2.0 Existing Conditions

2.1 Introduction

This section provides a brief history of the Westlink and considers more recent improvements on the M1 and M2 motorways delivered by the Roads Service Design, Build, Finance and Operate (DBFO) Package 1 Contract. In particular, this section looks in detail at the existing traffic, engineering and environmental conditions in the vicinity of the York Street junction with reference to current engineering roads standards, the ongoing Northern Ireland Water (NI Water) Belfast Sewers Project (BSP), utilities, land, ports and airports, previous roads studies undertaken in the area, drainage, topography and ground conditions.

2.2 The Development of the Westlink, M2 and M3

2.2.1 Initial development and construction

Belfast can trace the development of its arterial Trunk Road network back to the 1930s. By then the rapid development of urban motorised traffic was forcing planners and engineers to examine the introduction of major roads into and around the city centre.

By 1938 a start had been made to the Sydenham Bypass to address traffic related problems and it soon became apparent that the River Lagan served as a barrier to the movement of traffic across the river. Options were developed over the intervening years for crossings involving solutions to ensure navigation could continue upstream. At this time the recommended solution was for a high level bridge between High Street and Middlepath Street. This soon became interlinked in the post war years with the aspirations to create a network of ring roads as advocated in the 1946 Outline Advisory Plan. These roads were proposed to be at ground level rather than being elevated. However as the assessment developed it became apparent that unless grade separation was introduced the schemes would not be viable.

In 1956 the Housing Act was introduced which designated large areas of central Belfast as redevelopment zones. This offered a unique opportunity to integrate the new arterial networks within the developing landscape replacing the Victorian urban sprawl of sub standard housing and industry. Also at that time the Northern Ireland Government had taken the decision to proceed with the M1 and M2 approach motorways into the city from the south and the north respectively.

By 1961 a new Inner Ring Road Scheme, known as the Grade Separated Scheme, was adopted which was based largely on elevated dual two lane carriageways with high level roundabouts. This was further refined by the adoption of the Ministry of Commerce Motorway Committee's recommendations that full grade separation of the ring road with the new motorway radial routes was required. Influenced by the development of similar schemes in the United States of America, the proposals continued to be consolidated. By 1964 Belfast Corporation approved in principle a largely elevated dual three-lane motorway with hardshoulders to 50mph standards. In doing so the Corporation appointed Travers Morgan and Partners to develop the proposals resulting in their report entitled "Report on

Belfast Urban Motorway" dated February 1967. This defined the Belfast urban motorway framework including the radial connections. An ambitious phased construction strategy was proposed leading to completion by 1976.

As part of the Report a considerable emphasis was given to the proposed intersection of the motorways flowing in from the north and the south of the city and their connection to the crossing of the River Lagan. This would be what is currently termed York Street Interchange. A number of crossing points were considered over the River Lagan and these resulted in the Red and Blue routes. Each had a particular layout at York Street as illustrated on Figures 2.2.1, 2.2.2, 2.2.3 and 2.2.4. The Report recommended the complete Blue Route with a low level crossing of the Lagan.

It is interesting to note that in the 1967 Report, total estimated costs (including construction and compensation costs) for the recommended Blue Route were of the order of £60M[15]. When factored approximately using the Constructed Civil Engineering Cost Index published in Spon's Civil Engineering and Highway Works Price Book 2009[16], using a base year of 1970, this would equate to a total construction cost in 2007 of £1bn.

By 1969 the proposals for the major highway infrastructure were set out within the Belfast Transportation Plan and incorporated within the Belfast Urban Area Plan. This entailed the M1-M2/Harbour Link in the form of an elevated dual three-lane motorway from Broadway to the M2 and onwards across the River Lagan to join the Sydenham Bypass. This involved, inter-alia, a major interchange at York Street. Although land had been vested for a large part of the route by 1971, civil disturbance plagued the attempts to progress construction.

By 1974 the financial climate had changed and the public perception of urban motorways was shifting. The opposition of the new Belfast City Council (BCC) to the proposed urban motorway in particular led the Department of the Environment to appoint Travers Morgan and Partners in 1974 to undertake a Review of the Transportation Strategy for the Belfast Urban Area.

A subsequent report was published in 1976 and was then the subject of a lengthy Public Inquiry held in 1977. In April 1978 the Department issued a statement, which accepted most of the Inspector's recommendations. The scale of the scheme for the connection between M1 and M2 was reduced to dual 2 lane carriageways with an overall width of approximately 60 feet. The new road was to be depressed, where ground conditions permitted, in order to minimise noise and visual intrusion but it was not to be fully grade separated, with at-grade roundabouts provided at Broadway and Grosvenor Road and the existing at-grade signalised junction at York Street. These at-grade junctions have subsequently been identified as major structural deficiencies, or bottlenecks in the strategic road network. While many of the other road proposals envisaged in 1967 for the Belfast Urban Motorway were abandoned.

Between 1979 and 1983 the construction of the Westlink was undertaken with the first portion completed from the M1 at Donegall Road to Grosvenor Road in February 1981. The whole scheme was opened to traffic on 29 March 1983. Construction costs of the original Westlink were £23M[17], which if factored approximately using the same Constructed Civil

[15] "Belfast Urban Motorway" R. Travers Morgan and Partners (N.I.). February 1967.
[16] "Spon's Civil Engineering and Highway Works Price Book 2009", 23rd Edition, Taylor and Francis, ISBN 978 0 415 46557 1. 2009.
[17] "The Northern Ireland Motorway Achievement", Roads Service ISBN 0 9543056 3. 2002.

Engineering Cost Index published in Spon's Civil Engineering and Highway Works Price Book 2009, would equate to a total construction cost in 2007 of approximately £80M.

Over the same period the construction of the M2 foreshore section was undertaken, with the road opened to traffic on 22 May 1973. Construction costs of the M2 foreshore were £7.5M, which would equate to a total construction cost in 2007 of approximately £150M on the same basis as before.

After completion of the Westlink and M2 foreshore, the next scheme was the construction of the M3 motorway carried on the Lagan Bridge and the NIR railway line carried on the Dargan Bridge. The scheme connected into the M2 foreshore section at Dock Street and connected to East Belfast at Middlepath Street. The construction works commenced in August 1991 and were completed in two phases, with opening of the Dargan Bridge in November 1994 and opening of the Lagan Bridge in January 1995. The connection to Middlepath Street was a temporary measure until the relocation of existing rail maintenance facilities at Bridge End were completed, upon which time it was connected directly to the Sydenham Bypass. These works were completed in May 1998. Construction costs of the scheme were £33M, which would equate to a total construction cost in 2007 of approximately £60M on the same basis as before.

2.2.2 Recent Improvements

In 2006 the award of the first Roads Service DBFO Package 1 Contract, included a number of major improvements to the Westlink and M2 at a capital cost of approximately £137M. These works are undertaken by Highway Management Construction on behalf of the Highway Management (City) Limited concessionaire. The upgrading of the M1 and Westlink to a dual 3 lane standard over a 4km length on the western approach to the city provides additional capacity on the network with the construction of grade separated junctions at Broadway and Grosvenor Road removing two major bottlenecks that had existed since the completion of the original Westlink. The M2 Improvements between Junction 4 (Sandyknowes) and Junction 2 (Greencastle Interchange) provide a dual 3 lane standard in both directions, increasing the capacity of the south-bound carriageway into the city over a 6km length.

2.3 Traffic

Existing conditions in the York Street area are subject to significant congestion during periods of peak traffic demand due to the convergence of traffic from the Westlink, the M2 and M3 and the local surface streets. This demand is controlled by a series of signalised junctions, where signal timings are monitored to improve traffic flow during peak periods. Existing traffic conditions are described in detail within Section 7. A general location plan detailing the classification of the main roads and streets within the study area is shown in Figure 2.3.1.

2.4 Engineering

2.4.1 Existing Road Network

2.4.1.1 Introduction

This section provides a broad engineering assessment of the existing roads on the strategic road network (Westlink, M2 and M3) and local city centre streets not included in the strategic road network (York Street, Great George's Street, York Link, Nelson Street, Little York Street, Shipbuoy Street, Dock Street, Corporation Street, Trafalgar Street, North Queen Street and Clifton Street). The assessment considers the following areas:

- route descriptions for the Westlink, M2, and M3;
- horizontal standards on the Westlink, M2 and M3;
- vertical standards on the Westlink, M2 and M3;
- route descriptions for local city centre streets;
- horizontal standards on local city centre streets;
- vertical standards on local city centre streets; and
- route length summary;

The assessment of the Westlink will be curtailed to the extent of the study area at Clifton Street grade separated junction. The assessment of the M2 will be curtailed to the extent of the study area at Junction 1A (Duncrue Street) to the north and the Lagan Bridge to the south. The assessment of the M3 will be curtailed to the extent of the study area at the Lagan Bridge.

The Design Speed used in assessing the layout and standard of the existing junction is based upon the speed limit applied to the section of the main carriageways (Westlink, M2 and M3) under analysis and the requirements, in particular, of TD 9/93 entitled "Highway Link Design" (DMRB 6.1.1). The Design Standard TD 22/06 entitled "Layout of Grade Separated Junctions" (DMRB 6.2.3) is also referenced in the following text.

An initial assessment of the vertical alignment of the main carriageways on the strategic road network (Westlink, M2 and M3) has been made based upon the speed limit applied to the section of the main carriageways under analysis and the requirements, in particular, of TD 9/93.

In a similar manner to the assessment of the horizontal alignments provided on these carriageways, the assessment of the vertical alignments will be extended outside the designated study area to encompass sections that have recently undergone significant improvements carried out as part of the Roads Service DBFO Package 1 Contract.

The existing road network is illustrated in Figures 2.4.1 to 2.4.3.

2.4.1.2 Westlink Route Description

The Westlink was built between 1979 and 1983, commencing at Junction 1 of the M1 motorway (Broadway) in south Belfast and terminating at the York Street junction to the north of the city centre. The route provides strategic links from the M1 to the M2, the M3

and the Shore Road in both north-bound and south-bound directions. It is part of the strategic road network, located on the Eastern Seaboard Key Transport Corridor, as identified in the RSTN-TP and the majority of its length is designated as a "special road". It also forms part of the Euro Route E01 defined by the United Nations Economic Commission for Europe (UNECE).

As part of the Roads Service DBFO Package 1 Contract, the Westlink has been subject to major improvements over some of its length. Completed in early 2009 the Westlink has been upgraded to a Dual 3 Lane Urban All-Purpose (D3UAP) section, as defined in DMRB TD 27/05 entitled "Cross Sections and Headrooms" (DMRB 6.1.2), from its start at a grade separated junction at Broadway to the existing grade separated junction at Divis Street. It should be noted that the finished lane widths do not meet the minimum requirements for a D3UAP section as set out in TD 27/05. A lane gain/lane drop arrangement reduces the route to a Dual 2 Lane Urban All-Purpose (D2UAP) section beyond the existing Divis Street junction and represents the extent of the recent improvements. At this point a narrow concrete safety barrier provides the central median with narrow hardstrips in each direction. To the north of Divis Street this D2UAP provision is maintained under the existing Peter's Hill overbridge, with direct taper merges and diverges on both carriageways to the Clifton Street grade separated junction. Again, the cross-section provided does not meet the minimum requirements for a D2UAP section set out in TD 27/05.

Immediately north of the Clifton Street junction, a lane gain to the nearside from Clifton Street provides three lanes heading north-bound out of the depressed section and onto the existing North Queen Street underbridge along with a narrow hardshoulder. The carriageway runs north on an embankment beyond the North Queen Street underbridge. Upon its final approach to the York Street junction, a direct taper from the offside of the north-bound carriageway provides separation for M3-bound traffic. At the intersection of the Westlink with York Street at the York Street junction a total of five lanes are provided, three are designated for the M2, the docks and York Street onward destinations, the remaining two are designated for the M3 and city centre onward destinations. The intersection at the York Street junction is traffic signal controlled.

The south-bound carriageway from the intersection of the Westlink with York Street at the York Street junction comprises three lanes, merging to two lanes south of the junction. The carriageway runs south on embankment with two lanes provided on North Queen Street underbridge. This provision is maintained as the carriageway enters into a depressed section south-bound to the Clifton Street junction, where a taper diverge provides a connection to Clifton Street, with city centre as an onward destination. Two lanes are provided south-bound from the Clifton Street junction towards the Peter's Hill overbridge, with taper merges and diverges to the previously identified lane gain arrangement on the south-bound carriageway at Divis Street.

2.4.1.3 Westlink Horizontal Standards

The Westlink is restricted to a speed limit of 50mph. In accordance with TD 9/93, this equates to a Design Speed of 85A kph and the existing alignment has been assessed to this standard.

As stated previously, a considerable section of the Westlink has undergone significant improvements under the M1/Westlink Improvements SRI. Although outside the study area

considered, it is important to include the horizontal alignment delivered through these improvements within the overall assessment of the horizontal alignment of the route.

Following completion of the improvements on the Westlink the route have an alignment comprising a series of relatively short straights connected by a number of tight horizontal radii. The minimum horizontal curvature provided to link these straights is 150m, a total of three-steps below the Desirable Minimum standard. It should be noted that this sub-standard radius occurs outside the study area, at the Mulhouse Road/Roden Street junction. Within the study area, north of Clifton Street junction, the Westlink is subject to a tight right-hand curve with a horizontal radius of approximately 350m. A curve radius of 350m falls two-steps below the Desirable Minimum standard. This curve reverses immediately east of North Queen Street underbridge, with the north-bound carriageway subject to a reverse left-hand curve of approximately 350m. The curve transitions to a straight immediately upon approach to the existing York Street junction. The south-bound carriageway forks from the north-bound carriageway and appears to maintain a right-hand curve with a radius of approximately 350m, transitioning to a straight alignment in advance of its intersection with the existing York Street junction.

Grade separated junctions have been provided at all conflict points, with the exception of the Mulhouse Road/Roden Street junction where an at-grade left-in, left-out arrangement is provided. Weaving lengths between all successive merges and diverges are below the Absolute Minimum standard of 240m for the 85A kph Design Speed. Furthermore, the positioning of successive merges on the south-bound carriageway at Grosvenor Road junction and Mulhouse Road/Roden Street junction is approximately 295m, less than the required 319m (3.75 x Design Speed) as set out in TD 22/06.

Table 2.4.1 summarises the horizontal alignment and the weaving lengths provided on the Westlink:

Table 2.4.1: Horizontal Standards on Westlink (post-M1/Westlink Improvements)

SECTION START	SECTION END	MINIMUM HORIZONTAL RADIUS	MINIMUM WEAVING LENGTH	DISTANCE BETWEEN SUCCESSIVE MERGES	DISTANCE BETWEEN SUCCESSIVE DIVERGES
Broadway Underpass	Mulhouse Road/ Roden Street junction	320m	470m	N/A	N/A
Mulhouse Road/ Roden Street junction	Grosvenor Road junction	150m	150m	295m	N/A
Grosvenor Road junction	Divis Street junction	1800m	N/A	N/A	690m
Divis Street junction	Clifton Street junction	350m	300m	N/A	N/A
Clifton Street junction	York Street junction	350m	N/A	N/A	N/A

2.4.1.4 Westlink Vertical Standards

As stated previously, the Design Speed for the Westlink is 85A kph. It is noted that on the section of the Westlink outside the designated study area, a minimum K value of 13 has been provided on sag curves and this corresponds to one-step below the Absolute Minimum K value set out in TD 9/93. In a similar manner, a minimum K value of 17 has been provided on crest curves and this corresponds to two-steps below the Desirable Minimum K value of 55. An instantaneous gradient of approximately 6% is provided on the carriageway at the transition between sag and crest curves between the Divis Street junction and the Clifton Street junction. Within the study area, crest curves have been provided on the depressed section of the route that appear to coincide with a one-step reduction in the Desirable Minimum K value, with a maximum gradient of approximately 5% at the transitions between sag and crest curves. The carriageway approaches the York Street junction at a relatively flat gradient of approximately 2%.

2.4.1.5 M2 Route Description

The M2 was also constructed between 1979 and 1983, with the foreshore section between Junction 1A (Duncrue Street) and the Lagan Bridge completed most recently. The M2 forms part of the strategic road network.

The foreshore section of the M2 included within the study area was constructed essentially as advance works in anticipation of the onward connection to the proposed structure, the Lagan Bridge, across the River Lagan. To avoid differential settlement of the 8m embankment, in relation to the piles, the earthworks were pre-consolidated using a number of techniques.

The M2 foreshore section is located on the Eastern Seaboard Key Transport Corridor, as identified in the RSTN-TP and is part of the T7 Trunk Road. The route north of the study area has also been subject to major improvements under the Roads Service DBFO Package 1 Contract which involved major widening and other improvements. The M2 also forms part of the Euro Route E01 defined by the UNECE.

The foreshore section of the M2 immediately north of Junction 1A characterises a dual 5 lane urban motorway, with the north-bound and south-bound carriageways described further below.

The south-bound carriageway of the M2 within the study area commences with a lane drop at Junction 1A (Duncrue Street) designated for city centre and docks traffic, which reduces the number of lanes to four on the south-bound carriageway. Of the four south-bound lanes, lanes three and four are designated for onward travel to the M3 whilst lanes one and two are designated for onward travel to the city centre and the Westlink. A hardshoulder is provided on the nearside, with a hardstrip provided on the offside. A wide central median is provided with safety barrier used as containment. The south-bound carriageway continues from Junction 1A on embankment to its crossing of Dock Street at the Dock Street underbridge. Immediately south of the Dock Street underbridge, lanes 1 and 2 south-bound diverge from the carriageway down a steep gradient into a lane gain arrangement with Nelson Street at street level. The remaining two south-bound lanes continue on embankment to the Lagan Bridge, where they become the start of the M3 south-bound carriageway. A narrow hardshoulder is provided to the nearside with a narrow hardstrip provided to the offside.

The north-bound carriageway commences on the Lagan Bridge, immediately north of Junction 1A on the M3. This structure is bounded to the west by the Dargan Bridge, which runs in parallel. The carriageway comprises two lanes with a narrow hardshoulder to the nearside and a narrow hardstrip to the offside. The Dargan Bridge continues to run parallel to the carriageway, to the lane gain arrangement from the York Street junction, where an additional three lanes join the north-bound carriageway in an alignment passing under the Dargan Bridge. This five-lane carriageway continues north on embankment to its crossing of Dock Street at the Dock Street underbridge. Immediately north of the Dock Street underbridge, the railway line carried on the Dargan Bridge provides a boundary to the west. The five lanes continue north beyond the study area.

Of the five north-bound lanes, lanes four and five are designated for onward travel to the M5 Motorway, lanes two and three are designated for onward travel on the M2 and lane one is designated for onward travel to the Shore Road at the next exit at Junction 1 (Fortwilliam).

2.4.1.6 M2 Horizontal Standards

The M2 is subject to the national speed limit over the majority of its length and therefore a Design Speed of 120A kph can be used for assessment of the existing horizontal alignment from the northern boundary of the study area to the merge and diverge arrangements at

Junction 1A. As with the assessment of the Westlink, the M2 has undergone significant improvements as part of Roads Service DBFO Package 1 Contract. Although outside the study area considered, it is important to include the horizontal alignment delivered through these improvements within the overall assessment of the horizontal alignment of carriageway.

The improvements to the M2 comprise on-line widening of the south-bound carriageway and accordingly no significant improvements have been made to the existing horizontal alignment. The existing horizontal alignment over the existing "hill section" is sub-standard with curves below the Desirable Minimum value. The existing horizontal alignment at Greencastle Interchange is also sub-standard, with the horizontal geometry on the main links approximately three-steps below the Desirable Minimum value. South of Greencastle Interchange, the carriageway has an almost straight alignment on the foreshore section. The existing Dock Street underbridge carries the M2 over the Dock Street junction. Junctions are positioned such the minimum weaving lengths and required spacing between successive diverges exceed the required standard.

Table 2.4.2 summarises the horizontal alignment and the weaving lengths provided on the M2:

Table 2.4.2: Horizontal Standards on M2 (post-M2 Improvements)

SECTION START	SECTION END	MINIMUM HORIZONTAL RADIUS	MINIMUM WEAVING LENGTH	DISTANCE BETWEEN SUCCESSIVE MERGES	DISTANCE BETWEEN SUCCESSIVE DIVERGES
Sandyknowes junction	Greencastle Interchange	550m	4400m	N/A	N/A
Greencastle Interchange	Fortwilliam junction	430m	1155m	N/A	N/A
Fortwilliam junction	Duncrue Street junction	Straight	1190m	N/A	N/A
Duncrue Street junction	York Street junction	570m	N/A	N/A	595m

2.4.1.7 M2 Vertical Standards

The identified Design Speed for the M2 is 120A kph. It is noted that on the foreshore section of the M2, the vertical alignment is relatively flat with a typical 0.5% instantaneous gradient, increasing to an instantaneous 3% gradient on approach to the Dock Street underbridge. Over the structure the alignment transitions to a crest curve with a K value of approximately 20, five-steps below the Desirable Minimum, with an instantaneous gradient of approximately 5% as it transitions into a sag curve on the embankment north of the Lagan Bridge, where it becomes the M3. The gradient on the off-slip from the M2 to Nelson Street is approximately 8%.

2.4.1.8 M3 Route Description

The M3 was constructed in the 1990s as part of the Lagan Bridge and Dargan Bridge works, with completion of Phase 2 of the works in 1998. The route is part of the strategic road network, located on the T1 Trunk Road network and provides a strategic link between Belfast and Bangor.

The section of the M3 within the study area comprises a Dual 4 Lane Urban Motorway (D4UM), as defined in TD 27/05 at its south-east extent. Narrow hardshoulders and hardstrips are provided on the nearside and offside of both carriageways respectively. The majority of this section is elevated above street level on the Lagan Bridge and bounded to the west by the Dargan Bridge, with the track elevated to a similar level. On the north-bound carriageway, lanes one and two form a lane drop arrangement at Junction 1A. These two lanes continue north on a ramp structure where widening is provided to increase the lanes available to four. The four lanes continue in an alignment under the Dargan Bridge to the intersection at street level with Nelson Street, where an additional left-turn filter lane is provided. This junction is signal controlled. The two remaining north-bound lanes on the mainline continue on the structure to form the start of the M2 immediately north of Junction 1A. On the south-bound carriageway, the M3 commences immediately south of Junction 1A on the M2, with two lanes continuing south to a lane gain arrangement at Junction 1A. At this point, two lanes travelling south from a street level signal controlled junction with Nelson Street join the elevated carriageway in structure, with four lanes continuing south beyond the extents of the study area.

2.4.1.9 M3 Horizontal Standards

The M3 is restricted with a 50mph speed limit within the study area and therefore a Design Speed of 85A kph can be used for assessment of the existing horizontal alignment.

From the eastern boundary of the study area, the M3 comprises a right-hand curve of approximately 320m radius as the carriageway is carried on the existing Lagan Bridge. A 320m curve radius is 2-steps below Desirable Minimum for the identified Design Speed.

Within the study area, there are no successive merges and diverges on the M3 to allow an assessment of weaving lengths. However, if the assessment of the M3 is extended to the east to include the existing Middlepath Street junction, a weaving length of approximately 350m exists on the north-bound carriageway between the lane gain at Middlepath Street and the lane drop to the existing York Street junction. This is in excess of the 240m Absolute Minimum weaving length required for this 85A kph Urban Road. In a similar manner on the south-bound carriageway between the lane gain at York Street junction and the lane drop at Middlepath Street, a weaving length of approximately 290m is provided, again in excess of the 240m Absolute Minimum.

Table 2.4.3 summarises the horizontal alignment and the weaving lengths provided on the M3:

Table 2.4.3: Horizontal Standards on M3

SECTION START	SECTION END	MINIMUM HORIZONTAL RADIUS	MINIMUM WEAVING LENGTH	DISTANCE BETWEEN SUCCESSIVE MERGES	DISTANCE BETWEEN SUCCESSIVE DIVERGES
MIddlepath Street junction	York Street junction	320m	290m	N/A	N/A

2.4.1.10 M3 Vertical Standards

The identified Design Speed for the M3 is 85A kph owing to the imposed speed limit of 50mph. The vertical alignment on the M3 in a south-bound direction from the M2 starts with a sag curve with a K value of approximately 13, on the embankment north of the Lagan Bridge. The sag curve connects into a 4% gradient on the Lagan Bridge which connects into a further series of crest and sag curves which meet or exceed standard K values.

2.4.1.11 York Street Route Description

York Street route runs in a generally south to north direction to form the western side of the gyratory system. At its start at the intersection with Great Patrick Street five one-way lanes are provided to its intersection with Great George's Street at a signal controlled-junction. A left-turn filter lane is provided to provide access to a Roads Service public car-park facility and onward travel to the Westlink. North-east of this junction, six one-way lanes are maintained with access provided on the nearside to an existing Roads Service public car park. Lanes one and two continue to the intersection with York Link, with onward travel through a signal controlled junction whilst lanes three, four and five are designated for onward travel to the M2 in a fork away from lanes one and two. To the offside, lane 6 provides a link to York Link at a priority junction. A dedicated access for buses is provided from lane 6 to an existing bus-stop at the corner of York Street and York Link. North of the York Street and York Link intersection, two one-way lanes provide onward north-bound travel and a single lane separated by a traffic island provides connection to the north-bound carriageway of the M2 via the M2 on-slip.

2.4.1.12 Great George's Street Route Description

Great George's Street runs in a generally south to north direction through the existing York Street junction and forms the southern side of the gyratory system. A single carriageway, it commences at the intersection between Nelson Street and the off-slip from the M3 and comprises seven one-way lanes. Lane seven is a dedicated access to Little York Street. Six one-way lanes are maintained through to the intersection with York Street at a signal controlled junction. At this junction, lane one is designated for onward travel to North Queen Street, lanes two, three and four are designated for onward access to the Westlink and lanes five and six are designated for onward travel onto York Street, with the M2 and M3 as ahead destinations. The route then reduces to a single carriageway west of this junction, providing one-way access to existing housing developments. The route terminates at a priority junction with North Queen Street.

2.4.1.13 York Link Route Description

York Link runs in a generally west to east direction through the existing York Street junction and forms the northern side of the gyratory system. A single carriageway, it commences at the intersection between the Westlink and York Street and comprises two one-way lanes initially. A third lane opens to provide three lanes under both the Lagan Bridge and Dargan Bridge and the route terminates at its intersection with Nelson Street at a signal-controlled junction. Lanes one and two at this point are designated for onward travel to the M3 via an on-slip ramp structure and lane three is designated for onward travel onto Nelson Street, with city centre as an ahead destination.

2.4.1.14 Nelson Street Route Description

Nelson Street comprises two one-way single carriageways travelling generally north and south away from its intersection with Dock Street. The north-bound Nelson Street carriageway comprises a single carriageway leading away from a signal controlled junction at Dock Street to Duncrue Street. Two lanes are provided in the north-bound direction with a dedicated bus-lane provided in a south-bound direction.

The south-bound Nelson Street runs in a generally north to south direction and forms the eastern side of the York Street gyratory system. A single carriageway, initially two lanes are provided for onward travel to the city centre and M3 and a single lane diverges across a large traffic island to join the two lanes on the off-slip from the M2 in a lane gain arrangement. This traffic island continues to provide separation through to its intersection with York Link at a signal-controlled junction. South of this junction, the route travels under the Lagan Bridge and Dargan Bridge and intersects with Great George Street and the off-slip from the M3 at a signal controlled junction. Five lanes are provided, with two lanes remaining separated by a traffic island. These two lanes provide south-bound onward travel through the junction where the carriageway opens to provide a total of five lanes at its intersection with Great Patrick Street. The remaining three lanes at the junction provide onward access onto Great George Street.

2.4.1.15 Little York Street Route Description

Little York Street, also called Nile Street on existing BCC street signs, is a short length of narrow single carriageway that provides access to the existing Park-and-Ride facility (Northside) and Shipbuoy Street located in the centre of the York Street junction's gyratory system. It has no through connection to York Link.

2.4.1.16 Shipbuoy Street Route Description

Shipbuoy Street is a short length of narrow single carriageway that is accessed from Little York Street. It serves as access for lands in the centre of the York Street junction and includes a large turning area as no through connection to Nelson Street is provided.

2.4.1.17 Dock Street Route Description

This route comprises a short length of single carriageway with two lanes in each direction separated by a traffic island running between two structures. The route passes under the Dargan Bridge and the M2 and terminates on each side at a signal-controlled junction. The

junction of Dock Street and Nelson Street was recently altered as part of a temporary traffic arrangement to facilitate works for the NI Water BSP and it is expected that the junction will revert to its former arrangement upon completion of these works.

2.4.1.18 Corporation Street Route Description

This route runs in a generally north to south direction from its intersection with Dock Street at a signal controlled junction to its intersection with Dunbar Link at another signal controlled junction. A single carriageway, it comprises two south-bound lanes with two lanes in the opposite north-bound direction reverting to a single lane north-bound for buses only. It should be noted that road traffic with the exception of buses can only travel north along this route to Clarendon Dock. The route passes under the Lagan Bridge and is currently closed to through traffic to facilitate the NI Water BSP. The route also provides access in the north-bound direction to a small Roads Service public car park located underneath the M3 off-slip. The Roads Service Eastern Division's Belfast North Section Office, the Newtownabbey and Carrickfergus Section Office and the Department of the Environment's Road Transport Licensing Division, is located to the west of Corporation Street in a single Roads Service Corporation Street depot.

2.4.1.19 Trafalgar Street Route Description

This short length of narrow single carriageway is accessed from Corporation Street and provides access to the rear of properties on Corporation Street, including the Roads Service Corporation Street Depot.

2.4.1.20 North Queen Street Route Description

The section of this route considered within the study area comprises a short length of single carriageway passing under the Westlink, running in a generally north to south direction. A wide carriageway is provided with a single lane running in each direction separated by hatched road markings.

2.4.1.21 Clifton Street Route Description

Within the study area, Clifton Street comprises a single carriageway running in a generally east to west direction. The route intersects the Westlink at the existing Clifton Street grade separated junction, with on-slips and off-slips providing access to and from the Westlink. This junction is controlled by signals. Typically two lanes are provided in each direction, with ghost islands used to facilitate right-turn movements.

2.4.1.22 Local Roads – Horizontal Standards

With the exception of the Westlink, M2 and M3, all other existing carriageways in the study area comprise single carriageways with horizontal alignments in keeping with their urban location and nature. The fixed speed limit on these restricted roads is 30mph, with 60B kph the appropriate Design Speed. The majority of these carriageways comprise horizontal curve radii that are less than the Desirable Minimum of 255m which is typical of carriageways in an urban environment. Junction arrangements are typical of those commonly found in urban locations, including at-grade and grade separated junctions.

2.4.1.23 Local Roads – Vertical Standards

With the exception of the Westlink, M2 and M3, all other existing carriageways in the study area comprise single carriageways with vertical alignments in keeping with the relatively flat topography of the study area in the vicinity of the York Street junction.

2.4.1.24 Route Summary

Table 2.4.4 summarises the type and approximate length for each road and street considered in this existing route assessment:

Table 2.4.4: Approximate Road/Street Lengths and Classification

ROAD/STREET NAME	CLASSIFICATION	APPROXIMATE LENGTH (m)
Westlink	A12	570
M2	M2	560
M3	M3	660
York Street	A2	830
Great George's Street	A2	430
York Link	A2	150
Nelson Street	A2	840
Little York Street	U617/U618	80
Shipbuoy Street	U617	80
Dock Street	A2	300
Corporation Street	A2	690
Trafalgar Street	U617	90
North Queen Street	B126	740
Clifton Street	A6	340

Note: Little York Street is named as Nile Street on existing BCC street signs.

2.4.2 Topography and Ground Conditions

2.4.2.1 Topography

The topography of the land traversed has an influence on the horizontal and vertical alignment of the routes considered. The topography of the study area is relatively flat, given its proximity to sea level, with typical levels at York Street junction being approximately 2.0m Above Ordnance Datum (AOD). The M2 is elevated to a level of approximately 10.0m AOD, approximately 8.0m above the surrounding streets from Dock Street underbridge and increases to tie-in with the Lagan Bridge and Dargan Bridge, which are elevated to approximately 12.0m AOD. Within the study area, the M3 is supported on the Lagan Bridge. The Westlink is located at the west of the study area in a depressed section at Clifton Street, approximately 7m below the surrounding streets. The carriageway rises out of this cutting and approaches the existing York Street junction on an embankment falling from approximately 9.0m AOD at North Queen Street underbridge to meet the typical street level of 2.0m AOD at the York Street junction.

2.4.2.2 Ground Conditions

The solid and drift geology for the area is considered in more detail within Section 6, in particular Figure 6.12.1. The map indicates that the site is underlain by drift deposits comprising quaternary alluvium and glacial deposits from the Pleistocene Period to the present. The estuarine alluvium thickness is shown to be at least 10m, particularly along the study area. The map indicates that the geology of the site consists of Sherwood Sandstone Group (formerly the 'Bunter Sandstone') of the Triassic Period. The bedrock formation consists of sandstone, silty sandstone and mudstone alternations.

For the Travers Morgan and Partners report of February 1967 entitled "Report on Belfast Urban Motorway", a review of the Belfast Sheet of the Geological Survey of Northern Ireland (GSNI) along with an additional site investigation led to the development of geological sections along the proposed route, which was similar to the present location of the Westlink, M2 and M3 routes. A copy of the geological section prepared for this area and included as Figure 7 of the report is reproduced as Figure 2.4.4.

Previous borehole records were obtained from the Belfast Cross Harbour Road and Rail Links (Contract 1) Site Investigations[18] and the following soil and rock lithologies were identified in the following stratigraphic order:

- Made Ground;
- Estuarine Alluvium (Sleech) and Peat;
- Alluvial Deposits;
- Glacial Deposits; and
- Sedimentary rock alternations.

[18] "Belfast Cross Harbour Road and Rail Links Site Investigation, Contract 1", Glover Site Investigations Ltd. May 1989.

These boreholes suggest ground water level variation between depths of 0.5m to 2.5m below ground level (bgl). It is also anticipated that groundwater level is subject to tidal influence. Table 2.4.5 summarises in-situ test results in stratigraphic order.

Table 2.4.5: Summary of historic in-situ tests

STRATA	DESCRIPTION	SPT N VALUES	DEPTH TO TOP (m)	THICKNESS (m)
Made Ground	Reworked glacial deposits – clay and silt	-	0	0.3 – 1.0
Estuarine Alluvium (Belfast Sleech)	Silty clay	1 to 4	0.3 – 1.4	8.3 – 11.3
Peat	Friable sub-amorphous with decayed roots	5 to 6	9.5 – 12	< 1.6
Alluvial Deposits	Sandy gravel/ gravelly sand	7 to 25	10.1 – 12.2	0.4 – 3.7
Glacial Deposits	Boulder clay	16 to refusal	10.8 – 15.4	7.6 – 37.3
Sedimentary Rock Alternations	Sandstone	-	13.8 – 15.1	-

Further information on the existing ground conditions is available in the Preliminary Sources Study report prepared by Scott Wilson in December 2008 for Roads Service.

2.4.3 Drainage and Hydrology

2.4.3.1 Overview

The low lying nature of the area and its close proximity to a tidal section of the River Lagan and Belfast Lough has significantly influenced the development of drainage infrastructure within the study area over the years. Information relating to the existing drainage network in the area has been received from Department of Agriculture and Rural Development (DARD) Rivers Agency and NI Water.

Based on the data received, with the exception of the Lagan River, there are no known open or culverted drains or rivers either designated or otherwise within the study area. Outside the study area, the Farset River flows west to east approximately 240m south of the study area and the Mile Water flows west to east approximately 400m north of the study area.

Utilising the information received from the NI Water, Rivers Agency and Roads Service record drawings for recent schemes it has been ascertained that the drainage regime within the site area consists of a series of networks of road gullies and collector pipes. This network collects runoff from the existing carriageways, adjacent areas and outfalls by gravity to combined storm and foul water sewers which are in general owned and maintained by NI Water. Buildings in the area also discharge both storm water and foul sewage to these combined sewers.

The River Lagan is the predominant waterway within the wider Belfast area and for some 5.6 km upstream of the Lagan Bridge is subject to tidal influence. Consequently the river has a significant impact on the potential flooding risk pertaining to the Scheme study area. Information received from Rivers Agency in connection with rivers and culverts and from NI Water in connection with the current drainage regime suggests that the potential flood risk from sources within the study area is minimal. However the recently published Rivers Agency Strategic Flood Map (NI) Rivers and Sea[19] which sets out those areas which may potentially experience flooding as a result of their proximity to rivers or the sea suggests that the study area falls within the zone which is at risk of potential flooding if the existing flood defences were breached or overtopped. Figures 2.4.5, 2.4.6 and 2.4.7 illustrate the existing information published by Rivers Agency with respect to the study area.

NI Water have provided existing sewerage infrastructure records for the York Street area but it is noted that road drainage pipes are generally not shown on these records as they are installed and maintained by Roads Service and are generally of smaller diameter. As-built drawings for the Lagan and Dargan Bridges, constructed in the early to mid 1990s and the Westlink, constructed in the early 1980s have also been sourced. Information obtained from each of these various sources have been combined and are as shown in Figure 2.4.8. A schematic version of this drawing which has been prepared to illustrate the main facilities including the main sewers is indicated as Figure 2.4.9.

A drainage scheme which is currently under construction within Corporation Street adjacent to the site is the BSP. This scheme involves the installation of a large diameter tunnel at significant depth, i.e. greater than 20m below existing road level, to improve existing drainage infrastructure during severe rainfall events in the greater Belfast area. Information on the line and level of this tunnel has been sought and has been provided by NI Water. This information has also been included in Figures 2.4.8 and 2.4.9.

The study area generally drains in an easterly direction from the western extents of the study area (i.e. Westlink towards the Belfast docks area) via road drainage infrastructure and NI Water combined sewerage. The existing network of NI Water pipes discharges into a large 1500mm to 2100mm diameter combined sewer, known as the Low Level Sewer, which gravitates in a northerly direction along Corporation Street. The proposed BSP storm tunnel follows roughly along the same line as this existing sewer but is being installed at considerably lower depth i.e. approximately 25m below existing ground level. These large scale sewers flow in a northerly direction out of our study area to Duncrue Street Wastewater Treatment Works, a facility which is owned, maintained and operated by NI Water. From a review of the existing records it appears that there is currently no pumped road drainage within the Scheme study area.

[19] "Strategic Flood Map (NI) – Rivers and Sea", www.riversagencyni.gov.uk/index/strategic-flood-maps.html, last accessed February 2009.

2.4.3.2 Road Drainage – West-bound Westlink and Great George's Street

At the Clifton Street overbridge, there is a high point in the existing longitudinal alignment of the Westlink. The drainage at this point breaks and the west-bound carriageway between Clifton Street and York Street drains east through gulleys and collector pipes to the York Street/Great George's Street junction where it outfalls to a 600mm diameter combined sewer. This combined sewer drains east along Great George's Street, picking up road drainage gullies before eventually connecting into the main Low Level Sewer in Corporation Street.

There are connections into the main 600mm diameter sewer in Great George's Street at Little York Street and Nelson Street.

2.4.3.3 Road Drainage – East-bound Westlink, York Street and Dock Street Drainage

On York Street there are two primary combined sewers which flow in a northerly direction. One of the sewers is indicated to be of 375mm diameter and is located in the centre of the York Street carriageway. This 375mm sewer gravitates into an adjacent sewer in York Street, which varies in size from 375mm diameter to 750mm diameter. This connection occurs in the vicinity of the Cityside Retail Park. The road gullies in York Street appear to discharge directly into these sewers.

At the York Street/Dock Street junction the 750mm diameter sewer changes direction and continues in an easterly direction. It runs beneath the M2 and Dargan Bridge in the north footpath and connects into a larger 1050mm diameter sewer which in turn connects into the main Low Level Sewer in Corporation Street.

2.4.3.4 Road Drainage - York Link Drainage

York Link drains in three separate catchments through a succession of gullies and combined sewers. The west section drains via a 225mm diameter combined sewer which connects to the 600mm diameter sewer in York Street at the Molyneaux Street junction.

The central section of York Link is drained by a 225mm diameter combined sewer which flows in an easterly direction and discharges into a 225mm diameter combined sewer in Nelson Street which flows to and connects into the Low Level Sewer in Corporation Street.

The east section of York Link is the on-slip ramp which rises towards the existing elevated highway. Runoff is collected by gullies and a collector pipe in the east verge which discharges to the same 225mm diameter combined sewer in Nelson Street as the central section, which ultimately discharges to the Low Level Sewer in Corporation Street.

2.4.3.5 M2 and M3 Motorway Drainage and Nelson Street

On the section of the M2 that is within the study area i.e. from the bridge over Dock Street to the Lagan Bridge, highway runoff again drains through gullies to collector pipes. From a high point in the longitudinal road alignment at the Dock Street bridge, the west side of the M2, south of the high point, drains down the off-slip to the Westlink and connects into the 600mm diameter combined sewer in York Street. The east side of the M2, south of the road high point, drain to a road low point. From the low point, downstream pipe-work follows a

path down the embankment and connects into a storm sewer in the east footway of Nelson Street.

The M2 off-slip onto Nelson Street and a central section of Nelson Street also drain to this storm sewer in the east footway of Nelson Street. From this manhole a 600mm diameter sewer connects to the Low Level Sewer in Corporation Street.

At either end of Nelson Street runoff is collected by gullies and fed to sewerage in the adjoining roads i.e. Great George's Street at the south end and Dock Street at the north end.

The remaining existing drainage within the study area is that of the Lagan and Dargan Bridges which were constructed in the early to mid 1990s. Both the railway line and highway are elevated structures spanning between piers which are supported on pile caps and piles. The as-built drawings received for the project show that the highway drains to gullies which discharge to a single carrier drain within the hollow concrete deck. The carrier drain connects to down-pipes which have been cast in to certain concrete piers. These down-pipes then connect into carrier pipes at ground level which then outfall to adjacent NI Water sewers.

As-built drawings with respect to the ground level drainage and some details of elevated highway drainage have been sourced, however specific drainage drawings for the elevated highway and the railway line have not been obtained. An assumption has been made that a typical as-built drawing of drainage detail applies throughout the elevated highway.

2.4.3.6 Belfast Sewers Project

The main storm tunnel for the BSP is a 4.05m internal diameter tunnelled pipeline which is located approximately 25m below existing ground level. Within the study area this tunnel is located in Corporation Street and takes the form of a gravity sewer which falls in a northerly direction towards Duncrue Street Wastewater Treatment Works. A smaller 2.44m diameter tunnel is located in Donegal Quay which changes direction to flow in a westerly direction along Corporation Square where it connects into the main 4.05m diameter tunnel at the junction with Corporation Street. At this location there is a new 12.5m internal diameter shaft i.e. Shaft 10 as shown on Figure 2.4.9 previously.

There are two existing combined sewer overflow culverts which are located in Frederick Street, Great Patrick Street and Gamble Street which currently outfall to the River Lagan. These culverts are being diverted as part of the BSP into Shaft 10, via a 1500mm diameter sewer to be installed just east of and parallel to Corporation Street.

2.4.4 Public Utilities

Given the historical and more recently developed nature of the site, it was anticipated that there would be an extensive network of underground utility service cables, ducts and pipes to be accommodated. In order to establish the extent of this network the existing known major utility providers were contacted to establish if they had apparatus within the study area and to request information on the location and type of any identified apparatus. A C2

Preliminary Enquiries letter was sent to the various utility providers in accordance with the Northern Ireland Roads and Utilities Committee (NIRAUC) Agreement[20].

As a result of the C2 Preliminary Enquiries it has been established that utility infrastructure owned and maintained by a variety of utility companies e.g. gas, electricity, potable water, storm water, foul sewers, and telecommunications traverse the study area forming potential constraints upon any improvements scheme. The main concentrations of infrastructure are found within the footprints of the existing carriageways and footways in the study area.

The utility infrastructure present within the area serves not only the adjacent residential, commercial and industrial development but also similarly developments beyond the study area.

Existing information has been received from the providers who own plant within the study area and these are summarised below in Table 2.4.6:

Table 2.4.6: Responses from service providers

SERVICE PROVIDER	RESPONSE
Phoenix Natural Gas	Plant affected.
Northern Ireland Electricity (NIE)	Distribution and High Voltage (HV) apparatus affected.
Firmus Natural Gas	Unaffected.
Police Service of Northern Ireland (PSNI)	Unaffected.
Cable & Wireless	Plant affected.
Rivers Agency	Unaffected.
Ericsson Services	Plant affected.
Meteor	Unaffected.
Motorway Communications: Roads Service Traffic Information and Control Centre (TICC)	Plant affected.
NI Water	Plant affected.
Eircom UK	Plant affected.
British Telecom (BT) NI	Plant affected.
Orange Mobiles	Unaffected.
Virgin Media	Plant affected.

[20] "Measures Necessary Where Apparatus is affected by Major Works (Diversionary Measures) 2nd Edition", Northern Ireland Road Authority and Utilities Committee, May 2005.

SERVICE PROVIDER	RESPONSE
Vodafone	Unaffected.
02	Plant affected.
PSNI Traffic Branch	Plant affected.
Roads Service Street Lighting	Plant affected.
National Grid Wireless	Unaffected.

2.4.5 Public Utilities

From the information received, a breakdown of the service provider and its service utility within each of the streets in the study area was identified and is detailed in Table 2.4.7. The approximate locations of the existing services are detailed on Figures 2.4.10 to 2.4.14.

Table 2.4.7: Description of Apparatus in the Scheme study area

ROAD/STREET	UTILITY PROVIDER	SERVICE UTILITY
York Street	NI Water	2 no. water mains; 1 no. Distribution Trunk of 300mm diameter on east side of road and 1 no. Distribution Main of 150mm diameter on west side of road
	NI Water	2 no. combined sewers; 1 no. 375mm diameter, other unknown diameter but established to be smaller than 500mm diameter
	Roads Service	Street lighting cables and associated lighting columns
	Roads Service	Motorway communication cables
	Roads Service	Traffic signal cables
	Cable & Wireless UK	Apparatus/cables along east side of street
	BT	Apparatus/cables along west side of street
	NIE	mV, 6.6kV and 11kV underground cables adjacent to and crossing road
	Phoenix Natural Gas	Low pressure gas mains of 125mm diameter on both sides of street on south side of Westlink. Only on west side, north of Westlink
York Link	NI Water	225mm diameter combined sewer
	Roads Service	Street lighting cables and associated lighting columns
	Roads Service	Motorway communication cables
	Roads Service	Traffic signal cables

ROAD/STREET	UTILITY PROVIDER	SERVICE UTILITY
	NIE	mV, 6.6kV and 11kV underground cables adjacent to and crossing road
Little York Street	NI Water	1 no. combined sewer of 300mm diameter and 1 no. collection sewer of 150mm diameter
	NI Water	1 no. distribution main of 125mm diameter
	BT	Apparatus/cables crosses street
	NIE	mV underground cables adjacent to and crossing road
Nelson Street	NI Water	1 no. combined sewer of 225mm diameter and 1 no. collection sewer of 150mm diameter
	Roads Service	Street lighting cables and associated lighting columns
	Roads Service	Motorway communication cables
	Roads Service	Traffic signal cables
	Cable & Wireless UK	Apparatus/cables along east side of street
	NIE	6.6kV, 11kV and 33 kV underground cables adjacent to and crossing road
	BT	Apparatus/cables along both sides of street
Westlink	Roads Service	Street lighting cables and associated lighting columns
	Roads Service	Motorway communication cables
	Roads Service	Traffic signal cables
	Phoenix Natural Gas	Low pressure gas mains of 250mm crossing Westlink
M2 On-slip	Roads Service	Street lighting cables and associated lighting columns
	Roads Service	Motorway communication cables
	NIE	mV and 6.6kV cables crossing under road
Corporation Street	NI Water	2 no. distribution water mains; 1 no. 250mm diameter on east side of road and 1 no. 150mm diameter on west side of road
	NI Water	1 no. combined sewer of 1500mm diameter and 1 no. combined sewer of 225mm diameter with other sewers connecting to trunk sewer
	Roads Service	Street lighting cables and associated lighting columns
	Roads Service	Traffic signal cables

ROAD/STREET	UTILITY PROVIDER	SERVICE UTILITY
	Cable & Wireless UK	Apparatus/cables along west side of street
	BT	Apparatus/cables along both sides of street
	NIE	mV, 6.6kV, 11kV and 33kV underground cables adjacent to and crossing road
	Phoenix Natural Gas	1 no. medium pressure gas main of 250mm on eastern side of street and 1 no. historical gas main of unknown size on west side of street
	Eircom UK	Apparatus/cables along west side of street and crossing street
	Virgin Media	Apparatus/cables along east side of street and crossing street
Great George's Street	NI Water	1 no. combined sewer of 550mm diameter in middle of road that narrows to 500mm adjacent Little York Street and 1 no. collection sewer of 100mm diameter on west side of road
	NI Water	1 no. distribution water main of 125mm diameter on west side of road
	Roads Service	Street lighting cables and associated lighting columns
	Roads Service	Traffic signal cables
	BT	Apparatus/cables along both sides of street
	Phoenix Natural Gas	1 no. medium pressure gas main of 315mm diameter and 2 no. historical mains on west side of road
	NIE	mV, 6.6kV, and 33kV underground cables adjacent to and crossing road
M2/M3 (Lagan Bridge)	Roads Service	Street lighting cables and associated lighting columns
	Roads Service	Motorway communication cables

2.4.6 Land Ownership

A summary of the information available from Land and Property Services Northern Ireland (LPSNI) for the area under consideration, correct as of December 2008, is shown in Figures 2.4.15 and 2.4.16.

2.5 Environmental

2.5.1 Introduction

The study area is located within North Belfast, close to the docks area and lowest reach of the River Lagan, set within an almost exclusively urban setting. Belfast City itself lies at the head of Belfast Lough, flanked by the gentle slopes of the Castlereagh and Holywood Hills to the east and the basalt escarpment of the Antrim Plateau to the north-west, which

constrain the development within Belfast, both urban and green field. Significant private and public investment has led to considerable urban renewal, improved infrastructure and significant new urban housing over the past thirty years, with the Waterfront and Laganside areas particularly benefiting from this regeneration.

Belfast is the capital city of Northern Ireland and the largest hub on the regional transport system. The city occupies a strategic location on the Eastern Seaboard Key Transport Corridor, serving as a regional gateway with important links to other European cities. The railway services for Northern Ireland, and cross border link to Dublin are served from Belfast, via Central and Great Victoria Street Stations. The Belfast area has good road communications with other main centres of population within the province, with a number of routes radiating from the city, including the M1, M2 and M3 motorways.

2.5.2 Historical

With reference to the Belfast Area Metropolitan Plan (BMAP) - Draft Plan 2015, the origins of Belfast can be traced to the early 13th Century, where a small settlement originated at the mouth of the River Lagan. This settlement began to develop as a market place and port during the 17th and 18th Centuries, with the development of the manufacturing industry increasing the growth of the settlement towards the end of the 19th and beginning of the 20th centuries. Belfast was granted city status by Queen Victoria in 1888. Principal industries around this time were linen, shipbuilding, tobacco and heavy engineering. Belfast prospered and by 1901 was the largest city in Ireland, with one of the largest shipyards in the world.

Whilst the character of the study area is currently dominated by the impacts of a modern transportation network, character is also defined by a strong link to Belfast's industrial past which still bares a significant mark on the urban fabric. The early development of the study area owes itself to the Industrial Revolution when the city expanded northwards as a consequence of the developing docklands. New streets were built in the area at this time, with names such as Pilot, Trafalgar, Nelson and Dock Street, giving a broad indication of the significance of this area in relation to its maritime legacy. The connection to the maritime past remains to this day with buildings such as St George's Church (built in 1819), Sinclair Seamen's Church (built in 1853) and The Harbour Commissioners Office (built in 1854) reflecting the historic use of the area and the connection to the docklands. All of the aforementioned buildings are architecturally Listed, however the most significant of these is The Harbour Commissioners Office situated in Corporation Square where Belfast's shipbuilding industry grew from and remains the home of the Belfast Harbour Commissioners.

The character of the study area is also defined by one of Belfast's oldest surviving pieces of maritime heritage, Clarendon Dry Dock No. 2, which is still in working order over 180 years after it was built on the site of the city's first shipyard. Clarendon Dry Dock No. 1 was completed in 1800, followed in 1826 by Clarendon Dry Dock No. 2, where the Victoria (a ship used for survey work and maintenance of the navigational lights and fog horns of the port) is still serviced and repaired and the dry dock is still operated by the same Victorian engineering design features. At the time of completion in 1826, the port handled 210,000 tonnes of cargo.

Due to the expanding docklands and industrial development, Belfast became the fastest growing urban centre in the United Kingdom, with its population rapidly increasing from

19,000 in 1801 to well over 70,000 in 1841. York Street has been a main thoroughfare of Belfast since the early 19th Century, developing from a residential district into an industrial zone, once home to two industrial enterprises that were the largest of their kind in the world; Mulholland's York Street Mill and Gallagher's tobacco factory. The linen mill was founded in the early nineteenth century by Thomas Mulholland and his sons, and the tobacco factory founded in 1867 by Thomas Gallagher, both contributing greatly to the surge of people into this area. At the time, York Street was also a main shopping area and another notable York Street establishment was the foundry of John Rowan and Son.

The principal industries in Belfast during the 19th century were linen, shipbuilding, tobacco and heavy engineering, all of which have contributed greatly to the character of the study area.

2.5.3 Port of Belfast

The Port of Belfast is Northern Ireland's principal maritime gateway, serving the Northern Ireland economy and increasingly that of the Republic of Ireland. About 60% of Northern Ireland's seaborne trade and 20% of the entire island's is handled by the Port which receives over 6,000 vessels each year.

The Port is also a major centre of industry and commerce, its Harbour Estate is home to some of Northern Ireland's most important urban regeneration projects and it is the region's leading logistics and distribution hub.

With 1.2 million passengers and half a million freight units annually, Belfast is Ireland's busiest ferry port. It is also the island's leading dry bulk port, dominating the market with regard to imports of grain and animal feeds, coal, fertilisers and cement, and exports of scrap and aggregates. Over 95% of Northern Ireland's petroleum and oil products are also handled at the Port.

2.5.4 George Best Belfast City Airport

George Best Belfast City Airport is owned by ABN AMRO Global Infrastructure Fund. It is a regional airport serving a range of destinations, mainly in Great Britain and Ireland. Situated on the south shore of Belfast Lough adjacent to the A2 Sydenham bypass, one of the main arterial routes into the city, the airport has grown significantly in recent years and is a key strategic gateway to the province. The airport currently caters for over 2.5 million passengers per year, representing approximately 40% of the scheduled domestic air traffic to and from Northern Ireland.

It first opened as a commercial airport in 1938 and was launched as the Harbour Airport for commercial traffic in 1983. The new terminal opened in June 2001 and in 2005 there were just over 2.2 million passengers through the terminal.

The primary market is the short haul scheduled services sector accounting for 54% of the Northern Ireland population and business passengers account for 65% of the market.

2.5.5 Local Context

Located at the southern end of one of the main routes (York Street/York Road/Shore Road) in Belfast, the study area is centred on the northern fringe of the city centre. The area is very much a degraded urban landscape; however has attributes and features reflective of the ever-changing face of Belfast, from the Industrial Revolution through to contemporary 21st Century developments.

At the core of the study area, the main characteristic is its legacy of 20th Century transport planning which has changed the urban fabric, to achieve not only easier traffic movements around the periphery of the city, but to essentially act as one of the primary road transportation hubs for the Province, providing a northern gateway to the city. As such the area is dominated by large scale physical infrastructure features, such as the Lagan and Dargan Bridges which have caused a certain degree of severance, disconnecting the city centre from the western docks and ferry terminal. Also part of this transportation legacy, is the Westlink which due to its at-grade intersection with York Street, disrupts the continuity of this route. Much of the land in the core of the study area is either Brownfield or currently in use as city car parking space.

The periphery of the study area is also very much reflective of the ever changing face of the Belfast urban fabric, providing not only evidence of previous historical land uses but also how buildings and sites with strong historical links to Belfast's industrial past (in particular shipbuilding) still contribute significantly to character, cultural heritage and to continued development through their current use.

2.5.6 Industry

Belfast currently has a broad base of service industries, with 83% of people employed within this sector in 2001. The manufacturing industry within the city has declined in significance in recent years, with reduced employment opportunities within this sector. Nevertheless, the manufacturing sector accounted for 76% of total exports in 2006. Key employers within Belfast include Bombardier Aerospace, Queens University and the Belfast Health and Social Care Trust.

As mentioned previously, the study area has a strong industrial heritage, based around traditional industries such as shipbuilding, tobacco and heavy engineering, but while these industries have suffered decline from an increasingly competitive international market, the area has adapted and changed with the times. This is particularly reflected in the restoration of the Clarendon Dock area in 1993 into one of Northern Ireland's most prestigious business parks, currently housing offices and apartments and is home to a range of national and international companies. These include Laganside Corporation, Tesco, Lagan Holdings, W & R Barnett Limited, Grant Thornton, Capita, Department of Education (NICCEA) and Regus. The redevelopment of the Clarendon Dock area is still ongoing.

Although the study area has seen significant changes in the type of industry providing the main employment base, it has remained a focal retail centre. Of particular significance is the Cityside Retail Park (formerly Yorkgate) which is a major employer and important retail, service and district centre for the surrounding area. Of particular significance is the link to the industrial past, as the expansive site of the retail park was once home to York Street Mill and Gallagher's Tobacco Factory. At present businesses located within the retail park

include, Tesco, Asda (living), New Look, Movie House Cinema, Burger King, Arena Leisure, Peacocks and Sports Direct, amongst others.

Yorkgate Business Park is situated on a thin strip of land between the M2 and York Street. Located opposite the Cityside Retail Park. Phase I was completed in January 2007 at a cost of £2M. Galway House (Phase I) is the first of four buildings to be built on the site, providing retail space on the ground floors and office space above, currently housing The Golf Centre and Unison (Public Sector Union).

2.6 The 2005 Reports

In 2005, Scott Wilson published a report that examined a range of options to improve the efficiency of the "at-grade" York Street junction. This examination involved a staged approach that dealt with the short, medium and long term solutions. This work focused on traffic control measures and major junction remodelling. However, the brief was specific in its requirement to only consider partial grade separation with links and ramps considered under the existing structures.

The results of the assessment into possible traffic control measures are contained in a report entitled "M1/Westlink/M2/M3 York Street Improvements Traffic Management Options Final Report" dated June 2005. The possible traffic management measures identified in this report involved accommodating additional traffic lanes into the constrained existing junction but this solution was on the margins of acceptability, involving very tight road geometry and potentially adverse impacts on pedestrians.

The possible long term solution involved completely remodelling the existing junction to introduce grade separation. The assessment concluded that a solution was feasible within the constraints of the site. If constructed, it would provide continuous links in all key directions, with the exception of the link from the M3 north-bound carriageway to the Westlink south-bound carriageway. The results of this assessment were published in a report entitled "York Street Interchange Preliminary Appraisal Report" dated December 2005.

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