MWH

BUILDING A BETTER WORLD

DESIGN PHILOSOPHY STATEMENT

Lincoln Road Corridor Improvements

Prepared for Auckland Transport

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QUALITY STATEMENT

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Auckland Transport

Lincoln Road Corridor Improvements

Design Philosophy Statement

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1 Introduction

This Design Philosophy Statement (DPS) details the standards, design parameters and assumptions that have been used to develop the preliminary detail design of the Lincoln Road Corridor Improvements project for Auckland Transport (AT). The DPS gives AT and key stakeholders the opportunity to comment on the initial design criteria that will be adopted for the design of this project. By receiving these comments during this early design development project phase, we were able to ensure that our end solution meets AT's expectations.

This DPS outlines the project standards, design parameters and assumptions being applied as at May 2016. This is, however, a live document and it is intended that it will be updated as required as the project progresses.

2 Background

Lincoln Road is classified as a regional arterial route carrying more than 40,000 vehicles per day. It is a major link for commuters and freight because of its direct access between the motorway network and businesses in the surrounding area. At most times of the day, it suffers from heavy congestion and is noted to have limited provision for active/public transport.

In September 2010, the former Waitakere City Council (WCC) approved the preferred option from the Lincoln Road Corridor 2008 scheme assessment report to be progressed to the preliminary design phase.

In March 2011, Auckland Transport commenced the preliminary design phase for the Lincoln Road Corridor Improvements Project. The preliminary design included the replacement of the existing flush median with a raised planted solid median and the widening of Lincoln Road to provide a bus/transit lane in each direction. Based on the findings of preliminary design, approximately 85 properties will be directly affected by the project including either part or full land acquisitions. The first round of consultation with the affected property owners, the wider community, and other stakeholders was undertaken during December 2013. The Preliminary Design was finalised on the 31 May 2016 for lodgement with the Notice of Requirement.

Auckland Transport's project objectives are:

1. To accommodate more people travelling to and along Lincoln Road by improving corridor efficiency.
2. To improve public transport reliability within the Project area.
3. To improve safety for all road users, including by providing cycling infrastructure.
4. To integrate Auckland Transport's Lincoln Road improvements with the NZTA Western Ring Route upgrade via the Lincoln Road Motorway Interchange.

2.1 Project Site

The extent of the project site is shown in Figure 2-1.

Figure 2-1: Extent of the project site

3 Design Standards

The preliminary design will comply with the current versions of the following documents:

- Building Act;
- Health and Safety in Employment Act;
- Resource Management Act;
- New Zealand Standards (NZS);
- NZTA standard specifications and publications;
- Austroads publications (including New Zealand supplements where applicable);
- Auckland Council policy documents; and
- Draft Auckland Transport Code of Practice (ATCOP).

Where conflicts between these documents occur, or where issues are not explicitly covered, MWH will notify AT to seek confirmation of the preferred approach.

4 Design Philosophy

4.1 Roading and Traffic Engineering Design

4.1.1 Design Standards

The applicable standards being utilised for the design of this project include the following:

- Austroads Guide to Road Design (AGRD) series, particularly:
  - Part 3: Geometric Design;
  - Part 4: Intersections and Crossings;
  - Part 4A: Un-signalised and Signalised Intersections;
  - Part 5: Drainage Design;
  - Part 6: Roadside Design, Safety and Barriers; and
  - Part 6A: Pedestrian and Cyclist Paths.
- Austroads Guide to Traffic Management (AGTM) series.
- NZTA Road Traffic Standards (RTS) series particularly:
  - RTS14 – Guidelines for Facilities for Blind and Vision Impaired Pedestrians; and
  - RTS18 – New Zealand On-road Tracking Curves for Heavy Motor Vehicles.
- Code of Practice for Temporary Traffic Management (COPTTM).
- NZTA Manual of Traffic Signs and Markings (MOTSAM).
- NZTA Traffic Control Devices (TCD) Manual.
- NZTA Pedestrian Planning Guide.
- Auckland Transport Code of Practice (ATCOP).
- Auckland Council Code of Practice (ACCOP).

4.1.2 Design Speed and Posted Speed

The existing posted speed limit along Lincoln Road is 50 km/h. This speed limit is considered appropriate for a road of this type due to the large amount of residential/commercial property

connections, intersections, and businesses located along the corridor. Due to this varied land use, the road experiences a high number of pedestrians from desire lines between the residential and commercial/business areas.

The proposed design retains the posted speed limit of 50 km/h. As per design guideline recommendations, the vehicle operating speed can be 10 km/h above the posted speed limit. Therefore, a design speed of 60 km/h has been adopted for the design of this project.

4.1.3 Design Vehicle

4.1.3.1 Design Vehicle Standards

For heavy vehicles, including 18 m semi-trailers, 13.5 m tour coaches, 11.5 m large rigid trucks and 8 m medium rigid trucks, RTS18 – New Zealand On-road Tracking Curves for Heavy Motor Vehicles will be used.

For passenger cars the 99th percentile car detailed in ATCOP Chapter 7, Road Layout and Geometric Design will be used.

RTS18 states that the tracking curves define the physical space necessary for the vehicle to execute the intended manoeuvre and do not include clearances. The recommended minimum vehicle envelope clearance of 500 mm will be added to each side of the tracking curve.

4.1.3.2 Design Vehicle at Intersections

An 18m semi-trailer will be the design vehicle for all movements at signalised intersections, except for double right turn movements where the design vehicles will be a 18m semi-trailer in the outside lane and a 11.5m rigid truck in the inside lane.

The only double left turn movement is from Universal Drive into Lincoln Road northbound has now been replaced with a single high entry angle give way arrangement. The design vehicle for this location is an 18m semi-trailer.

At non-signalised intersections the design vehicle will be an 11.5m rigid truck.

4.1.3.3 Design Vehicle for Vehicle Crossings

The following design vehicles will be used at vehicle crossings:

- 99th percentile car, at vehicle crossings serving residential properties
- 11.5m rigid truck, at vehicle crossings serving commercial and business premises

4.1.4 Over-dimension Route

Lincoln Road is classified as an over-dimension route. The design will therefore comply with the following specification:

- New Zealand Heavy Haulage Association, Road Design Specifications for Over-dimension Loads, Revision 4 – March 2010.

4.1.5 Typical Cross Section

4.1.5.1 Preliminary Design Typical Cross Section

A typical cross-sectional for Lincoln Road was prepared as part of the preliminary design and is shown in Figure 4-1.

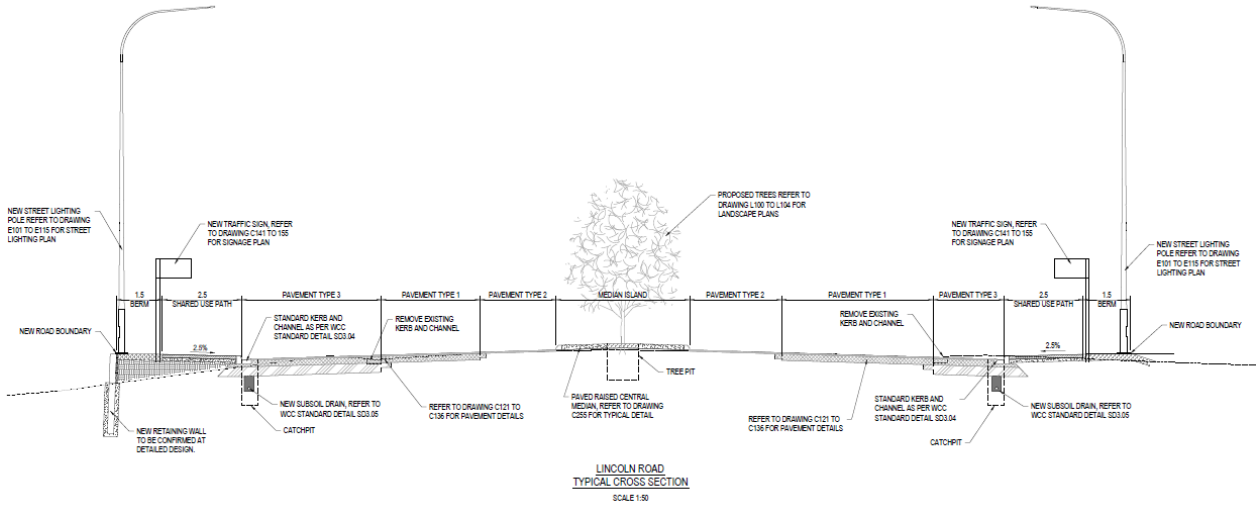

Figure 4-1: Extract from GHD Preliminary Design Drawing 51-30961-C116 showing a typical cross section for Lincoln Road.

Widths for this typical cross section were:

- 1.5m wide berm each side
- 2.5m wide shared path each direction
- 3.5m wide transit lane each in direction (kerb side lane)
- Two 3.2m general traffic lanes in each direction
- 2.5m wide raised median.

During the development of the preliminary design, however, several amendments have been made to the typical section. Where possible the following provision will be made;

- 3.8m Copenhagen style segregated cycle/pedestrian facility on each side
- 3.2m T3 lane in either direciton
- Two 3.2m general traffic lanes in either direction
- 2.5m wide raised median where possible

Due to the changing nature of Lincoln Road, the exact division of the road width changes. A typical arrangement, however is shown in the figure below. Full details can be found in the preliminary design drawings.

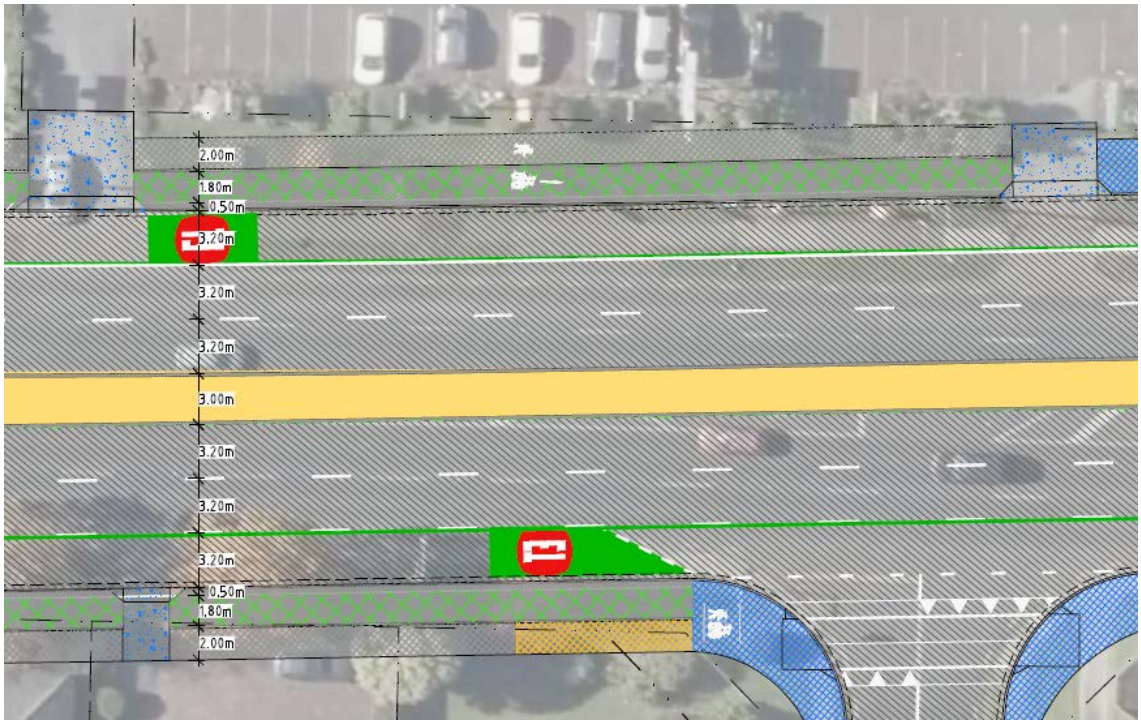

Figure 4-2 Typical layout on Lincoln Road

4.1.5.2 Footpath and Cycle Lanes

Although preliminary design drawings showed a 2.5m wide shared path along both sides of Lincoln Road, AT has indicated that a shared facility is not an acceptable design solution for this project and that the type of facility provided will be reconsidered as part of the detail design phase of the project.

It has been agreed with AT that 1.8m wide 'Copenhagen style' cycle lanes will be provided as indicated in Figure 4-3. The cycle lane is raised up above, and separated from, the adjacent traffic lane by a standard height kerb. The cycle lane is separated from the adjacent footpath by a low height kerb, creating a tiered arrangement. In addition to the kerb, a 0.5m wide buffer step would be provided between the cycle lane and the traffic lane to provide further separation.

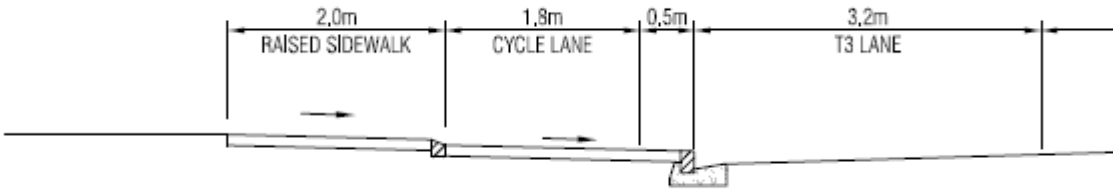

Figure 4-3: 'Copenhagen style' cycle lanes

This arrangement will require more space than the 2.5m shared path used in the detail design. In order to provide the extra space required, without increasing land acquisition requirements, AT has directed that the 1.5m berms should be removed from the typical cross section and the kerb side transit lane reduced in width from 3.5m to 3.2m (measured to kerb face).

4.1.5.3 Raised Median

A raised median was shown in the preliminary design drawings and will be adopted for the detail design. This will replace the existing flush median. The typical width of this median is 2.5m, but it will be narrower in areas near intersections where additional space for right turn bays or tracking areas for turning vehicles are required.

The raised median is intended to prevent drivers from turning right into or out of the vehicle crossings of properties adjacent to Lincoln Road. Instead these drivers will be required to make a U-turn manoeuvre at one of the signalised intersections along the route. The signal phasing should be selected to permit this to occur safely, by ensuring that vehicle movements which may conflict with U-turns are not permitted in the same phase.

There are several historical crashes recorded in NZTA's CAS database where vehicles turning right into or out of the vehicle crossing of properties adjacent to Lincoln Road have been involved in a crash. The additional traffic lanes, combined with the expected increase in traffic volumes in Lincoln Road will exacerbate this existing problem unless these right turn movements are prohibited.

An assessment of the effects of changing from a flush to a raised median was carried out for AT by GHD during the preliminary design phase of this project. This assessment and its findings is described a report prepared by GHD titled Impact of Raised Median Report (April 2013).

4.1.6 Vertical Alignment

The existing vertical alignment of Lincoln Road is relatively flat and the new design will follow the levels at the existing centreline of the road relatively closely. It is not expected that significant issues will arise during the detail design with regard to achieving a satisfactory vertical alignment with regard to minimum K values, driver sight lines over vertical curves and other similar vertical design considerations. Nonetheless, compliance with Austroads Guide to Road Design, Part 3: Geometric Design will be confirmed during the detail design and any issues identified remedied.

There are two sections of Lincoln Road which have horizontal curves will require superelevation. There are the located between chainage 50 to 195 and chainage 280 to 450. The amount of superelevation and development at each end will be in accordance with Austroads.

The project presents an opportunity to carry out reshaping of the existing pavement surface to remedy existing deficiencies. These deficiencies might be issues like poor drainage, excessive crossfall or irregular shape. The topographic survey of the existing surface will be used to identify these issues during the geometric design process.

Where practical, the design will minimise construction cost by reusing the existing pavement wherever practical while balancing the other vertical design considerations listed in this section. Where other considerations do not dictate a change in surface levels the design will retain the existing surface levels,

especially along the crown of the road. Where other considerations require a change to surface levels the geometric design will favour lifting the surface rather than lowering it, as this would affect the structural integrity of the pavement and may require a full depth reconstruction.

The tie-in at property boundaries will be considered when undertaking the vertical design as there is an opportunity here to reduce the heights of new retaining walls and the extent of accommodation works inside private properties.

Stormwater drainage is an important consideration when undertaking vertical design, especially around intersections and locations where superelevation is being introduced. The design will co-ordinate longitudinal grades with superelevation transitions to ensure that there are no flat areas.

Where existing services which are not being relocated are below the pavement then cover for these services will be taken into account as part of the detail design.

4.1.6.1 Crossfall and Road Widening

When widening the road one of the following treatments will be applied depending on the crossfall of the existing carriageway surface adjacent to the widening:

- **Case 1: Existing crossfall between 2% and 4%**

Where the existing crossfall is between 2% and 4% the design will widen the road by extending the crossfall or the existing carriageway.

- **Case 2: Existing crossfall more than 4%**

If the existing crossfall is more than 4% the design will adjust the existing carriageway surface to provide a 3% crossfall then extend the road at the same crossfall.

Adjustments to the existing crossfall will retain the existing road centreline levels but will raise levels at the edge of the carriageway.

The exact means by which the road levels will be lifted will be determined by the pavement design, but in areas where existing pavement is being resurfaced only and the increase in surface levels it not too great it is likely to be via mill and fill techniques, while in areas where the pavement is subject to rehabilitation additional basecourse material may be introduced.

- **Case 3: Existing crossfall less than 2%**

If the existing crossfall is less than 2% the design will adjust the existing carriageway surface to provide a 3% crossfall then extend the road at the same crossfall.

This will be achieved by building up levels at the centre of the carriageway then tapering out so that the increase in level where the carriageway widening meets the existing surface is at or close to zero.

4.1.7 Intersections

4.1.7.1 Signalised Intersections on Lincoln Road

The design will include four signalised intersections on Lincoln Road which will be upgraded as part of the project. These intersections are as follows:

- Lincoln Road / Triangle Road / Central Park Drive intersection
- Lincoln Road / Universal Drive / Universal Drive Extension intersection
- Lincoln Road / Mitre 10 Mega and Pak'n'Save entrance / Bible College entrance intersection
- Lincoln Road / Pomaria Road / Te Pai Place intersection

Traffic modelling has been carried out as part of the previous stages of the project and this was used to identify the preferred lane assignments and phasing for the intersections. Except as required to provide for U-turn movements these will be incorporated into the detail design. Reassessment of the lane assignments were outside MWH's agreed scope of work.

The new raised median on Lincoln Road will necessitate U-turn movements at signalised intersections from the Lincoln Road approaches to the signalised intersections in order to allow access to adjacent properties. Some modification of the signal phasing proposed in the detailed design may be required to

facilitate safe U-turn movements, however the signal phasing should be kept as close as possible to the phasing used in the preliminary design.

Changes to signal phasing to permit safe U-turns will require confirmation by traffic modelling. This modelling was outside MWH's agreed scope of work and this will be done by AT's internal traffic modelling team using the existing Paramics model.

4.1.7.2 Non-signalised Intersections on Lincoln Road

There are three non-signalised intersections on Lincoln Road within the extent of works which are as follows:

- Lincoln Road / Paramount Drive intersection
- Lincoln Road / Daytona Road intersection
- Lincoln Road / Poinsettia Place intersection

These intersections are currently controlled with 'stop' and 'give way' controls and will remain so in the detail design, however due the new raised median on Lincoln Road the right turn out of these intersections will be prohibited as part of the design.

At the Lincoln Road / Paramount Drive intersection and Lincoln Road / Daytona Road intersection right turn movements into the side road from Lincoln Road will be provided for by way of right turn bay located within the raised median.

Lincoln Road / Poinsettia Place intersection the right turn movement into Poinsettia Place from Lincoln Road will be prohibited. Poinsettia Place is a cul de sac serving predominately residential properties and the traffic volumes on this road are lower than the other side roads.

4.1.7.3 Other Intersections

On Universal Drive the access to Lincoln North Shopping Mall will be signalised as part of the project. There is currently an existing staggered signalised pedestrian crossing located close to this access which will be replaced with a signalised pedestrian facilities integrated into the new signals layout.

4.1.8 Traffic Signals

The traffic signals will be designed in accordance with the Auckland Traffic Management Unit *Traffic Signals Design Guidelines (Version 3.0 August 2010)* and the Signals New Zealand User Group (SNUG) *National Traffic Signal Specification (Version 3.0 November 2012)*. AT's traffic signals specialists and the Joint Transport Operations Centre (JTOC) will have an opportunity to review the signals designs before the design is finalised.

4.1.9 Traffic Signs and Road Markings

The traffic signs and road markings are to be designed in accordance with the following documents:

- ATCOP
- Manual of Traffic Signs and Road Markings (NZTA)
- Land Transport Rule: Traffic Control Devices 2004
- NZTA Traffic Control Devices (TCD) Manual.

Road markings at the intersections will be designed to meet the vehicle turning track requirements identified in Section 4.1.3.

At each of the signalised intersections, the length of the right turn bay or right turn traffic lane will be determined from the predicted queue lengths within the traffic modelling produced by AT.

4.1.10 Vehicular Access to Adjacent Properties

All adjacent properties with vehicle crossings onto Lincoln Road or other roads within the project site will retain vehicle access. For the properties on the west side of Lincoln Road between Daytona Road and Triangle Road access will be via a new service lane. This lane, and its impact on property access, is discussed in Section 4.1.11.

For all other properties existing vehicle crossings will need to be rebuilt and relocated due to the widening of the carriageway. This will require some accommodation work within the adjacent properties

to provide a smooth tie-in. This work will be subject to negotiation and consultation with property owners to reach agreement on the works require in each property. The design drawings will make reference to signed property agreements and any specific requirements identified within the agreements.

Rebuilt vehicle crossings will comply with ATCOP Chapter 7, Road Layout and Geometric Design.

4.1.11 Service Lane

There are a number of residential properties containing single household detached dwellings located on the west side of Lincoln Road between Daytona Road and Triangle Road which currently have vehicle crossings providing access directly onto Lincoln Road. The ground surface within these properties is below the level of the surface of Lincoln Road and once the road is widened to provide an extra northbound lane in this section of Lincoln Road it will not be practical to retain or rebuild these vehicle crossings due to the steep grade which would result. Instead the detail design will provide access by way of a service lane running behind these properties.

A turnaround area will be provided at the end of the service lane.

This service lane, including turnaround area, will be designed to accommodate an 11m rigid truck as the design vehicle for swept path / tracking purposes. This size of vehicle has been selected to allow a suitable size maintenance vehicle to access the stormwater filtration cartridge system located within the land acquired for the service lane.

AT provided a specific brief for this location, which was incorporated into the design.

4.1.12 Bus Stops

Lincoln Road is a regular service public bus route and there are six bus stops on Lincoln Road within the project extents.

The preliminary design included recessed bus bays at all bus stops. AT has requested that these be removed from the detail design and instead buses will stop in the kerb side transit lanes.

Except as where necessary to accommodate the cycle lanes, the design of bus stops and facilities provided at bus stops will be in accordance with ATCOP, Chapter 20: Public Transport - Buses. All bus shelters will be new shelters shall be in accordance with a standard AT design.

4.1.13 Parking

There are existing parking facilities adjacent to a row of shops at 260-282 Lincoln Road. Whilst this facility will be retained, there is the potential loss of around 11 spaces.

No on-street parking is currently permitted in Lincoln Road and, in keeping with this road's regional arterial function, none will be provided in the detail design.

There is no on-street parking permitted in within the sections of Universal Drive, Universal Drive Extension, Triangle Road, Central Park Drive or Pomaria Road which are part of the project site.

Some existing on-street parking spaces in Paramount Drive, Daytona Road and Poinsettia Place near the intersections with Lincoln Road are expected to be lost to accommodate the new speed tables proposed at these side roads. Approximately two to four spaces will be lost at each side road.

4.1.14 Speed Tables

The preliminary design includes speed tables across some slip lanes at signalised intersections and intersections with minor side roads. The location of these tables has subsequently been amended in the detail design based on the outcome of the design workshop with AT internal stakeholders and the design team held on 28 May 2015. Following the consultation with internal stakeholders, raised tables will be provided at the following locations;

- Lincoln Road SB left into Central Park Drive
- Central Park Drive left into Lincoln Road
- Across Daytona Reserve access
- Across Paramount Drive
- Lincoln Road SB left into Universal Drive Extension

- Lincoln Road NB left into Universal Drive Extension
- Lincoln Road left into Pak n Save
- Across Poinsettia Place
- Lincoln Road SB left into Te Pai Place

Where speed tables are located on a slip lane or where a traffic island separates opposing directions of travel 'Swedish style' speed tables will be used.

In other locations, where speed tables need to serve bi-directional traffic, the tables will be in accordance with the applicable standard engineering detail drawing from ATCOP, Chapter 8: Traffic Calming Devices/LATM.

4.2 Pavement Design and Surfacing

4.2.1 Design Standards

The following standards and guidelines will be used during preparation of the pavement design:

- Austroads Pavement Technology Part 2: Pavement Structural Design
- NZ Supplement to Austroads Pavement Design Guide
- ATCOP Chapter 16 Road Pavements and Surfacings.

A computer program CIRCLY will be utilised in the analysis and design of pavement.

4.2.2 Design Life

The pavement design life will be 25 years, excluding surfacing which will have a design life of 8 years.

4.2.3 Design Traffic

ADDT values used for pavement design will be based on AT's Paramics traffic model prepared before and during the preliminary design phase of the project.

The assumed percentage heavy commercial vehicles (HCV%) for pavement design purposes will be 10%.

The design traffic will be calculated in accordance with the Austroads Pavement Technology Part 2 – Pavement Structural Design.

4.2.4 Preliminary Design

During the preliminary design phase of the project investigation of the subgrade and existing pavement was undertaken and a preliminary pavement design was prepared. This investigation and design work is documented in a July 2011 memorandum from GHD titled Pavement Design for Lincoln Road Corridor Upgrade. This memorandum is appended to GHD's preliminary design report.

The preliminary pavement design included both new pavement for widening of the existing carriageway and also rehabilitation of existing pavement which site investigation determined to have only a limited design life.

For new pavement areas the preliminary design consisted of the following:

- 50 mm asphalt surfacing on chipseal membrane (SMA at major intersections / AC14 elsewhere)
- 200 mm AP40 foam bitumen stabilised basecourse
- 300 mm GAP300 sub-base.
- Subgrade design CBR of 3.5% or greater

For pavement rehabilitation areas the recommended treatment was:

- 50 mm asphalt surfacing on chipseal membrane (SMA at major intersections / AC14 elsewhere)
- 200 mm foam bitumen stabilised basecourse (existing material to be treated).
- Existing sub-base to remain.

The thickness of the surface wearing course will be reviewed in light of new guidance on minimum surfacing layer thickness provided in Notes to NZTA M10:2014 Specification for Dense Graded and Stone Mastic Asphalts.

4.2.5 Detail Design

The following steps should be considered during the detail design phase;

1. Review and gap analysis of prior testing and design work
2. Confirmation of design life, AADT and HCV% values for pavement design with AT
3. Additional pavement and geotechnical testing to cover any gaps in existing information reviewed as part of Step 1
4. Meet with AT and agree which potential pavement design options should be considered as part of the design process.
5. Undertake CIRCLY analysis of the options and estimate cost per square metre of the options.
6. Agree final preferred pavement design with AT.
7. Prepare design drawings and specification showing the pavement design.

4.3 Stormwater

4.3.1 Design Standards

There are a number of design standards and codes of practice for stormwater management in New Zealand. The standards that will be applied in the stormwater design requirements for this project are as follows:

- Auckland Council Code of Practice for Land Development and Subdivision, Chapter 4 – Stormwater (ACCOP)
- ATCOP, Chapter 17: Road Drainage
- ARC Technical Publication No.10 (TP10) – Design Guideline Manual Stormwater Treatment Devices
- ARC Technical Publication No.90 (TP90) – Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region
- ARC Technical Publication No.108 (TP108) – Guidelines for Stormwater Runoff Modelling in the Auckland Region.

4.3.2 Stormwater Options Report

In April 2015 MWH prepared the 'Lincoln Road Corridor Improvements Option Report'. This report documents at a high level the stormwater management options considered during the early stages of the detail design and makes a recommendation for a preferred option to be adopted as part of the detail design.

The recommended option is to convey run-off from the entire catchment via a piped network to a new structural filtration (filter cartage) system to be located within land acquired for the new service road at 312 Lincoln Road. A new discharge pipe would then connect the filtration system to a new discharge pipe in Daytona Strand (a recreational reserve).

The conclusions of this report are subject to confirmation by AT and Auckland Council's consenting team.

4.3.3 Catchment Description

The catchment for this project extends along Lincoln Road from the SH16 motorway interchange to the Te Pai Place / Pomaria Road intersection, a total length of 1.3 Km. This section of Lincoln Road travels along a ridge line, with very little stormwater runoff contributed from areas outside of the road corridor. The catchment has a general slope from south to north, with local high points around the Triangle Road / Central Park Drive intersection and the Te Pai Place / Pomaria Road intersection.

The stormwater runoff from the Lincoln Road corridor drains to the Lincoln Catchment to the west and the Central Park Catchment to the east. There are currently two main discharge points and a number of smaller discharge points from the various sub-catchments.

The catchment was divided into ten sub-catchment areas by GHD during the preliminary design. During preparation of the Stormwater Options Report MWH identified that there are some areas where flows drain onto the project site which have not been included in these catchments, it is therefore expected that there will be a slight increase in catchment area with resultant increases in design flows.

4.3.3.1 Catchment Management Plans

There are two catchment management plans (CMP) which cover the Lincoln Road Corridor Improvements project area, the Lincoln Catchment and Central Park Catchment. Both CMPs have been prepared and lodged with the former ARC; however there is no network discharge consent for either catchment. Thus the outcomes of these CMPs must be treated as advisory only.

4.3.3.2 Water Sensitive Design

Water sensitive design by means of treatment within the road corridor using swales, rain gardens or similar measures was considered during the preliminary design phase of the project, but rejected due to the lack of space within the road corridor. MWH's stormwater engineers have reviewed the basis for this decision and concur with the reasoning.

No stormwater treatment will be provided within the road corridor as part of this project, instead stormwater treatment will be provided in land adjacent to the corridor.

4.3.3.3 Treatment Extents

The PAUP states that when major upgrade works are carried out on a road that stormwater treatment must be provided for the entire carriageway surface. The Operative Air, Land and Water Regional Plan only states that the new impermeable surface area is to be treated.

AT's approach is to provide treatment to the increased area and future proof for full treatment if agreed on at a later stage.

4.3.4 Design Basis and Assumptions

These are the stormwater assumptions and design basis.

• Flow calculations	TP-108, Graphical Method
• Design Return period	1 in 10 years
• Time of concentration Tc	10 minutes minimum
• Design rainfall	TP-108, 10yr 24 hour
• Runoff Curve Numbers	98 for impervious surfaces, 74 for pervious surfaces.
• Impervious proportion	Areas of new and existing imperious surface for each sub-catchment were determined by GHD during the preliminary design phase of the project. These will be reviewed and confirmed by MWH as part of the detail design.
• Pipe hydraulic design, and incoming / outgoing connections	Any pipe design required will use the Colebrook White formula for assessing the required sizing. Pipe roughness, k_s = as per ACCOP.
• Kerb and channel	Both sides of roads.
• Catchpits	In accordance with ATCOP. Sump outlets will be a minimum of 225mm diameter.
• Subsoil drains	Minimum of 100mm into the subgrade. The pipe is to be connected to the catchpits from one direction only (i.e. graded into only, no outlets).

• Manholes	Where manholes are required: Pipes to have a minimum fall of 50mm across manhole pipe size. Pipe diameter differences match, at crown to crown. Manhole to manhole connections are to be a minimum diameter of 300mm, and a run no greater than 100m.

4.4 Lighting Design

4.4.1 Design Standards

The lighting design will be based on relevant sections of the AS/NZS 1158:2005 Lighting for Roads and Public Spaces (Parts 1.1 and 3.1) and ATCOP, Chapter: 19 Street Lighting. All electrical installations shall comply with the New Zealand Wiring Rules AS/NZS 3000:2007.

4.4.2 Lighting Category

Table 4-4-2-1 shows the AS/NZS 1158 lighting category which will be adopted for design. These categories were selected by AT during the preliminary design phase of the project.

Table 4-4-2-1: Lighting category

Road / Location	Lighting Category
Lincoln Road	V2
Central Park Drive	V3
Triangle Road	V3
Universal Drive / Universal Drive Extension	V3
Lincoln North Mall intersection (on Universal Drive)	V2
Te Pai Place	V4
Pomaria Road	V4
All other side roads category	P (see note 1)
Pedestrian(Zebra) crossings	X1

Note 1: Exact P category for side roads to be confirmed with AT before street light design commences.

In addition to the illumination level requirements of AS/NZS 1158, the design will also comply with all additional ATCOP specific requirements, in particular the ATCOP requirement for horizontal point illuminance on signalised pedestrian crosswalks of 20 lux for V1 and V2 category roads and 10 lux for V3 or V4 category roads.

4.4.2.1 Luminaires

LED luminaries will be used in order to minimise energy use and environmental impact and reduce maintenance costs.

As per the preliminary design CREE/Ruud LEDway luminaires type will be used, with 4300K LEDs operating at 700mA. 120 LED(272W) units will generally be used, except where smaller luminaires are more appropriate for specific situations.

Street light luminaires used at ‘zebra’ pedestrian crossings require optics specifically designed for pedestrian crossings. There is a list of luminaires approved for use at pedestrian crossings in ATCOP,

but, at the date of preparation of this design philosophy statement (May 2015), these are all metal halide type luminaires. MWH's street lighting engineer will confirm the type of luminaire to be used at pedestrian crossings with AT's street lighting team, and will use the type directed by them (LED or otherwise).

4.4.2.2 Street Light Poles

Street light poles will be unpainted galvanised street octagonal section poles. Poles on Lincoln Road shall have a 12 m mounting height and a mitred outreach. The poles are frangible non-slip base assemblies. Poles will conform to the requirements of ATCOP Chapter 19 Street Lighting.

Poles will be positioned at the back of the footpath close to the property boundary. Lincoln Road is an over-dimensional vehicle route and positioning street light poles near the boundary will minimise the impact the poles will have on these vehicles.

Poles will not be positioned on the central median as the foliage of street trees located in the median will interfere with the lighting. There is also an existing 910 mm diameter Watercare water main located under the centre of Lincoln Road which would potentially clash with the foundations of any street light poles located in the median.

Where street lights are located close to signals joint use poles will be used.

4.5 Landscape and Urban Design

4.5.1 Standards

The landscape and urban design elements of the detail design will be designed based on the relevant sections of the following national guidelines, NZTA guidelines and Auckland Council policy documents:

- Bridging the Gap – NZTA Urban Design Guide
- Landscape Guidelines – NZTA
- Design of Streets – North Shore City Council (now part of Auckland Council)
- New Zealand Urban Design Protocol
- Ministry of Justice National Guidelines for Crime Prevention through Environmental Design (CPTED) and National Guidelines for Injury Prevention through Environmental Design (IPTED)
- ATCOP

4.5.2 Soft Landscape

As a result of the space required for road widening along Lincoln Road, opportunities to include landscape planting treatments are limited.

Where the raised median is 2.0m or wider and safety and visibility considerations permit trees will be included in the design at 10m intervals. These trees will be installed in tree pits to prevent the root systems causing damage to adjacent pavement. As per the preliminary design the trees will be Tulip Trees (Liriodendron tulipifera), subject to approval by Auckland Council Parks and Iwi.

There is a 910 mm diameter watermain running under the centre of Lincoln Road and trenches were dug to confirm the location of this services and this work revealed that the main is sufficiently deep to allow planting of trees above. This, however, will be subject to agreement from Auckland Council.

Every effort will be made to retain trees in the design as they provide significant benefits to the road environment.

- They change over time creating interest and variation
- Create habitat for wildlife
- Help to improve air quality
- Improve the appearance of the road
- Provide shade
- Reduce stormwater quantities
- Reduce wind speed

- Soften built form, in this case 'big box retail' and car parking space, and wide expanses of carriageway.

Design of Streets – a reference handbook for high quality streets. NSCC (2009)

In addition to trees, low level planting will also be provided in the central median. Species selected for this planting will be hardy and easy to maintain. When mature, their size will be such that they do not protrude into adjoining traffic lanes or grow to a height which interferes with driver sight lines. No irrigation system is included in the design and this will also be a factor when designing the planted areas. Where soft landscaping is provided suitable subsoil drainage will also be installed to prevent the ingress of water into adjoining pavement layers.

The preliminary GHD design had a 1.5m wide berm area between the footpath and property boundary, which could have provided space for planting. In order to incorporate separate pedestrian and cyclist facilities on both sides of the road, however, these have been removed from the preliminary detailed design.

4.5.3 Hard Landscape

There is some potential to provide enhanced amenity through the selection of materials of hard stand areas. However this must be balanced against the need to achieve a value for money solution which is easy to maintain.

In order to minimise both construction and maintenance costs materials conforming to standard engineering details from ATCOP will be used wherever practical. Table 4-5-3-1 summarises the main ATCOP details which will be used.

Table 4-5-3-1: Hard landscaping detail summary

Asset Type	ATCOP Drawing Number	Notes
Footpaths	FP001	Broom finish
Kerb and channel	GD009	Type 3 Extruded kerb and channel
Traffic islands	GD007	Except where traffic island is planted
Speed tables	'Swedish style' speed tables	-
Pram crossings	FP009	Tactile ground surface indicators will be provided at all pram crossings
Vehicle Crossings	GD017, GD018, GD019	-

Tactile ground surface indicators shall be provided at all pram crossings in accordance with RTS14 and ATCOP. In order to minimise maintenance costs and address concerns with slipperiness in wet conditions these will be 300x300x60mm yellow pigmented concrete tiles.

'Copenhagen style' cycle lanes have been selected as the main cycling facility for Lincoln Road and there will be a need to differentiate them from the adjoining footpath. This will be achieved both by the separating kerb, and also a contrasting surface texture and colour.

Bus stops are also areas where there is a need to differentiate pedestrian and cyclist areas. Public transport patrons must cross the path of cyclists when boarding and alighting from buses and a different surface texture and colour can help warn both bus users and cyclists of the potential hazard.

4.6 Utilities

4.6.1 Design Standards

There are a number of design standards and codes of practice for electricity, telecommunications and gas in New Zealand. The standards that can be applied in the other utilities design requirements for this project are as follows.

- Auckland Council Code of Practice for Land Development and Subdivision
- Auckland Transport Code of Practice
- Watercare Code of Practice
- Services' companies specific requirements

4.6.2 Services Cross Section

The location of the new utilities within the road reserve will be generally in accordance with ATCOP, however the presence of existing services means that this is not likely to be achieved in all cases. Due to the nature of the corridor and the number of strategic assets, a specific road cross-section will be prepared and circulated to AT and the services companies for discussion and agreement.

4.6.3 Design Basis Approach and Assumptions

In order to meet the requirements of the utility providers the following assumptions and design approach have been made:

• Responsibilities of utility owners.	Each of the service providers will carry out preliminary and detailed design sizing of their specific utility based on information supplied by AT and MWH. This excludes Watercare assets, as detailed below Utility providers will be required to carry out installation of their specific services.
• Responsibilities of MWH	Provide preliminary design drawings of the location of the services corridor to each of the respective utilities (other than Watercare) for comment Provide preliminary and detail design drawings for any changes to Watercare services required as part of the project in accordance with Watercare's Code of Practice. These designs are subject to Watercare approval and Auckland Council engineering approval. Prepare common service trench details and ducting requirements.
• Costs	Watercare - Diversions: 50% AT, 50% Watercare Watercare - Betterment cost: 100% by Watercare Other Services – Diversions : 100% by AT Other Services – Betterment: 100% by Service Company