

4. Engineering Assessment

4.1 The following section addresses the engineering issues associated with the proposed M2/A26 Link.

Carriageway Standard

4.2 The transition between the M2 motorway in the north and Ballee Road East, which is an All-Purpose Dual Carriageway, required careful consideration. It is recommended that the motorway standards be terminated at the point of divergence of the existing merge and diverge slip roads and that the extension to the south be continued as an All-Purpose Dual Carriageway. The alignment is based on standards pertaining to the dual carriageway (D2AP) and has been designed in accordance with Design Manual for Roads and Bridges (DMRB) Volume 6; with particular reference to the following standards: -

- TD9/93 Highway Link Design
- TD27/96 Cross Sections and Headroom

4.3 The forward visibility along each carriageway has been checked in accordance with TD9/93 in order to highlight any sections where verge or central reserve widening may be required.

Departures

4.4 At this preliminary stage of design development there have been no departures from standard identified for the chosen route option. However, a number of potential relaxations from standard have been identified and these are summarised as follows: -

- a one step reduction in horizontal curvature required on the proposed M2 extension between chainages 1068m and 1735m.
 - a one step reduction in stopping sight distance required for the offside lane of the proposed M2 extension between chainages 910m and 1000m.
 - a one step reduction in stopping sight distance required on the proposed M2 extension between chainages 1440m and 1240m.
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- up to two step reduction in stopping sight distance required for the nearside lane of the proposed M2 extension between chainages 1570m and 1190m.

Existing Structures

- 4.5 There are no structures currently proposed on the scheme. Culvert locations and requirements remain to be confirmed.

Geotechnical Considerations

Geology and Soils

- 4.6 The geology of the area was initially determined from the reference to the following maps and historic information:
- Ballymena: 1:50,000 Geological Map, Sheet 20 Ballymena
 - Historic borehole 67SE121 located at the northern over bridge/ off ramp intersection to Larne Road Roundabout
 - Historic borehole 67SE112 on the hill to the south of the Larne Road Roundabout in the area of the proposed cutting
 - Historic borehole 67SE125 at the tie-in with the A26 Ballee Road East
- 4.7 A more detailed analysis of the existing geology of the area can be found in the Preliminary Sources Study Report (PSS), February 2004 (ref: 04N001/M2).
- 4.8 As proposed in the PSS a detailed ground investigation was scheduled and subsequently carried out, the findings of this are contained within:
- Northern Corridor, M2 Ballymena, Report No: 04-265, November 2004

Solid Geology

- 4.9 Geological maps indicate that the route is underlain by olivine basalt lava flows of the Lower Basalt Formation.
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- 4.10 Subsequent explorative site operations indicate this to be correct with basalt indicated to be moderately strong and fine grained.
- 4.11 Rockhead reduces in level from the tie in with the M2, at around 57.9mOD, to the tie in with the A26 at around 44.7mOD.
- 4.12 Rockhead is present near the surface around the area of the Larne Road roundabout and also to the north with the tie in to the M2.
- 4.13 A local sharp rise in ground level just to the north of Limentary road is not indicative of a local rise in rockhead but is a feature indicative of a glacial drumlin.

Drift

- 4.14 From geological maps the route is indicated to be underlain by glacial till. Low-lying boggy areas to the southern end and near the Larne Road roundabout, both associated with watercourses, indicate alluvium to be present.
- 4.15 Soft deposits typical of alluvial conditions were encountered in exploratory holes BH05, TP05, TP06 and TP08. These were associated with flattening of existing ground levels and in close proximity to watercourses. Deposits were found to consist of soft clay with organic matter present and occasionally containing gravel.
- 4.16 Glacial till was encountered during the ground investigation and was present in the majority of exploratory holes. This was often found at or near surface consisting of firm to stiff gravelly sandy clay with cobbles and boulders.
- 4.17 Gravel deposits were found to overlie rockhead particularly on the southern and lower lying southern half of the route corridor. This was found to consist of medium dense to dense clayey gravel with occasional cobbles. Occasionally it is noted that this is weathered rockhead of decomposed basalt.
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- 4.18 Rock exposures are present around the area of the Larne Road roundabout and to the north where it ties in with the existing M2.
- 4.19 A glacial till drumlin is present to the north of Liminary Road with a maximum thickness found to be greater than 10m below ground level (mbgl).
- 4.20 A more detailed report on particular features around the Larne Road roundabout has been produced and can be located in the Area North of Larne Road Roundabout to Existing M2 Report, December 2004, ref:104N001/1/A.

Mining, Quarrying and Landfill

- 4.21 Worked coal measures were not found to underlie the proposed route corridor. Deep mineral exploration was not carried out during the ground investigation.
- 4.22 No indication of previous quarrying work was shown to be present along the route corridor.
- 4.23 There are not known to be any active landfill sites directly affecting the proposed scheme alignment or within the locality.

General

- 4.24 It is anticipated that one of the principal aims of highway design will be to achieve an approximate earthworks balance between suitable material won in cutting and material required for construction of embankments. This will help minimise the environmental impact of the construction process that is resultant from off site disposal and too minimise the cost of importing material.

Cuttings

- 4.25 The proposed alignment of the A26 will require entirely new cuttings to be created.
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- 4.26 One significant cutting is anticipated to the north of Limentary Road with a maximum depth of around 9.5mbgl. Predominant ground conditions here consist of glacial till extending to a basalt rockhead. Rockhead is shown to be >9.6mbgl and side slopes are not likely to require excavation of this.
- 4.27 It is anticipated that cutting slopes will be stable at 1v:2h in glacial till.
- 4.28 Top of slope drainage may be considered to shed surface runoff away from the cutting face and limit the potential for shallow superficial slips. Face drainage may also be required to deal with seepages and limit the potential for superficial surface failures.
- 4.29 From laboratory testing carried out during the ground investigation it is likely that material with moisture contents of between 18-22% will be acceptable for use as cohesive engineering fill. Moisture contents >22% can be considered for reuse as landscape fill or possibly as engineering fill after treatment.
- 4.30 Geotechnical Risks that may affect cuttings are summarised in **Appendix B**.

Embankments

- 4.31 The proposed alignment of the A26 will require entirely new embankments to be created.
- 4.32 The ground conditions expected to be encountered by embankments on the proposed route corridor consists primarily of glacial till overlying a shallow, occasionally weathered, basalt rockhead.
- 4.33 Settlement of new embankments is expected to be low where founded on glacial till deposits.
- 4.34 Two areas exist along the route corridor where soft alluvial deposits extend to a maximum of 1.1mbgl. These are present to the south of Limentary Road encountered in BH05, TP05, TP06 and TP08 and are associated with local watercourses.
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- 4.35 Stability of the relatively low height embankments irrespective of the founding conditions should not be an issue. Geotextiles may be required to form a working platform for construction of embankments underlain by alluvial deposits.
- 4.36 Where embankments are founded on alluvial deposits this may be excavated and replaced with class 6A fill. To prevent differential settlement, excavation and replacement of these soils with granular fill, or surcharging may also be required.
- 4.37 New embankment side slopes are anticipated to be created at 1v:2h; steeper side slopes may be created by using class 1 granular fill.
- 4.38 Geotechnical Risks that may affect embankments are summarised in **Appendix B**.

Subgrade

- 4.39 Imported class 1 granular fill below the subbase for embankments will have a CBR exceeding 15%; this excludes the need for capping.
- 4.40 Imported or 'won' class 2 cohesive fill can expect CBR values to vary between 2-5% and will require the use of a capping layer.
- 4.41 Where soft alluvial soils are present at or near grade a full capping, additional over excavation or the use of geotextiles may be required.

Man-made Features

- 4.42 The principal man made feature in this area is the existing A26 Ballee Road East dual carriageway and associated embankment approaching the Larne Road Roundabout which in turn connects to the M2 motorway.
- 4.43 Limentary Road bisects the area and connects into the existing A26 to the west. Adjacent residential properties are accessed from the road side or by laneways.
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- 4.44 Several farm buildings and residential properties are present just to the south of Liminary Road and sprawl toward the A26 forming an access road onto the Ballee Road East carriageway.

Historical Development

- 4.45 The site of the proposed extension and associated roadways are currently undeveloped farmlands which are maintained from farm buildings east of the existing A26.

Soil Chemistry and Contaminated Land

- 4.46 The rural site environment is unlikely to harbour contaminated ground. The anticipated ground conditions comprising principally glacial soils are unlikely to be aggressive to concrete. Appropriate soil tests will be carried out during the course of the ground investigation.
- 4.47 The area inside Larne Road Roundabout and northwards to the tie-in with the M2 has been used in recent years by Roads Service to store waste material arising from road maintenance such as gully waste and cleared manhole debris. Contaminant tests were scheduled as part of the Ground Investigation to determine if any hazardous industrial waste is present. The results of which are contained in the Factual Report.
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