TRANSPORT AND WORKS ORDER ACT 1992

PLANNING (LISTED BUILDINGS AND CONSERVATION AREAS) ACT 1990

TRANSPORT AND WORKS
(INQUIRIES PROCEDURES) RULES 2004

THE NETWORK RAIL (ORDSALL CHORD) ORDER

VOLUME 2: MAIN PROOF OF EVIDENCE

ENGINEERING & CONSTRUCTION

Roger Colton

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1. INTRODUCTION

1.1 Personal Details

1.1.1 My name is Roger Colton. I am a Director of RCC Consulting Ltd. I am a Chartered Civil Engineer (CEng), a Fellow of the Institution of Civil Engineers, a Member of the Chartered Institute of Highways and Transportation and a Member of the Permanent Way Institution.

1.1.2 I have worked in the field of civil, structural and geotechnical engineering for 50 years in the UK and internationally. I have worked in the rail sector for the past 20 years 8 of which I was employed by Network Rail (NR) and for the past 4 years as a technical consultant to them and other clients on new and upgrading rail schemes.

1.1.3 My rail sector experience has covered the feasibility, preliminary and detailed design and construction of stations, bridge structures, tunnels, line of route infrastructure for sections of the Hong Kong Airport Railway and extensions to the Hong Kong Mass Transit Railway, new railway projects for Network Rail at North Doncaster, Hitchin, Stafford and Norton Bridge and the modernisation of rail infrastructure for the West Coast Mainline, Evergreen 3 and Thameslink.

1.1.4 I was contracted by NR in January 2011 to review all the GRIP 2 civil engineering reports for the Northern Hub project which included the reports for the Ordsall Chord and associated links to Manchester Victoria and Manchester Piccadilly stations. Subsequently I undertook a role with the project team and consultants in progressing the engineering feasibility and
preliminary design of the Ordsall Chord proposals and I have since been retained by NR in a reviewing and advisory role through the design iterations and production of the Proposed Scheme and consideration of alternative alignments.

1.1.5 I am presenting this engineering evidence on behalf of NR.

2. SCOPE OF EVIDENCE

2.1.1 My evidence concerns the development of options and chosen design of the Ordsall Chord and its associated structures, constructability of the Proposed Scheme and the engineering constraints imposed on the design. I will also address why certain apparently feasible alternatives proposed by objectors do not meet operational and functional criteria or standards.

3. SCHEME DEVELOPMENT AND GRIP 2 (PRE FEASIBILITY)

3.1.1 Section 4 of the NR Statement of Case sets out the work undertaken by NR prior to commencement of the engineering feasibility studies, the design for the GRIP 2 study and that the Ordsall Package should be core project for the central Manchester scheme to link Manchester Victoria to Piccadilly.

3.1.2 The GRIP 2 pre-feasibility work was undertaken by Mott Macdonald (MM) under contract to NR. At the outset of this work MM were instructed to avoid the Middlewood Locks development site in the presentation or consideration of feasible options. This is referred to in Duncan Law’s Proof of Evidence. This restriction was not lifted until January 2013 upon the release of HS2
Phase 2 reports which identified Manchester Piccadilly as the terminus station.

3.1.3 The conclusion of the GRIP 2 report was that 3 options (6, 7 & 8) for the chord line should be taken forward for further consideration. A sub option (10b) to allow for a mainline connection to MOSI was also recommended for further study.

3.1.4 The 3 options identified for the chord line at that stage all directly impacted upon Stephensons Bridge in a manner that would not require its demolition but would rely upon it for partial abutment support as the chord line crossed the River Irwell. These options are shown in Appendix A.

3.1.5 The GRIP 2 study output identified the constraints within which a chord line was feasible from an engineering perspective. These were;

- rail connections to the Chat Moss and Castlefields viaducts
- crossing Stephensons Bridge
- crossing the River Irwell, and
- crossing the Manchester Salford Inner Ring Road.

3.1.6 The reports considered that the removal of Prince’s bridge would be required. and also discussed structural form possibilities for the crossings but made no recommendations of bridge types or spans.

3.1.7 The option for the MOSI connection was based on an assumption, without the benefit of detailed topographical surveys, that the vertical alignment of the existing connection at a possible crossing point was similar to that of the
adjacent Castlefield viaduct. However this option requires that at the crossing point the chord line should ideally be straight and with no cant\(^1\). The alignment design for the chord line was not sufficiently developed at GRP 2 level of study to confirm if this was feasible and meet all other constraint issues. This option could only provide a mainline connection but could not permit the operation of the internal railway service.

3.1.8 A further study was undertaken for a MOSI connection but this was based upon a link towards Salford Central and connected only to the southern sidings within MOSI. This link would require a separate bridge structure crossing the River Irwell and a widened bridge structure over the Inner Ring Road. This connection would also not permit the operation of the internal railway service.

4. **OPTION SELECTION (GRIP 3)**

4.1.1 Parsons Brinckerhoff (PB) were contracted by NR to undertake the GRIP3 preliminary design work for the Ordsall Chord and the required works along Castlefield corridor, remodelling of Manchester Oxford Road station and additional platforms at Manchester Piccadilly station.

4.1.2 The output from the GRIP 2 study was the baseline for the next stage of preliminary design with a requirement to also review and optimise all previous work.

\(^1\) Cant: - Difference in level between rail head centres of a curved track.
4.1.3 Additionally a study was undertaken to determine the optimum line speed for the chord to accommodate the capacity requirement that the core Manchester projects should provide, this was then set at 30mph.

4.1.4 Based upon feedback from stakeholder and public consultations on the option alignments recommended in the GRIP2 reports a requirement was introduced to avoid any direct impact upon Stephenson’s Bridge.

4.1.5 This requirement had a major impact upon the Ordsall Chord scheme footprint. Early development work showed that this could only be achieved by impacting with the Liverpool Road flats (Woolham Place). This was deemed undesirable and so further iterative design alignments resulted in the connection point with Castlefield viaduct starting further towards Oxford Road and widening the viaduct to accommodate a southward slew to enable the curvature of the chord line to physically avoid direct impact upon Stephenson’s Bridge and the Liverpool Road flats.

4.1.6 With this line speed set it is possible to determine minimum radii of track curvature, sight lines for signalling and train standage requirements.

4.1.7 Having established a basic alignment option PB were able to consider structural options for crossing Water Street, the approach to Stephenson’s Bridge approach arches, crossing the River Irwell and the Inner Ring Road.

4.1.8 Further alignment design iterations took account of introducing maximum curvature or straight track across the major bridge structures crossing the River Irwell and the Inner Ring Road and more efficient alignment approaches to Castlefield and Chat Moss viaducts.
4.1.9 The outcome of the iterative design process is the production of the Proposed Scheme.

5. DESCRIPTION OF PROPOSED SCHEME

5.1.1 The Planning Drawings of the Proposed Scheme are contained within the Order. The following is a brief description of the project with extracts of the Order plans included to aid the description.

5.1.2 The proposed Ordsall Chord is elevated throughout, supported on either modified existing structures or new structures with associated overhead line equipment, plant, junction equipment and signalling. The Chord line will link two existing railway lines, these being the Bolton line between Ordsall Lane junction and Castlefield junction (situated on the Castlefield Viaduct) and the Chat Moss line, between Ordsall Lane junction and Deal Street junction (situated on the Middlewood Viaduct). The Ordsall Chord will comprise 30mph twin tracks and the junctions at each end are designed to permit parallel movements. An overall plan of the Proposed Scheme is attached at Appendix B.

5.1.3 The chord works can be split into six distinct sections:

- Area 1 – Castlefield;
- Area 2 – Water Street Area;
- Area 3 - Stephenson’s Bridge Approach;
- Area 4 - River Irwell Crossing and Trinity Way;
- Area 5 – Middlewood (L&MR) Viaduct;
Area 6 – Salford Central; and

New signalling and overhead line electrification structures

5.1 Area 1: Castlefield

The first components of the Ordsall Chord development consist of new signal and overhead line gantries and track realignment situated on top of the existing Castlefield (MSJ&AR) Viaduct. This viaduct carries the Bolton lines, a double rail track.

5.1.1 The arches beneath are each numbered for reference purposes (referred to as COL). At COL 117, the south west side of the viaduct will be widened between the Castlefield Basin and the River Irwell. This widened section will be constructed adjacent to the existing brick viaduct masonry arches and will accommodate the realigned Bolton lines, the turn out for the new Ordsall Chord lines and their associated (700mm wide) maintenance walkways. The
new structures will consist of pre-cast reinforced concrete piers with a pre-cast concrete arch and spandrel above.

5.1.3 The architectural concept of the arch widening is referred to in the Proof of Evidence of Peter Jenkins but in engineering terms the external facade of the widened section will be inclined by circa 10-15 degrees (from vertical) and the piers and arches will follow the shape and pattern of the existing brick viaduct piers and spandrels behind. However, the new arch spans will be situated approximately 100mm higher than the existing, resulting in visibility of the existing brick structure behind. The existing brick parapets of the Castlefield Viaduct will be partially removed to accommodate the new track alignments and associated ballast. The replacement parapet (again inclined at circa 10-15 degrees) will consist of a painted steel finish. Grouted steel anchors will be used to connect the new structures to the existing structure to provide increased stability for narrow sections of widening.
5.2 **Area 2: Water Street Junction**

![Figure 2: Area 2: Water Street Junction](image)

5.2.1 The existing Grade II listed Cast Iron Bridge (located at COL 125A on Water Street) which is listed with the Castlefield Viaduct, will be removed and replaced by two new metal ‘half through' bridge structures, each separately spanning Water Street. The existing bridge being a cast iron structure cannot be widened in materials consistent with its current design to accommodate the extent of widening required.

5.2.2 The southern bridge will carry the new realigned Bolton lines which continue on the Castlefield Viaduct, and the northern bridge the Ordsall Chord lines.
Minimum headroom to the Water Street carriageway will be maintained under both bridge structures.

5.2.3 The northern bridge spanning Water Street, carrying the Ordsall Chord lines, will also span a former cattle ramp which extends along the back of the pavement on the north side of Water Street. This cattle ramp forms part of the 1830’s Viaduct and was constructed to provide direct access for cattle stored in the arches below to the platform above, where they could be loaded onto trains. The chord will continue after this abutment on a series of piers across the car park site, until it meets the south elevation of the 1830’s Viaduct. The piers of this part of the structure have again been designed so that they align with the piers of the existing Grade II listed 1830’s Viaduct allowing visibility of the existing viaduct openings and enabling them to be brought back into use in future.
5.3 Area 3: Stephenson’s Bridge Approach

The new Chord will cross the existing 1830’s Viaduct arches between Water Street and Stephenson’s Bridge. The existing structure consists of a series of arch vaults supported on brick piers. It was extended in the 1860’s on its north side (referred to as the Zig Zag Viaduct) to provide additional arches and storage space and supports a rail connection which leads into MOSI. The adjoining structures are separated in the middle by an open walkway.

5.3.2 Where the Chord crosses the 1830’s Viaduct, it will saddle the existing structure which is retained beneath. However, to accommodate the development proposals, the existing structure will need to be strengthened. This will specifically entail the strengthening of existing piers through cored
piles with concrete saddling above the existing arch barrels. A part section of this strengthening arrangement is shown below in Fig 4. In total, 4 arch spans of the 1830’s Viaduct will be crossed by the chord. However, given the structural interaction between adjacent spans, all spans between Water Street and Stephenson’s Bridge will be strengthened. Areas of re-pointing and brickwork repairs will also be required to this structure. Given the historic nature of this structure, the strengthening proposals will be developed in such a way as to minimise disruption to its external appearance. In this regard I refer to Peter Jenkins Proof of Evidence.

5.3.3 The alignment of the proposed Ordsall Chord on top of this structure will remove the existing rail lines which connects the former Liverpool Road Station with the mainline network. At the upper level, installation of a buffer stop and security fencing is proposed. Removal of existing tracks will be necessary during the construction period and subsequently reinstated up to the edge of the new viaduct.
Partial demolition of the Grade II listed Zig Zag Viaduct attached to the north side of the 1830’s Viaduct, is required to enable the construction of the River Irwell Bridge and its abutment. Four vaults (including the Manchester abutment of the Girder Bridge) will be demolished and replaced by a concrete buttress wall and three new vaults to reflect the stagger of the existing vaults and the Manchester abutment to the Network Arch.; Strengthening works and fabric repairs will be carried out to the remaining part of the structure.
5.4 Area 4: River Irwell Crossing and Trinity Way

A single span Network Arch bridge will be constructed over the River Irwell connecting the southern abutment with the north west bank. The shape of the structure will be inclined on the outside face to provide interest to this structure when viewed from different positions. Painted steel is proposed for the main metallic component parts of the new bridge structure. Stainless steel bars are proposed for the hanger arrangements and connections to the arch. The deck is proposed to be concrete/steel composite construction. Reinforced concrete will be used to construct the new abutments. I refer to Peter Jenkins Proof of Evidence with regard to the architectural description.
5.4.2 Because of its alignment and height, the Ordsall Chord will require the removal of the Grade II listed Girder Bridge and Prince’s Bridge. This will be replaced by a new bridge for pedestrians and cyclists will pass beneath the Network Arch.

5.4.3 On the northwest bank, the Network Arch will tie into the half through bridge spanning Trinity Way. The abutments on the northwest bank will be located between the River Irwell towpath and Trinity Way and will again be angled at circa 10-15 degrees. This will provide continuity to the design along its length and ensure the abutments complement the overall external appearance of the structure. A curved clad element attached to the two faces of the north bank abutment will provide a visually seamless connection between the design approach of the Network Arch Bridge and that of the proposed Trinity Way Bridge.

5.4.4 The main metallic component parts of the new bridge structures over Trinity Way will be painted steel. The deck will be concrete/steel composite whilst reinforced concrete will be used to construct the new abutments, bearing shelves and abutment widening. As the structure is a half through bridge, 4 piers will be required to provide structural support as it crosses Trinity Way. A concrete containment barrier is required on the carriageway facing side of each of the piers in line with highway safety standards.

**REPLACEMENT PEDESTRIAN AND CYCLE BRIDGE**

5.4.5 The existing Prince’s Bridge which crosses the River Irwell will need to be demolished to allow the new Network Arch to be constructed. A new
footbridge at the same location as the current structure is proposed. The existing location has been retained on the basis that it aligns with current desire lines and approach infrastructure.

5.4.6 The design of the replacement pedestrian bridge will consist of walkways cantilevered off each side of a central beam with relatively open balustrades encouraging views across to Stephenson’s Bridge. This deck will give the bridge a very slender profile. The balustrades will have handrails at appropriate height for cyclists and pedestrians, with a wire-infill detail.

5.4.7 The bridge at its landing points will be supported by concrete cantilevers cut into the existing Prince’s Bridge abutments, retained to provide a memory of the former structure. Also retained will be the piers at either end of the existing trusses, with their plaques on each bank.

REPLACEMENT UTILITIES BRIDGE

5.4.8 The existing Prince’s Bridge pedestrian and cycle bridge carries utilities across the River Irwell. A new bridge located next to the Castlefield Bridge on the inner ring road to carry the diverted utilities is to be constructed. This new bridge is referred to as the utilities bridge in the TWAO documents. This bridge will mimic the structural form and appearance of the road bridge, whilst retaining separation between the two. The details of the design are governed by the requirements of the utilities companies, including a combination of cable routes and some large pipes and the requirements of Manchester and Salford City Councils.
5.4.9 This bridge also provides an opportunity for a temporary diversion route for the pedestrian and cycle routes between the demolition of Prince’s Bridge and the replacement bridge.

5.5 Area 5: Middlewood (L&MR) Viaduct

![Figure 6: Area 5: Middlewood (L&MR) Viaduct](image)

Figure 6: Area 5: Middlewood (L&MR) Viaduct

5.5.1 Once the proposed Ordsall Chord has crossed Trinity Way, it will tie into the east side of the existing Middlewood Viaduct. This viaduct carries the Chat Moss lines, a double rail track with adjacent currently redundant track bed,
and the arches beneath are each numbered for reference purposes (referred to as DSE). The existing arches of the viaduct are to be retained except for the east half of DSE 146 (14-19) where the new structure ties into the existing viaduct. Widening of the existing masonry arches will also be required to the north of this along with the removal of sections of the parapets at arches DSE 146 (20-33). The existing DSE 146 (19A) riveted metallic girder bridge span and skewed brick parapet will be replaced by a precast filler beam concrete slab deck.

5.5.2 Widening is also required on the west side of the Middlewood (L&MR) Viaduct at the north corner of the Middlewood Locks site where it meets the Manchester Bury & Bolton Viaduct (DES 146).

5.5.3 The widened sections will comprise in situ reinforced concrete piers at ground level, with precast concrete arches and spandrels at track level which will be inclined outwards from the arch, providing a consistent approach to the overall scheme design. A steel parapet facade is proposed to ensure consistency throughout. A cantilever walkway is proposed on the east of the Viaduct to enable access for maintenance and inspection.
5.6 Area 6: Around Salford Central Station

The Chat Moss lines currently pass through Salford Central Station and connect into the Salford lines at Deal Street Junction. In this section, the new Ordsall Chord lines will occupy a section of the redundant track on the Middlewood Viaduct structure. New ballasted track will be installed in this location with a turnout to connect the new Ordsall Chord line to the Chat Moss Lines. The Chat Moss lines will be realigned to the north of their existing alignment (over the widened section) and will then extend through the central redundant platforms at Salford Central Station. Passive provision for future platforms at Salford Central has formed part of the design process.
5.7 New signalling and overhead line electrification structures

5.7.1 The application site falls within an area covered by the North West Electrification Project (NWEP). The NWEP Works are required in order to meet the UK Government’s commitment to install 25kV Overhead Line Electrification (OLE) on more of Britain's rail network as set out in the document entitled ‘Britain’s Transport Infrastructure: Rail Electrification’, published by the Department for Transport in July 2009. Most of this work will be completed prior to completion of the Proposed Scheme but where possible the designs will be integrated to minimise rework.

5.7.2 The Ordsall Chord will be a new section of double track electrified railway that forms a connection between the existing Bolton lines, north of Castlefield Junction to the Chat Moss lines at Salford Central Station. The Northern Hub electrification of Ordsall Chord will interface directly with NWEP Phase 1 & 2C works. As the Ordsall Chord will be electrified, a series of overhead line equipment (OLE) structures are proposed. At present, there is no OLE provision in the area; however as part of a wider NWEP programme detailed above, OLE equipment will be installed as part of Phase 1. The key challenge for the design of the OLE is to ensure that both lines which Ordsall Chord links together will have been electrified under the aegis of NWEP by the time Ordsall Chord is constructed.

5.7.3 The relevant part of the North West Electrification Project (NWEP) consists of the following routes Phases:
5.7.4 Phase 1 December 2013: Castlefield Junction – Ordsall Lane Junction – Chat Moss – Parkside Junction – Lowton Junction, to permit direct electric services from Glasgow to Manchester Airport.

5.7.5 Phase 2 December 2014: Phase 2A: Waterloo Branch Junction - Earlestown East Junction; Phase 2B: Huyton Junction – St Helens Central – Springs Branch Junction; Phase 2C: Ordsall Lane Junction – Manchester Victoria and Windsor South Junction – Deal Street Junction; to permit electric services from Liverpool Lime Street to Manchester Victoria, Manchester Piccadilly and Preston

5.7.6 Phase 3 December 2015: Preston North Junction – Blackpool North (including remodelling & resignalling): to permit direct electric services from London Euston and Liverpool to Blackpool North.

5.7.7 Phase 4 December 2016: Ordsall Lane Junction & Windsor South Junction – Bolton – Lostock Junction - Euxton Junction: to permit electric services from Manchester Victoria & Manchester Piccadilly to Preston, Blackpool North (via Bolton) and Glasgow Central (via Bolton)

5.7.8 Phase 5 December 2016 Manchester Victoria to Stalybridge (first route segment forming part of North Transpennine Electrification Project): Stalybridge Feeder Station energised: to permit electric services from the west through Manchester Victoria to terminate at Stalybridge.

5.7.9 As part of the NWEP Project, Network Rail have begun to install OLE support structures OLE structures along Castlefield Viaduct as part of NWEP Phase 1. The remainder of the Phase 1 and 2C Structures will be
installed in 2014 prior to the implementation of the TWAO Order. Therefore, the proposals for OLE as part of the Ordsall Chord development have taken account of this existing provision, and relate to the net new requirement only.

6. CONSTRUCTION METHODOLOGY

6.1 Procurement

6.1.1 Network Rail has concluded that the method of delivery of the works will be by a construction alliance. This is a contractual arrangement between Network Rail, a construction contractor and engineering consultant, signalling, trackwork and electrification contractors.

6.1.2 Network Rail will enter into separate contracts with each of the statutory undertakers for provision and diversion of services, as required, by the works to deliver the scheme.

6.2 Programme

6.2.1 Network Rail, during the development of the scheme, built up an outline methodology and programme for the construction of the works. This facilitated discussion with rail stakeholders (principally train operators) to agree access to the operational network to facilitate delivery of the scheme.

6.2.2 The methodology has been agreed in principal with the necessary stakeholders and is subject to a detailed programme review by the newly formed construction alliance.
6.2.3 Subject to the TWAO being granted by the end of November 2014, Network Rail is looking to commence main works on site in January 2015.

6.2.4 Following granting of planning permission in November 2013, works have commenced at the north side of Castlefield bridge adjacent to Trinity Way Road for the construction of a pedestrian and cycle-bridge which will carry the service diversion routes away from Princes Bridge. Works commenced on site in February 2014 with completion of bridge and service diversions scheduled for December 2014.

6.2.5 Network Rail decided to carry out these associated works separately to minimise any potential impact on the main construction works. Similarly, a programme of utility diversion works has been agreed and commissioned with statutory undertakers. This is due to commence in the of Spring 2014 with completion by Winter 2014.

6.3 **Utilities diversions**

6.3.1 It has been identified during the design process that there are utilities at or in the vicinity of the proposed works which will require diversion prior to commencement of the main works.

6.3.2 Liaison with statutory undertakers has taken place to agree a methodology and programme for diversions necessary.

6.3.3 Road, lane and footpath diversions will be required for reasons of safety. Coordination with the Regional Centre Portfolio Manager and his team and the Manchester Streetworks Panel will continue.
6.3.4 A Location plan, list of utility diversion works at each location together with road closures, lane closures and impact on residents and business, programme and durations is attached at Appendix C:

6.3.5 As with all civil engineering projects, during the course of works unidentified services may be encountered. Any previously unidentified services will be diverted by the statutory authorities and will minimise further impacts on residents and business.

6.4 Site Compounds

6.4.1 Proposed compounds and locations are shown in the Order.

6.4.2 The Order will require Network Rail to compensate affected owners in accordance with the Code which applies to all compulsory purchase in England and Wales.

**Compound 1**

6.4.3 Compound 1 will be the main compound used to facilitate construction of the Ordsall chord, and will contain the main site office and welfare facilities.

6.4.4 The site is south of the Castlefield (MSJ & R) Viaduct, currently occupied by the Big Yellow warehouse. In addition to welfare facilities that will be located at this site, the compound will be required to carry out works to widen the Viaduct on the south elevation and to assemble and install the bridge replacing the existing bridge over Potato Wharf.

6.4.5 To establish Compound 1, demolition of existing buildings on the site will be required. Works will be carried out during normal day time working.
Compound 2

6.4.6 Compound 2 is also located south of the Castlefield (MSJ & R) Viaduct between Water Street and the River Irwell. The compound will be used to widen the viaduct between Water Street and the River Irwell, facilitate access to the Nikal site, material storage and assembly of the replacement Water Street bridges.

Compound 3

6.4.7 Compound 3 is located between Water Street and the River Irwell and South of the Marriott Hotel.

6.4.8 The compound will be utilised for material storage and handling, fabrication and erection by crane, of the network arch.

Compound 4

6.4.9 Compound 4 is located north of the River Irwell bordered by Trinity Way.

6.4.10 The compound will utilised for provision of welfare and site office accommodation, storage of materials, positioning of plant to construct foundations and the bridges over Trinity Way.

Compound 5

6.4.11 Compound 5 is located within the Middlewood area adjacent to the Viaduct.

6.4.12 The compound will be utilised for welfare and site offices accommodation, storage of materials, positioning of plant and equipment for construction of foundations and structures for the widening of the viaduct.
6.4.13 The area will also be utilised for the lifting of rail infrastructure materials to the viaduct.

6.5 Impacts

Traffic

6.5.1 I refer also to Proof of Evidence of Jim Pearson

6.5.2 Water Street is an important route for Compounds 1 (estimated 700 vehicle movements), 2 (estimated 600 vehicle movements), 3 (estimated 2,000 vehicle movements) and 4 (estimated 3,400 vehicle movements). The cumulative impact is likely to cause inconvenience.

6.5.3 Construction vehicle impacts are managed through the implementation of a Traffic Management Plan (TMP) as required in the DPP in Schedule 1: Condition 6: Code of Construction Practice: Condition 6(ii) (d).

6.5.4 The TMP is an important document in mitigating the potential disturbance of this activity.

6.5.5 Prevention of mud from the construction site being deposited on local roads will be controlled by wheel washing and road sweeping as required.

Noise

6.5.6 In this issue I refer to Proof of Evidence of Jim Pearson and Alec Glendinning.
6.5.7 Lighting will be installed at compounds for security Nuisance Management Plan, as required in the Deemed Planning Permission (DPP) in Schedule 1: Condition 6: Code of Construction Practice (CoCP): Condition 6(ii) (e), will address the potential for light pollution with attention paid to directional and downward pointing floodlighting.

6.6 Castlefield Viaduct Widening

6.6.1 Standard Daytime Works - March 2015 to December 2015

During this period, compound 1 will be used as the working area to widen the existing Castlefield viaduct to the west. This will involve extending arches on the viaduct from Water Street to Potato Wharf. This work will be during the daytime standard working hours of 08:00 to 18:00 (Mon to Fri); 08:00 to 13:00 (Sat) with 30 minutes either side of the start and finish to setup, close down and clean the working site.

6.6.2 Appendix D shows the proposed locations and extent of the arch widening. The majority of this work will be completed from Compound 1 (including the widened structures from Water Street down to the Youth Hostel).

6.6.3 At the same time, three arch extensions will be constructed immediately adjacent to 133 Liverpool Road. This is also shown in Appendix D. It also includes the temporary use of Area C on the east of Castlefield viaduct.

The works will involve:
6.6.4 This will involve concrete finishing works, snagging works and site clearance. There is also likely to be some high level works on the Ordsall Chord structure across Water Street. Due to the separation between this worksite and the operational railway on the Castlefield Viaduct, this can be completed during the day and should not significantly affect the residents at Woollam Place, Liverpool Road and Potato Wharf Apartments.

6.7 Impacts

Local residents

6.7.1 The southern end of the Ordsall Chord, and its link into the existing Castlefield viaduct, must be constructed in the vicinity of a number of apartment blocks including Liverpool Road apartments and Woollam Place apartments. To a lesser extent the apartments on Potato Wharf Road east of the existing Castlefield viaduct and the Potato Wharf apartments to the west could potentially be impacted by construction activities in Compound 1 and widening of the Castlefield viaduct on the west side (see Appendix D).
6.7.2 The street which runs between the Castlefield viaduct and The Liverpool Road Apartments will be closed in order to facilitate the widening eastwards of the viaduct. Alternative routes of access are available.

6.7.3 It is envisaged that methods could be employed for the arch widening works which reduce the extent of disruption to the spaces beneath the arches, which are used for parking by residents. Should arch strengthening be required, the works will be within the arches themselves and parking amenity will be temporarily lost.

6.7.4 I refer also to the Proof of Evidence of Jim Pearson and Alec Glendinning.

YHA

6.7.5 Powers of temporary access or occupation are required in relation to land used for parking which is needed for construction and access purposes.

6.7.6 The YHA will be compensated for this disruption and alternative parking provided as appropriate.

6.7.7 Pedestrian access to the YHA will be maintained throughout duration of works.

6.7.8 I refer also to the Proofs of Evidence of Jim Pearson and Alec Glendinning.

Royal Mail

6.7.9 Widening of the Castlefield viaduct necessitates relocation of the Post Box adjacent to Hobbs Cafe, on Water St.
6.7.10 Network Rail and The Royal Mail have entered into a separate legal agreement regards costs associated with relocation of this asset and any potential impact on

Giant’s Basin parking at Potato Wharf owned by C&Rt (21 & 31 on land plans)

6.7.11 Powers of temporary access or occupation are required in relation to land used for parking which is needed for construction and access purposes.

6.7.12 The landowner will be compensated for this disruption and alternative parking provided as appropriate

6.8 Works Connected to the Existing Railway

6.8.1 The works previously described are the main works that will be completed without any disruption to the operating railway.

6.8.2 In order to construct and connect the southern section of the Ordsall Chord to the existing railway, a programme of “possession” work is required. “Possession” work requires a closure of the railway to facilitate safe working conditions and also as it would not be possible to run trains whilst work was ongoing.

6.8.3 “Possessions” of the railway are planned for construction and maintenance activities, typically during the night, on weekends and bank holidays.

6.8.4 Below is a summary of the “possession” works that are currently planned for the construction of the southern section of the Ordsall Chord as it connects to the Castlefield (MSJ&AR) Viaduct.
Railway Possessions Anticipated

6.8.5 These are based upon the preliminary design information available to date and upon an outline indicative construction programme which is subject to change and that the overall number of possessions and durations needed could well be much less. The final possession regime is established via a regulatory process requiring the discussion and agreement of train and freight operating companies (TOC’s and FOC’s)

Pre 11-Day Possession requirements

4 x 54 hour possessions May to June 2015

6.8.6 Castlefield viaduct strengthening works will require a series of possessions. These possessions run from 00:01 Saturday to 06:00 Monday so include both Saturday and Sunday.

6.8.7 The structural surveys are ongoing to assess the scale of strengthening works required.

6.8.8 Pointing brickwork, grouting using small plant and equipment etc. Possibly some coring/drilling required.

6.8.9 Assuming description of works is correct, levels of noise generated will not be significant.

6 x 29 hour possessions September to October 2015

6.8.10 Viaduct widening and rail systems work will require a series of possessions. These possessions run from 00:01 Sunday to 05:00 Monday
6.8.11 Use of cranes and mobile elevated platforms to lift and place arch sections and parapet units on to piers that have previously been constructed during daytime working hours

9 x 54 hour possessions October 2015 to December 2015

6.8.12 Rail systems work will require a series of possessions. The main works include:

- OLE structure installations on existing Castlefield viaduct
- Signal gantry installations
- Cable bridge installation
- Track installation with associated follow up works.

Midweek possessions

6.8.13 Short 6-hour possessions, often midweek or Saturday nights for various construction activities.

6.8.14 Various rail works will be required, including track, signalling and telecoms, which could generate significant levels of noise.

11-day possession - December 24th 2015 to January 2nd 2016

6.8.15 The preceding works facilitate the completion and commissioning of this section of the works, as well as the installation of the new bridge linked to the Ordsall Chord.
6.8.16 24-hour continuous working over an 11 day period possession will be required

Main works include:

- temporary removal of overhead line equipment (OLE) equipment including main wire to facilitate bridge construction works;
- temporary removal of OLE structures adjacent to Water Street Bridge to facilitate bridge construction works;
- removal of railway track from Castlefield (MSJ&AR) Viaduct and excavation of old railway ballast/formation;
- demolition of old parapet wall on Castlefield (MSJ&AR) viaduct and provide engineered connection from old structure to the new structure;
- in parallel with demolishing the old parapet wall, removal of the cast iron Water Street Bridge. This has the potential to be a significantly noisy activity due to the potential resilience of the existing fixings. A crane will be located on the junction of Water Street and Liverpool Road to facilitate this construction activity;
- in parallel with demolishing the old parapet wall, using the possession period to replace a time-expired bridge deck adjacent to Liverpool Road;
- making good the existing bridge abutments and the new Castlefield Viaduct bridge is installed across Water Street onto the new railway alignment;
• erecting new steel beams across Water Street for the new Ordsall Chord Bridge on to (daytime constructed) piers to support the new chord, with a crane located on the junction of Water Street and Liverpool Road;

• installing new railway ballast and track on Castlefield Viaduct;

• re-installing OLE structures and wires; and

• commissioning existing Castlefield Viaduct railway track on new alignment.

• removal and replacement of Potato Wharf Bridge

Post 11-Day Possession requirements

2x54 hour weekend possessions January 2016

6.8.17 These possessions will be used for final track alignment activities.

7 x 54 hour possessions October 2016 to December 2016

The main works include:

• installing new track (including ballast, sleepers & rail) including switches and crossings at Water Street railway junction;

• OLE structure installations on the new Ordsall Chord structure across Water Street;

• installing new OLE wire runs across the new Ordsall Chord structure across Water Street; and

• signal gantry installations on the new Ordsall Chord structure across Water Street.
6-hour weekend possessions from October 2016 to December 2016

6.8.18 Possessions required to complete enabling works prior to the main Ordsall Chord commissioning in December 2016. This will include, but is not limited to material deliveries, surveys, cable installations, trough installations and signal testing.

1x 54 hour possession in Jan 2017

6.8.19 Possession required for track follow up works including adjustments to final track alignment. These activities are likely to cause nuisance overnight.

6.9 Impacts

Local highway network

6.9.1 Cranes will be working in the Water Street junction area to lift formwork, rebar and arch sections, when constructing the widening of the existing Castlefield viaduct, and larger items when completing the Water Street Bridge renewal.

6.9.2 A stretch of Water St and Liverpool Road from the junction with Water St to Wollam place will be stopped up for the duration of the 11-day blockade. Vehicle access to MoSI, car parking within the Liverpool Road & Woollam Place Apartments complexes, and for deliveries and parking at the Commercial Hotel public house will be maintained throughout duration of works.
6.9.3 Footpath diversions will be required for reasons of safety but pedestrian access to residential properties will be maintained at all times.

6.9.4 I refer also to the Proof of Evidence of Jim Pearson.

6.9.5 Coordination with the Regional Centre Portfolio Manager and his team and the Manchester Streetworks Panel will continue.

6.10 “Nikkal” site – cattle ramp, 1830’s viaduct and “zig-zag” viaduct

6.10.1 Works for this viaduct section will be undertaken from Compounds 1 and 2

6.10.2 High Level Construction Sequence

1. Construct piling platforms and cast piles for new viaduct piers in the Nikkal site

2. Cast new piers, fix formwork for new bridge deck and concrete. Fix new parapets and fascia units

3. Pile through existing piers in the 1830 viaduct, fix formwork and cast the reinforcing saddle slab.

4. Demolish 4 sections of zig zag building for south River Irwell bridge abutment. I refer to the Proof of Evidence of Peter Jenkins for the detailed location.

5. Install abutment foundation piles and construct the pile cap.

6. Fix formwork and construct the abutment.
7. I refer to the Proof of Evidence of Peter Jenkins with regard to the final treatment of the zig zag building surrounding abutment.

8. Complete remedial and refurbishment works to zig zag building and 1830’s viaduct.

6.11 River Irwell Crossing

*Construction Sequence*

6.11.1 Prior to any work, advance ground investigation carried out and temporary works designed for ground improvement, initially for sheet piling rig and service crane operations and also for main piling adjacent to training wall for both north and south sides.

1. Install temporary works required for heavy plant and establish exclusion zones along river banks.

2. Install sheet piling to both north and south abutments.

3. Excavate and remove Stephenson’s extension bridge foundation.

4. Install piling platform and install abutment piling.

5. Excavate and construct abutment bases, abutments and bearing.

6. Install temporary support piles from along the centre line of Princes bridge. Place header beams on H piles and block up supporting Princes bridge at mid-point.
7. With the centre line of Princes bridge propped, using a 110t crawler crane sited on the bridge and install the tubular steel piles

8. Following removal of Princes Bridge install temporary works beams and deck out plan area.

9. Construct bottom chord girders on temporary jacks/bearing and erect transverse deck beams. Install permanent soffit and seal water tight.

10. Place reinforcement and concrete deck.

11. Following deck concrete gaining sufficient strength install trestle supports and construct the top chord of network arch bridge in sections. Mobile elevated work platforms will be lifted on to the concreted deck to aid erection of steel work.

12. As the top chord sections are completed the chord bracing members will be installed.

13. On completion of the top chord construction the anchor blocks for the ties will be installed followed by the placement of the ties.

14. Chord ties will be tensioned as per the designers sequence and load requirements.

15. Complete all deck concrete works i.e. robust kerbs and service routes plus install cantilever walkways.

16. Install the deck expansion joints.

17. Transfer the completed structure to the permanent bearings, via jacking.
18. Apply spray applied waterproofing to bearing gallery, and apply anti-slip surfacing to the wearing surfaces. Apply deck waterproofing.

19. Remove temporary works from within the river channel.

20. Lay protection to the waterproofing membrane, and lay the bottom ballast.

21. Handover to the P-way track team for track laying.

6.11.2 Following engagement with river users with regards to navigation requirements during the works, Network Rail have investigated the feasibility of providing a 7m waterway (maximum) or a 5m waterway (minimum with oars pulled in) for rowing boats to manoeuvre during construction. These widths are considered sufficient for other river traffic to pass through. River traffic under these conditions will be strictly controlled and managed with pilot boats in attendance at all times. Access to the Manchester Bury and Bolton canal will also be available during the works. This is envisaged to be a worst case scenario pending completion of detailed design of the network arch structure in line with cost effective erection methodology.

6.11.3 Closure of the river will be required at certain times due to the nature of the works being carried out, and these will be for, but not limited to, reasons of safety.

- Dismantling of the steel girder extension bridge
- Dismantling of Princes bridge
- Installation of piling (temporary) supports to construction the new chord
• Elements of the chord construction deemed unsafe to river traffic

6.11.4 Wherever possible, the river will be open to traffic and if deemed necessary, pilot craft will be provided to facilitate navigation of the river by users. Times and dates for full closure are not yet confirmed

6.12 Trinity Way

6.12.1 Works for this viaduct section will be undertaken from Compounds 4 and 5

6.12.2 High Level Construction Sequence

1. Install Phase 1 traffic management, narrow west bound carriageway to minimum 3m. Temporarily close footpath and towpath access.

2. Remove existing retaining wall and install piles for south pier abutment. Construct south abutment.

3. Construct temporary carriageway widening, lighting, drainage, signage and footpath adjacent to west bound carriageway. Construct central crossover and establish Phase 2 traffic management with east bound traffic crossed over to opposite carriageway.

4. Install piles for central piers and north abutment, construct bases and north abutment.

5. Construct central piers and install falsework for cross beams and bearing shelf. Construct cross beams and bearing shelf to piers and north abutment. Install bridge bearings.
6. Deliver west side main bridge beams to site and lift on to temporary bearings and temporary towers over west bound carriageway.

7. Weld up main beams and install cross beams, fix deck formwork and lower structure onto permanent bearings.

8. Install permanent formwork and concrete west side bridge deck.

9. Return east bound traffic to permanent east bound carriageway.

10. Deliver east side main bridge beams to site and lift on to temporary bearings and temporary towers over west bound carriageway.

11. Weld up main beams and install cross beams, fix deck formwork and lower structure onto permanent bearings.

12. Install permanent formwork and concrete east side bridge deck.

13. Return west bound traffic to permanent carriageway, remove temporary carriageways and reinstate highway infrastructure.

6.12.3 Coordination with the Regional Centre Portfolio Manager and his team and the Manchester Streetworks Panel will continue.

6.13 Middlewood Viaduct

6.13.1 Works for this viaduct section will be undertaken from Compound 5.

6.13.2 This short section of viaduct connects the Trinity Way structure with Middlewood viaduct and is constructed clear of highway infrastructure and public interface.
6.13.3 The eastern half 4 arches of the Middlewood viaduct and a metallic girder bridge span, which carries currently redundant track, will be demolished and replaced by new bridge decks connecting to the trinity Way structure.

6.13.4 Extensions of the arches on the west side will be undertaken in a similar manner to the required for the Castlefield viaduct.

7. COMMUNITY AND STAKEHOLDER LIAISON

7.1.1 Network Rail’s commitment to proactive communication with the community will continue with local residents, businesses, developer and other stakeholders during the construction phase.

7.1.2 Liaison will continue to take place with local residents and other stakeholders directly affected by the construction.

7.1.3 A team is being set up to deal proactively with consultee issues during the construction period.

7.1.4 Coordination with the Regional Centre Portfolio Manager and his team and the Manchester Streetworks Panel will continue. Network Rail is also committed to continuing to engage with local residents and key consultees via one to one meetings and a number of technical Working Groups with key consultees. This includes the Ordsall Chord Working Party, the Highways Working Party and the Utilities Working Group.
8. OTHER ROUTE OPTIONS CONSIDERED

8.1 Tunnel and Flyover Options

8.1.1 The S of C refers to 4 other route options considered that are different to those options considered in the pre feasibility, feasibility and preliminary design stages of the project. Three of these options were investigated at a high level to test feasibility.

8.1.2 It should be noted that the development of all these route alignments are sensitive to gradients since they are required to accommodate all rail traffic including freight. In the absence of specific data and as a starting point for preliminary design a gradient of 1:125 is considered to be reasonable design criteria and is in line with track design standards.

8.1.3 A tunnel option was considered following from an earlier proposal for a tunnel linking Manchester Victoria and Piccadilly stations albeit on a different alignment crossing under central Manchester. This earlier proposal was not progressed due anticipated very poor ground conditions which would have made tunnelling a very expensive solution.

8.1.4 The tunnel concept considered in the early study (Fig 8 below) followed a different alignment based around existing rail corridors where ground conditions were better understood. As noted in the S of C the main issue with this route was the length of gradients required to transition from an elevated alignment at Piccadilly to an appropriate underground depth for tunnelling and then back up to an elevated structure at Victoria.
These gradient sections were so long that they would have created unacceptable impacts on the major road network in Manchester and Salford and required major diversions to the River Medlock.

The second alternative alignment considered was that of a long chord flyover as shown in Fig 9 below. The long chord description comes about again due to long gradients required to avoid other rail infrastructure. The main high level obstacle to overcome on the Castlefield corridor is the Metrolink structure near to Deansgate Station. Designing a vertical alignment for this route at acceptable gradients resulted in a three tier transportation corridor around this part of the city centre with unacceptable environmental and townscape impacts. In addition it required large amounts
of land, impacted strongly on a number of regeneration sites in Manchester and Salford and by inspection a very expensive option.

8.1.7 In April 2011 the NR project team, in response to heritage concerns arising from the GRIP 2 pre-feasibility reports, investigated a shorter version of the long flyover option to understand the implications of gradients to freight traffic and the curvature required to rejoin the Chat Moss lines close to Salford Central Station.

8.1.8 An alignment was perceived that avoided the climb over the Metrolink Structure referred to above. This alignment, shown in outline in Fig 10 below and in more detail in Appendix E, commences at a turn out on Castlefield viaduct close to the YHA hostel building and is required to pass over the
Chat Moss viaduct close to the Ordsall Lane junction before returning to rail level near to Salford Central.

Fig 10: Short chord Flyover Option

8.1.9 The minimum curvature that could be achieved to create an acceptable horizontal alignment was 300m. However, from the starting point on Castlefield viaduct to the high point of the flyover the flattest gradient that could be achieved was 1:83. Based on these 2 parameters this would limit the freight usage to 2270 tonnes.

8.1.10 This option suffered from unacceptable impacts similar to the long chord flyover described above.
8.2 Alternative Proposal - Option 15

Key Requirements

8.2.1 The introduction of this alternative into the feasibility design process is referred to in the Proof of Evidence of Duncan Law.

8.2.2 The feasibility study of Option 15 has been completed with the requirements identified for the GRIP Stage 3 Ordsall Chord project considered and knowledge from working on the project to date in mind.

8.2.3 The key requirements considered at this concept stage in line with the project remit are:

- The Chord, Chat Moss & Bolton Line triangle should have sufficient capacity to allow a 2x4 car class 380 train to stand on all routes whilst traffic passes at either end.

- The chords should deliver a constant 30mph speed, as this is the aspiration in the core Manchester area to deliver the headway and capacity requirements of the scheme.

- The chords are to be electrified throughout.

- Retain a MoSI connection if feasible.

- The need for approach control signalling should be minimised and avoided if possible.

- The chords should be developed with no specific freight standage requirements.
Permissible Speed

8.2.4 The permissible speed through the Chord, new Chat Moss lines and Bolton lines is to be 30mph throughout. The exception being the crossover to the west of Ordsall Lane Junction that can be 25mph and used in times of perturbation².

Engineering

8.2.5 A plan showing the track alignment necessary for option 15 is attached at Appendix F and that showing the required civil engineering to deliver the infrastructure is attached at Appendix G.

8.2.6 Option 15 has been assessed on a preliminary basis by Track (permanent way), Civil and Signalling engineering disciplines.

8.2.7 No design work has been completed for the OLE and electrification discipline, however the potential impact of Option 15 on future and existing electrified infrastructure has been assessed and this concluded a significant interface with the North West Electrification Programme (NWEP).

² Perturbation – a standard term referring to a mode of use abnormal to its usual operation.
8.3 Description of Option 15

*Castlefield to Salford Central Chord*

*South Section*

![Diagram](image_url)

**Fig 11: Crossing the River Irwell and Trinity Way**

8.3.1 At the south end of the chord, the Option 15 alignment leaves the Bolton Lines on the Castlefield Viaduct by means of a double junction. To accommodate the double junction within the deck of the existing bridge crossing the River Irwell (the 1845 bridge) the new alignment at the south junction would require modification to widen the deck area of the 2 span...
brick arch structure and replacement of the bridge spans over Trinity Way. It is an assumption that widening of the 1845 bridge structure is possible but remains a significant project risk until the existing structure is fully investigated.

8.3.2 Crossing Trinity Way two new structures would be required. The first to replace the existing half through structure supporting the Bolton lines, as the alignment of the structure does not align with the proposed track.. The second span would support the new chord lines. The structure would be in the region of 40m in length and as such, it is likely that this will be a half through structure. Cognisance needs to be paid to the provision of support of the OLE and to signal sighting over this structure.

8.3.3 Two further half through structures would be required to support the chord over Middlewood Street. The existing structure supporting the MoSI line over Trinity Way would have to be removed to accommodate the location of the new Ordsall Chord structure.

- The main chord has a minimum radius of 210 metres. This radius has been utilised in tandem with the south junction location, to navigate the chord to the west of the Grade I Listed Stephenson’s Bridge, enable the chord to tie back into Salford Central Station and to split the MBB canal basins symmetrically in the Middlewood Locks site to minimise the impact on the MBB Canal. The two track chord is parallel throughout with a standard 1970 mm interval and severs the existing Chat Moss Viaduct.
• A radius of 210m is less than the minimum of 250m required by construction and maintenance standards for stressing of continuous welded rail and so would have to be jointed track or to provide other means of track stability such as slab track or stabilised ballast at an increased cost. Jointed track introduces problems with accelerated track wear with a potential for derailment. Check rails are normally introduced at radii less than 200m and could be introduced here as a precaution but again this increases installation and maintenance costs.

• Noise from the jointed track and wheel squeal at this radius and line speed will also be a significant issue and in this regard I refer to the Proof of Evidence submitted by Alec Glendinning.

• The alignment cuts close to the south west parapet of the Grade 1 listed Stephenson’s Bridge which may require demolition of part of the parapet. Again this is subject to further alignment design and structural investigation and remains a significant risk to this option.
North Section

Fig 12: Chord northern tie in to Chat Moss and MBB Lines

8.3.4 In order to minimise the impact on the urban realm and maximise permeability through the development site the remaining chord to its reconnection to the north end approaching Salford Central should be on elevated structure, possibly single bulk columns supporting reinforced concrete cantilever decks. In this regard I refer to the Proof of Evidence of Peter Jenkins.
8.3.5 At the north end of the chord, the alignment joins the new Chat Moss Viaduct, briefly forming a four track railway before a turnout links the Down Chord to the new Down Chat Moss alignment forming a three track railway.

8.3.6 This arrangement gives five tracks through Salford Central when considering the Salford Lines that are not affected by the project.

8.3.7 The reconnection to the Salford Central approach at the north end of chord could be a form of earth embankment or reinforced earth retaining walls.

**Salford Central to Chat Moss Chord**

**North Section**

![Diagram of the northern section of the new Chat Moss Chord](image)

Fig 13: Northern Section of new Chat Moss Chord
8.3.8 At the north end from Salford central the alignment to Chat Moss would continue on an earth or retained embankment referred to above and then on to elevated structures as previously described.

8.3.9 The crossing of East Ordsall Lane and the Manchester Bury Bolton Canal presents more of a significant engineering challenge. At this location the clearance over East Ordsall Lane at existing ground levels would only be 3m and a further 5.5m to top water level in the canal. Two possible options exist; either to close East Ordsall Lane to through traffic, or lower both the canal and road to maintain through traffic.

8.3.10 Plans showing the existing road layout and a possible road realignment proposal are shown below.

Figure 14 – Option 15 site constraints and approximate rail to existing ground levels
Closure of East Ordsall Lane will require the approval by Salford City Council and oral discussions with the Council indicate that they would not give approval to this closure. The impact of this closure on the local road network has not been investigated, nor has the impact on any possible redevelopment proposals for the remaining Middlewood development site.

Lowering East Ordsall Lane at the canal crossing point would appear to be even more problematic in that its close proximity to the junction makes it highly unlikely to achieve acceptable road gradients. Lowering of the canal would also be more problematic since this would entail the provision of an additional locking system. However to achieve this it would require a substantial diversion of the existing canal system and removal of one of the
turn-around basins. The full impact of this has not been investigated and would not be acceptable to the Canal and River Trust who have already objected to Option 15.

8.3.13 If closure of East Ordsall Lane was possible then a 60m span structure crossing over the MBB canal and Hampson Street is suggested to enhance the public realm. If it is required to retain East Ordsall Lane as a through route then a longer structure of some 90m span would be required.

**South Section**

![Diagram showing southern end of new Chat Moss Chord and Connection to new Ordsall Lane Junction](image)

**Fig 16:** Southern end of new Chat Moss Chord and Connection to new Ordsall Lane Junction
8.3.14 To the south of Hampson Street, where the alignment crosses Middlewood Street, which has to be closed due to lack of headroom, the Chat Moss lines are likely to be supported on a shallow earth embankment or on fill between retaining walls. An embankment is likely to be the cheaper solution, however it would have the larger footprint. For both, a culvert may be required to allow access to the existing utilities if these are not diverted.

8.3.15 Modifications to the access point serving the new midpoint auto transformer (MPATS) installation compound will be required and would entail substantial retaining wall structures

Remodelled Ordsall Lane Junction

Fig 17: Remodelled Ordsall Lane Junction
8.3.16 To the west of the existing Chat Moss viaduct is Ordsall Lane Junction. This junction is remodelled and would have to be moved approximately 130m west as part of this option. The new Chat Moss lines and existing Bolton Lines will come together at the new Ordsall Lane Junction location, by means of a double junction. A second double junction then allows for the Windsor Link (Bolton Lines) and Chat Moss Lines to Eccles to diverge. This arrangement provides the desired Bolton to Piccadilly route as a priority to achieve the required capacity through this important junction.

8.3.17 To illustrate the difference between the remodelling of Ordsall Lane junction as part of option 15 compared to that required as part of the Core Manchester Performance project please refer to Appendix H. Appendix I shows an extract from this plan indicating the location of the western most part of this junction and this is approximately 140m from Oldfield Road bridge and clearly shows that the lines to the west pass through the existing bridge piers. Appendix J is an extract from the Option 15 plan in the vicinity of Oldfield Road Bridge and this shows that the western most part of the Ordsall Lane junction is only approximately 10m from Oldfield Road bridge with the lines to the west clearly clashing with the existing piers.

8.3.18 The Oldfield Road overbridge cannot be maintained with the Option 15 alignment because the junction has moved so close to the structure. The railway currently passes beneath Oldfield Road Bridge and the pier locations of this structure limit the possible track alignments and as such this structure will have to be replaced by one with piers to suit the proposed
alignment. This is a road overbridge and a replacement deck would likely take the form of a precast concrete beam or steel composite structure.

8.3.19 Immediately to the west of the remodelled Ordsall Lane Junction, a crossover provides a route from the Up to the Down existing Chat Moss lines, followed by a turnout for passive provision to the Creative Logistics Sidings. Appendix K is a plan that indicates the extent of the sidings and the existing access point, new access point for the Proposed Scheme and the access point for Option 15. Effectively Option 15 reduces the available standage from 440m to 225m. The full impact on the capacity of the Creative Logistics Sidings has not been fully investigated at this stage, but the significantly reduced standage available arising from the Option 15 access point is likely to make the sidings unsuitable for freight operation and therefore unacceptable.

8.3.20 A high level construction sequence for Option 15 is contained in Section 8.5 below.

8.4 Inter Disciplinary Issues

Signalling

8.4.1 Signal sighting around the new chord will mean that the structures will require the main structural members below the driver’s eye level, approximately 2.75m above rail. Consequently through truss and arch type solutions would require careful design consideration to ensure that signal sighting was not compromised. Additionally OLE supports could be supported from twin track cantilever supports, with the leg of the support on
the outside of the curve. This could be difficult at any potential locations where half through girders are utilised.

8.4.2 An Option 15 preliminary signalling proposal was created based on the Central Manchester Signalling Scheme Plan generated in cognisance of all inner Northern Hub projects. For the purpose of the Option 15 study, it was assumed that proposed works on interfacing projects are completed. On this basis, the preliminary signalling design for Option 15 has been considered taking into account signalling alterations on all lines feeding into the interfaces at Ordsall Lane junction and Deal Street Junction that occur due to other interfacing Northern Hub projects. At Ordsall Lane junction, this is the signalling modifications west towards Eccles as part of CMP. At Deal Street Junction, this is the signalling modifications west of Victoria Station due to alignment Option 4 of the Manchester Victoria West project.

8.4.3 A standback for signal sighting purposes has been assumed to be 20m. An overlap of 70m has been used, in accordance with signalling design standards, as a minimum where speeds are 30mph, with longer overlaps provided where possible. The Option 15 proposal provides the minimum standage for a 2x4 car class 380 train 189m in length on all chord lines.

8.4.4 Bi-directional signalling is a requirement of the Ordsall Chord project and is provided within the Option 15 signalling design. On this basis the signalling arrangement offers full bi-directional functionality throughout the central Manchester area shown. The track layout is however less flexible than the Proposed Scheme and creates a limitation on capacity when bi-directional
working is in use due to the track layout reducing the speed to 25mph in this mode.

8.4.5 Initial calculations have shown that full braking distance is available for the proposed line speeds with the exception of one signal on the Up Chat Moss line. These calculations would have to be reassessed once details of the track gradients have been confirmed and any signal positions have been adjusted for signal sighting and so this option remains a risk in this respect.

8.4.6 Headways have not been assessed as part of the development of this scheme, the future train pattern for this area shows a significant increase in number of trains and as a result headways may be critical. A full assessment of headways and Railsys modelling of the proposed timetable would be required and so this remains a significant risk.

**Electrification**

8.4.7 An OLE design has not been produced for this option.

8.4.8 The following is an overview to the potential impacts of the Option 15 alignment proposal.

8.4.9 The North West Electrification Project (NWEP) Phase 1 is currently being installed to electrify the railway from the west along the Chat Moss lines, through Ordsall Lane Junction and along the Castlefield Viaduct to Castlefield Junction.

8.4.10 NWEP Phase 2C is currently being designed. This project electrifies the Windsor Link, integrating with NWEP Phase 1 at Ordsall Lane Junction and
electrifies the Chat Moss Viaduct through Salford Central Station to Manchester Victoria.

8.4.11 Both NWEP Phase 1 and Phase 2C projects would be impacted by the development of Option 15.

8.4.12 The clash between the track alignment and the now installed Ordsall Lane midpoint auto transformer site (MPATS) is probably the biggest electrification issue (Figure 6).

Figure 18 - Option 15 MPATS interface
8.4.13 If the MPATS equipment were to be moved, major civils works would be required to create new foundation bases on a different site and the 25kV and other cabling (mainly LV & SCADA/data/telecoms) would have to be diverted, connected and commissioned. This would require blockades to the operational NWEP Phase 1 & Phase 2C electrification. It is considered that relocating the Ordsall Lane MPATS would cost at least as much as the initial installation with a consequence of disruption to operational service.

8.4.14 It may be possible to relocate the westerly most transformer that the alignment clashes with. However, the re-routing of cables to the relocated transformer may cause complications and require a number of railway possessions to complete the changeover. The track alignment would require adjustment to ensure a sufficient clearance to the MPATS switchgear building, to allow for a safe cess walkway and containment kerb.

8.4.15 On the existing Middlewood Viaduct, around 500m of brand new OLE infrastructure would have to be abandoned. The 25kV feeder cable route from Ordsall Lane MPATS to Salford Central Station would have to be routed along the new viaducts. Oldfield Road Overbridge would require rebuilding from an electrification perspective and also due to the track alignment.

8.4.16 An assumption or project risk is that any track vertical alignment changes under Liverpool Street Overbridge (OLW/OBR1) would not require that bridge to be rebuilt.
8.5 Construction Methodology

8.5.1 As part of the initial feasibility study for Ordsall Chord Option 15, a high level strategy for constructing Option 15 has been developed and any key assumptions that have been made during production of the assessment recorded. Of significance is the requirement for a 20 day blockade to complete the Ordsall Lane junction remodelling and reconstruction of Oldfield Road bridge and an 8 month closure of Oldfield Road.

8.5.2 The need for the long closure of Oldfield Road is the close proximity of the Ordsall Lane junction to the bridge structure as indicated in Appendix K. The work to complete the junction remodelling and reconstruct the bridge piers is further complicated by the need to maintain the existing railway connections operational and to connect with a new Chat Moss chord line to bring this into operation before the old chord can be severed.

High Level Construction Sequence

8.5.3 The proposed high level construction sequence is indicated below:

- Dismantle Oldfield Road bridge and remove the piers. First stage works to remodel Ordsall Lane junction.
- Construct the new Chat Moss Lines structure across the Middlewood Site. This would require a full road closure of Middlewood Street and East Ordsall Lane and constrains the completion of the Ordsall Lane junction remodelling.
8.6 Complete the renewal of Trinity Way structures and extend the River Irwell Bridge structure. This stage would need to be completed before the Ordsall Lane track remodelling.

8.6.1 Complete the remodelling of Ordsall Lane Junction and bring into service the new Chat Moss Lines. To complete this stage it would be necessary to renew Oldfield Bridge at the same time as the track remodelling is undertaken. It should be noted that Oldfield Road Bridge would be subject to an 8 month full road closure. This stage is also constrained to the completion of the new Chat Moss structure and requires a 20 day blockade. This in all likelihood will not be acceptable to the train and freight operators.

8.6 Complete the remodelling of Ordsall Lane Junction and bring into service the new Chat Moss Lines.

8.6.1 Install new Ordsall Chord Structure across Middlewood Site.

8.6.1 Install the new Trinity Way Structure for Ordsall Chord.

8.6.1 Install the south Junction.

8.6.1 Open new Ordsall Chord.

8.6 Temporary Land Requirements

8.6.1 Attached at Appendix L is an initial proposal of temporary land requirements for office and welfare accommodation, car parking, plant storage, storage of materials and stockpiling of spoil for disposal and assembly of bridge structures.
8.6.2 Temporary land take is required adjacent to Trinity Way and the River Irwell for construction of the new Trinity Way bridge structures to be built off-line and transported into position and the widening of the 1845 bridge.

8.6.3 Temporary land take is required in the vicinity of Oldfield Road for the remodelling of Ordsall Lane junction and local track realignments in various stages and the reconstruction of Oldfield Road bridge.

8.6.4 The temporary land will be required for the full duration of the construction works.

8.7 Construction Issues with Option 15

8.7.1 Whilst it may be perceived that the construction of Option 15 is made easier by its location being mainly in a cleared site there are a number of significant negative issues associated with this option. Some of these are listed below:

- The need for a 20 day blockade to construct the remodelled Ordsall Lane junction and constrained to an Easter or Christmas holiday period. This is likely to be unacceptable to train and freight operators

- Renewal of existing Trinity Way structure on the Bolton lines includes the removal of the central piers and will require temporary closures of Trinity Way.

- Renewal of Oldfield Road Bridge would be required for which an 8 month closure of Oldfield Road is necessary due the staging of works
necessary for remodelling Ordsall junction and repositioning of the bridge piers.

- Impact on roads within Middlewood Locks area including closures of Middlewood Street and East Ordsall Lane.
- Hampson Street will require lowering by approx. 2.5m to pass under the Chat Moss Chord. It is not clear that this can be effectively drained without resort to pumping.
- Impact on residents at flats on Middlewood Road
- A road closure of Trinity Way would be required when the existing Bolton lines structure is replaced.
- Complexity with installation of bridge decks across Trinity Way and Hampson Street.
- Recently installed OLE infrastructure would require modification or replacement.
- Construction traffic impacts on local road network for delivery of materials and removal of spoil.
- Potential for dealing with and remediating contaminated land.
- A significant amount of work is undertaken on elevated structures.
- Impacts the MPATS installation requiring at least its modification or replacement.
8.8 Risks and Issues with Option 15

8.8.1 Within the engineering description of Option 15 above I have highlighted a number of significant elements of risk and uncertainty surrounding this option that would require further investigation and design to confirm or eliminate the concerns and these are collated below:

1. Railsys modelling may show that the design cannot meet the capacity requirements.

2. Requirement to relocate Creative Logistics Sidings.

3. River Irwell Bridge cannot be widened on existing structure and needs to be rebuilt.

4. Conflict with the south west parapet of Stephenson’s Bridge.

5. Ordsall Lane Bridge cannot support the track relocation and has to be rebuilt.

6. East Ordsall Lane and Middlewood Street cannot be permanently closed.

7. Utilities have not been investigated and may require diversion. Deep sewers are known to cross the Middlewood site and may conflict with bridge structures.

8. Timetable, system and performance modelling of the option have not been undertaken.

9. Track Geometry sub 250m radius. 210m radius jointed track increases the potential for derailment.
10. Signalling design has not been fully tested.

11. Dealing with the potential of contaminated land within the Middlewood site.

12. Relocation of the Ordsall Lane MPATS installation.

13. Abandonment and modifications required to the newly installed OLE installations.

14. Significant modifications may be required to the MBB Canal system.

15. Impact on the planning and development proposals for the Middlewood site. I refer to the Proofs of Evidence of Peter Jenkins and Jill Stephenson on this issue.

8.9 Operational Risks and Issues

1. Potential of capacity and performance issues as described in 8.8.1.

2. Risk of derailment on 210m radius curves due use of jointed track.

3. Loss of bi-directional functionality at Ordsall Lane junction.

8.10 Option 15 Costs

8.10.1 For the purposes of cost comparison between Option 15 and the Proposed Scheme costs Alan Williams and myself have worked through the following scenarios:

- Option 15 base (embankments) scheme A
- Option 15 enhanced (viaducts) structural scheme B

  With 2 variants on each option

- A and B plus costs of East Ordsall Lane permanently closed, and
9.1.1 A and B plus East Ordsall Lane not permanently closed and the canal diverted and lowered

The output from this exercise is contained within the Proof of Alan Williams.

9. OBJECTIONS

9.1 Sam Kennion

9.1.1 Mr Kennion has submitted two alternative proposals for the Ordsall Chord.

9.1.2 The first is an alignment shown at Appendix M

9.1.3 The proposal is a variant of Option 15, but with chord lines slightly further to the east and has all the disadvantages discussed above plus those set out below.

9.1.4 Critically the standage on the Bolton Lines is reduced to substantially less than the required minimum standage. This alternative has a maximum operational standage of 140m and therefore could not accommodate a train stood waiting to cross the chord line junctions. Figs 19 and 20 below illustrate the standage required and what happens if this is not provided. This in turn reduces the capacity and train performance through the Ordsall Lane junction. Trains from the west would have to stand back west of Oldfield Road if trains were manoeuvring through the chord lines and similarly trains from Piccadilly to Chat Moss or Bolton would have to stand back on Castlefield corridor if a train was manoeuvring from Salford to Chat Moss.
Fig 19: Sketch describing minimum standage dimensions

Fig 20: Sketch indicating effect of chord line not achieving minimum standage
9.1.5 Other issues highlighted in the drawings and within the text of Mr Kennion’s objection which make the alternative unworkable are:

- The critical radius emerging from Castlefield corridor towards Salford appears to be much less than the 210m radius required to deliver a line speed of 30mph.

- The curve approaching Ordsall lane junction also appears less than 210m and passes through the new MPATS installation requiring its replacement.

- The proposal does not indicate the link to the Creative Logistics sidings and as such this issue remains a significant risk to programme and budget.

- The proposal features track directly spanning the MBB Canal turn-arounds and impacts on the public realm in this location, an issue that the Canal and Rivers Trust have considered to be critical to canal users.

- The rearranged Hampson Street/Trinity way junction would require closure of this junction for some months and the East Ordsall Lane/Hampson St/Ordsall Lane junction appears to be a complicated and reduced capacity signalled junction.

- Mr Kennion asserts that his proposal improves the area remaining for development. It is difficult to see how this is achieved and I refer to the Proof of Evidence of Peter Jenkins in this regard.
9.1.6 In summary the proposed alternative removes all of the benefits that the Proposed Scheme is designed to create, is technically and operationally flawed, reduces the capacity and performance of Ordsall Lane junction, will not deliver the line speed and has radii that will further increase the risk of derailment and increased maintenance liability.

9.1.7 In response to other specific points made by Mr Kennion as follows:

- *Much reduced impact on the important heritage features of the area.*

- This is only achieved at a significantly higher cost than the Proposed Scheme with unacceptable impact on regeneration and development opportunity.

- *The largest bridge will be significantly shorter than the current proposal and therefore cheaper.*

- A large span bridge over the MBB canal and central area is proposed and it also comprises a number of other large span structures and viaducts and so in terms of structural cost could be more expensive than the Proposed Scheme.

- *None of the construction will be over water and so will be easier and therefore cheaper*

- All of the structures are elevated and for a longer overall length and as such impose a similar issue of working at height as the Proposed Scheme.
• **Likely fewer construction compounds**

• This alternative proposal will require the whole of the development site as temporary land for construction of bridges to be transported to location, materials storage, waste management handling, offices and welfare facilities so will not be less than for the Proposed Scheme.

• **Potential to ease the curve coming off Castlefield Viaduct, over the river, ring-road and Ordsall Lane**

• Whilst there is indeed the potential for the alignment to developed in this manner, it would come at the expense of adverse impacts elsewhere

• **Retains MOSI connection and has potential to enhance it**

• The radius of the curve off the Chat Moss viaduct is substantially below standard. Whilst this may suit the rolling stock described by Mr Kennion, it is unclear who will maintain this connection if it does not match with NR standards? The cost of providing the connection and bridge structures will be expensive and have an ongoing maintenance liability.

• **Flyover sub option would give grade separation at Ordsall Lane junction, easing train pathing and improving safety**

• The option described cannot meet the requirements for freight traffic, is technically and operationally flawed and so cannot achieve the assertions made. Furthermore the cost, and impact on regeneration, of these proposals is excessive and cannot be justified in terms of the benefits
• **Reduced impact on current nearby residents.**

• Whilst the impact on the residents of the Castlefield area would be reduced, the alternative alignment would impact on the Middlewood Flats and any future development of what would be left of the Middlewood site. Furthermore the scale and scope of the works demanded by the proposals would generate more impact on the local area during the construction phase.

• *I think it is important to point out that my proposal is quite different to Option 15*

• The difference between Option 15 and the proposals put forward is that they are technically and operationally flawed and have a greater impacts on the canal and highway infrastructure.

• **Slightly east of option 15. Therefore reduced impact on Middlewood regeneration site.**

• I Refer to Peter Jenkins' Proof of Evidence.

• *No need to modify the canal.*

• Canal modification may not be required, but the impact upon this infrastructure, which has recently been subject to significant investment, is substantial.

• *Potentially fewer Bridges and none over 50m (or maybe less)*
The proposal features 4 bridges, some of which have significant spans. It should also be noted that the proposals would demand a bridge or bridges over the spur from East Ordsall Lane, and modification of replacement of the spans over Trinity Way and Ordsall Lane. These requirements have not been captured on the plans submitted.

- **Access to DBS (Creative Logistics) sidings near to Ordsall Lane Junction, from Victoria direction can be retained.**

- The alignment as proposed cannot be achieved due to the issue of standage referred to above,

- **Straight section of viaduct likely cheaper to build & maintain than all curved.**

- There are no grounds for this statement.

- **Whole route likely to be cheaper to build than option 15 due to reduced impact on surroundings including canal, road and existing railway infrastructure.**

- The only sections of the route likely to be cheaper are the embankment sections. Embankments are not seen as an acceptable design response in view of the proposed development opportunities for the area and have been discounted in Option 15 to minimise the impact on public realm and maximise permeability through the development site at a recognised increased cost to the scheme.

- **Salford is well provided with regeneration & development sites and my**
9.1.8 proposal affects the area less than option 15. Buildings could also be developed on the site to enclose large parts of this version of the chord (i.e. have it 'tunnel' through them) and therefore further reduce its impact and deliver further development opportunities.

- It is not clear how Mr Kennion's proposal affects the area less than option 15 since the chord lines are at a similar location within the site. With regard to the suggestion to enclose the railway within buildings then this is a vision that requires extensive debate with planners, developers and maintainers. Railways in tunnels are notoriously difficult and expensive to maintain and impose a substantial fire risk. Mitigating the impact of noise and vibration within the enveloping buildings is beyond current technologies.

9.1.8 In summary this proposed alternative is technically and operationally flawed, reduces the capacity and performance of Ordsall Lane junction, will not deliver the line speed and has radii that risks derailment and further increases the maintenance liability.

9.1.9 The second proposal put forward by Mr Kennion at Appendix N is to make the Salford to Chat Moss chord a flyover above the Castlefield to Salford Chord and make Ordsall Chord a grade separated junction. There is insufficient length of approach distance to cross over the chord from Salford and provide an acceptable gradient for freight traffic. The radius required to make the turn over the Castlefield to Bolton lines is too tight for 30mph and
the down ramp back to Chat Moss, at the necessary gradient, will require Oldfield Road to be permanently closed.

9.1.10 The cost of this proposal will be very high, it cannot accommodate freight movements and the grade separation at Ordsall Lane junction is not necessary to provide the required capacity for the central Manchester operations.

9.1.11 Mr Kennion makes a third suggestion at Appendix O based on a turn back arrangement requiring trains to be shunted into a siding adjacent to the Bolton lines west of Oldfield road bridge and then manoeuvre out to proceed to either Salford or Piccadilly. This arrangement is quite impractical for achieving the required capacity between Salford and Piccadilly.

9.1.12 Mr Kennion has also produced a number of sketches to propose a connection to MOSI. None of them are detailed sufficiently to show that they are workable solutions and the curvature is generally so severe that it would be extremely limiting on locomotive plant that could make use of the connections and all would involve significant cost to construct.

9.2 Mark Whitby

9.2.1 Mark Whitby has objected to the Proposed Scheme and suggested alternative alignments that seek to avoid the heritage issues. These alternatives are variants of Option 15 which he asserts will cost less to deliver and will not have the same level of impact on regeneration opportunities in the area.
9.2.2 He claims in his Statement of Case that the alternative alignment proposed by NR (Option 15) is unnecessarily extravagant and its costs overstated.

9.2.3 Mark Whitby’s assertions about cost and regeneration impact will be addressed in Mr Williams and Mr Jenkins’ Proofs of Evidence.

9.2.4 His Proof of Evidence contains plans that purport to show the Proposed Scheme and Option 15. However these plans show differences in detail to the plans submitted by NR in the Order and in the Statement of Case.

9.2.5 His Proof of Evidence also refers to 4 alignments 16A and B and 17A and B. On 6th March 2014 Mr Whitby submitted yet a further alternative which he describes as an “Option 15 Rationalisation”.

Alignment 16A

9.2.6 This alignment shown at Appendix P is similar to “baseline” Option 15 but with the 2 chords crossing the Middlewood Locks site moved slightly east and closer together, ostensibly to create less impact upon the remaining developable land and reduce construction costs. This issue is dealt with in Peter Jenkins’ proof.

9.2.7 From railway engineering perspective, this alternative is technically flawed and reduces capacity and operational performance for the following reasons:

1. The standage available on the Bolton lines between the Chat Moss chord and the Ordsall Chord does not meet required minimum operational standage of 189m train length plus 20m signal standback. This option
could not accommodate a train stood waiting to cross the chord line
junctions giving rise to a reduction in capacity and reduction in
performance. An explanation of this issue is referred to above in the
discussion of Mr Kennion’s proposals.

2. One of the operational risks identified with the 210m radius is the risk of
derailment due to the need for jointed track. This alternative has a
significantly longer length of track at this radius than option 15 thus
further increasing this risk and increased track maintenance considerably
through track wear and requires more expenditure in solutions for track
fixity such as slab track or ballast stabilisation.

3. This alternative proposal has significant lengths of track with curvature of
210m. This curvature will produce significant noise from the jointed track
and wheel squeal and I refer to the Proof of Evidence of Alec
Glendinning

4. The Ordsall Lane junction is configured to prioritise north-south
movements whereas it needs to be configured to prioritise east-west
movements to achieve the required junction capacity. The layout as
shown is likely to be constrained to 25mph and introduces a high skew
switched diamond crossing which requires a high level of maintenance.

5. The alignment crossing the River Irwell assumes that the existing
structure does not need to be renewed or widened. NR preliminary
design shows that this is not the case and the structure requires at least
modification to accommodate the 30mph double junction and track
alignment. It is quite possible that by reducing the speed to 20 or 25mph a double junction could be accommodated without modification to the structure. However this does not fit the capacity requirement for 30mph linespeed around central Manchester.

6. This alternative assumes that no work is required beyond Oldfield Road Bridge. This is because Ordsall Lane junction has been incorrectly modelled and it also needs to move further west to accommodate the required standage noted in 1 above. This will in turn impact upon Oldfield Road bridge and extend trackwork for some distance beyond. As noted in relation to Option 15 this will require a 20 day blockade to remodel the junction and an 8 month closure of Oldfield Road.

7. The Chat Moss chord impacts directly upon the newly installed MPATS (mid-point auto transformer) station and it will have to be relocated at a cost of £6m.

8. The northern end of the 2 chords is shown on embankment. This will add to the landtake requirement and reduce the permeability through the site. In this respect I refer to the Proof of Evidence of Peter Jenkins who will cover the regeneration and development issues.

9. The alternative plan shows no change to the Creative Logistics sidings itself but it removes the access/egress point and doesn’t show where the new access point can be located.

10. The plan shows the existing Princes Bridge removed and a new footbridge located elsewhere (costs for this work is not included in his
estimate). Option 15 does not require this bridge removed or replaced but Mr Whitby assumes that NR will fund this work.

11. The plan shows the existing Middlewood viaduct demolished. NR have no proposal to demolish this substantial structure within the Option 15 proposal.

12. The Hampson St/Trinity Way highway junction is removed and replaced by another intersection to the north. This will be signal controlled and require some widening of Trinity Way to incorporate a right turn lane for south bound traffic. (not included in his estimate)

13. A new junction is created at East Ordsall Lane which will also require signal control and will be a bigger footprint than shown on the plan to accommodate turning movements. (not included in his estimate)

14. The suggested road alignment introduces a longer journey route from Oldfield Road to Trinity Way requiring through traffic to permeate the whole redevelopment site.

15. The text describes a reduction in width of Trinity Way but does not say what this means or how acceptable this would be to Salford and Manchester City Councils.

16. The Chat Moss viaduct crosses over one of the MBB canal turn arounds reducing its attractiveness to canal users. An issue raised by the Canal and River Trust in its objection to Option 15 and so this crossing location exacerbates that issue.
9.2.8 The costing exercise carried out for Option 16a is addressed by Alan Williams

Alignment 16B

9.2.9 The suggested alignment 16B shown at Appendix Q is very similar to 16A but retains a 250m radius throughout except for the curve west of Trinity Way which presumably has a 210m radius.

9.2.10 This option is still technically flawed for all the same reasons as 16A above with only a slightly improved standage but is still operationally unacceptable.

Alignment 17A

9.2.11 This alignment shown at Appendix R, with that of 17B shown at Appendix S, is suggested by Mr Whitby as something that is of higher cost but with improvements to the urban environment, enhanced operational value and public benefit.

9.2.12 This alignment has chords that are similar to 16A being 210m radius except that the Salford to Chat Moss line passes under the Bolton Lines at Ordsall Lane junction.

9.2.13 Whilst the plan shows the down gradient section it does not show an uphill gradient section where it emerges south of the Bolton lines. It is presumed that the Bolton Lines similarly are raised to split the differences in rail to rail levels. The horizontal alignments have been drawn to show that all movements are possible, however they do not prioritise the movements for the required capacity.
9.2.14 Raising the Bolton line and Chat Moss line vertical profile will require the permanent closure of Oldfield Road. The bridge could not be raised in height sufficiently without impeding access to local premises.

9.2.15 The gradients required for the dive under/flyover cannot meet the requirements for freight movements within the distances indicative on the plan and so would only be suitable for a passenger only scheme and therefore unacceptable since this would prohibit freight movements west of Manchester.

9.2.16 The rerouting of Ordsall Lane to its junction with Trinity Way retains the former Hampson Street/Trinity Way junction in addition to requiring the additional junction to cater for Oldfield Road to Trinity Way traffic.

9.2.17 The alignment suggested could not therefore produce enhanced operational or public benefit and would be significantly more expensive due to the grade separation infrastructure.

Alignment 17B

9.2.18 This alignment is similar to 17A except that it removes the Salford to Bolton chord and viaducts to create more developable space. However it is not clear without undertaking a Railsys analysis and timetable modelling exercise that the junction at Ordsall Lane could cope with the additional traffic and movements and would be even more limiting on freight movements west of Manchester.
9.2.19 This alternative amalgamates all the west of Manchester traffic though one complex junction. If the junction became blocked through derailment, train malfunction, failure of signalling or OLE infrastructure then it would effectively block all traffic into Manchester from the west and vice versa and so from a railway operations perspective would present an unacceptably high risk.

9.2.20 The suggestion is even more costly than 17A and substantially reduces operational benefit to an unacceptable level. The assertion of improvement to the urban environment is debateable. That it gives an opportunity for improvement depends on how the local authority views that opportunity.

9.2.21 With regard to the alignments 17A and B, and the flyover option proposed by Mr Kennion, it should be noted that grade separation of Ordsall Lane junction was comprehensively studied at GRIP stages 1 and 2 with a number of options considered. The conclusion was that a grade separation acceptable to all traffic, including freight, was not achievable due to the constraints of the connecting routes and the overall footprint to incorporate acceptable gradients for freight traffic. The only grade separation that might be possible was one for passenger traffic only with freight having to access the existing Chat Moss/Middlewood viaduct for east-west traffic and this option still required the permanent closure of Oldfield Road. This option would also only work if Ordsall Chord was constructed as per the Proposed Scheme.
Alignment “15 Rationalisation”

9.2.22 The plan for this alternative is shown in Appendix T. The plan purports to portray the track layout as that of Option 15. However it differs significantly in that it doesn’t show the required widening of the 1845 bridge nor the removal and replacement of structures crossing Trinity Way including that of the MOSI mainline connection.

9.2.23 This plan does replicate the required standage on the Bolton lines as Option 15 and the connection to a remodelled Ordsall Lane junction.

9.2.24 Apart from the issues referred to above the proposal has other defects relating to impact on the Middlewood redevelopment site. These briefly are:

- The MOSI connection over the chord will be on a cant transition section and has all the problems of temporary crossings described in Section 9.5 below..

- The turn out for the MOSI connection, if one were feasible, would have to be taken off a straight section of track.

- The S bend in the diverted East Ordsall Lane will not comply with urban roads design standards. This would be classified as a local distributor road by SCC so this layout would be unacceptable to them.

- The vertical alignment of the diverted East Ordsall Lane will be non-compliant in relation to gradient. The road will have to pass over the MBB canal at least 3m above ground level to accept walking and canal traffic. At this elevation the down gradient to Hampson St will be
approximately 1:10 approaching a road junction and so would be unacceptable to SCC.

- The Canal and River Trust are objecting to Option 15 and this proposal creates additional impacts in relation to the upper level mooring pound.

- The new road junction proposed at Trinity Way will have to be signalled and will require Trinity Way to be widened to provide a right turn lane.

- The embankments are only marginally less in extent than option 15 baseline and with less permeability from/to the eastern most land plot to the rest of the development. I refer to the Proof of Evidence of Peter Jenkins and Jill Stephenson in relation to planning and redevelopment issues.

9.2.25 To conclude upon the first 4 alternative alignments proposed by Mr Whitby all are technically flawed, do not make any improvement to Option 15 as asserted, cannot be delivered at a cheaper cost, are more disruptive to the railway network and cannot meet the required operational and performance benefits that the Proposed Scheme is designed to create. The latest alternative proposed by Mr Whitby as a “rationalised” alternative to Option 15 could not deliver the required linespeed from the turn out to the Ordsall Chord and offers unacceptable highway proposals detrimental to the Middlewood development site and the MBB canal.
9.3 **Richard Siddall/Matt Sacca**

9.3.1 These 2 objectors have proposed the same alternative for a flyover connecting Castlefield Corridor and Middlewood viaduct as shown in their sketch at Appendix T.

9.3.2 This proposal is a very much shortened version of the short chord flyover alternative investigated by NR as discussed in 8.1.7 to 8.1.10 above. The gradients in this suggestion are considerably steeper than the rejected NR version with that connecting to the Middlewood viaduct approximately 1:20 or less. The track radius is also much less than 200m. On both track curvature and gradients the proposal would be wholly unacceptable.

9.4 **Niall Gunn**

9.4.1 Mr Gunn has proposed an alternative for a chord alignment as shown in Appendix V. His base proposal as drawn is for a short chord line from the Castlefield Corridor to the Chat moss Lines at Middlewood viaduct. The radius required to make this connection and miss Stephenson’s bridge would be so severe that trains could not negotiate the curve. For a direct comparison of the curvature required please see Fig 8 describing the turn out section for Option 15.

9.4.2 Mr Gunn further suggests raising the levels of Castlefield and Middlewood viaducts to accommodate the gradients necessary (to meet operational requirements). It is assumed that this is suggested as a means of retaining a fixed crossing between the MOSI line and the mainline network, The level difference between these lines is significant and, as such, the increase in
track levels would be required over a significant distance due to the constraints on track gradients as demonstrated by the alternatives referred to earlier for the short flyover option. This would be expensive and have a negative impact on the townscape of the area.

9.4.3 The issues regarding the retaining of a MOSI connection are referred to below.

9.5 MoSI Connection

9.5.1 A number of objectors have made reference to a need to maintain the historic mainline connection from MOSI to the operational network. NR have considered a number of potential options to achieve this and reviewed suggestions made by objectors.

9.5.2 The S of C refers in Sections 6.7 to 6.11 the options considered for maintaining a mainline connection into MOSI. These options fall into 2 types, a form of fixed connection or temporary crossing facilities.

*Fixed Type Connections*

9.5.3 The first of these is the original concept of a fixed diamond crossing. As noted earlier this concept was proposed on the assumption of similar track levels at the crossing point of the chord to those on the adjacent Castlefield viaduct. Upon completion of the topographical surveys and definitive rail levels available from the Proposed Scheme alignment design it was confirmed that in fact the new chord track levels are approximately 0.5m higher than those of the current mainline connection, in addition at this point
9.5.4 The difference in rail height would require raising the track height on the approaches to the crossing over both Stephenson’s Bridge and Water Street. This would require gradients of approximately 1:38 and a shorter than desirable length of “hump” to limit the impact of raising the track on both structures. This alignment will limit the type of locomotive wheel base that could use the mainline connection.

9.5.5 The more problematic issue is a fixed crossing of the canted track. No standard crossing components are available that can accommodate these differences in rail levels and it is not clear if a bespoke design could be introduced or manufactured.

9.5.6 The second type of fixed connection is a parallel chord. Referring to Appendix H, the proposal shows the single track chord on a turn out from the Ordsall Chord on the Salford side of the River Irwell crossing the river on a separate structure over the Zig Zag building with a new bridge over Water Street connecting with the southern tracks into MOSI.

9.5.7 Whilst this connection is theoretically possible it impacts substantially upon the Zig Zag building and the Grade 1 listed Warehouse and Station Building. This maintains a connection to the rail network but does not reinstate the

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3 Cant Transition – Section of track between zero cant and maximum cant

4 Parallel Chord – A secondary chord running parallel to the main chord as shown in Appendix H
existing mainline connection or permit the internal rail service. I Refer to
Proof of Evidence of Bernadette Bone.

**Temporary Crossings**

9.5.8 Temporary crossings are non permanent solutions for providing rail access via turn outs or crossings.

9.5.9 In April 2012 NR received a suggestion from a member of Friends of MOSI for a drawbridge solution to provide a temporary crossing of the chord to maintain the mainline connection. NR and PB reviewed this proposal and responded with a view that the arrangement was impractical and had underlying safety issues, particularly in respect of OLE infrastructure. NR advised the proposer of the findings of the review.

9.5.10 Subsequently NR received a revised suggestion for a swingbridge and noting the agreed impracticalities of the drawbridge proposal. NR and PB again reviewed this proposal and concluded that it was still an impractical proposal due similar issues of safety and the span required for what would be a heavy moveable cantilever structure and ownership.

9.5.11 The 2 suggestions made above were reviewed at a time when NR and PB were not in possession of topographical data and had therefore assumed that the rail levels of the mainline connection were similar to that of the rail levels on Castlefield corridor as noted previously. Subsequently the large difference in rail levels makes the drawbridge and swingbridge proposals even less practical due to the amount of rail elevation required on Stephenson’s Bridge and Water Street and to accommodate the structure
depth due to the required minimum 7.5m span of the swingbridge to keep it clear of operational infrastructure, the rail levels for the MOSI connection would have to be substantially higher than that necessary for the fixed crossing.

9.5.12 During the consideration of the suggestions referred to above NR initiated its own review for a temporary crossing using a bespoke form of non-intrusive crossing. NR requested PB to investigate potential measures and 2 concepts were considered using lift in rail sections over the chord with the chord sitting on slab track locally to facilitate built in locating chairs or mechanically lifted in sections with sleepers bearing on the chord sleepers. This concept is shown below in figs 21 and 22.

**Fig 21: Slab track with locating plinths without crossing system installed**
9.5.13 The second system involved the assembly piecemeal of handleable sections of track set into fixed chairs with a concrete slab supporting the main chord lines. An elevation of this concept is shown in Figure 21 below.

9.5.14 Both of these systems relied heavily on plant and labour resources with substantial time required to install and prove with little control over alignment.
and a subsequent risk of derailment. OLE isolation would be required to protect the operational railway once the system had been removed.

9.5.15 NR then reviewed the installation/operational and decommissioning issues related to the use of these systems and concluded that:

1. The issues regarding rail height and gradients were similar to that required for the fixed crossing as noted above.

2. Overhead line isolations would be required for installation, use and dismantling of the system.

3. Installation, use and dismantling of the system would require possessions of the mainline with substantial risk of overrun and disruption to services.

4. Risk of derailment due to poor alignment during use of the system causing severe disruption to services.

5. Installation and removal of the system requires a large amount of mechanical and manual handling.

9.5.16 A multi-disciplinary review by PB and NR including operations and maintenance staff considered that the proposed temporary crossing arrangements were impractical and carried a high risk of prolonged disruption to the operational network its potential for derailment in use and recommended no further development work on these temporary crossing concepts.
9.6 National Grid Gas Plc

9.6.1 I understand that National Grid Gas Plc ("NGG") have served a statement of case in relation to the proposed scheme by Network Rail ("NR") for Ordsall Chord on 12 March 2014.

9.6.2 Their statement of case and covering letter acknowledges that both NR and NGG are continuing to negotiate protective provisions (either in the Order or by contractual agreement). NGG and NR are hopefully that they will reach an agreement in relation to such provisions shortly.

9.6.3 NGG’s statement of case provides at paragraph 3.3 (a-f) that the protective provisions are inadequate and NR respond to these points as follows:

1. (3.3 (a)) They fail to provide for adequate written notice to be given to NGG before it is required to remove its apparatus in order minimise disruption to its gas network (which includes homes and businesses).

2. ((3.3 (b)) NGG claim that NR have failed to include provisions to ensure that the pipeline system is safe and to minimise disruption. For example, they do not specify that NR is not to undertake any works to remove, relocate or otherwise interfere with (including carrying out and survey works or trial holes) NGG’s apparatus without the prior written consent of NGG. Neither do they provide that NR must also comply with any conditions and/ or plans provided by NGG and all relevant health and safety obligations to ensure the apparatus is protected.
9.6.5 Network Rail is willing to agree that NGG will relocate its pipelines and undertake the relevant works. Impacts on apparatus which are not being relocated are addressed by paragraph 8 of the protective provisions.

3. (3.3(c)) NGG provide that there is a requirement for NGG to use its “best endeavours” to obtain third party rights is unreasonable as this may interfere with its statutory obligations to maintain an economic system where these “best endeavours” provide to be unreasonably costly, and NR fails to fully reimburse NGG.

9.6.6 The protective provisions already provide for reimbursement of costs in carrying out any relocating works and this includes NGG using their “best endeavours” to obtain third party rights.

4. (3.3(d)) Where NGG’s apparatus is to be relocated, the draft provisions fail to ensure that NGG will be granted sufficient rights to use and maintain such apparatus in order to comply with its statutory duties.

9.6.7 Paragraph 7 of the protective provisions provides for the terms of any rights granted for relocated apparatus to be agreed with NGG. NR is willing to spell out in an agreement that these rights will give effect to all reasonable requirements of NGG for ensuring the safety and efficient operation of its apparatus.

5. (3.3 (d)) They fail to ensure that NGG is not obstructed from accessing its apparatus.
9.6.8 Access to NGG’s apparatus in streets is added by section 69 of the New Roads and Street Works Act 1991 and Paragraph 2 of Schedule 11 to the Order. As regards access to private land Network Rail is willing to offer a contractual commitment that access is maintained.

6. (3.3 (f) the provision dealing with the reimbursement of NGG’s “reasonable expenses” and the draft indemnity does not sufficiently protect NGHG from incurring extensive costs or provide a sufficient indemnity from third party liabilities which is contrary to its obligation to maintain an economic system.

9.6.9 Paragraph 9 of the protective provisions properly addresses NGG’s costs in relation to works or apparatus required as a result of the overall works and paragraph 10 confers a full indemnity in respect of damage to apparatus or interruption in the supply of services caused by the works.

10. CONCLUSION

10.1.1 Based upon the remit for the Northern Hub project with the requirement to deliver an “Ordsall Chord” and with the constraints imposed on its location NR have produced a robust and feasible Proposed Scheme that satisfies the remit and the specified requirements.

10.1.2 Heritage issues have been a major constraint and consideration in this exercise in particular the Grade 1 listed structures and buildings associated with the 1830 railway. The research, planning and design resources applied to minimise and mitigate the impact on these structures and the museum have been significant. Means by which a mainline connection could be
10.1.3 From an engineering perspective the planning and design of the Proposed Scheme and the structures proposed can meet all the standards for design and for railway operations and maintenance.

10.1.4 Alternatives proposed for long or short chord flyover options although avoiding any impact on the heritage issues or the museum have serious impacts on the local townscape and at such an enormous expense which cannot be justified.

10.1.5 The alternative Option 15, although not developed to the same level of engineering detail as the Proposed Scheme, is a technically viable but compromised option with major defects, increased maintenance costs and performance risks to the extent that NR views this option as an unacceptable solution to the provision of an Ordsall Chord.

10.1.6 The alternative options proposed by Messrs, Kennion, Whitby, Siddall, Sacca and Gunn are all technically and operationally flawed and cannot be viewed or promoted as either better, cheaper or superior alternatives to option 15 which as noted above is not a reasonably acceptable alternative to the Proposed Scheme.
11. WITNESS DECLARATION

I hereby declare as follows:

(i) This proof of evidence includes all facts which I regard as being relevant to the opinions that I have expressed and that the inquiry’s attention has been drawn to any matter which would affect the validity of that opinion.

(ii) I believe the facts that I have stated in this proof of evidence are true and that the opinions expressed are correct: and,

(iii) I understand my duty to the inquiry to help it with matters within my expertise and I have complied with that duty.