result of the removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001).

1.1.9 The AP1 amendment regarding the additional land permanently required for the realignment and extension of Crewe tunnel (AP1-001-001) has also been taken into consideration in terms of the traffic effects associated with the management of the additional excavated material generated by the construction works, which is discussed in Section 7 of this report.

1.1.10 The environmental effects of the removal of the HS2 WCML connection (SES1-004-001) and the removal of MA02 Borrow Pit D (SES1-002-002) are reported in the community area (CA) reports in Volume 2 of the SES1 and AP1 ES. The CA referenced in this report are:

- Wimboldsley to Lostock Gralam (MA02);
- Pickmere to Agden and Hulseheath (MA03);
- Hulseheath to Manchester Airport (MA06);
- Davenport Green to Ardwick (MA07); and
- Manchester Piccadilly Station (MA08).

1.1.11 This update should be read in conjunction with the Borrow pit report in the main ES (the main ES Borrow pit report) see Volume 5, Appendix: CT-008-00000[2] of the main ES.

1.1.12 The construction of the AP1 revised scheme will require approximately 7.1 million m^3 of acceptable engineering materials compared to the 10 million m^3 required for the original scheme. This is primarily a result of the removal of the HS2 WCML connection and other changes to the original scheme. Most of these acceptable engineering materials (approximately 4.5 million m^3) will be provided through excavations along the route of the AP1 revised scheme. However, it is anticipated that additional acceptable engineering materials will be required at some locations to construct parts of the AP1 revised scheme. As

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Borrow pit report,* Volume 5, Appendix: CT-008-00000. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

described in the main ES Borrow pit report the requirement for additional materials is primarily driven by the high speed rail embankments in MA02.

1.1.13 The three borrow pits (MA02 Borrow Pits A, B and C) reported in the main ES Borrow pit report will provide a large proportion of the acceptable engineering fill materials needed to construct high speed rail embankments in MA02. The demand for additional acceptable engineering materials to be sourced from the three borrow pits (MA02 Borrow Pits A, B and C) has not changed and the selection of the locations and assessment of impacts for the three borrow pit locations remain as reported in the main ES Borrow pit report and the main ES. In addition, the restoration strategy reported within the main ES Borrow pit report for MA02 Borrow Pits A, B and C also remains unchanged with the required restoration materials transported to the three borrow pit locations from the Crewe tunnel construction activities, via conveyor within the land required for construction, with no traffic impacts on the public highway network.

1.1.14 The removal of the HS2 WCML connection (SES1-004-001) has led to a requirement to reassess the type and quantity of acceptable engineering materials required to construct the AP1 revised scheme. This reassessment has indicated that the demand for acceptable engineering materials can be largely met through the redistribution of acceptable engineering materials from construction activities within the land required for construction in MA03, MA06, MA07 and MA08 areas.

1.1.15 As a result of this reassessment of materials required to construct the AP1 revised scheme, there is no longer a requirement for the majority of high quality granular acceptable engineering materials that would have been provided by MA02 Borrow Pit D, and consequently this borrow pit will be removed from the AP1 revised scheme. The removal of MA02 Borrow Pit D (SES1-002-002) will result in the additional import of acceptable engineering materials from quarries, over and above the material that becomes available through re-distribution. As a consequence, the environmental and traffic impacts associated with the construction, operation, and restoration of MA02 Borrow Pit D have been removed from the AP1 revised scheme, as reported in SES1 and AP1 ES Volume 2.

1.1.16 Sections 2 and 3 of this report describe the results of the reassessment of materials required to construct the AP1 revised scheme, including the sources, types, and quantities of material available and the required demand for the types of materials needed for construction of the AP1 revised scheme.

1.2 Scope of the assessment

1.2.1 This Borrow pit report update considers the changes to the original scheme as amended by the SES1 design changes and AP1 amendments. It provides an update to sections of the main ES Borrow pit report that have been subject to change to take account of the removal of one of the four borrow pits from the original scheme. This report covers the removal of MA02 Borrow Pit D (SES1-002-002) and retention of MA01 Borrow Pits A, B and C.

1.2.2 The sections of the main ES Borrow pit report that have been updated within this report are:

- Section 1: Background;
- Section 2: Material requirement and potential sources;
- Section 3: Assessment of potential sources of material;
- Section 7: Traffic and transport assessment; and
- Section 10: Conclusions.

1.2.3 The remaining sections of the main ES Borrow pit report remain unchanged. These are the sections that discussed the background and methodology for the selection of potential borrow pit locations, appraisal of potential borrow pit locations and the strategy for operation and restoration of the borrow pits. Therefore, the text, tables and figures associated with these sections of the main ES Borrow pit report have not been reproduced in this Borrow pit report update.

1.3 Geology of the land required for the original scheme

1.3.1 This section remains unchanged from the main ES Borrow pit report.

1.4 Hydrogeology

1.4.1 This section remains unchanged from the main ES Borrow pit report.

2 Material requirement and potential sources

2.1 Introduction

2.1.1 This section remains unchanged from the main ES Borrow pit report.

2.2 Material demand and availability

2.2.1 The engineering classification of all excavated materials referred to in this section is based upon the Design Manual for Roads and Bridges (DMRB), Volume 1, Specification for Highways Works. Series 600, Earthworks classification[3]. The engineering classes of material relevant to the AP1 revised scheme are summarised in Annex A.

2.2.2 The total volume of acceptable engineering materials required to construct the AP1 revised scheme is currently estimated to be 7.1million[4] m^3 comprising approximately:

- 1.9 million m^3 of high-quality granular material (Class 6) for constructing embankments, prepared subgrade, for ground improvement (dig and replace) and the transitions between structures and earthworks;
- 0.1 million m^3 of granular material (Class 1) required for embankment fill and ground treatment; and
- 5.1 million m^3 of cohesive material (Class 2) of which:
  - 2.8 million m^3 is required for the construction of high speed railway embankments;
  - 1.0 million m^3 for the construction of highways embankments; and
  - 1.3 million m^3 of suitable fill for use in landscape mitigation earthworks.

2.2.3 Table 1 provides a summary of the types and volume of acceptable engineering material (fill) required to construct the AP1 revised scheme; the types and volume of site-won acceptable engineering materials that excavations may yield and be available for reuse; and the types and volume of acceptable engineering materials that are in deficit. This deficit volume equates to the supply of acceptable engineering material that will be required from alternative sources for construction of the AP1 revised scheme.

[3] Department for Transport (2016), *Manual of Contract Documents for Highways Works, Volume 1, Specification for Highways Works, Series 600 – Earthworks.*

[4] Overall quantities of materials have been rounded to provide clarity on the types and total quantities of materials required to construct the AP1 revised scheme.

Table 1: Volumes of acceptable engineering fill required for construction of the AP1 revised scheme

	Volume of Class 6 – high quality granular fill (m^3)	Volume of Class 1 - general fill – granular (m^3)	Volume of Class 2 - general fill – cohesive (m^3)	Total volume (m^3)
Fill required	1,911,200	77,000	5,104,000	7,092,200
Site-won	0	77,000	4,398,000	4,475,000
Deficit	**1,911,200**	**0**	**706,000**	**2,617,200**

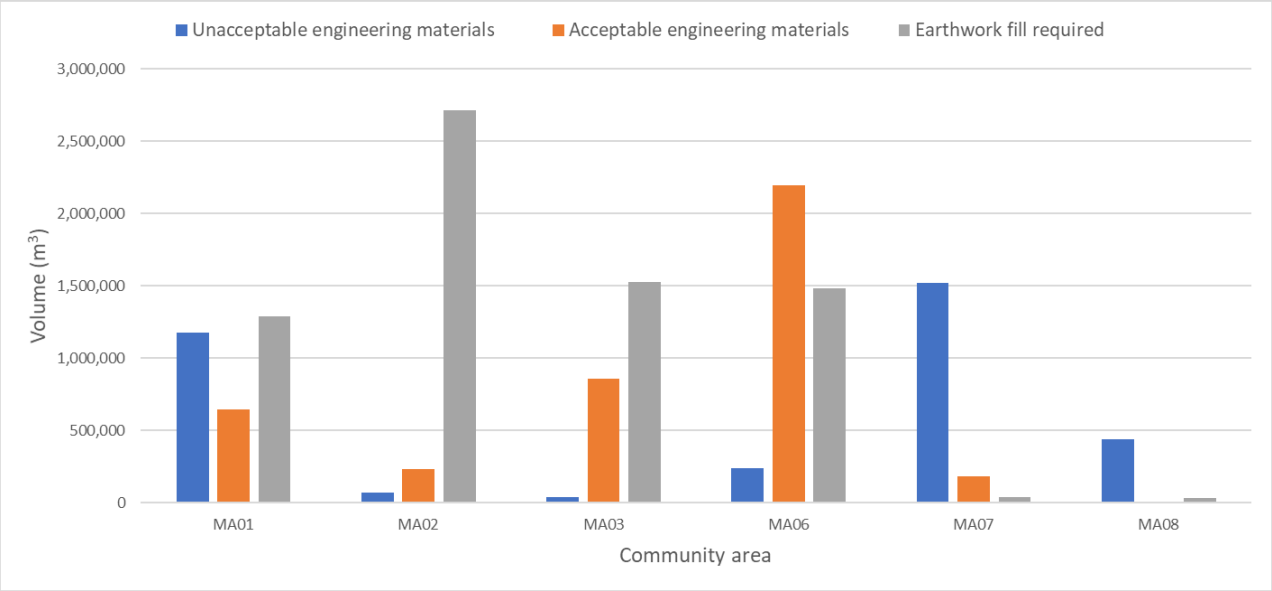
2.2.4 Earthworks along the route of the AP1 revised scheme from MA01 to MA08 will generate site-won acceptable (and unacceptable) engineering materials (see Table 1). The acceptable excavated materials will be reused to meet the demand for acceptable engineering material in the areas where materials are required for construction of the AP1 revised scheme.

2.2.5 The balance of site-won acceptable engineering material relative to the requirement for earthworks fill in each CA is shown on Figure 1 which also shows volumes of anticipated site-won unacceptable engineering materials that will be generated within each CA. The site-won unacceptable engineering materials are likely to require further analysis to determine their potential for reuse within the AP1 revised scheme in areas where less stringent engineering conditions are required for the materials, such as landscape earthworks. If site-won unacceptable materials are deemed not suitable for reuse within the AP1 revised scheme they will be disposed offsite to landfill.

2.2.6 Figure 1 shows that there will be a surplus of site-won acceptable engineering materials generated in MA06 and MA07 compared to the earthwork fill required in these CA. This surplus of material will be redistributed mainly to MA03 where there is a deficit of acceptable engineering material. Figure 1 also shows that there will be a large deficit of site-won acceptable engineering materials within MA01 and MA02 and this demand cannot be met through the redistribution of excavated materials from MA06 or MA07. As a result, alternative sources of acceptable engineering materials are required to make up the earthworks fill deficit in these CA.

2.2.7 Figure 2 shows the CA that are in materials balance and highlights the CA that are in materials deficit.

Figure 1: Summary of material availability within the community areas (CA)



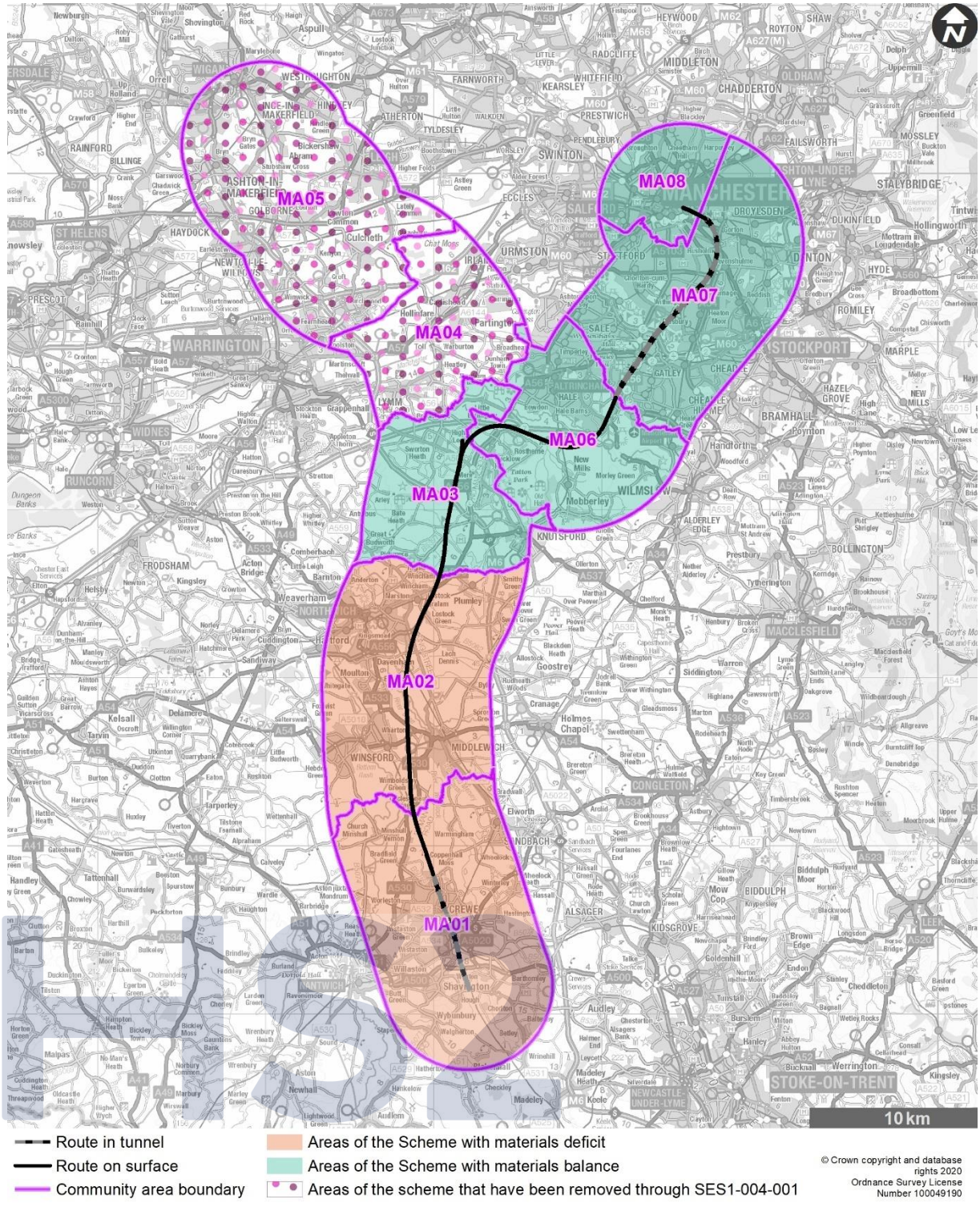
2.2.8 Figure 2 shows that an overall balanced distribution of site-won acceptable engineering materials can be achieved across the MA03, MA06, MA07 and MA08 CA, with no deficit. Figure 2 also highlights that there is a deficit of earthwork fill within MA02, which is associated with the requirement for acceptable engineering materials to construct the high speed railway embankments in this CA.

2.2.9 The total volume of acceptable engineering materials that cannot be sourced from site-won acceptable engineering material is approximately 2.6 million m^3 (see Table 1). This large deficit of earthwork fill means that alternative sources of acceptable engineering materials are required for construction of the AP1 revised scheme, including borrow pits and quarries.

2.2.10 The exceptions to the balanced distribution of site-won excavated materials are:

- the demand for high quality engineering fill (Class 6) that cannot be sourced from excavations within the land required for construction or from borrow pits; and
- the required disposal of site-won unacceptable materials generated from construction of the Manchester tunnels.

Figure 2: Excavated material balance for the AP1 revised scheme



2.3 Materials acquisition strategy for the Proposed Scheme

2.3.1 This section remains unchanged from the main ES Borrow pit report.

2.4 Reuse of excavated material along the route of the Proposed Scheme

2.4.1 This section remains unchanged from the main ES Borrow pit report.

2.5 Direct reuse of excavated materials

2.5.1 This section remains unchanged from the main ES Borrow pit report.

2.6 Reuse of excavated cohesive materials following stabilisation

2.6.1 This section remains unchanged from the main ES Borrow pit report.

2.7 Alternative sources of supply

2.7.1 This section remains unchanged from the main ES Borrow pit report.

3 Assessment of potential sources of material

3.1 Introduction

3.1.1 This section remains unchanged from the main ES Borrow pit report.

3.2 Reuse of excavated materials

3.2.1 This section remains unchanged from the main ES Borrow pit report.

3.3 Demand for imported materials

3.3.1 This section remains unchanged from the main ES Borrow pit report.

3.4 Use of borrow pits

3.4.1 This section remains unchanged from the main ES Borrow pit report.

3.5 Summary of sources

3.5.1 Acceptable engineering fill materials are required to meet the deficit of acceptable engineering material fill required for construction of the AP1 revised scheme. Site-won acceptable engineering fill materials will be used within the works on the basis of the highest grade of site-won acceptable engineering material being allocated to the most appropriate demand for engineering fill. Once demand is met locally, materials will then be distributed to the next location requiring acceptable engineering fill materials for construction. Surpluses of site-won acceptable engineering fill materials will then be cascaded to the next best use, that is, to use a lower quality engineering fill material for engineering works where the use of a lower quality engineering fill material is acceptable. This will maximise the reuse of site-won acceptable engineering materials and reduce the volume of excavated material disposed off-site to landfill.

3.5.2 The cascade of site-won acceptable engineering fill materials will not address a deficit of acceptable engineering materials needed for the construction of the AP1 revised scheme. The quality of site-won acceptable engineering fill materials that will be generated during excavations are not all anticipated to meet the engineering criteria for construction of high speed railway embankments in MA02, which requires the use of a high quality engineering fill material for construction of the embankment core and general engineering fills for the embankment shoulders. As presented in Table 1, there will be an overall deficit of approximately 1.9 million m^3 of high quality granular engineering fill (Class 6) material and 706,000m^3 of general engineering fill (Class 2) material.

3.5.3 The use of quarries as a sole source of high quality (Class 6) and general fill (Class 2) engineering materials is not considered feasible. This assessment considers the information provided by quarry operators on the certainty of supply of materials to meet the construction programme, the distance of quarries from the identified areas of demand and the potential impacts of traffic on local highways and communities.

3.5.4 The deficit of high quality granular engineering fill (Class 6) materials that cannot be sourced from within the land required for construction or from borrow pits will need to be sourced from quarries located close to the scheme. The deficit of general engineering fills (Class 2) will be wholly sourced from MA02 Borrow Pits A, B and C.

4 Methodology for selection of borrow pit locations

4.1.1 All sub-sections in Section 4 remain unchanged from the main ES Borrow pit report.

5 Selection of potential cohesive borrow pit locations

5.1.1 All sub-sections in Section 5 remain unchanged from the main ES Borrow pit report.

6 Selection of potential granular borrow pit locations

6.1.1 All sub-sections in Section 6 remain unchanged from the main ES Borrow pit report.

7 Traffic and transport assessment

7.1 Introduction

7.1.1 There has been one SES1 design change and one AP1 amendment to the original scheme that directly affects the traffic and transport assessment that was presented in the main ES borrow pit report. The relevant changes are:

- the removal of MA02 Borrow Pit D, north of Moss Lane (SES1-002-002); and
- additional land permanently required for the realignment and extension of the Crewe tunnel (AP1-001-001).

7.1.2 These changes to the original scheme in conjunction with the reassessment of the excavated material volumes and redistribution of acceptable engineering materials across the CA, will affect the volumes of excavated material that will be transported as well as the timing within the construction programme. This section has been updated to reflect these changes.

7.1.3 The removal of MA02 Borrow Pit D (SES1-002-002) will remove the construction traffic impacts on the B5081 Byley Road as this construction traffic route will no longer be required.

7.1.4 The traffic impacts relating to the transport of the additional excavated materials generated from the tunnel realignment and extension (AP1-001-001) are also discussed in this section.

7.1.5 This section also provides a high-level comparative assessment of the traffic and transport impacts of the retention of the three selected borrow pits (MA02 Borrow Pits A, B and C) within the AP1 revised scheme compared to a scenario without MA02 Borrow Pits A, B and C.

7.1.6 Throughout this section, both laden and unladen Heavy Goods Vehicles (HGV) journeys are included in the analysis. Unless otherwise stated, HGV journey totals include both legs of a trip to import or export material to and from the AP1 revised scheme and therefore the number of laden HGV journeys can be assumed to be 50% of the totals expressed, except where directional flows are stated.

7.2 HGV movements of excavated material

7.2.1 MA02 Borrow Pits A, B and C will be located adjacent to the route of the AP1 revised scheme, within the land required for construction, with most of the material excavated from the borrow pits and incoming material (for restoration of the borrow pits) planned to be transported via Articulated Dump Trucks (ADT) on dedicated site haul routes. Use of site haul routes avoids the need to transport excavated materials to or from the borrow pits along the public highway network.

7.2.2 A proportion of excavated material (approximately 110,500m^3) from MA02 Borrow Pit C will need to be transported on the public highway network between the A533 Bostock Road

Transfer Node (TN03) and the Rudheath embankment Transfer Node (TN05). The locations of these transfer nodes are shown on Figure 3.

7.3 Implications of removal of MA02 Borrow Pits A, B and C

7.3.1 If MA02 Borrow Pits A, B and C were removed, it would result in the need to transport construction material on the public highway network rather than on dedicated site haul routes within the land required for construction. This would have a detrimental impact on the public highway network in the vicinity of the AP1 revised scheme due to the requirement for additional construction HGV journeys to transport material to the scheme from external sources.

7.3.2 The assessment has been based on the AP1 revised scheme programme for the movement of excavated material for the following material types:

- import – material required to construct the AP1 revised scheme arriving from external sources (e.g. quarries); and
- export – excavated material removed from site (e.g. from cuttings) for disposal at external locations (e.g. landfill or for reuse by other schemes).

7.3.3 For the purpose of these assessments:

- material previously proposed to be extracted from borrow pit(s) has been replaced by imported material from quarries and sustainable sources;
- material previously assigned to backfill the borrow pit(s) has been re-designated as exported material; and
- no material is proposed to be required for restoration of the borrow pit(s).

7.3.4 This high-level assessment has been undertaken based on the assumed use of the construction transfer nodes (TN) being able to cater for the additional movements from the removal of the borrow pits or a change in the borrow pit strategy. The TN have been selected and assigned based on borrow pit locations and their proximity to the identified areas of fill.

7.3.5 If MA02 Borrow Pits A, B and C were to be removed from the AP1 revised scheme, the following implications would arise:

- an increase in the import of acceptable engineering materials transported from external sources via the public highway network, requiring approximately 140,100 additional HGV journeys to be made on the public highway network;
- excavated materials arising from the construction of the AP1 revised scheme, that would have been reused for restoration of the borrow pit(s), would require space for stockpiling and either of the following in order to transport the material from the site:

  - 1,177 return train journeys (assuming a loading capacity of 600m^3 per train), requiring 3,354 train paths on the WCML; or
  - 166,100 HGV journeys[5] to export material from the Crewe tunnel construction, in addition to the 166,100 journeys required to import material for construction.
- an increase in both volumes and overall duration of HGV journeys on the public highway network in the vicinity of all transfer nodes between Crewe North RSD TN02 and Rudheath Embankment TN05. The A530 and the A54, in particular, would experience periods of increased HGV journeys;
- with removal of MA02 Borrow Pits A, B and C, the intensity of the volume of HGV would increase closer to the AP1 revised scheme, resulting in greater impacts on communities through which these additional HGV journeys would pass;
- an increase in HGV journeys on the public highway network between quarries and the strategic road network (these additional movements have not been included in this assessment as these journeys are assumed to form part of original consents to operate these quarries); and
- an adverse impact on the resilience of the programme for construction of the AP1 revised scheme, since use of borrow pits provides greater control over the supply of materials where and when required.

7.3.6 Table 2 shows the additional HGV journeys associated with the removal of MA02 Borrow Pits A, B and C. These journeys include both loaded and unloaded HGV from and to quarries supplying material if MA02 Borrow Pits A, B and C were to be removed from the AP1 revised scheme. As such, these reflect the importation of materials only and do not take account of the potential additional HGV journeys required for export of excavated material by road if excavated material cannot be removed from the AP1 revised scheme by rail, which are considered separately.

Table 2: Additional total external HGV import movements associated with removal of MA02 Borrow Pits A, B and C

Borrow pit	HGV journeys using public highway network	HGV journeys moved from site haul routes to public highway network
MA02 Borrow Pit A	0	64,000
MA02 Borrow Pit B	0	49,400
MA02 Borrow Pit C	26,000	26,700
Total	**26,000**	**140,100**

7.3.7 If MA02 Borrow Pit A was removed, it would require replacement materials to be sourced and transported which would result in 64,000 additional HGV journeys that would be routed through Crewe RSD North TN02, with additional traffic coming from M6 junction 16 via the A500 Alsager Road, the A51 and the A530 Nantwich Road.

[5] The figure of 166,100 reflects the total number of HGV journeys required to import 706,000m^3 of acceptable engineering material that would otherwise be sourced from the three cohesive borrow pits.

7.3.8 If MA02 Borrow Pit B was removed, it would require replacement materials to be sourced and transported which would result in 49,400 additional HGV journeys that would be routed through Crewe RSD North TN02. These additional HGV journeys would come from M6 junction 16 via the A500 Alsager Road, the A51 and A530 Nantwich Road.

7.3.9 If MA02 Borrow Pit C was removed, it would require replacement materials to be sourced and transported which would result in 52,700 HGV journeys being routed through the following transfer nodes as follows:

- 7,700 additional HGV journeys via construction compound MA02/05a, A533 Bostock Road TN03, with the additional traffic coming from M6, junction 18 via the A54 Holmes Chapel Road, A54 Middlewich Road and A54 Chester Road through central Middlewich;
- 19,000 additional HGV journeys via construction compound MA02/09, Gad Brook Viaduct South TN04, with the additional traffic coming from M6 junction 18 via the A54 Holmes Chapel Road, the B5309 Centurion Way, the B5309 King Street and the A530 King Street; and
- 26,000 HGV journeys from construction compound MA02/05a, A533 Bostock Road TN03 into construction compound MA02/11a, Rudheath Embankment TN05, with the additional traffic coming from M6 junction 19 via the A556 Chester Road/Shurlach Road. These movements are already planned to use the public road network in the vicinity of the AP1 revised scheme.

Carbon emissions impact associated with importing materials from quarries

7.3.10 If MA02 Borrow Pits A, B, C were removed and the acceptable engineering materials were imported from quarries, the overall carbon emissions impact would be as presented in Table 3.

Table 3: Estimated net carbon emissions impact of importing material from quarries by road

Borrow pit name	Material volume (m^3)	Average journey length (km)	Vehicle journeys (laden)	kg CO_2e per km (laden)	Vehicle journeys (unladen)	kg CO_2e per km (unladen)	Total kg CO_2e (tonnes)
MA02 Borrow Pit A	272,000	67	32,000	1.07	32,000	0.65	3,700
MA02 Borrow Pit B	210,000		24,710		24,710		2,900
MA02 Borrow Pit C	113,500		13,350		13,350		1,500
MA02 Borrow Pit C (already on public highway network)	110,500	40*	13,000		13,000		900
Calculated total	**706,000**		**83,060**		**83,060**		**9,000**

Note: Materials journey from transfer node to site location similar to material journey from borrow pit to site location on site haul routes so neutral for calculation purposes.

** Net additional distance compared to route from TN03 to TN05 via M6 J18 and M6 J19*

7.3.11 The carbon emissions impact of transporting materials associated with MA02 Borrow Pit C has been calculated separately for those trips that would transfer from haul routes to the

public highway network and the net additional impact of longer journeys to TN05 that would originate from quarries if MA02 Borrow Pit C was removed.

7.3.12 The total net carbon emissions impact of importing material from quarries rather than being sourced from MA02 Borrow pits A, B and C is estimated as 9,000 tonnes (see Table 3).

7.3.13 The analysis in Table 3 assumes that excavated materials from the extended Crewe tunnel construction works would either be used to restore MA02 Borrow Pits A, B and C and for the provision of landscape earthworks or be exported by rail for disposal off-site at landfill. If all the excavated material were to be moved by road this would further increase total carbon emissions.

Export of Crewe tunnel arisings by rail

7.3.14 Approximately 347,000m^3 of excavated materials generated from the extended Crewe tunnel construction works would need to be exported by rail[6] (to reduce the use of HGV on the road), resulting in a total of 1,158 train journeys, comprising 579 laden journeys and 579 unladen journeys. This is based on a laden train volumetric capacity of 600m^3. As a result of the extension of the Crewe tunnel, the volume of excavated material required to be transported has increased by 87,000m^3 which would result in an additional 290 train journeys. This additional material would be exported by rail from the railhead at MA02/01a Crewe Rolling Stock Depot South satellite compound and TN01.

7.3.15 Table 4 shows the estimated net total carbon emissions impact of exporting the excavated materials from the extended Crewe tunnel construction works that cannot be accommodated in the restoration of MA02 Borrow Pits A, B and C.

Table 4: Estimated total carbon emissions impact of exporting excavated materials from the extended Crewe tunnel construction by rail for disposal

Train journey direction	Volume of excavated material (m^3)	Train journeys	Distance (km)	Total train kms	Kg CO_2 per train km*	Total kg CO_2e (tonnes)
Outbound laden train	347,000	579	150	86,850	55	4,800
Inbound unladen train	0	579	150	86,850	22	1,900
Estimated total carbon emissions impact of exporting excavated materials from the extended Crewe tunnel construction by rail for disposal (that cannot be accommodated in the restoration of borrow pits)						**6,700**

**assumes a diesel powered Class 66 locomotive and uses value of 27.5g CO_2e /tonne km to calculate emissions for a 2000 tonne laden train and 800 tonne unladen train (ORR Rail Emissions 2019-20).*

7.3.16 The excavated materials from the extended Crewe tunnel construction works would be exported by train over a period of 2.5 years. It would require an average of one daily return train journey from March 2029, increasing to four daily return train journeys from July 2030 and then falling to two daily return journeys for the last 5 months from March 2031 until July

[6] It is estimated that these rail journeys would have a maximum distance of 150km, as this is the maximum practicable distance for a return trip to be possible by a train in one day.

2031. The increase in train movements from 2030 would occur due to the restoration of borrow pits being completed while construction of the Crewe tunnel is ongoing and generating excavated material that would need exporting from the AP1 revised scheme.

7.3.17 If MA02 Borrow Pits A, B and C were removed, all excavated material generated by the extended Crewe tunnel construction works would need to be exported off-site for disposal by rail. These rail export journeys would be in addition to those calculated in Table 4.

7.3.18 Stockpiling excavated materials at the Crewe RSD would require more space which would have an adverse impact on the programme for construction of the AP1 revised scheme caused by the logistical impact of having to store large quantities of excavated materials at Crewe RSD North until it could be exported off-site to restore the borrow pits.

7.3.19 The additional impact of having to export material from the Crewe tunnel by rail rather than backfilling MA02 Borrow Pits A, B and C would require a total of 2,354 additional train movements (1,177 laden journeys and 1,177 unladen return journeys).

7.3.20 Table 5 shows the estimated total carbon emissions of exporting the excavated materials from the extended Crewe tunnel construction works by rail for disposal, if this material could not be used in the restoration of MA02 Borrow Pits A, B and C.

Table 5: Estimated total carbon emissions impact of exporting excavated materials from the extended Crewe tunnel construction by rail for disposal, if not used for restoration of borrow pits

Train journey direction	Volume of spoil (m^3)	Train journeys	Distance (km)	Total train kms	Kg CO_2 per train km*	Total kg CO_2e (tonnes)
Outbound laden train	706,000	1,177	150	176,550	55	9,700
Inbound unladen train	0	1,177	150	176,550	22	3,900
Total carbon emissions impact of exporting additional excavated materials by rail for disposal (if not used for restoration of borrow pits)						**13,600**

**assumes a diesel powered Class 66 locomotive and uses value of 27.5g CO_2e /tonne km to calculate emissions for a 2,000 tonne laden train and 800 tonne unladen train (ORR Rail Emissions 2019-20).*

7.4 Assessment of traffic impacts

7.4.1 If MA02 Borrow Pits A, B and C were removed, it would add a substantial number of HGV trips to the public highway network, since the transport of acceptable engineering material required for construction would no longer be limited to site haul routes within the land required for construction for the AP1 revised scheme. The daily flows of HGV that would need to use the public highway network to get to the TN would be limited by each compound's ability to process the HGV bringing this material from remote quarries.

7.4.2 Due to the construction routes taken between quarries and TN, in some locations the cumulative impact of removing MA02 Borrow Pits A, B and C would be greater than the HGV capacity of a single compound or TN. This is because some routes would carry HGV travelling between multiple TN.

7.4.3 An assessment of traffic impacts has been undertaken and has considered:

- routes between compounds and the strategic road network and use of the strategic road network itself. Routes between the strategic road network and specific quarries or clusters of quarries have not been assessed as these are considered to be within individual quarries' planning/use consents;
- flows do not include light vehicle or car movements which may be affected;
- a manual estimate of the projected flows; and
- only the period of peak generation of the borrow pits which typically forms only a short period within the overall project construction programme when base layer materials provided by the borrow pits are required for construction of earthworks.

7.4.4 The assessment of traffic impacts in this document only considers the period affected by import and export of material associated with the borrow pits and the potential impact of their removal from the AP1 revised scheme.

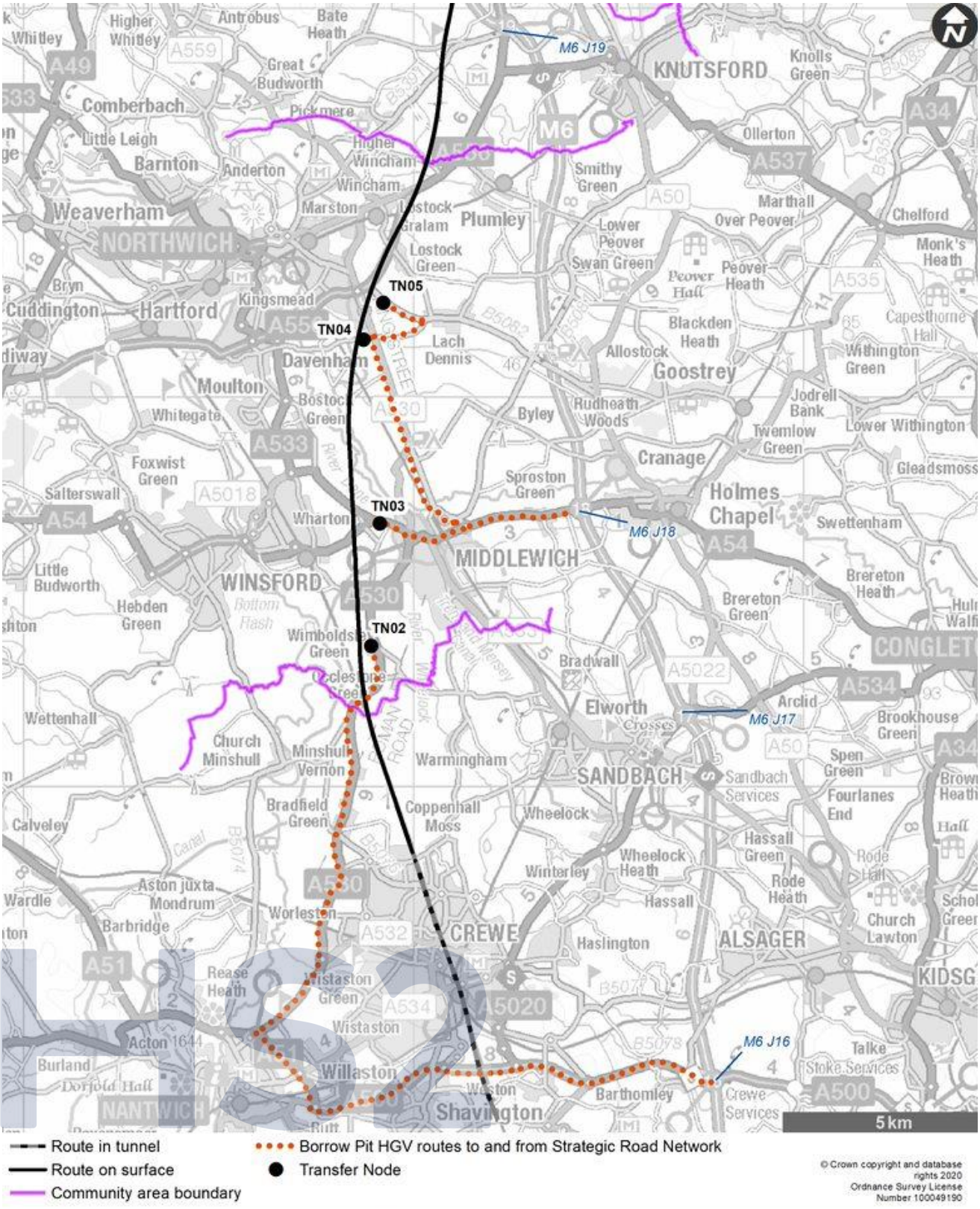
7.4.5 The removal of MA02 Borrow Pits A, B and C would result in additional HGV journeys occurring from 2028 until 2031, which is later in the construction programme than was reported within the main ES borrow pit report.

7.4.6 The assessment considers the following TN:

- TN02 – Crewe RSD North Transfer Node;
- TN03 – A533 Bostock Road Transfer Node;
- TN04 – Gadbrook Viaduct South Transfer Node; and
- TN05 – Rudheath Embankment Transfer Node.

7.4.7 Figure 3 shows the construction traffic routes between the M6 and TN that would be used to import acceptable engineering material between the strategic road network and the scheme if MA02 Borrow Pits A, B and C were not included in the AP1 revised scheme and which would therefore be subject to an increase in HGV traffic.

Figure 3: Primary construction traffic routes that would be affected by removal of MA02 Borrow Pits A, B and C



Assessment of traffic impacts for the removal of MA02 Borrow Pits A, B and C

7.4.8 The removal of MA02 Borrow Pits A, B and C would mostly affect construction traffic flows in 2028 and 2029. This would add over 140,000 HGV journeys to the public highway network and significantly extend the distance travelled for a further 26,000 HGV journeys during this period. A comparison has been made between HGV construction traffic flows expected with and without MA02 Borrow Pits A, B and C.

7.4.9 In this section, peak daily construction HGV journeys include both laden and unladen journeys, with hourly HGV journeys also provided for each direction. Rail systems HGV journeys have been excluded from this analysis, since these activities add only small numbers of daily HGV journeys during the period being assessed.

7.4.10 Table 6 shows that the removal of MA02 Borrow Pits A, B and C would mean that up to 450 HGV journeys daily would move from site haul routes onto the public highway network between the M6 and the AP1 revised scheme.

Table 6: Traffic impact on public highway network of removing MA02 Borrow Pits A, B and C

Transfer node (TN) and affected roads	Peak daily HGV importing material			Peak month of borrow pit activity
	With borrow pits	Without borrow pits	Change	
TN02 A530 Middlewich Lane north of Crewe, near Flowers Lane	1277	1719	442	June 2029
TN03 A533 Bostock Road	624	788	164	May 2028
TN03 A54 Holmes Chapel Road in Middlewich near Lewin Street	624	807	183	May 2028
TN04-TN08A B5309 Centurion Way, north of Byley Road	735	842	107	September 2029
A556 Chester Road, south of M6 junction 19	478	524	46	September 2029

7.4.11 The peaks shown in the table above relate to construction HGV journeys associated with material imported to the AP1 revised scheme. Further peaks in construction HGV journeys occur at other times in the overall construction period.

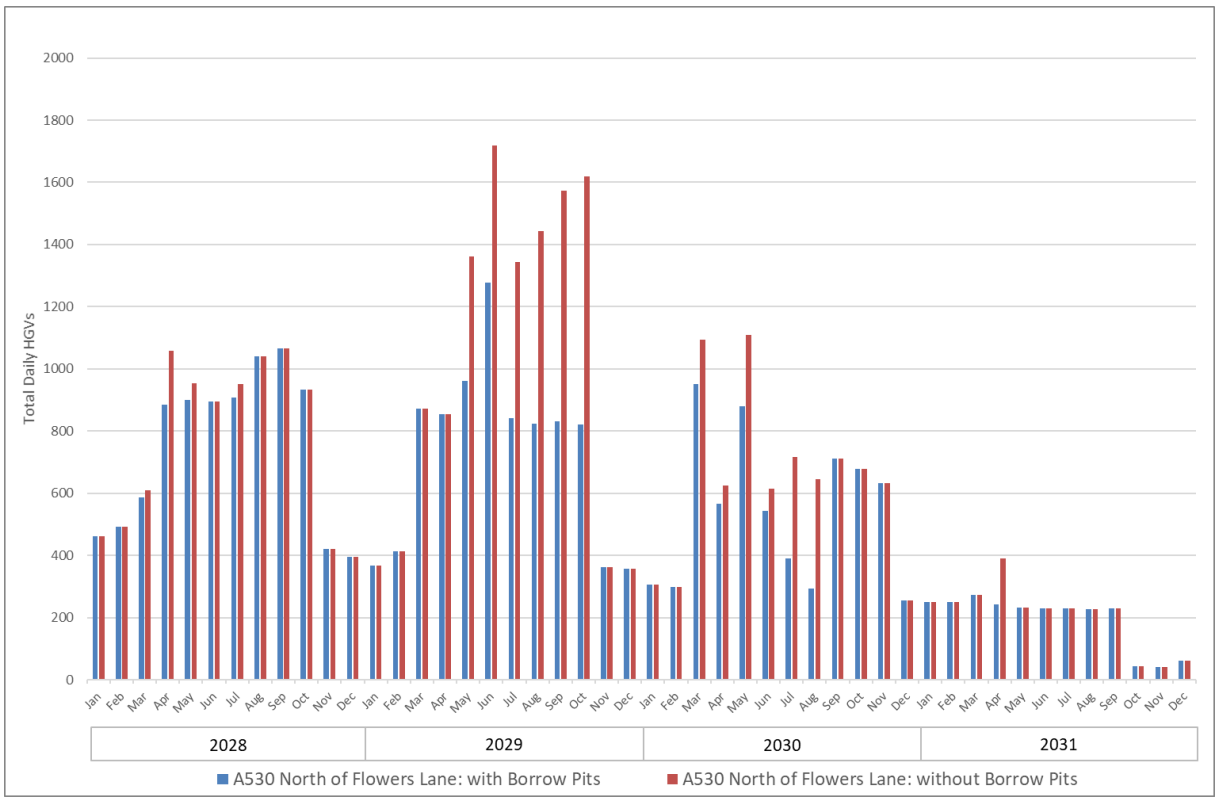
7.4.12 The excavated material already assumed to be moved from MA02 Borrow Pit C using the public highway network is not included in the changes shown in Table 6, but HGV journeys associated with moving this material are included in other HGV flows. These journeys are assumed not to change their routes to and from the M6.

7.4.13 It should be noted that during winter months in each year, when earthwork construction activities are more difficult, HGV journeys are generally lower than during the period from March to October and this means that overall peak HGV journeys generally occur in the middle period of each year.

A530 Middlewich Lane north of Crewe, near Flowers Lane

7.4.14 If MA02 Borrow Pits A, B and C were removed, a maximum of 1,719 HGV per day, equivalent to 86 HGV per hour in each direction, would be predicted to use the A530 Middlewich Lane to access TN02 during June 2029. This compares to a maximum of 1,277 HGV per day, equivalent to 64 HGV per hour in each direction, if the borrow pits are retained with the AP1 revised scheme. This pattern of construction traffic is shown in Figure 4.

Figure 4: Daily HGV flows with and without MA02 Borrow Pits A, B and C for A530 Middlewich Lane north of Crewe, near Flowers Lane



7.4.15 The greatest increase in HGV journeys resulting from removal of the MA02 Borrow Pits A, B and C on A530 Middlewich Lane would occur between May and October 2029 and would cause the highest daily movement on this road during construction.

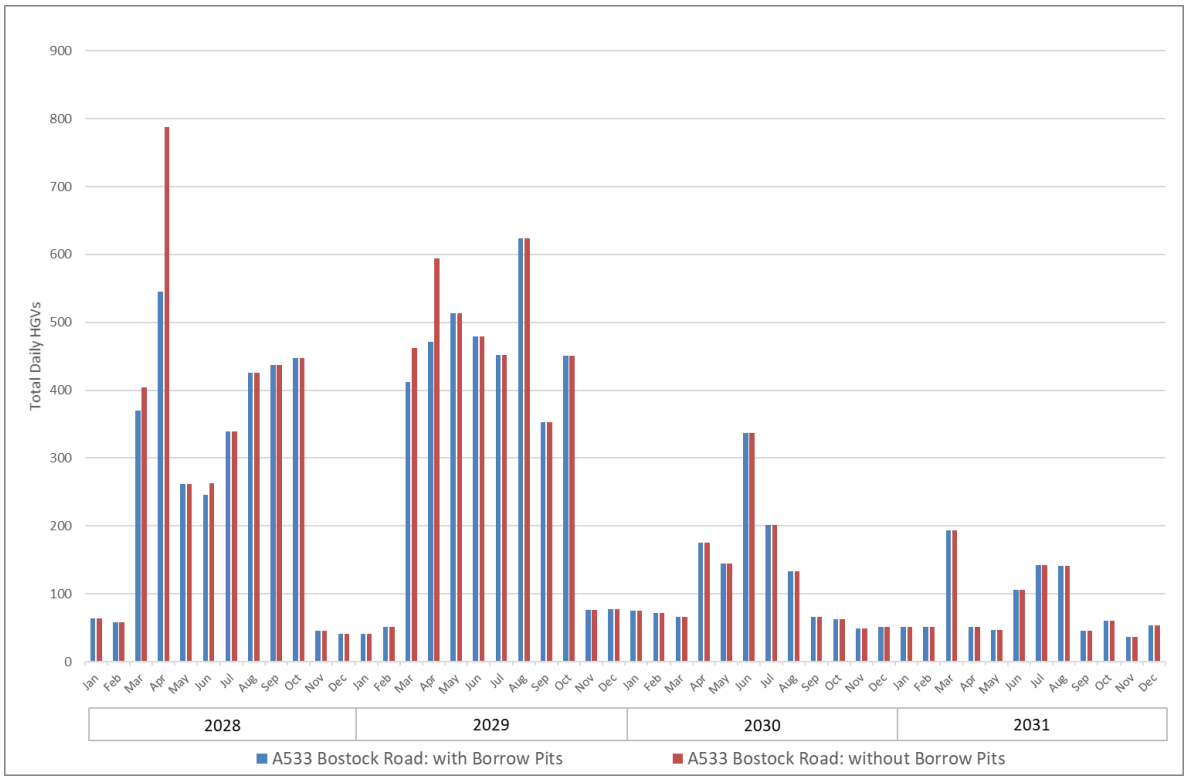
7.4.16 If MA02 Borrow Pits A, B and C were removed, there would be a more substantial peak in daily HGV journeys occurring on A530 Middlewich Lane that would continue for a period of six months and be greater in volume than would be the case if borrow pits were used. This increase is due to TN02 being used to import almost 70% of all excavated material required.

7.4.17 As well as this increase in overall construction traffic, a smaller increase in HGV journeys would occur between March and July 2028, March and August 2030 and for a single month in July 2031.

A533 Bostock Road

7.4.18 If MA02 Borrow Pits A, B and C were removed, a total of approximately 788 HGV per day, equivalent to 40 HGV per hour in each direction, would be predicted to use the A533 to access TN03 near the A533 Bostock Road, west of Middlewich, in April 2028. This compares to fewer than 550 HGV per day, equivalent to 28 HGV per hour in each direction, in this month and a peak of 624 HGV daily (31 hourly in each direction) overall in August 2029 if the MA02 Borrow Pits A, B and C are retained. The new peak in construction HGV caused by removal of MA02 Borrow Pits A, B and C would therefore become the highest daily total of HGV expected on this road during construction of the scheme. This pattern of construction traffic is shown in Figure 5.

Figure 5: Daily HGV flows with and without MA02 Borrow Pits A, B and C for A533 Bostock Road



7.4.19 With the use of MA02 Borrow Pits A, B and C, the highest daily peak of 624 HGV would occur in August 2029. A further smaller peak in HGV would occur in March and April 2029. The impacts on the A533 Bostock Road would be shorter in duration when compared to the impacts on A530 Middlewich Lane that would result from removal of MA02 Borrow Pits A, B and C, with only March, April and June 2028 and March and April 2029 experiencing increases in HGV numbers. The magnitude of these changes in HGV numbers would also be lower than those shown for A530 Middlewich Lane, with a peak increase of 240 HGV in April 2028, up from 510 to 750 HGV daily.

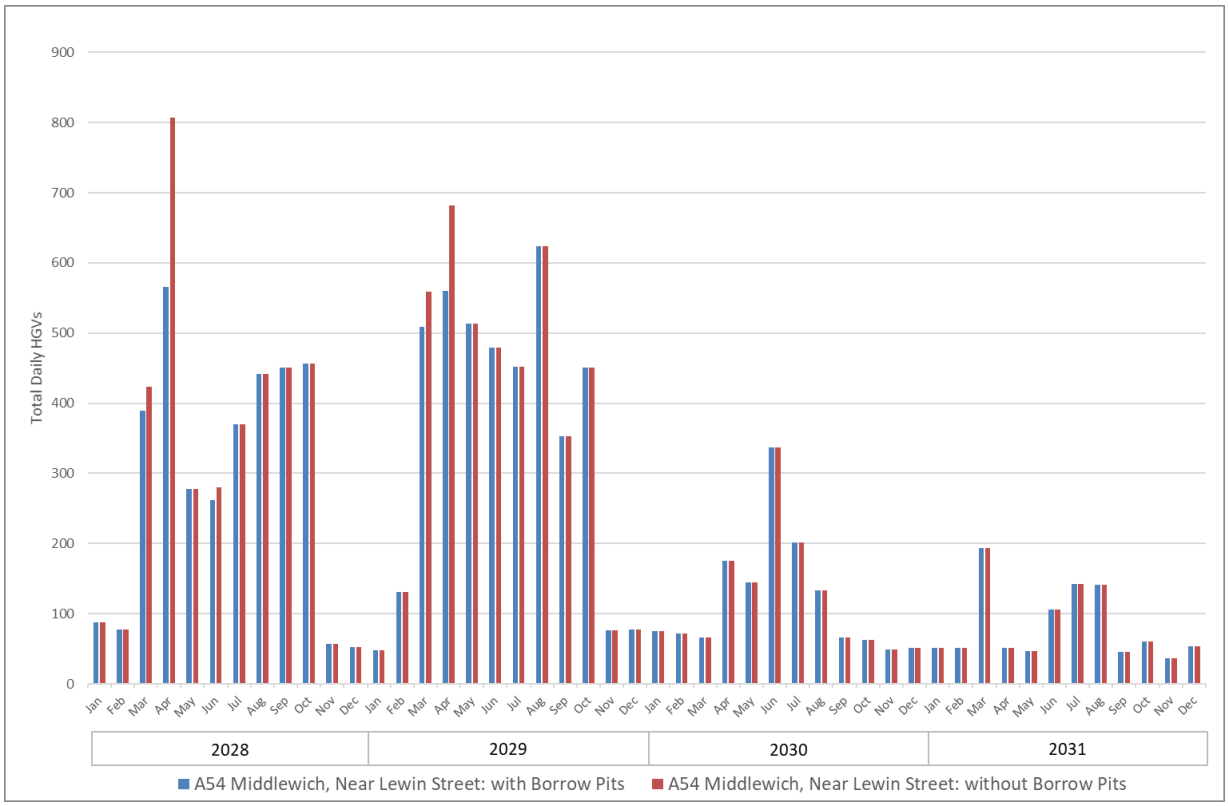
The A54 Holmes Chapel Road in Middlewich, near Lewin Street

7.4.20 If MA02 Borrow Pits A, B and C were removed, the overall peak in HGV flows would increase to approximately 807 HGV per day, equivalent to 41 HGV per hour in each direction. Removal of the borrow pits would significantly increase this peak.

7.4.21 The 807 HGV peak resulting from removal of MA02 Borrow Pits A, B and C would occur in April 2028, and would affect the A533 at Bostock, and along the A54 Holmes Chapel Road through Middlewich to and from M6 junction 18. This compares with a peak of 550 HGV daily in April 2028 and 624 in August 2029 with borrow pits retained. A further, smaller peak in HGV traffic would occur in March and April 2029. The additional peaks that would be caused by removal of the borrow pits are however relatively short.

7.4.22 The pattern of construction traffic is shown in Figure 6.

Figure 6: Daily HGV flows with and without MA02 Borrow Pits A, B and C for A54 Holmes Chapel Road, Middlewich near Lewin Street



7.4.23 As with A533 Bostock Road, the highest daily peak of 624 HGV with MA02 Borrow Pits A, B and C retained will occur in August 2029.

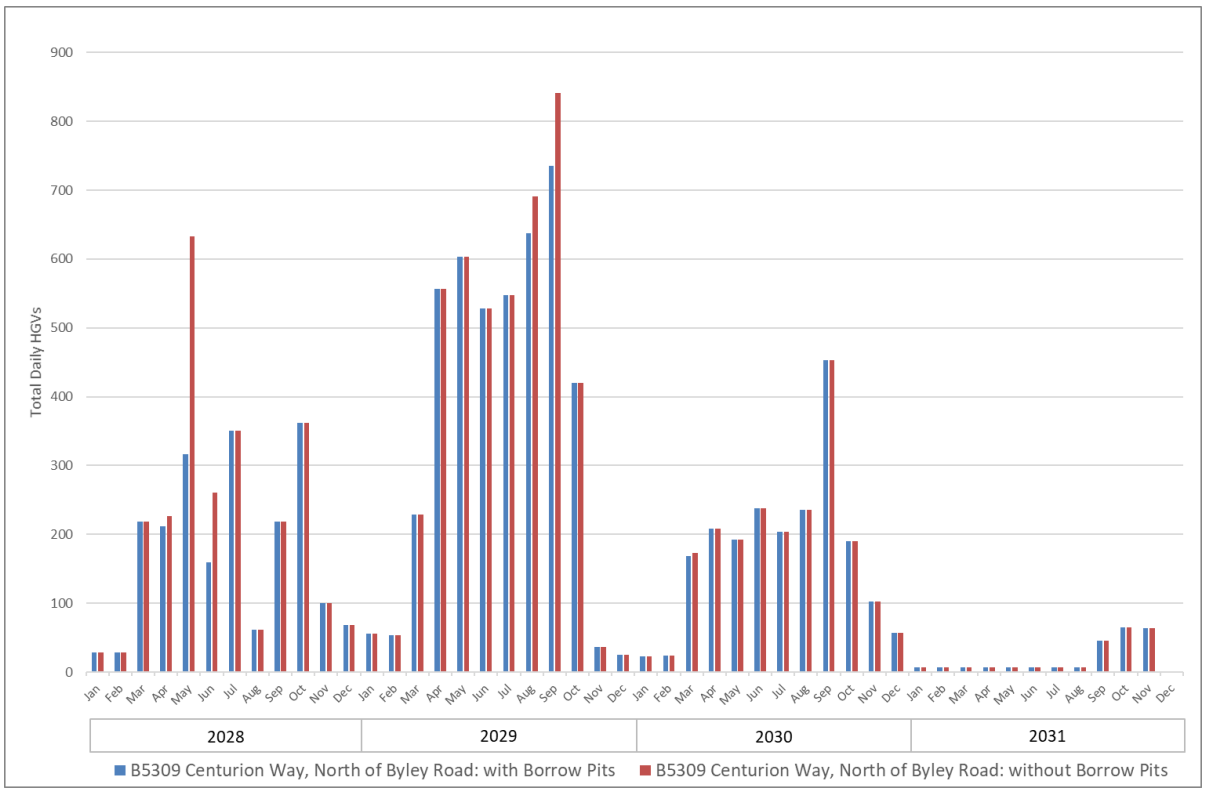
B5309 Centurion Way, north of B5081 Byley Road

7.4.24 For the B5309 Centurion Way route, around the east and north of Middlewich, there would be an increase in HGV flows in May 2028 and a new overall peak in construction traffic

occurring in September 2029. In May 2028 daily construction HGV flows would almost double from approximately 320 HGV to approximately 630 HGV per day, equivalent to an increase in HGV from 16 to 32 per hour in each direction.

7.4.25 In September 2029, a smaller increase to a new overall peak of approximately 840 construction HGV daily would occur; equivalent to an hourly flow of 42 HGV in each direction. This pattern of construction traffic is shown in Figure 7.

Figure 7: Daily HGV flows with and without MA02 Borrow Pits A, B and C for B5309 Centurion Way

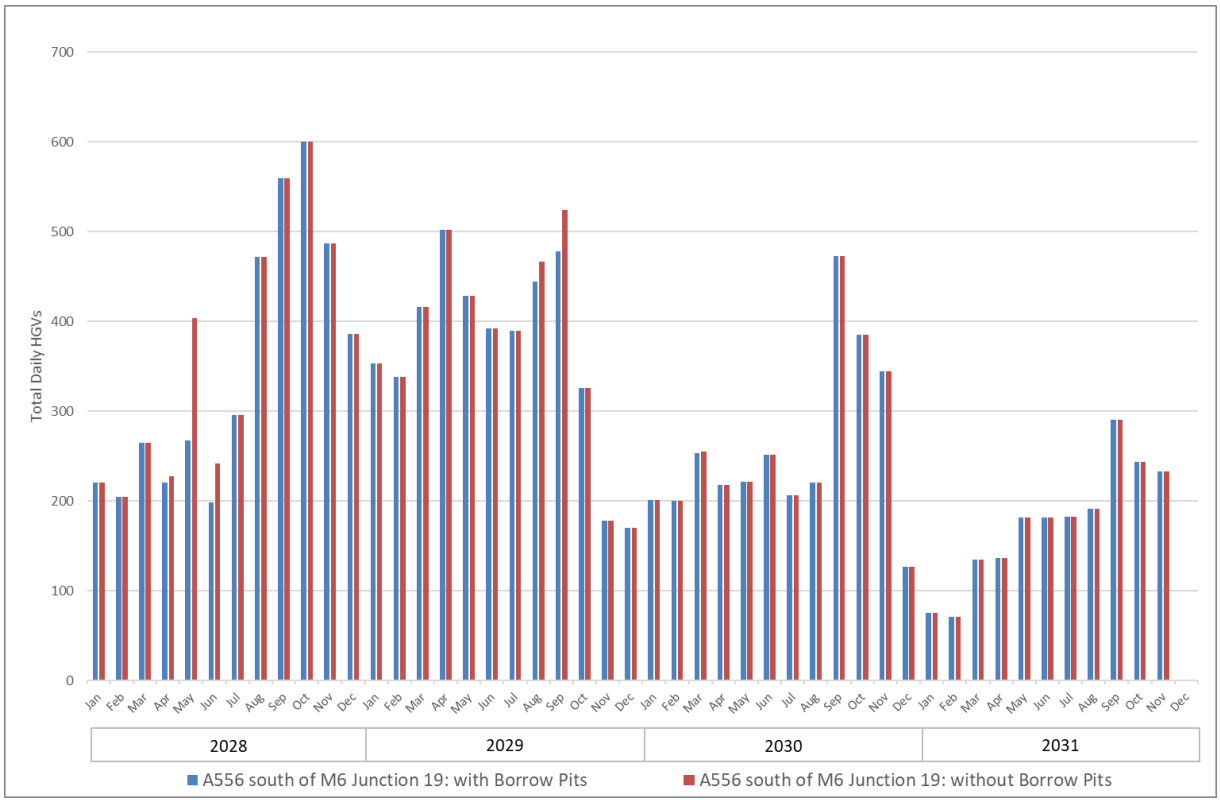


7.4.26 The increase in construction HGV resulting from removal of MA02 Borrow Pits A, B and C can be attributed to this route being used by most HGV to access the Gadbrook TN04 and Rudheath TN05 transfer nodes.

The A556 Chester Road south of M6 junction 19

7.4.27 The A556 Chester Road south of M6 junction 19 would form the alternative route for access to Gadbrook Viaduct South TN04 and Rudheath Embankment TN05. If MA02 Borrow Pits A, B and C were removed, there would be increases in construction traffic flows between April and June 2028 and again in August and September 2029. In May 2028, daily HGV would increase by approximately 135 to a total of 400 HGV, equivalent to approximately 20 HGV per hour in each direction. In August and September 2029, the increases would be less than 50 HGV per day. This pattern of construction traffic is shown in Figure 8.

Figure 8: Daily HGV flows with and without MA02 Borrow Pits A, B and C for A556 Chester Road south of M6 junction 19



7.4.28 Although there would be an increase in construction HGV traffic resulting from removal of MA02 Borrow Pits A, B and C, the overall daily peaks in construction traffic along the A556 Chester Road would not exceed the peaks of 600 HGV daily that would occur if the borrow pits are used.

Strategic road network

7.4.29 As well as adding HGV trips to the public highway network in the vicinity of the AP1 revised scheme, the removal of MA02 Borrow Pits A, B and C would mean that these HGV trips would also use the strategic road network, including the M6.

7.5 Summary

7.5.1 The primary purpose of MA02 Borrow Pits A, B and C is to avoid the need to import approximately 706,000m^3 of general engineering fill materials by road to construct the AP1 revised scheme. The use of MA02 Borrow Pits A, B and C will avoid causing new and higher peaks in construction HGV traffic on the public highway network that would occur if these materials were sourced and transported from quarries to construct the AP1 revised scheme.

7.5.2 The use of MA02 Borrow Pits A, B and C will reduce HGV flows on the A530 Middlewich Lane route around the west and south of Crewe. This impact is mainly due to TN02, which will be accessed from the A530 Middlewich Lane serving MA02 Borrow Pits A and B, which accounts for approximately 70% of all excavated material from borrow pits. The borrow pits will avoid

a substantial increase in HGV accessing TN02 from quarries and save further impact on the A51 and A500 Alsager Road on the construction traffic route between the scheme and the M6 at junction 19. The scale of change in HGV flows would however be greater on the A530 Middlewich Lane than on the A51 and A500 Alsager Road due to other HS2 construction traffic.

7.5.3 The traffic assessment has shown that the use of MA02 Borrow Pits A, B and C will result in the saving of additional train movements that would otherwise be required to export excavated materials generated from the extended Crewe tunnel construction works as a large proportion of the excavated materials will be used for the restoration of MA02 Borrow Pits A, B and C. This will also result in substantial total carbon emissions savings when compared with the carbon emissions impact of exporting the excavated materials for disposal to landfill by rail, if the materials were not used for the restoration of the borrow pits.

7.5.4 The excavated materials from the extended Crewe tunnel construction works that will be used for the restoration of MA02 Borrow Pits A, B and C will be transported via conveyors within the land required for construction. This will avoid traffic and carbon emissions impacts on the public highway network that would otherwise be associated with the need to import restoration materials from other sources.

8 Borrow pit operations

8.1.1 All sub-sections in Section 8 remain unchanged from the main ES Borrow pit report.

9 Restoration strategy

9.1.1 All sub-sections in Section 9 remain unchanged from the main ES Borrow pit report.

10 Conclusions

10.1.1 This report provides an update to the main ES Borrow pit report to reflect the removal of MA02 Borrow Pit D (SES1-002-002) as a result of the removal of the HS2 WCML connection (SES1-004-001) from the AP1 revised scheme. Elements of the main ES Borrow pit report that related to the requirement for borrow pits and the selection, operation and restoration of the borrow pits remain unchanged and these sections have not been reproduced in this report for clarity. This report should be read in conjunction with the main ES Borrow pit report.

10.1.2 The removal of the HS2 WCML connection (SES1-004-001) has led to a requirement to reassess the type and quantity of acceptable engineering materials required to construct the AP1 revised scheme. This reassessment has shown that the demand for acceptable engineering materials in MA03, MA06, MA07 and MA08 can be largely met through the redistribution of excavated acceptable engineering materials from construction activities within the land required for construction in MA03, MA06, MA07 and MA08.

10.1.3 The quality of site-won acceptable engineering fill materials that will be generated during excavations are not all anticipated to meet the engineering criteria for construction of high speed railway embankments in MA02, which require the use of a high quality engineering material for construction of the high speed rail embankment core and general engineering fill for the embankment shoulders.

10.1.4 There will be an overall deficit of approximately 1.9 million m^3 of high quality engineering fill (Class 6) material and approximately 706,000m^3 of general engineering fill (Class 2) material which will be required to construct the AP1 revised scheme.

10.1.5 The deficit of high quality engineering fill materials (approximately 1.9 million m^3) that cannot be sourced from within the land required for construction or from borrow pits will need to be sourced from quarries located close to the scheme. The deficit of general engineering fill materials (approximately 706,000m^3) will be wholly sourced from MA02 Borrow Pits A, B and C.

10.1.6 As a result of the reassessment of materials required to construct the AP1 revised scheme, there is no longer a requirement for the additional engineering fill materials that would have been provided by MA02 Borrow Pit D and therefore this borrow pit and is no longer required.

10.1.7 The primary purpose of MA02 Borrow Pits A, B and C is to avoid the need to import approximately 706,000m^3 of general engineering fill materials by road to construct the AP1 revised scheme. The use of MA02 Borrow Pits A, B and C will also avoid causing new and higher peaks in construction HGV traffic on the public highway network that would occur if these materials were sourced and transported from quarries to construct the AP1 revised scheme.

Annex A – Classification of engineering materials

Table A1: Classification of engineering materials

Type	Material class	Typical description	Example end use
Unacceptable materials	U1A	Geotechnically unsuitable materials which can be treated for use as general/landscaping fill	Treat and use as general/landscaping fill or remove from works
	U1B	Materials that are unsuitable for reuse by virtue of an excess concentration of contaminants that render the material 'contaminated' (as defined by statutory regulation or HS2 Ltd project requirements) at the place and environmental setting of its final deposition	Treat as necessary to achieve site specific threshold criteria for the receiving location and use as general/landscaping fill or remove from works
General fill	1	Granular fill such as sand, gravel, and crushed rock e.g. sandstone	High speed railway embankment fill Other fill e.g. highway fill
	2	Cohesive fill – clay	High speed railway embankment shoulder fill. Other fill e.g. highways embankment fill or landscape areas
Landscape fill	4	Various fill for use in environmental mitigation earthworks	Landscape and environmental mitigation earthworks
Topsoil	5	Topsoil or turf	Topsoiling/landscaping
Subsoil	5s	Agricultural subsoil	Subsoil underlying topsoil
High quality granular fill	6	Selected granular fill such as sand, natural gravel, crushed gravel and crushed rock (but typically excludes rocks such as mudstones)	High speed railway embankment fill High quality granular fill such as capping layers, structural backfill, and fill below water
Treated cohesive fill	9	Stabilised cohesive materials (Class 2)	Use in high speed rail embankment cores

Note: The classification of materials is based upon the Design Manual for Roads and Bridges (DMRB), Volume 1, Specification for Highways Works, Series 600, Earthworks classification. There are sub-classes to each of the material classes identified above. The table provides a generic description for the purposes of this report.

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