A6 to Manchester Airport Relief Road

B003 –Mill Lane Accommodation Bridge Preliminary Design Report Report No. 1007/704/151

August 2013

STOCKPORT METROPOLITAN BOROUGH COUNCIL

MANCHESTER CITY COUNCIL

Cheshire East Council

PRELIMINARY DESIGN REPORT

Structure Name : Mill Lane Accommodation Bridge

Structure Number : B003

Report No. 1007/704/151

Report Control Sheet

Version	Date	Status	Prepared By	Checked By	Approved By
P1	29/08/2013	Draft	J Watton	M Ellis	N Sheena
P2	13/09/2013	Final	J Watton	M Ellis	N Sheena

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1. Description of Site

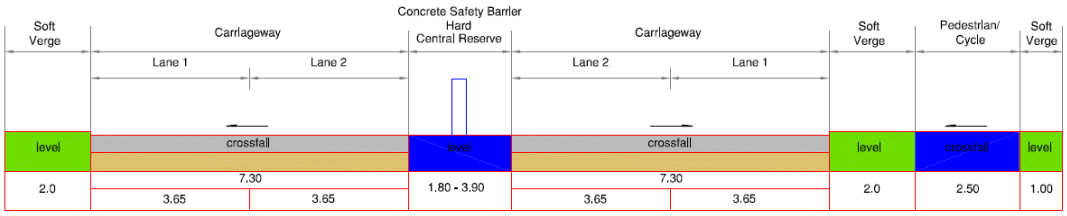
The Mill Lane Accommodation Bridge is part of the A6 to Manchester Airport Relief Road (A6MARR) and is proposed to give farmers, pedestrians, cyclists and equestrian access across the relief road. The bridge is to be located approximately 100m and 140m south-west of Buxton railway and Buxton Road respectively at route chainage 8670m approximately.

There are a large number of residential properties on Mill Lane to the north of the site and several on Old Mill Lane to the west of the proposed bridge crossing. The immediate surrounding area of the proposed bridge is open farm land. An aerial location plan at 1:1250 scale is included in Appendix A.

2. Highway Details

Over Structure – Mill Lane Accommodation Bridge – 3.0m wide single carriageway with two verges and string courses. (2 x 0.5m verges + 3.0m carriageway + 2 x 0.5m string courses)

Under Structure – Relief road (26m) with a central reserve of 3.9m. Typical dimensions and arrangement are as follows:



A6MARR typical cross section

3. Proposed Structure

The proposed structure will be a single span fully integral construction bridge. The superstructure will be in the form of pre-cast pre-stressed concrete U-beams and an in-situ reinforced concrete (R.C.) slab deck. The bridge superstructure will be supported on full height R.C. abutments which will be founded on bored piles. In-situ reinforced concrete wing walls, founded on piles, are also proposed. A proposed General Arrangement drawing is included in Appendix B.

4. Span Arrangements

The bridge will be a zero skew single span of 27.2m, measured between the centres of each abutment, orientated square to the relief road.

5. Headroom and Clearances

Over a highway, the headroom under new bridge is required to be at least 5.3m plus sag compensation in accordance with TD27/05. Therefore, with this clearance the superstructure need not be designed for impact loads.

6. Road Restraint System (Bridge Parapets)

The bridge parapets will be type N2 steel parapet with galvanised steel mesh infill in accordance with TD 19/06 and the Road Restraints Risk Assessment Process (RRRAP). Working width class is to be no greater than W4 and will be decided in the final phase of the design. Parapet height is to be 1.8m above finished road level at both verges to accommodate equestrian access and a 600mm high solid infill panel should be provided at the bottom of the parapet to obstruct an animal's view of the road below.

7. Preferred Structural Options

7.1 Superstructure Options

It is proposed that the bridge will be a single span, fully integral pre-cast pre-stressed concrete U-beams supporting an in-situ reinforced concrete slab deck. Refer to drawing 1007/3D/DF7/A6-MA/B003/701 and the 3D Model in Appendix B for further details.

For a span range up to 30m, fully integral construction is normally considered a cost effective option. Elimination of movement joints removes a major cause of maintenance problems from penetration of dirt, water and de-icing salts, which corrode substructures and bearings.

The advantages for using pre-cast concrete beam construction are as follows:

- Low capital & whole-life cost
- Fast and efficient build
- Factory quality with engineered tolerances
- Low maintenance
- The beams can be lifted individually
- Permanent formwork provides self-supporting system during construction and eliminates falsework
- Reduces site works which are weather dependent

Disadvantages:

- Precast concrete beams are usually heavier than comparable steel beams. As a result larger cranes might be required to lift the precast concrete beams
- Heavier superstructure mentioned above might lead to larger foundation sizes
- Delivery times are dependent on a specialist supplier

7.2 Substructure Options

It is proposed that the bridge will be supported on full height in-situ reinforced concrete wall abutments. They are regarded as the most suitable option considering the topography of the site, existing ground level and the feasibility of the work.

The R.C. wall abutments will be founded on piles in order to reduce settlements from the embankment and bridge loading. Further discussion regarding the geotechnical assessment is addressed in Section 8 of this report.

8. Geotechnical Information

The bridge is located across the line almost exactly above BH1003 (Geotechnical Engineering, 2005). This shows the ground conditions to likely be:

- A thin band of sandy CLAY 0.50m thick overlying;
- Medium dense to dense SAND and GRAVEL, becoming sandy slightly clayey GRAVEL to a depth of 3.40m bgl;
- Beneath this is cohesive GLACIAL TILL to 4.80m bgl which rests on:
- Weathered MUDSTONE bedrock. The weathered Mudstone is described as very weak with approximately 40% of its volume weathered to a sandy clay matrix to a depth of 5.40m bgl. The Mudstone is underlain by;
- Moderately strong fine and medium grained SANDSTONE encountered to a depth of 5.85m bgl; Weak to moderately weak SILTSTONE was then recorded to a depth of 7.00m bgl being completely weathered in places between 6.00 and 7.00m bgl;
- Moderately strong MUDSTONE was then encountered to a depth of 8.70m bgl overlying;
- Moderately strong SILTSTONE was encountered to a depth of 11.75. the Siltstone was interbedded with thin beds of sandstone and mudstone throughout;
- Weak MUDSTONE was found to underlie the Siltstone to a depth of 13.55m bgl. The Mudstone was interbedded with thin bands of Sandstone. Strong SANDSTONE was then encountered to termination depth of 14.70m bgl.

Groundwater was not encountered prior to use of water flush so an accurate GWL could not be obtained from the drilling. Subsequent monitoring of the standpipe installation showed that the highest groundwater level recorded was 4.71m bgl.

A review of the abandonment plans for the Poynton and Norbury collieries shows that the new location for B003 is not underlain by any historical workings and no movement is therefore expected from historic mine workings.

As there is only one borehole in the new proposed location for B003 this is considered insufficient and at least two additional holes, one either side of the proposed road, should be drilled to a depth of at least 10.00m bgl to confirm the ground conditions at the bridge abutments.

The bridge abutments are to be located at the base of the cutting slope adjacent to the proposed road. The foundations are expected to rest on the bedrock at the base of the proposed cutting. Due to the large moments to be resisted it will be necessary to employ piled foundations socketed into the underlying bedrock. To resist the

overturning moments it is considered that relatively short large diameter bored piles will be the most suitable. The results of rock testing resulting from the additional boreholes will be required to determine bearing capacity and lateral load resistance for the rock

9. Appearance

The superstructure on elevation comprises of approximately 1.47m deep pre-cast beams and 0.67m string course spanning across the relief road. The beams and slab deck will have a plain concrete finish. In addition, N2 steel parapets will be mounted on the string courses at either side of the bridge with the exposed faces of the abutments and wing walls to be ribbed concrete. Precamber may be introduced to give the bridge a more aesthetically pleasing elevation view. (Please refer to the 3D view of the bridge included in Appendix B).

Appendix A: Location Plans

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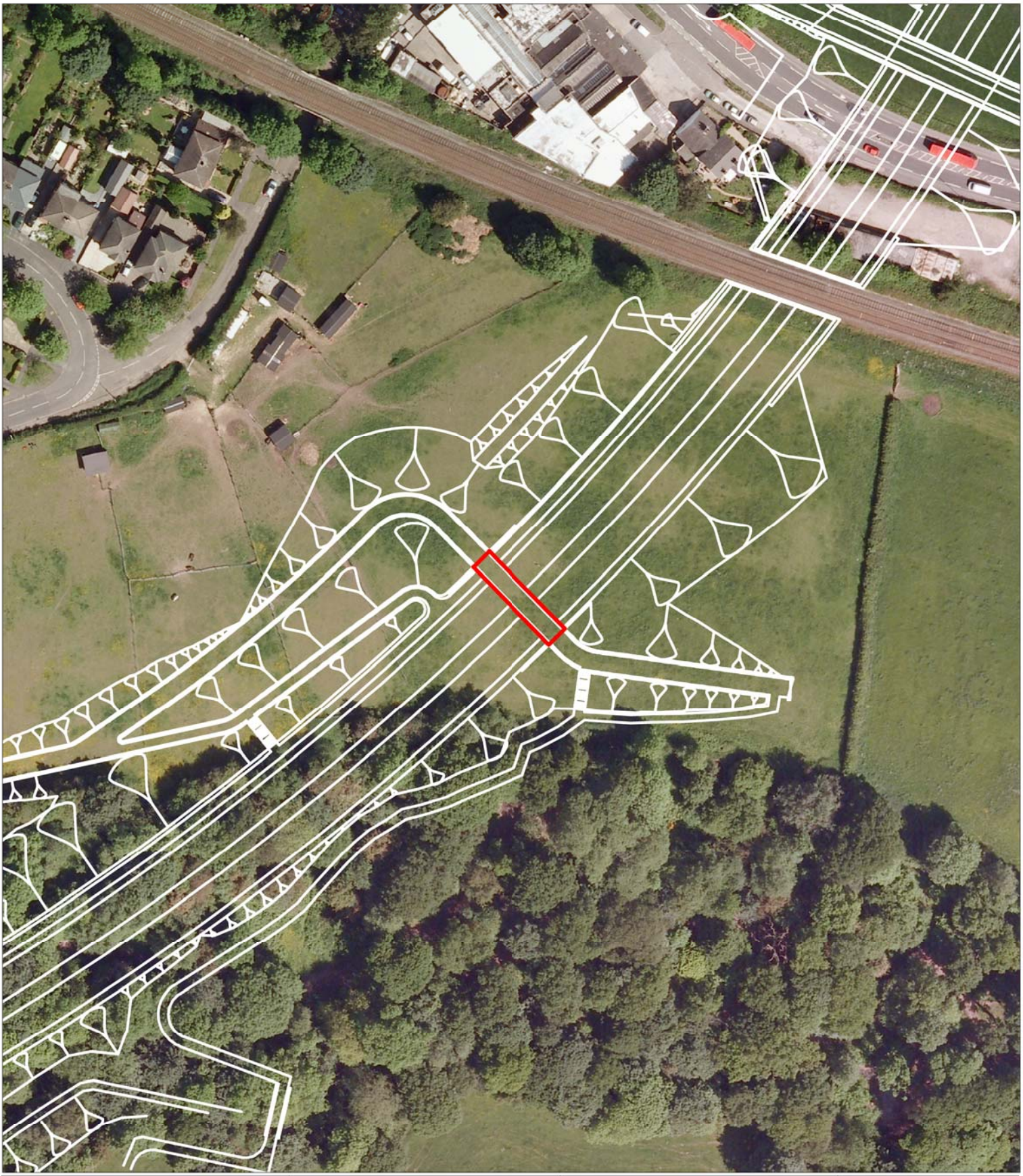
bluesky



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Date	12/08/2013	Date	12/08/2013	Date	12/08/2013
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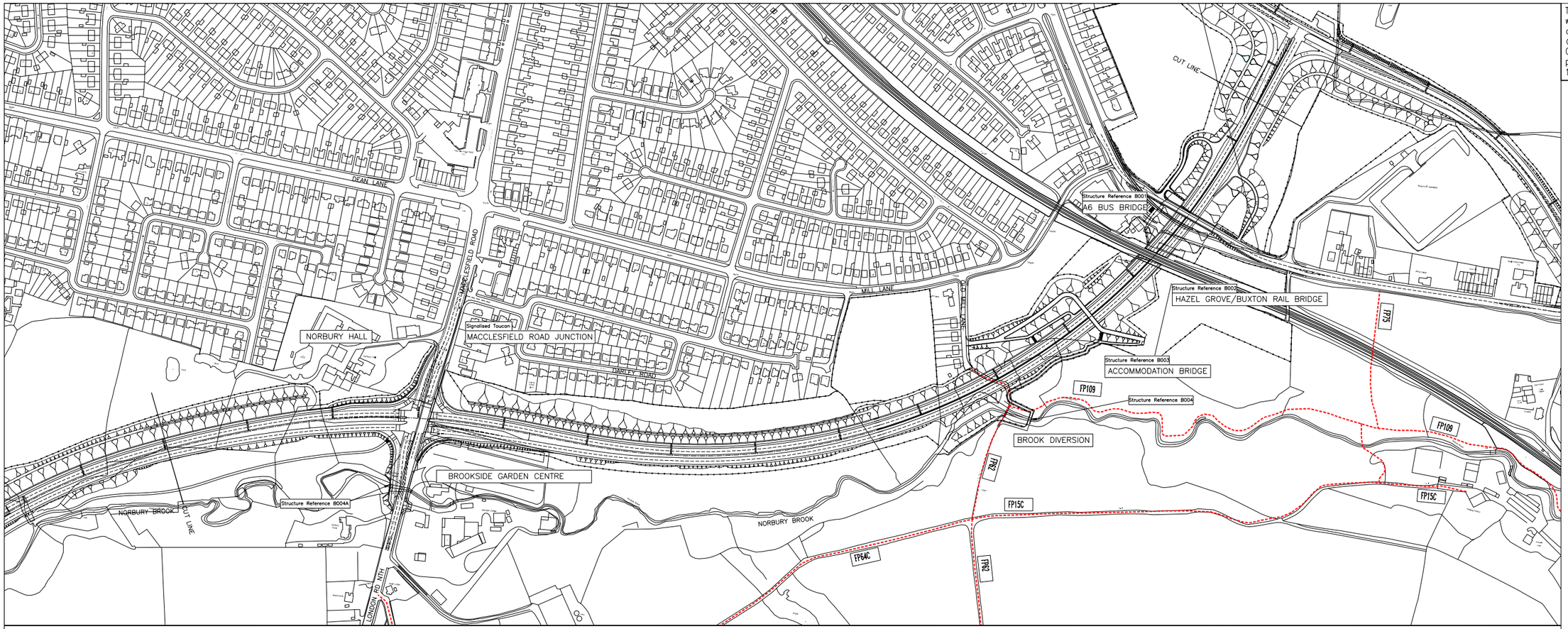
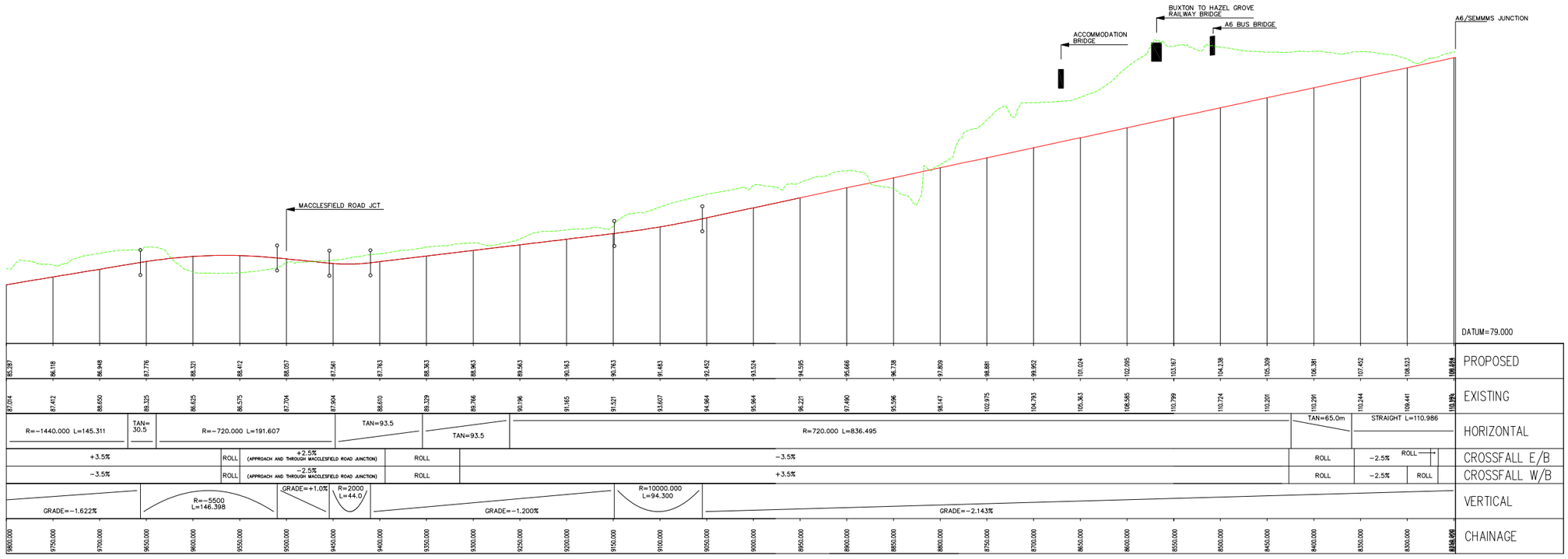
GIS Task	4268	Filename			
Drawing No.	1007-3D-DF7-A6-MA-B003-ALP			Revision	





SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD
(SPEED LIMIT 50MPH)

KEY

- EXISTING DEFINITIVE PROW
- EXISTING BRIDLEWAY
- PROPOSED FENCELINE

Rev.	Drawn	Checked	Date	Revision Details

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Job Title

A6 to MANCHESTER AIRPORT RELIEF ROAD

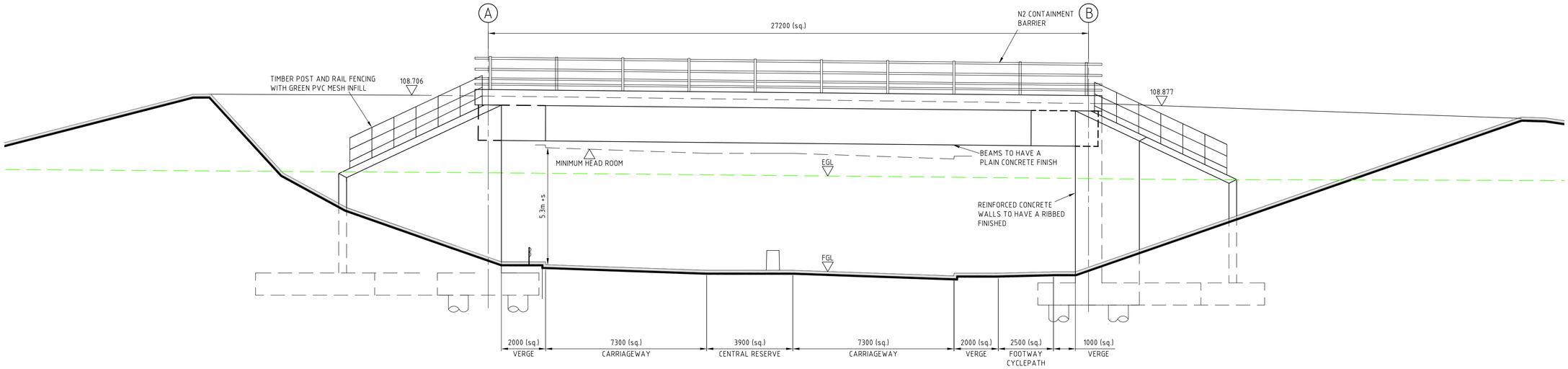
Drawing Title

DESIGN FREEZE 7 GENERAL ARRANGEMENT SHEET 2 of 9

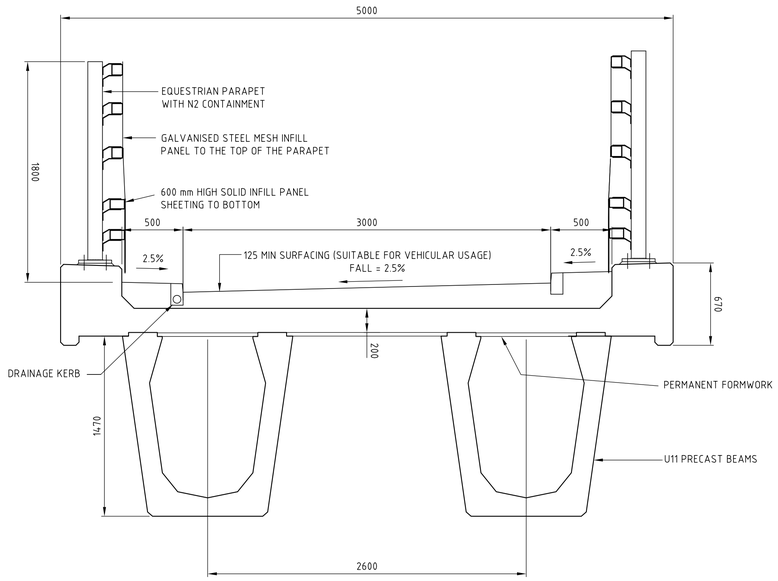
Drawn	Engineer	Checked	Approved
SP	SP	NH	
Date	Date	Date	Date
18.07.13	18.07.13	18.07.13	
Size	Scale		
A1	Hz 1:2500, Vt 1:250		
SCG No.	Filename		
Drawing No.			Revision
1007/3D/DF7/A6-MA/GA/202			

Appendix B: Proposed General Arrangement Drawing

3D Model



ELEVATION A-A
(1:100)



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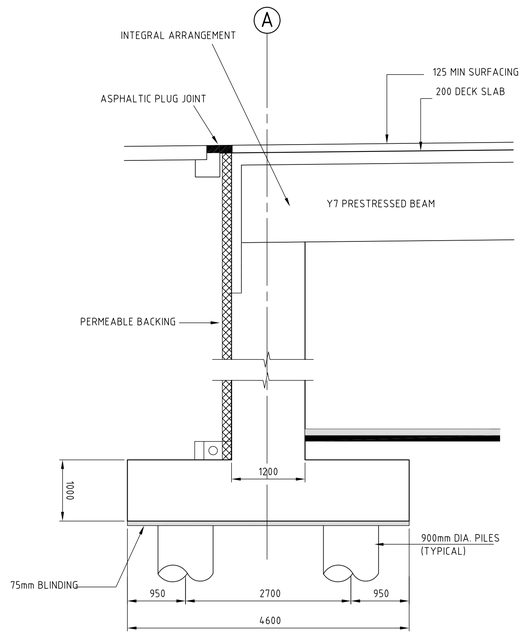

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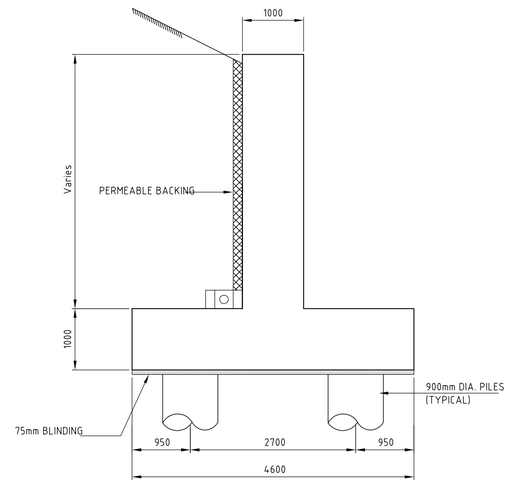

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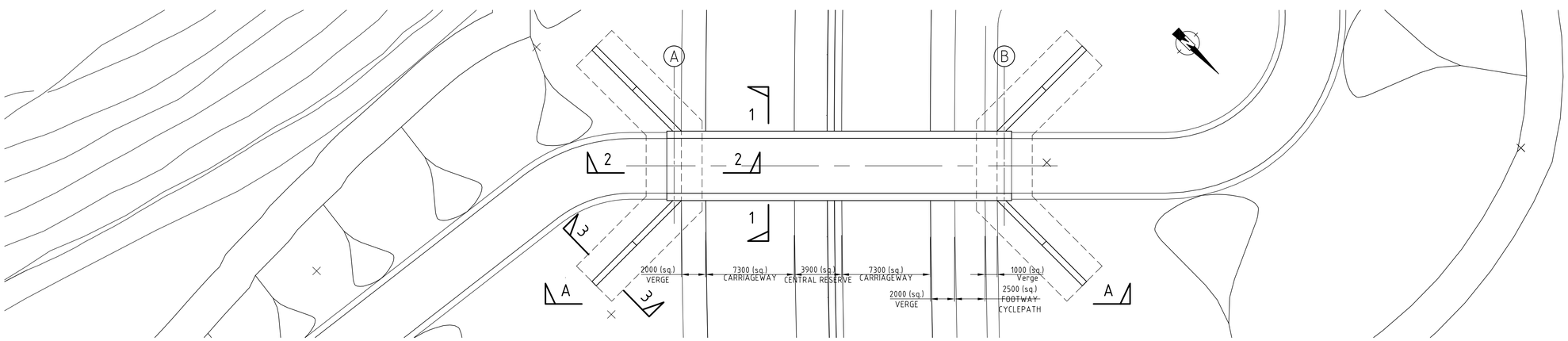

PLAN
(1:200)

NOTES

1. THIS DRAWING HAS BEEN PRODUCED MAINLY FOR THE PURPOSE OF PRELIMINARY DESIGN.
2. LEVELS ARE IN METRES AND ABOVE ORDNANCE DATUM.
3. ALL DIMENSIONS ARE IN MILLIMETRES.
4. THE OPTION SHOWN IN THIS DRAWING IS NOT FOR CONSTRUCTION.
5. THE FOUNDATION TYPE SHOWN ON THE DRAWING IS BASED ON THE LATEST AVAILABLE GEOTECHNICAL INFORMATION.
6. BASIC PRELIMINARY DESIGN HAS BEEN UNDERTAKEN TO DETERMINE THE GEOMETRY OF THE SECTION SIZES AS PER CLIENT'S INSTRUCTION.
7. THE ACCOMMODATION BRIDGE WIDTH IS IN ACCORDANCE WITH TD 27/05 AND AGREED WITH THE OVERSEEING ORGANISATION.
8. CONCRETE STRENGTHS:- DECK SLAB C32/ 40 10.
9. PERMANENT FORMWORK IS REQUIRED.
10. THIS DRAWING HAS BEEN PRODUCED BASED ON THE LATEST MX HIGHWAY MODEL – DRAFT DESIGN FREEZE 7, AS PROVIDED BY THE CLIENT
11. CONCRETE FINISHES TO BE AS PER MCHW SPECIFICATION SERIES 1700 11. U.N.O. :-

BURIED FOUNDATIONS :	F1, U1.
ABUTMENT COLUMNS :	F1.
BURIED FACE OF ABUTMENT :	F1.
WATERPROOFING :	F4.
PARAPET EDGE BEAM :	F3, U3.
DECK SLAB TOP SURFACE :	U4.

Rev.	Drawn	Checked	Date	Revision Details
A	CT	JW	13.09.13	ISSUED FOR PLANNING
-	CT	JW	28.08.13	FIRST ISSUE (FOR COMMENT)

south east manchester multi modal strategy

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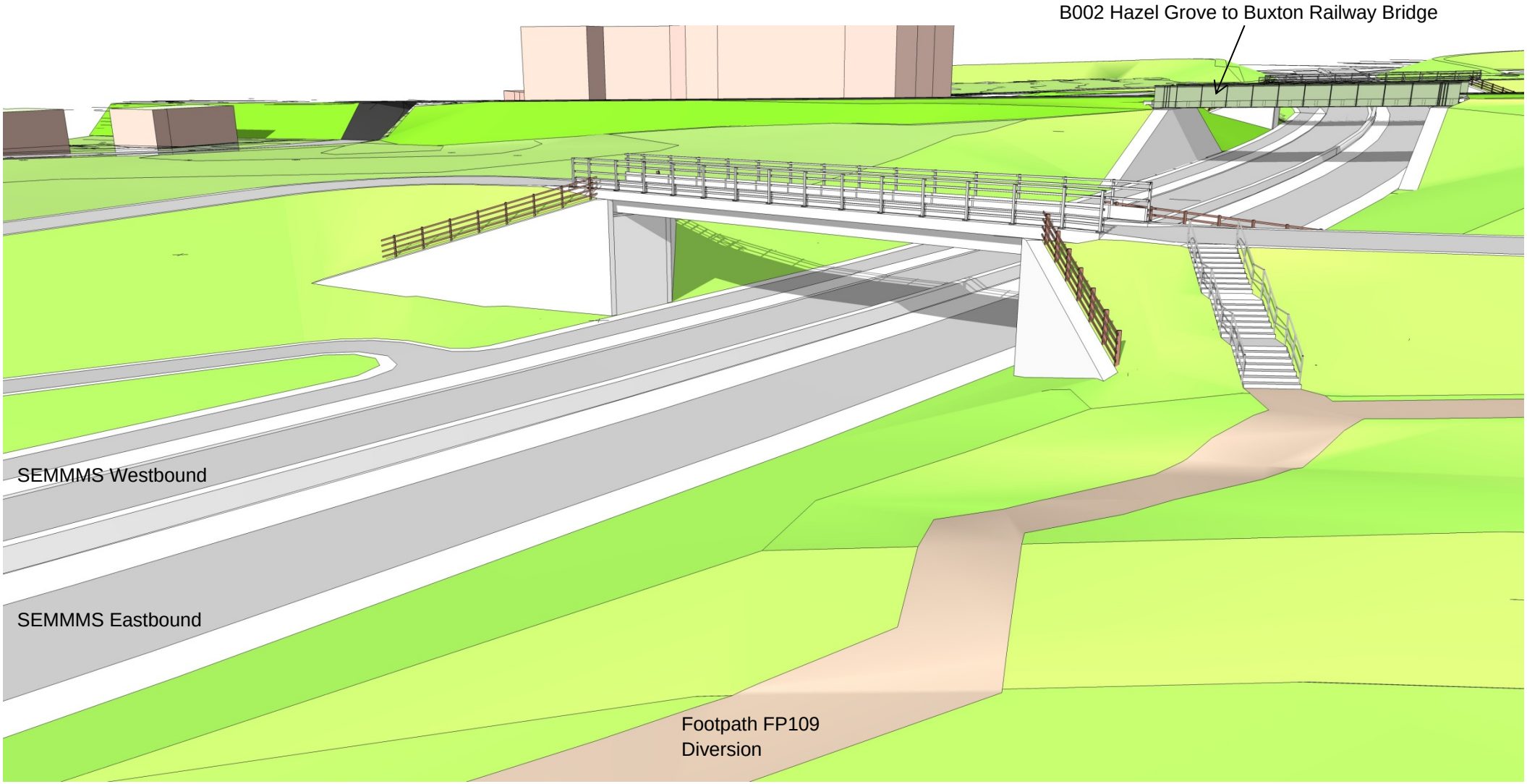
A6 TO MANCHESTER AIRPORT RELIEF ROAD

Drawing Title

B003 MILL LANE ACCOMMODATION BRIDGE GENERAL ARRANGEMENT

Drawn	Engineer	Checked	Approved
CT	JW	ME	NS
Date 28.08.13	Date 28.08.13	Date	Date
Size A1	Scale AS SHOWN		
SCG No.	Filename		

Drawing No. 1007/3D/DF7/A6-MA/B003/701 Revision A



B003 – Mill Lane Accommodation Bridge

View Looking North

Appendix C: Ground Investigation Information

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BOREHOLE LOG

BH1003

CLIENT STOCKPORT METROPOLITAN BOROUGH COUNCIL

SITE SEMMMS — Sheet 1 of 2

Start Date April 7, 2005 — Easting 393272.5 — Scale 1 : 50

End Date April 8, 2005 — Northing 385593.2 — Ground level 105.06mOD — Depth 14.70 m

progress date/time water depth	sample no & type	depth (m) from	depth (m) to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
07/04/05 0800hrs	1D*	0.00						TOPSOIL. (Drillers description) (TS - TOPSOIL)	0.30	104.76	
	2D*	0.50						Sandy CLAY. (Drillers description) (GFC - GLACIO-FLUVIAL COHESIVE)	0.80	104.26	
	3D*	1.00	1.65	nil	S 31			SAND and GRAVEL. (Drillers description) (S&G - SAND & GRAVEL)	1.20	103.86	
	4D	1.20	1.90					Dense red and orange-brown silty very sandy angular to subrounded fine to coarse predominantly sandstone GRAVEL with occasional fine gravel size coal fragments. (GFG - GLACIO-FLUVIAL GRAVEL)			
	5X	1.20									
	6X	1.90	3.10								
		3.10	3.55	nil	C 28						
	7X	3.10	4.20					3.10m: Becoming medium dense.	3.40	101.66	
		4.20	4.65	3.10	C 49			Very stiff indistinctly structured red-brown locally grey and orange slightly sandy CLAY with occasional subangular fine and medium mudstone lithorelicts. (CT - COHESIVE TILL)			
	8X	4.20	5.20					4.20 - 4.50m: Drilling disturbed.	4.80	100.26	
	9C	5.20	5.70	5.20		100 56 40		Very weak red-brown MUDSTONE comprising frequent angular blocky fine and medium lithorelicts in a very stiff slightly sandy clay matrix (40%). (MST - MUDSTONE) 5.20 - 5.40m: Bed of stiff red-brown clay with occasional subangular to subrounded fine and medium lithorelicts and green-grey fine gravel size silty reduction spots.	5.40	99.66	
		5.70	5.78	5.20	C*375						
	10C	5.70	7.20			100 91 0		Moderately strong red-brown and light grey fine and medium grained SANDSTONE. (SDST - SANDSTONE) 5.40 - 5.45m: Bed of moderately weak red-brown thinly laminated siltstone, NI. 5.45 - 5.55m: 65° curviplanar rough tight sandy clay smeared fracture.	5.85	99.21	
		7.20	7.26	5.20	C*500			Weak to moderately weak grey locally red-brown slightly micaceous SILTSTONE. NI, with very closely spaced randomly orientated planar and irregular rough tight fissures. Fissures are frequently smeared with red-brown clay and occasionally discoloured yellow-brown. (STST - SILTSTONE) 6.00 - 7.00m: Locally disintegrated to lithorelicts in a silt matrix. 6.55m: 60mm thick bed of strong fine grained sandstone.	7.00	98.06	
	11C	7.20	8.70			100 24 0					
								Continued Next Page	{8.00}		

EQUIPMENT: Geotechnical Pioneer rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-1.90m, (113mm) 1.90-5.20m. Waterflush rotary core drilled (116mm) 5.20-14.70m.

CASING: 143mm diam to 5.20m.

BACKFILL: On completion, a standpipe piezometer (19mm) was installed with tip at 14.70m, granular response zone 14.70-12.70m, bentonite seal 12.70-0.40m, concrete and raised cover 0.40-0.00m.

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks	CONTRACT	CHECKED
				Groundwater not encountered prior to use of water flush.	17360	

Geotechnical Engineering Limited

BOREHOLE LOG

BH1003

CLIENT STOCKPORT METROPOLITAN BOROUGH COUNCIL

SITE SEMMMS — Sheet 2 of 2

Start Date April 7, 2005 — Easting 393272.5 — Scale 1 : 50

End Date April 8, 2005 — Northing 385593.2 — Ground level 105.06mOD — Depth 14.70 m

progress date/time water depth	sample no & type	depth (m) from	depth (m) to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
								6.70m: Grading to a very weak indistinctly thinly laminated siltstone.			
		8.70	8.75	5.20	C*750			Moderately strong red-grey indistinctly thinly laminated MUDSTONE. Predominantly NI, with extremely closely to closely spaced randomly orientated curviplanar smooth tight fractures frequently with patchy non penetrative orange-brown staining and occasional clay smearing. Locally tending to a siltstone. (MST - MUDSTONE).	8.70	96.36	
	12C	8.70	10.20			100 65 8					
07/04/05 1800hrs 1.41m								Moderately strong and strong red-brown and green-grey slightly sandy SILTSTONE with very closely to closely spaced 5-65° planar and curviplanar smooth tight fractures. Fractures are frequently clay smeared with non penetrative orange-brown discolouration. Locally NI. (STST - SILTSTONE)			
		10.20	10.23	5.20	C**			9.20 - 11.20m: With frequent thin occasionally impersistent sandstone interlaminae.			
08/04/05 0800hrs	13C	10.20	11.70			85 79 0		9.80 - 9.95m: Grading to a thinly interlaminated siltstone and sandstone.			
								10.10 - 10.50m: Grading to a strong thinly interlaminated siltstone and sandstone.			
								10.20m: Fractures become predominantly closely spaced and inclined at 0-30°.			
								10.50 - 10.65m: Bed of weak red mudstone.			
								11.20 - 11.40m: Bed of strong light green-grey fine grained sandstone. NI.			
		11.70	11.74	5.20	C*750			11.40 - 11.55m: Bed of very stiff slightly sandy very closely fissured clay. Fissures are polished.	11.75	93.31	
	14C	11.70	13.20			100 0 0		11.55 - 11.75m: Bed of strong light yellow-grey fine grained sandstone.			
								11.70 - 12.20m: Drilling disturbed.			
								Weak and moderately weak blue-grey and red-brown MUDSTONE. NI, fractures are extremely closely spaced randomly orientated irregular smooth and frequently polished. Occasional subrounded medium gravel size concretions. (MST - MUDSTONE)			
		13.20	13.25	5.20	C*750			12.30m: 100mm thick bed of clay.			
	15C	13.20	14.70			93 5 0		12.40 - 13.00m: Occasional fractures with non penetrative yellow-brown and patchy black discolouration.	13.55	91.51	
								12.70 - 13.10m: With frequent thin veins and medium gravel size pockets of sandstone.			
								13.10 - 13.25m: Bed of strong green-grey siltstone/fine grained sandstone.			
08/04/05 1400hrs 2.26m								13.25m: 60mm thick bed of stiff friable slightly sandy clay.			
		14.70	14.75	5.20	C*750			Strong grey locally red-brown fine to coarse grained SANDSTONE. Predominantly NI, with very closely spaced subhorizontal and subvertical irregular rough open fractures often infilled with firm clay and fine and medium gravel. Some penetrative up to 5mm orange-brown discoloration. (SDST - SANDSTONE)	14.70	90.36	
								Borehole completed at 14.70m.	{18.00}		

water strike (m) | casing (m) | rose to (m) | time to rise (m) | remarks

Groundwater not encountered prior to use of water flush.

CONTRACT **17360**

CHECKED