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- A Design Information Sheet
- B Standard Signal and Phasing Layout Plan
- C Example of Standard Pole Numbering
- D Examples of Standard Signal Group Numbering
- E Examples of Standard Detector Numbering
- F Examples of Standard Signal Details
- G Standard Traffic Signal Lantern Display Symbols

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2. Glossary

Controller	The equipment (including the housing) that switches power to signal lanterns and controls the duration and sequence of signal displays as defined by the controller personality.
Controller Information Sheets (CIS)	A hard copy of the information used to make a Controller Personality that is contained within the PROM.
Controller Personality	The unique program stored in the PROM, which configures the controller to the specific operational design of the intersection.
Network Management Operation (NMO)	The consultant tasked with assisting the TMU with managing the flow of traffic throughout the Auckland Region
PCMCIA card	A computer card containing the controller personality information housed in the TSC/4 compliant controller. In this document PROM refers to either a PROM or a PCMCIA card.
PROM	A computer chip containing the controller personality information housed in the TSC/3 compliant controller. In this document PROM refers to either a PROM or a PCMCIA card.
Road Asset and Maintenance Management (RAMM)	An Internet accessible system that stores the Traffic Signal assets. Also records the activity of the Mtce Contractors on the Maintenance Contracts of the LTAs by the logging of faults as Dispatches and their completion by the Contractors. Contractors' claims are generated from the system at each month end.
RCA	Road Controlling Authority
Road Transport Authority of New South Wales RTA (NSW)	The Authority that is accepted as the basis for the TMU standards and for product approval
Sydney Coordinated Adaptive Traffic System (SCATS)	A fully adaptive area wide control system for traffic signals that is linked to all of the controllers via telecom lines or fibre optics.
Traffic Management Unit (TMU)	Organisation tasked with managing the flow of traffic throughout the Auckland Region by monitoring SCATS and also responsible for routing all fault calls to the various traffic signal maintenance contractors.
WinTraff	A software programme used to check the controller information by testing the software of the controller personality.

3. Background

The Auckland Traffic Management Unit (TMU) has prepared this document to assist practitioners when designing traffic signal installations to ensure that the standards used across the region are being utilised consistently. This guideline has been created to ensure that the designs of all intersections are to the highest standard, with variations being the exception rather than the norm. It is important that the information submitted as part of new or modified traffic signal layouts are standardised as much as possible. This will enable any further changes that may result from changing traffic conditions to be quickly and simply implemented.

This document lists the information that the TMU requires to be shown on the drawing for the **traffic signal layout plan**. The information covers all the basic data required for a contractor to install the traffic signal equipment. The information will also assist the TMU to create the CIS and the Controller personality as well as allow the TMU to set up the intersection on the SCATS network and provide good operational performance.

This document covers in some detail requirements for other plans required as part of any physical works such as existing survey and services, proposed construction or road marking. These are essential to provide as complete a picture as possible. Examples of a typical intersection layout and pictorial examples of the basic details such as pole numbering, signal group numbering and detector numbering are included in the appendices for reference.

4. Information Required

When a traffic signal design is undertaken for a client prior to submission to the TMU it is expected that the consultant will produce the following plans.

1. Cover Sheet
2. Existing Survey and Services
3. Proposed Construction and Set Out details
4. Proposed Signal and Phasing layout
5. Proposed Roadmarking layout and Signage
6. Tracking Plan
7. Standard Signal Details (optional)
8. Standard Construction Details (optional)

All plans are to be submitted to the TMU in hard copy at a minimum of A3 size. ACAD or PDF files are also required. This is to ensure that the plans are clear and concise for reviewers, safety auditors and contractors. Plans should be at a scale of 1:200 @ A1 with a minimum scale of 1:250 @ A1

This document deals primarily with the requirements of the Proposed Signal and Phasing Layout and the Standard Signal Details. The requirements for both of these will be detailed more extensively in Sections 3 and 4.

4.1 Cover Sheet

This sheet will have the name of the project a locality plan showing the location of the intersection and a drawing register.

4.2 Existing Survey and Services

This sheet will show the location of all services plotted from the various service authorities services plans. In addition the information collected by the topographical survey such as existing kerbs, driveways, local facilities such as manholes, valves, poles, streetlights and roadmarking and signs shall be shown.

4.3 Proposed Construction and Set Out

This sheet will show the extent of all new physical works to be undertaken such as kerb relocation, new islands, pram crossings including tactile pavers and where services are being relocated to if applicable.

4.4 Proposed Signal and Phasing Layout and Signage

This sheet will show the proposed kerbs and roadmarking and the location and type of all signal hardware. Also to be included on this plan is the ducting and cabling diagrams and signal phasing. The requirements of these topics are covered in more detail in Section 4 of this manual. The plans should be at least a scale of 1:250 at A1 size, preferably at 1:200 at A1.

4.5 Proposed Roadmarking Layout

This sheet will show the proposed roadmarking layout with dimensions including the tie ins with the existing roadmarking at the extent of the physical works. Any proposed signage should also be included on this plan.

4.6 Tracking Plan

This sheet will show the tracking of the largest vehicles deemed appropriate for the site. Of particular note should be the left and right turning vehicles with respect to limit line location and kerblines.

4.7 Standard Signal Details

This sheet will show the details particular to signal installations, such as traffic signal pole footings and loop wiring details. The requirements of these topics are covered in more detail in Section 4 of this document.

4.8 Standard Construction Details

This sheet will show the standard construction details particular to this project and may include such items as tram crossing details and kerb and channel details. These are optional for purely traffic signal design plans.

5. Proposed Signal and Phasing Layout

The traffic signal and phasing layout plans can be very complex and it is important that they contain all the information required in as clear a format as possible. For this reason it is desirable that all signal and phasing layout plans be at a scale of 1:200 @ A1 with a minimum scale of 1:250 @ A1. Copies of the plans must also be provided in ACAD or PDF format.

5.1 Information required on Signal and Phasing Layout Plans

The signal and phasing layout plans must show the following information. A copy of the required layout is attached in Appendix A.

- » Lane configuration
- » Lane widths/Carriageway widths (include cycle ways & advance cycle boxes where applicable)
- » Lane assignment (arrows) including Bus Lanes and Free Left Turn lanes as appropriate
- » Pedestrian crossing markings
- » Detector loop placement and numbered inside the loop
- » Dimensions to advance loops
- » Pedestrian detector numbers in the crossing lines adjacent to the kerb
- » Controller position
- » Chamber location and ducts
- » Poles with number and type (ie 5m outreach mast pole)
- » Push buttons and pedestrian lanterns
- » Pram crossings and tactile pavers
- » In-ground Pedestrian detectors, if used.
- » Aspects showing cowls
- » Signal groups numbered in a circle at the point of the vehicle display or in the centre of pedestrian crossing lines
- » Pedestrian movement number P1, P2, etc, adjacent to but outside of the crossing lines
- » Cabling and ducting diagrams
- » Signal phasing diagram
- » Signal groups diagram
- » Street Names
- » Property boundaries
- » Kerb lines
- » Vehicle crossings

- » Legend
- » North Point (Preferably up the page)
- » Title block
- » Notes including any on operation features e.g. 'Rest in A'; 'Z- allows filter'; etc

5.2 Detectors

The requirements for the detector numbering convention are detailed below. If the controller cabinet is relocated then the site must be renumbered to comply with the standard convention.

Note: Currently SCATS can only handle 24 vehicle inputs and 8 external inputs per intersection. So if any detectors are required for strategic control in SCATS they will need to be located in the range of 1-24.

5.2.1 Vehicle Detectors

Detectors are numbered anti-clockwise from the controller assuming that a line is drawn from the controller through the centroid of the intersection. Refer Appendix H for diagram. The first circuit is the Stop line loops, departure loops and counting loops are numbered first, with the departure loop being numbered after the stop line loop it is associated with. The second circuit is the dynamic loops, followed by the advance dynamic loops. The reason detectors are numbered anti-clockwise is so that an approach will read numerically correct left to right when viewed on a SCATS System Monitor display.

Where there is a secondary part to the signals such as at interchanges, the first circuit is around the part of the intersection closest to the controller, then around the second part of the intersection. Then back to the first part of the intersection for the second circuit. A line is drawn from the controller through the centroid of the second part of the intersection to give the starting point for each numbering circuit.

If a controller is relocated then the site must be renumbered to comply with the standard convention.

Table 1 Detector Card Configurations for TSC/3 Compliant Controllers

Detector Card	16 Detectors	24 Detectors	32 Detectors
Internal Detectors (Vehicles)	8	16	16
External Detectors (Pedestrian)	8	8	16

Detector Card Configurations for TSC/4 Compliant Controllers

When the new TSC/4 compliant controllers were first introduced each Detector card had 16 Internal Detectors (Vehicles) and 16 External Detectors (Pedestrian). Since then the manufactures have provided some flexibility to allow combinations to be used. It is important

for the designer to understand and number the loops and pedestrian call detectors in the appropriate manner as this impacts directly on the preparation of the software.

5.2.2 Pedestrian Detectors

Pedestrian detectors are numbered depending upon the card in use. First ascertain the number of detectors available at the controller if it is an existing site or determine the requirement if new. TSC/3 Controller Detector cards come in groups of 4 ranging between 4 and 32.

The TSC/4 Compliant controllers come with a standard 32 input Detector card. This consists of 16 vehicle inputs and 16 external inputs. Again this will depend on the type of controller and the configuration applied.

Table 2 Pedestrian Detectors

Detector Card	Pedestrian Detectors Allocated
PD 204	13-16
PD 208	13-16
PD 212	13-16
PD 216	29-32
TSC/4 Type	29-32

The pedestrian detectors are numbered from the highest number down as follows and may include more than 4 pedestrians facilities:

Table 3 Pedestrian Detector Slot Numbering (16 Detector)

Pedestrian Number	1 Ped	2 Peds	3 Peds	4 Peds	5 Peds
P1	16	16	16	16	16
P2		15	15	15	15
P3			14	14	14
P4				13	13
P5					12

A similar configuration will apply across the top end for 24 and 32 detector cards.

5.3 Pole Numbering

Poles are numbered in a clockwise direction from the controller assuming that a line is drawn from the controller to the centroid of the intersection. Refer Appendix C for diagram.

Where there is a secondary part to the signals such as at interchanges, the intersection closest to the controller shall be numbered first then the additional part can be numbered in the same format assuming that a line is drawn from the controller to the centroid of the secondary part of the intersection.

If a controller is relocated then the site must be renumbered to comply with the standard convention.

5.4 Signal Groups

Details on signal group conventions are detailed in Appendix D. With TSC/4 compliant controllers, the number of signal groups can range from 4 to 32 in modules of 4 signal groups.

Pedestrian signal groups in a 16 group controller will be denoted as (P1=16, P2=15, P3=14, & P4=13.) If only two Pedestrian groups then P1=16 and P2 = 15.

5.5 Phasing

The phasing diagram must show the following:

- » Each phase in a separate box with the phase label inside the box corner A, F, F1, etc.
- » Show only the movements that display green in each phase
- » Indicate movements by an arrow pointing in the direction that traffic will travel
- » Signal groups shown in a circle at the point of the movement arrow for vehicles and beside pedestrian movements
- » Any Special Flags inside the phase box Z-, Z+, etc
- » Indicate if filter turn movements are permitted

The phase sequence must also be shown on the plan, adjacent to the phasing diagram.

In general all traffic signals shall be consistent with the standard RTA (NSW) configuration. Standard phasing configurations are detailed below. Where standard phasing configurations are not appropriate, due to the site or traffic flow conditions the phasing should be designed to:

- » Minimise the number of phases;
- » Minimise cycle time;
- » Run as many compatible movements as possible in each phase;
- » Restrict each phase to non-conflicting movements;
- » Allow each movement to run in as many phases as possible (preferably allowing as many as possible to overlap from the previous phase or into the following phase);
- » Comply as closely as possible with the standard RTA configuration. Examples of a range of standard arrangements are found on the following pages of this document.

The phasing design should consider the use of filter right turn movements. The phasing design should provide the most flexible operation that will accommodate changes in traffic conditions without the need to reprogram the controller personality. This may result in a phasing sequence in which not all phases are used initially. An example of this is the inclusion of repeat right turn phases.

The phasing sequence (i.e. the order in which each phase runs) should be designed to provide the optimum coordinated flow along a corridor. This may change at different times of the day.

New controllers generally have 16 signal groups. Some have the capability to exceed this however this is rare. With TSC/4 compliant controllers, the number of signal groups can range from 4 to 32 in modules of 4 signal groups. The last four signal groups or how many are required will be dedicated for pedestrians.

5.5.1 Mid-Block Pedestrian Crossing

Required Signal Groups

Vehicle

- » SG 1 - Main road through movement clockwise from the controller
- » SG 2 - Main road through movement opposite to SG 1

Pedestrian

The mid-block crossing will normally have one pedestrian and can be catered for with a much smaller controller than would otherwise be required.

- » Pedestrian Movement 1 – At a right angle to the main vehicle flow (eg SG 4, 8, 12 or 16) but typically SG4.

Note

Staggered pedestrian Crossings require an additional signal group as the walk phases are normally split.

5.5.2 Tee Junctions

Required Signal Groups

Vehicle

- » SG 1 - Main Road through movement adjacent to main road right turn
- » SG 2 - Main Road through movement conflicting with main road right turn
- » SG 3 – Right turn from main road
- » SG 4 – Right turn or right and left turn from side road

Pedestrian

- » Pedestrian Movement 1 – across side road (i.e. parallel with SG2)
- » Pedestrian Movement 2 – across main road and to the left of the side road

Optional Signal Groups

Where provided use next available signal group in order below.

Vehicle

- Left turn from main road into side road
- Left turn from side road into main road

Pedestrian

If an existing controller has 8 signal groups and more than 4 vehicle groups then it may be necessary to renumber the pedestrian signal groups.

- Pedestrian movement across controlled left turn slip lane from main road
- Pedestrian movement across controlled left turn slip lane from side road

Phasing

Normal Phase Sequence = A : C : D

Alternative phase sequence A : B : C : D

A Phase – SG's 1, 2 and Pedestrian Movement 1. May also include left turn movement into side road from main road if controlled by a separate signal group.

Note : Where considered safe the right turn movement may be permitted to FILTER turn. Filtering will be controlled through the introduction of the Z- flag. Filtering enabled under Flexilink or SCATS control only. If filtering is enabled, the main road left turn signal group (if provided) shall be in the "OFF" state.

B Phase – SG's 1 and 3. May also include left turn from side road into main road if controlled by a separate signal group.

Note : B Phase introduction is controlled through introduction of Z+ flag in Flexilink or SCATS control only.

C Phase – SG 4 and Pedestrian Movement 2. May also include the left turns into and out of the side road, if controlled by separate signal groups.

D Phase – SG's 1 and 3. May also include left turn from side road into main road if controlled by a separate signal group.

5.5.3 Single Diamond Overlap With Split Side Road Phases

Required Signal Groups

Vehicle

- » SG 1 - Main road through movement clockwise from the controller
- » SG 2 - Main road through movement opposite to SG 1.
- » SG 3 – Right turn adjacent to SG 1
- » SG 4 – Right turn adjacent to SG 2

- » SG 5 – Side road movements to the left of SG 1 (clockwise from SG 1)
- » SG 6 – Side road movements to the left of SG 2 (clockwise from SG 2)

Pedestrian

- » Pedestrian Movement 1 – parallel to SG 1 (eg SG 16)
- » Pedestrian Movement 2 – parallel to SG 2 (eg SG 15)
- » Pedestrian Movement 3 – pedestrian on the left of the D phase side road (eg SG 14)
- » Pedestrian Movement 4 – pedestrian on the left of the E phase side road (eg SG 13)

Optional Signal Groups

Where provided use next available signal group in order below.

Vehicle

- Left turn adjacent to SG 1
- Left turn adjacent to SG 2
- Left turn from D phase side road
- Left turn from E phase side road

Pedestrian

- Pedestrian across controlled left turn slip lane from main road and parallel to SG 1
- Pedestrian across controlled left turn slip lane from main road and parallel to SG 2
- Pedestrian across controlled left turn slip lane from D phase side road
- Pedestrian across controlled left turn slip lane from E phase side road

Phasing

Normal Phase Sequence = A : D : E : F.

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2. May also include left turn movements into side road from main road if controlled by separate signal groups.

Note : Where considered safe the right turn movements may be permitted to filter turn. Filtering shall be permitted on the A-B (SG 1) approach under the following conditions:

- The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)
- Filtering shall be permitted on the A-C (SG 2) approach under the following conditions:
 - The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run)

Note : If filtering is enabled, the main road left turn signal groups (if provided) shall be in the "OFF" state.

B Phase – SG's 1, 3, Pedestrian Movement 1. May also include left turn parallel to SG 1 and from E phase side road if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or SCATS control only.

C Phase – SG's 2, 4, Pedestrian Movement 2. May also include left turn parallel to SG 2 and from D phase side road if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or SCATS control only.

D Phase (least busiest side road movement) – SG 5 or SG 6 and Pedestrian Movement 3 or 4
May also include left turn from main road parallel to SG 1 if controlled by a separate signal group.

E Phase – SG 5 or SG 6 and Pedestrian Movement 3 or 4. May also include left turn from main road parallel to SG 2 if controlled by a separate signal group.

F Phase – SG's 3 and 4. May also include left turn movements from side roads, if controlled by separate signal groups

F1 Phase – SG's 1, 3 and Pedestrian Movement 1. May also include left turn parallel to SG 1 and from E phase side road if controlled by separate signal groups

F2 Phase – SG's 2, 4 and Pedestrian Movement 2. May also include left turn parallel to SG 2 and from D phase side road if controlled by separate signal groups

5.5.4 Single Diamond Overlap with Combined Side Road Phase

Required Signal Groups

Vehicle

- » SG 1 - Main road through movement clockwise from the controller
- » SG 2 - Main road through movement opposite to SG 1
- » SG 3 – Right turn adjacent to SG 1
- » SG 4 – Right turn adjacent to SG 2
- » SG 5 – Side road to the left of SG1
- » SG 6 – Side road to the left of SG2

Pedestrian

- » Pedestrian Movement 1 – parallel to SG 1 (eg SG 16)
- » Pedestrian Movement 2 – parallel to SG 2 (eg SG 15)
- » Pedestrian Movement 3 – parallel and to the left of SG 5 (eg SG 14)
- » Pedestrian Movement 4 – parallel and to the left of SG 6 (eg SG 13)

Optional Signal Groups

Where provided use next available signal group in order below.

Vehicle

- Right turn adjacent to SG 5 (red arrow only for pedestrian protection)
- Right turn adjacent to SG 6 (red arrow only for pedestrian protection)
- Left turn adjacent to SG 1
- Left turn adjacent to SG 2
- Left turn adjacent to SG 5 (red arrow only for pedestrian protection)
- Left turn adjacent to SG 6 (red arrow only for pedestrian protection)

Pedestrian

- Pedestrian across controlled left turn slip lane from main road and parallel to SG 1
- Pedestrian across controlled left turn slip lane from main road and parallel to SG 2

Phasing

Normal Phase Sequence = A : D : E.

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2. May also include left turn movements from main road if controlled by a separate signal group.

Note : Where considered safe the right turn movements may be permitted to filter turn. Filtering shall be permitted on the A-B (SG 1) approach under the following conditions:

- The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)

Filtering shall be permitted on the A-C (SG 2) approach under the following conditions:

- The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run).

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the "OFF" state.

B Phase – SG's 1, 3, Pedestrian Movement 1. May also include left turn adjacent to SG 1 if controlled by a separate signal group

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or SCATS control only.

C Phase – SG's 2, 4, Pedestrian Movement 2. May also include left turn adjacent to SG 2 if controlled by a separate signal group

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or SCATS control only.

D Phase – SG 5, 6, Pedestrian Movements 3 and 4.

E Phase – SG's 3 and 4.

E1 Phase – SG's 1, 3 and Pedestrian Movement 1. May also include left turn adjacent to SG 1 if controlled by a separate signal group

E2 Phase – SG's 2, 4 and Pedestrian Movement 2. May also include left turn adjacent to SG 2 if controlled by a separate signal group

5.5.5 Double Diamond Overlap

Required Signal Groups

Vehicle

- » SG 1 - Main road through movement with stretched phase, clockwise from the controller
- » SG 2 - Main road through movement opposite to SG 1
- » SG 3 – Right turn adjacent to SG 1
- » SG 4 – Right turn adjacent to SG 2
- » SG 5 - Side road through movement clockwise from SG 1
- » SG 6 - Side road through movement clockwise from SG 2
- » SG 7 – Right turn adjacent to SG 5
- » SG 8 – Right turn adjacent to SG 6

Pedestrian

- » Pedestrian Movement 1 – parallel to SG 1 (eg SG 16)
- » Pedestrian Movement 2 – parallel to SG 2 (eg SG 15)
- » Pedestrian Movement 3 – parallel to SG 5 (eg SG 14)
- » Pedestrian Movement 4 – parallel to SG 6 (eg SG 13)

Optional Signal Groups

Where provided use next available Signal Group in order below.

Vehicle

- Left turn adjacent to SG 1
- Left turn adjacent to SG 2
- Left turn adjacent to SG 5
- Left turn adjacent to SG 6

Pedestrian

- Pedestrian across controlled left turn slip lane from main road and adjacent to SG 1
- Pedestrian across controlled left turn slip lane from main road and adjacent to SG 2
- Pedestrian across controlled left turn slip lane from main road and adjacent to SG 5
- Pedestrian across controlled left turn slip lane from main road and adjacent to SG 6

Phasing

Normal Phase Sequence = A : D : E : G.

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2. May also include left turn movements from main road if controlled by separate signal groups.

Note : Where considered safe the right turn movements may be permitted to FILTER turn. Filtering shall be permitted on the A-B (SG 1) approach under the following conditions:

- The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)

Filtering shall be permitted on the A-C (SG 2) approach under the following conditions:

- The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run)

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the "OFF" state.

B Phase – SG's 1, 3, Pedestrian Movement 1. May also include left turn parallel to SG 1 and left turn parallel to SG 6 if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or SCATS control only.

C Phase – SG's 2, 4, Pedestrian Movement 2. May also include left turn parallel to SG 2 and left turn parallel to SG 5 if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or SCATS control only.

D Phase – SG's 7 and 8. May also include left turn movements from main road, if controlled by separate signal groups

D1 Phase – SG's 5, 7 and Pedestrian Movement 3. May also include left turn parallel to SG 1 and left turn parallel to SG 5 if controlled by separate signal groups

D2 Phase – SG's 6, 8 and Pedestrian Movement 4. May also include left turn parallel to SG 2 and left turn parallel to SG 6 if controlled by separate signal groups

E Phase – SG's 5, 6, Pedestrian Movements 3 and 4. May also include left turn movements from side road to main road if controlled by separate signal groups.

Note: Where considered safe the right turn movements may be permitted to FILTER turn. Filtering shall be permitted on the D1-E-F1 (SG 5) approach under the following conditions:

- The mode of operation is Masterlink or Flexilink AND XSF 3 bit is set and there is no XSF 6 bit present (i.e. F2 phase is not permitted to run)

Filtering shall be permitted on the D2-E-F2 (SG 6) approach under the following conditions:

- The mode of operation is Masterlink or Flexilink AND XSF 3 bit is set and there is no XSF 5 bit present (i.e. F1 phase is not permitted to run)

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the "OFF" state.

F1 Phase – SG's 5, 7 and Pedestrian Movement 3. May also include left turn parallel to SG 6 if controlled by a separate signal group.

Note: Phase introduction controlled through introduction of XSF 5 Bit in Flexilink or SCATS control only.

F2 Phase – SG's 6, 8 and Pedestrian Movement 4. May also include left turn parallel to SG 5 if controlled by a separate signal group

Note: Phase introduction controlled through introduction of XSF 6 Bit in Flexilink or SCATS control only.

G Phase – SG's 3 and 4. May also include left turn movements from side roads, if controlled by a separate signal group

G1 Phase – SG's 1, 3 and Pedestrian Movement 1. May also include left turn parallel to SG 1 and left turn parallel to SG 6 if controlled by a separate signal groups

G2 Phase – SG's 2, 4 and Pedestrian Movement 2. May also include left turn parallel to SG 2 and left turn parallel to SG 5 if controlled by a separate signal groups

5.5.6 Filtering Right Turn Movements

At most intersections right turning traffic that has opposing movements will be provided for by installing a separate signal display, giving the right turning motorist a protected turn at some time in the phasing sequence. However under strict criteria 'filter turn' movements may be permitted in order to improve intersection efficiency.

Whilst the provision of filter turns may improve efficiency, it reduces the potential safety as conflicting movements may now occur. The phasing design must consider a balance between safety and efficiency. When considering allowing filtering, safety must be given a higher weighting in the decision process.

The phasing design at adjacent intersections should also be considered to provide consistency along a corridor and preferably throughout the region.

5.5.7 Repeat Right Turn Phases

A repeat right turn is where the right turn movement is introduced for a second time within the same phase cycle. Repeat right turns can be provided at any site with a right turn phase. Generally the controller logic will have two phases with exactly the same movements (i.e. for a Tee intersection B and D) with one phase only introduced when a special facility signal is activated (normally B using the Z+ flag).

Repeat right turn phasing can only be used under Masterlink or Flexilink control modes (**not** in isolated mode) and is generally provided at peak times. It is unusual to have a repeat right turn phase operating 24 hours a day.

Repeat right turn phasing is normally used where the single right turn phase does not provide sufficient capacity within a cycle for specific flow periods, or it is necessary for progression within a coordinated system.

A typical use is where a right turn bay is too short to cope with the number of right turning vehicles that can arrive within the cycle which results in the right turn queue extending into and blocking the through traffic lane. This reduces the capacity for the through movement and

increases the risk of 'nose to tail' type crashes occurring. The use of the repeat right turn is particularly important, under these circumstances, where there is only one through lane.

Repeat right turn phasing should only be considered under the above conditions. Generally, where vehicles may queue outside of the through lane (i.e. on a painted median), it is more efficient to provide a longer single right turn phase than two short phases.

5.5.8 Pedestrian Control

The hierarchy of signalised pedestrian control strategies range from providing full pedestrian protection through to partial protection during the early stages of the crossing movement. They fit broadly into the following range:-

1. Barne's Dance (scramble phase) – all vehicle traffic stopped (full protection).
2. Parallel from corner islands – only one parallel vehicle movement – no conflict (full protection).
3. Parallel from corner islands or kerbside – conflicting right and/or left turning vehicles delayed by Red Arrow control during Cross and clearance periods (full protection).
4. As for 3 but with conflicting vehicles delayed only during Cross and/or within part of the clearance period (partial protection).
5. Parallel from corner islands or kerbside with no Red Arrow protection. Vehicles are delayed by one of the late start options (partial protection).
6. Mid Block Control – vehicles stopped on both approaches to crossing located other than at an intersection (full protection)

The method of control adopted at any specific site is based on location, traffic volumes, pedestrian volumes and type (i.e. age or disability), intersection layout combined with the aim to provide safe, efficient movement for all users. However, when selecting control options, it is important to ensure, whenever possible, that a consistent approach is adopted within any given corridor. This may result in a more conservative approach being adopted at some intersections to maintain uniformity throughout that corridor.

At signalised intersections, near schools, where there is a high pedestrian demand at the same time each day, the signal operation should be adjusted to cater for the reoccurring demand. This will generally be achieved by increasing the 'Walk' and clearance times.

5.5.9 Cyclists

Cycle lanes are being progressively introduced along some of the main corridors. Cyclists are managed as part of the 'traffic mix' and there are currently limited special facilities for them at signalised intersections. These facilities are generally in the form of advance boxes and do not require special traffic signal control.

5.5.10 Bus Lanes

Bus priority is becoming more common and requires the allocation of a signal group to each approach using the same convention as above for individual sites. If the bus signal group is

demanded then the controller puts in a pre-specified delay to the through movement signal group.

6. Standard Signal Details

Standard signal details provide information for construction of those features particular to signal installations and include information on.

- » Traffic signal pole installation and foundation details;
- » Layout of furniture on traffic islands;
- » Stop line loop wiring plan details;
- » Ground planted overhead mast pole foundation details;
- » Stop line loop plan details;
- » Mast pole caged foundation details;
- » 600mm dia duct access chamber details;
- » Tactile paver layout details.

Copies of these details are attached in Appendix E.

Appendix A
Design Information Sheet



TRAFFIC MANAGEMENT UNIT
AUCKLAND

Design Information Sheet

Intersection Name:			
Intersection Identification:	Controlling Authority:	Intersection number:	
Date Requested:			
Type of Project (circle as appropriate)	New Intersection	Physical Modification	Software only Modification
Brief Issued By:			
Design Plan Number:			
Design Consultant:			
Designer Name:			
Designer Contact Number:			
Proposed Completion date:			
Entity to be Charged			

Design drawings to be supplied

Information required	Supplied*	Comments
Cover Sheet		
Existing Survey and Services		
Proposed Construction and Set Out		
Proposed Signal and Phasing Layout		
Proposed Roadmarking Layout		
Tracking Plan		
Signal Face Visibility		
Standard Signal Details		

* Y / N / NA / Unknown

Information required	Supplied*	Comments
Standard Construction Details		

Information to be supplied on Proposed Signal and Phasing Layout Plan

Information required	Supplied*	Comments
Lane configuration		
Lane assignment		
Pedestrian crossing markings		
Detector loop placements and number		
Dimensions to advance loops		
Pedestrian detector numbers		
Controller position		
Chamber location and ducts		
Pole locations and number		
Push button locations		
Pram crossing and tactile paver locations		
Aspects – showing cowls		
Signal groups including pedestrians		
Cabling and ducting diagram		
Typical phasing		
Street names		
Property boundaries		
Kerb lines		
Vehicle crossings		
Legend		

* Y / N / NA / Unknown

Information required	Supplied*	Comments
North point		
Title Block		
Notes		

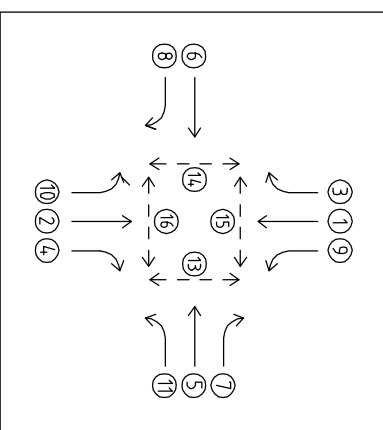
Appendix B

Standard Signal and Phasing Layout Plan

SIGNALS KEY

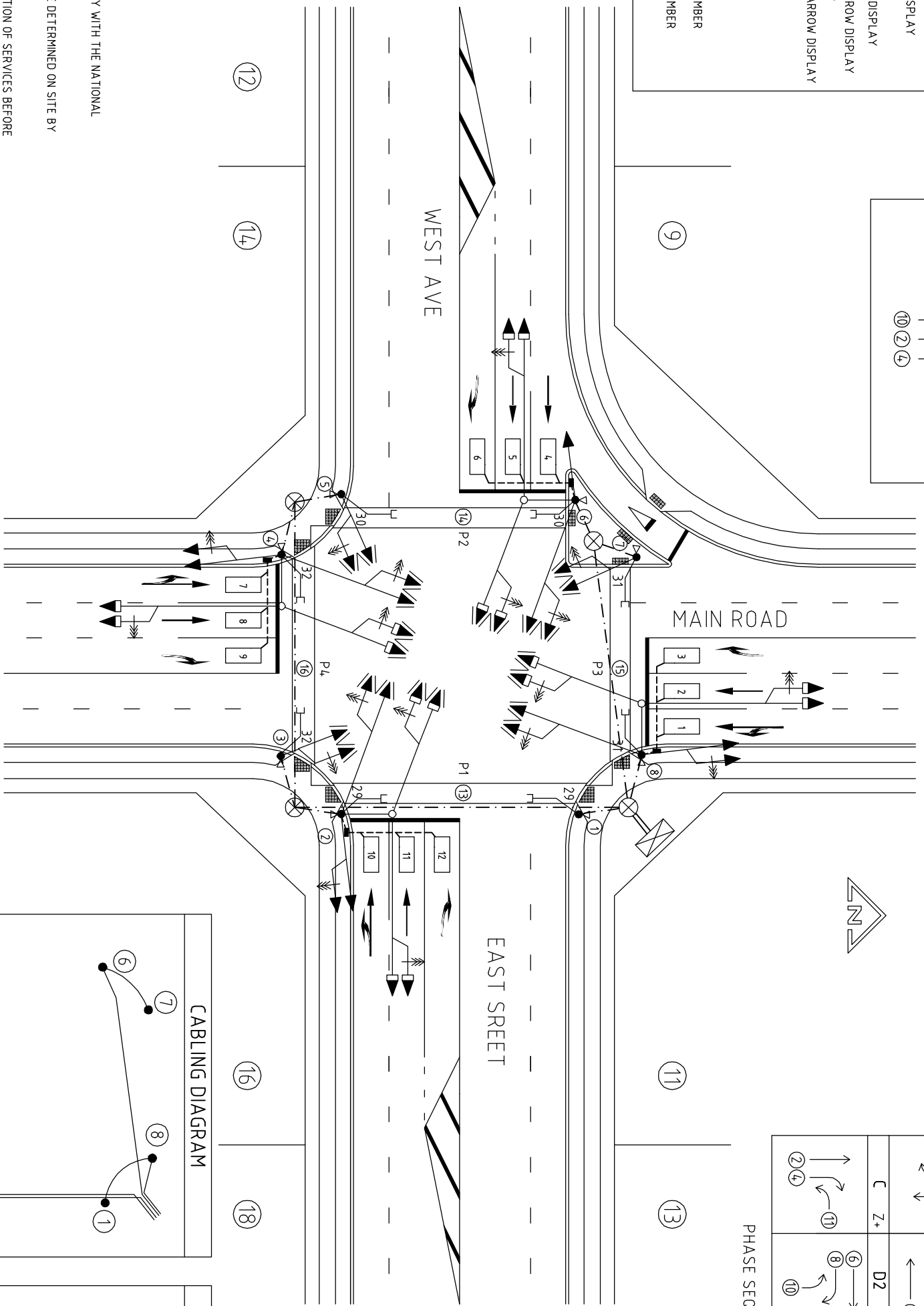
	CONTROLLER
	SIGNAL DUCT ACCESS CHAMBER
	KERB SIDE JUNCTION BOX
	POST AND POST NUMBER
	POST WITH OVERHEAD MAST ARM
	200mm ASPECTS - OPEN VISOR
	300mm ASPECTS - OPEN VISOR
	BUS ASPECT
	CYCLE ASPECT
	ASPECTS WITH CLOSED VISOR
	3 ASPECT DISPLAY
	3 ASPECT DISPLAY WITH SINGLE GREEN ARROW DISPLAY
	3 ASPECT DISPLAY WITH THREE ARROW DISPLAY
	3 ASPECT DISPLAY WITH SUPPLEMENTARY ARROW DISPLAY
	3 ASPECT DISPLAY WITH SUPPLEMENTARY TWO ARROW DISPLAY (R, Y AND G INDICATE COLOUR OF ARROW DISPLAY)
	3 ASPECT DISPLAY WITH SUPPLEMENTARY THREE ARROW DISPLAY
	PEDESTRIAN ASPECTS
	PEDESTRIAN CALL BOX AND INPUT NUMBER
	PEDESTRIAN CALL PAD AND INPUT NUMBER
	32mm DUCTING
	100mm DUCTING
	INDUCTANCE LOOP - STOPLINE LOOP AND LOOP NUMBER
	INDUCTANCE LOOP - ADVANCE LOOP AND LOOP NUMBER
	TACTILE PAVERS

SIGNAL GROUPS



PHASE	TYPICAL PHASING AND SIGNAL GROUPS					
	A	D	E	G		
SIGNAL GROUPS	 P2I, P1, P2, 1, 2	 9, 7, 10, 8	 P3, P4, 6, 5	 3, 4		
	B Z-	D1	F XSF5	G1		
	 3, 1	 9, 7, 5, 10	 6, 7, 5, 8, 10	 3, 1, 2, 4		
	C Z+	D2	F1 XSF6	G2		
	 2, 4, 11	 8, 10, 9, 7, 5	 6, 7, 5, 8, 10	 3, 1, 2, 4		

PHASE SEQUENCE A : D : E : G

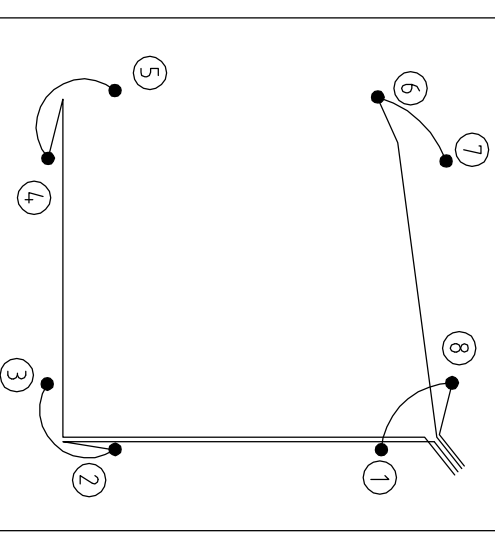


- NOTES**
1. TRAFFIC SIGNAL EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE NATIONAL SPECIFICATION.
 2. POLE POSITIONS ARE INDICATIVE ONLY. FINAL POSITIONS TO BE DETERMINED ON SITE BY THE ENGINEER AND CONTRACTOR.
 3. CONTRACTOR TO LIAISE WITH SERVICE AUTHORITIES FOR LOCATION OF SERVICES BEFORE ANY EXCAVATION.
 4. CONTRACTOR TO ALLOW FOR THE INSTALLATION OF E-PROM DAT AND TESTING.
 5. DUCTS BETWEEN CHAMBERS SHALL BE 100mm DIA.
 6. IF THRUSTED ONE 100mm DIA DUCT IS TO BE INSTALLED. IF OPEN CUT TWO 100mm DIA DUCTS ARE TO BE INSTALLED.

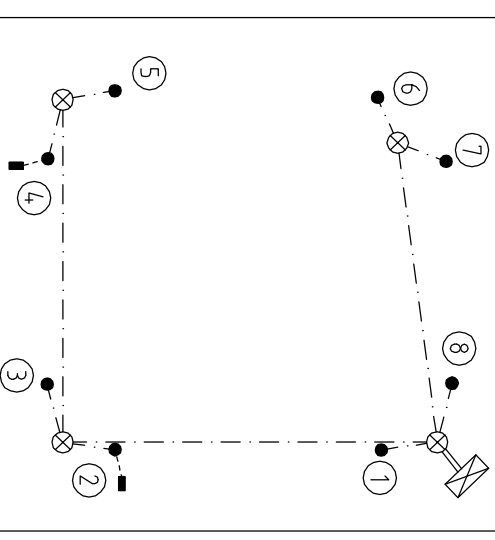
PLAN

SCALE 1:250 @ A1
OR 1:200 @A1 (PREFERRED)

CABLING DIAGRAM



DUCTING DIAGRAM



**AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU)
TRAFFIC SIGNAL STANDARDS**

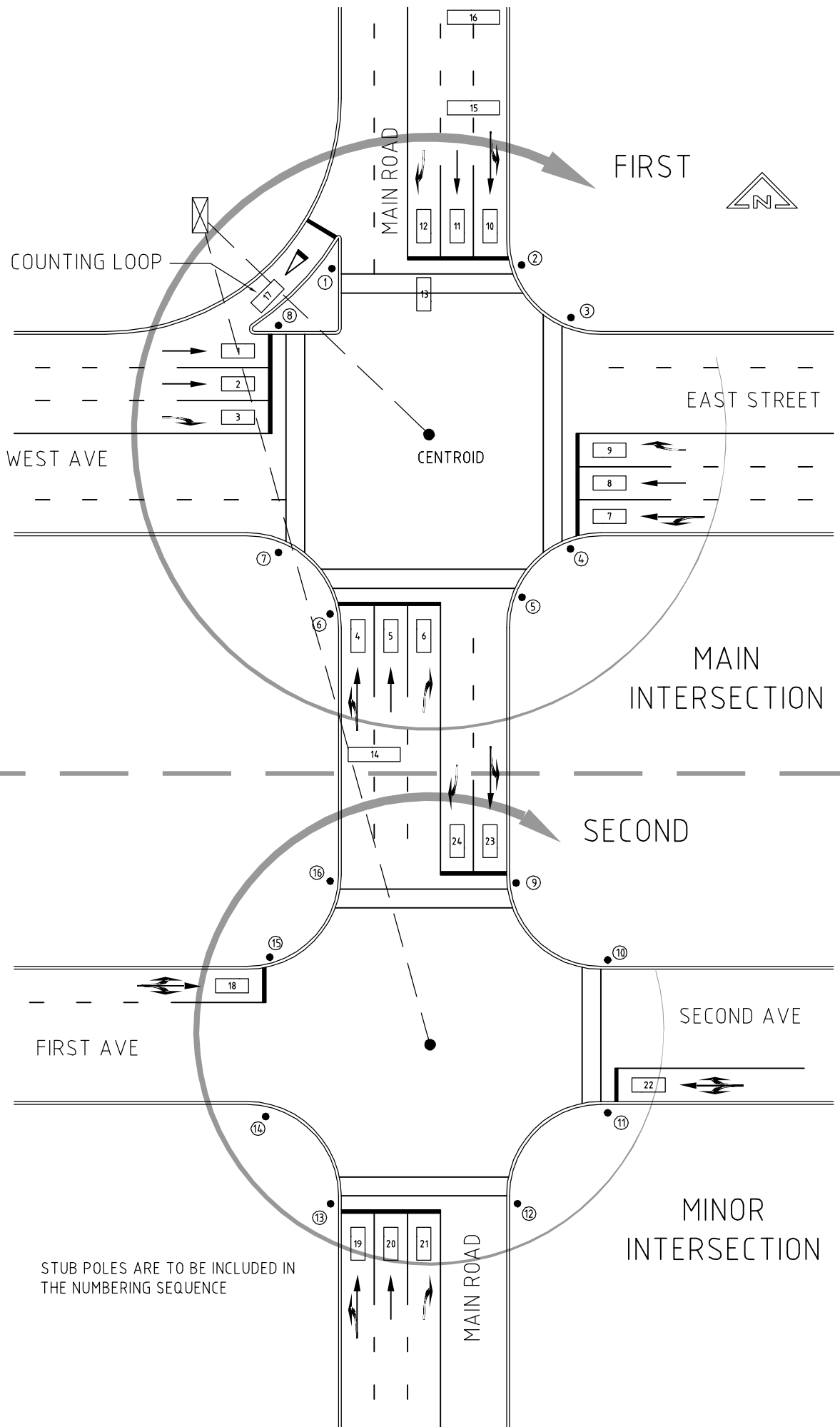
DRAUGHTING GUIDE

NOT TO SCALE

Figure 1

Appendix C

Example of Standard Pole Numbering

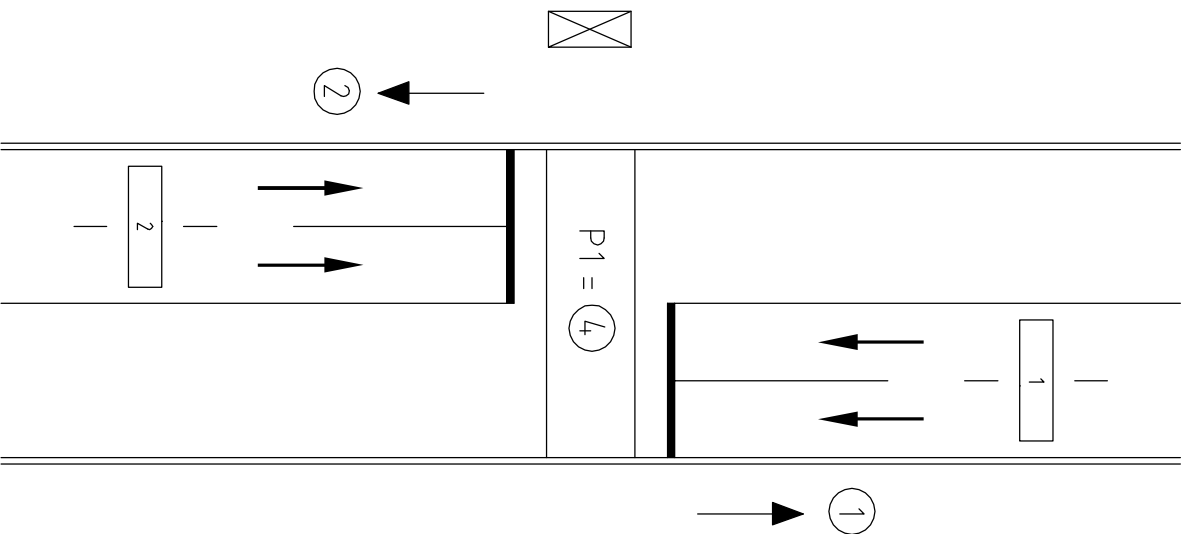


STUB POLES ARE TO BE INCLUDED IN THE NUMBERING SEQUENCE

Appendix D

Examples of Standard Signal Group Numbering

EXAMPLE



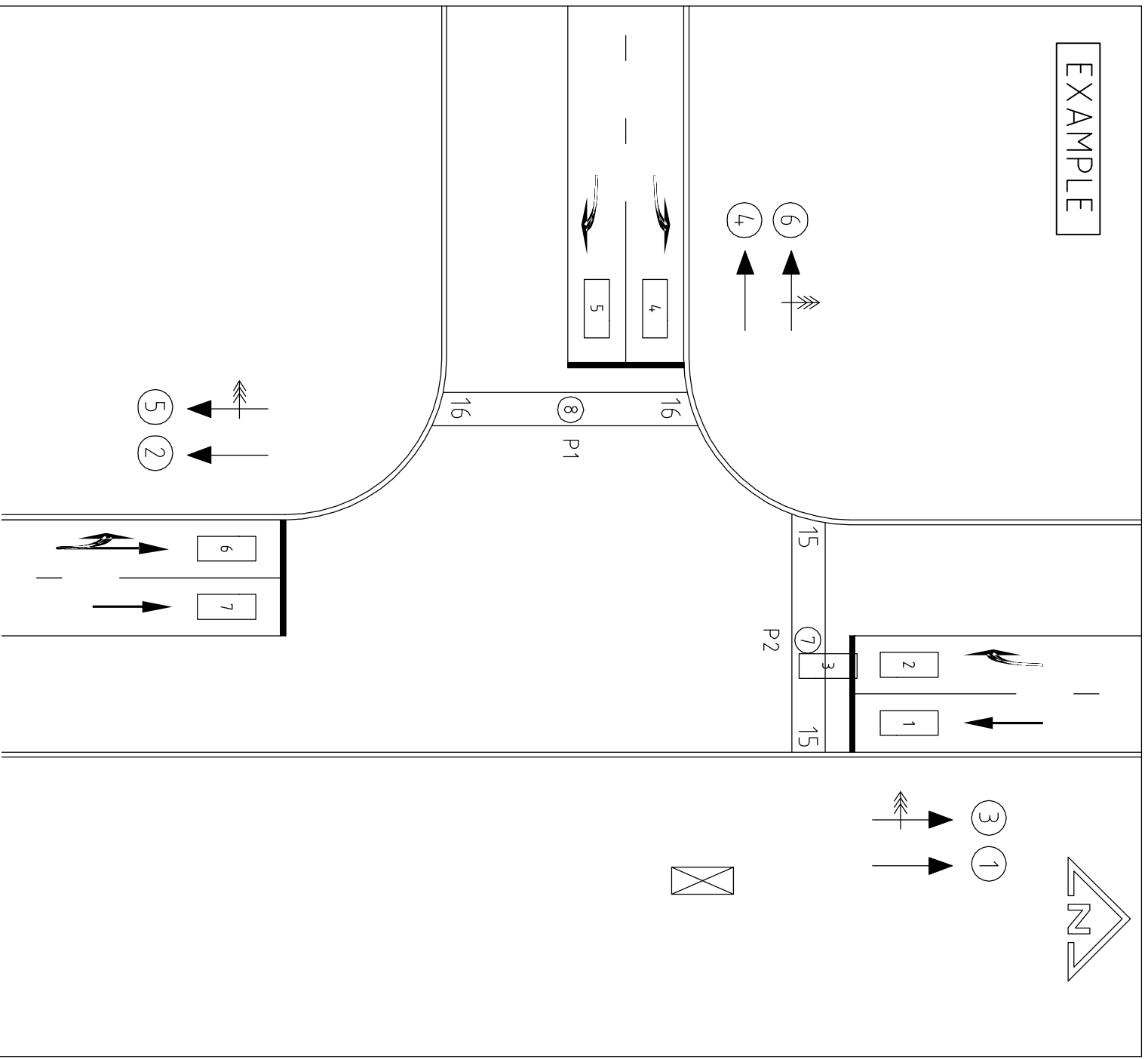
TYPICAL PHASING				
PHASE	A	B	C	D
SIGNAL GROUPS	A ① ↔	B ←-P1- ④-→	C Z+ ① ↔	D Z+ ←-P1- ④-→

PHASE SEQUENCE A : B
 ALTERNATIVE PHASE SEQUENCE A : B : C : D

AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU)
 TRAFFIC SIGNAL STANDARDS

NOT TO SCALE

STANDARD SIGNAL GROUP NUMBERING
 MID BLOCK PEDESTRIAN CROSSING
 Figure 4



EXAMPLE

TYPICAL PHASING

PHASE	A	B Z+	C	D
SIGNAL GROUPS				

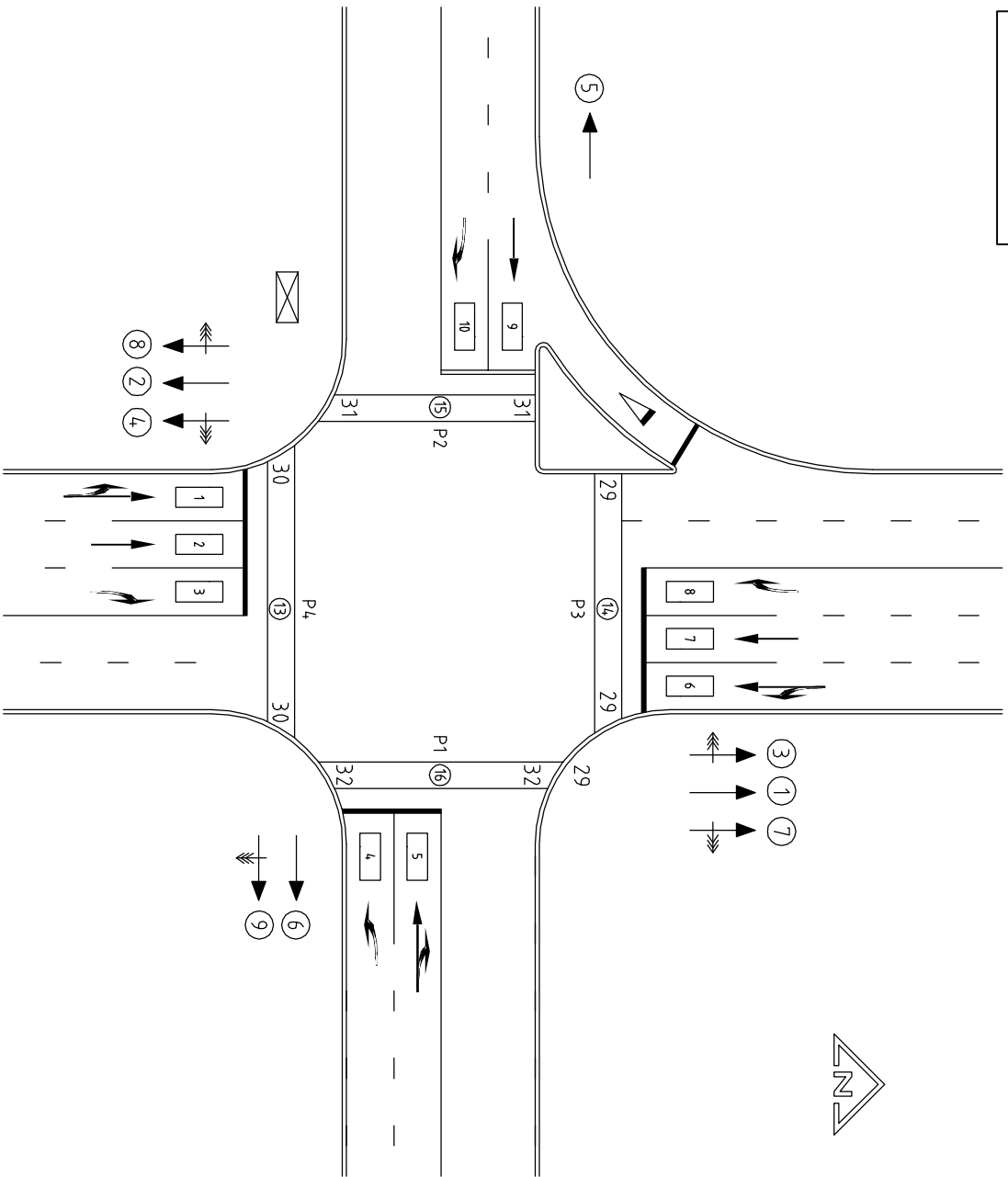
PHASE SEQUENCE A : C : D ALTERNATIVE PHASE SEQUENCE A : B : C : D
 ASSUMED THAT A 8 GROUP CONTROLLER
 PEDESTRIAN PROTECTION PROVIDED FOR THE PERIOD OF WALKTIME

**AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU)
 TRAFFIC SIGNAL STANDARDS**

NOT TO SCALE

**STANDARD SIGNAL GROUP NUMBERING
 T INTERSECTION
 Figure 5**

EXAMPLE



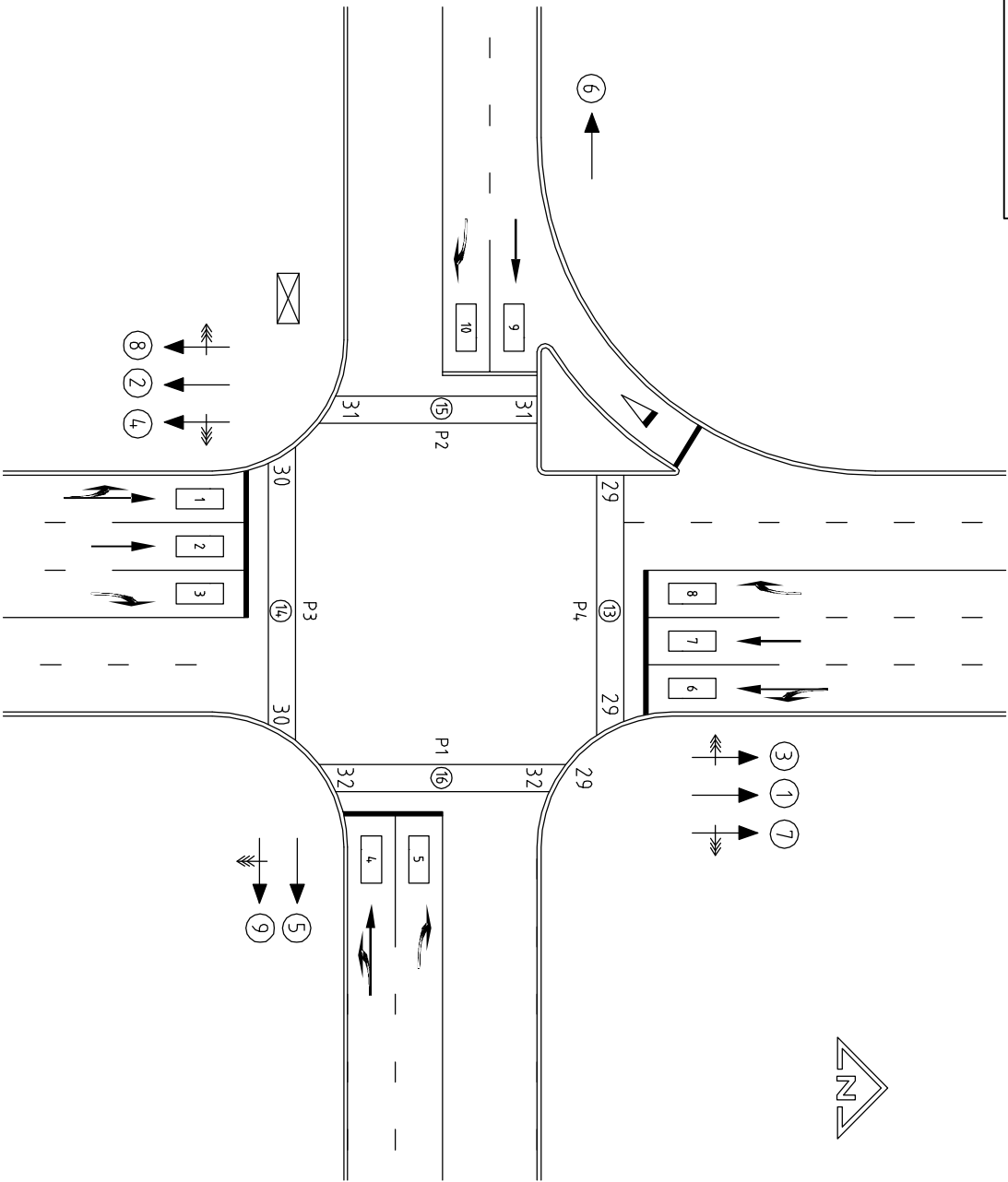
PHASE	A	D	E	F
SIGNAL GROUPS				
	<p>B Z-</p>			<p>F1</p>
	<p>C Z+</p>			<p>F2</p>

PHASE SEQUENCE A : D : E : F

AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU) TRAFFIC SIGNAL STANDARDS

STANDARD SIGNAL GROUP NUMBERING SINGLE DIAMOND OVERLAP WITH SPLIT SIDE ROAD PHASES NOT TO SCALE Figure 6

EXAMPLE



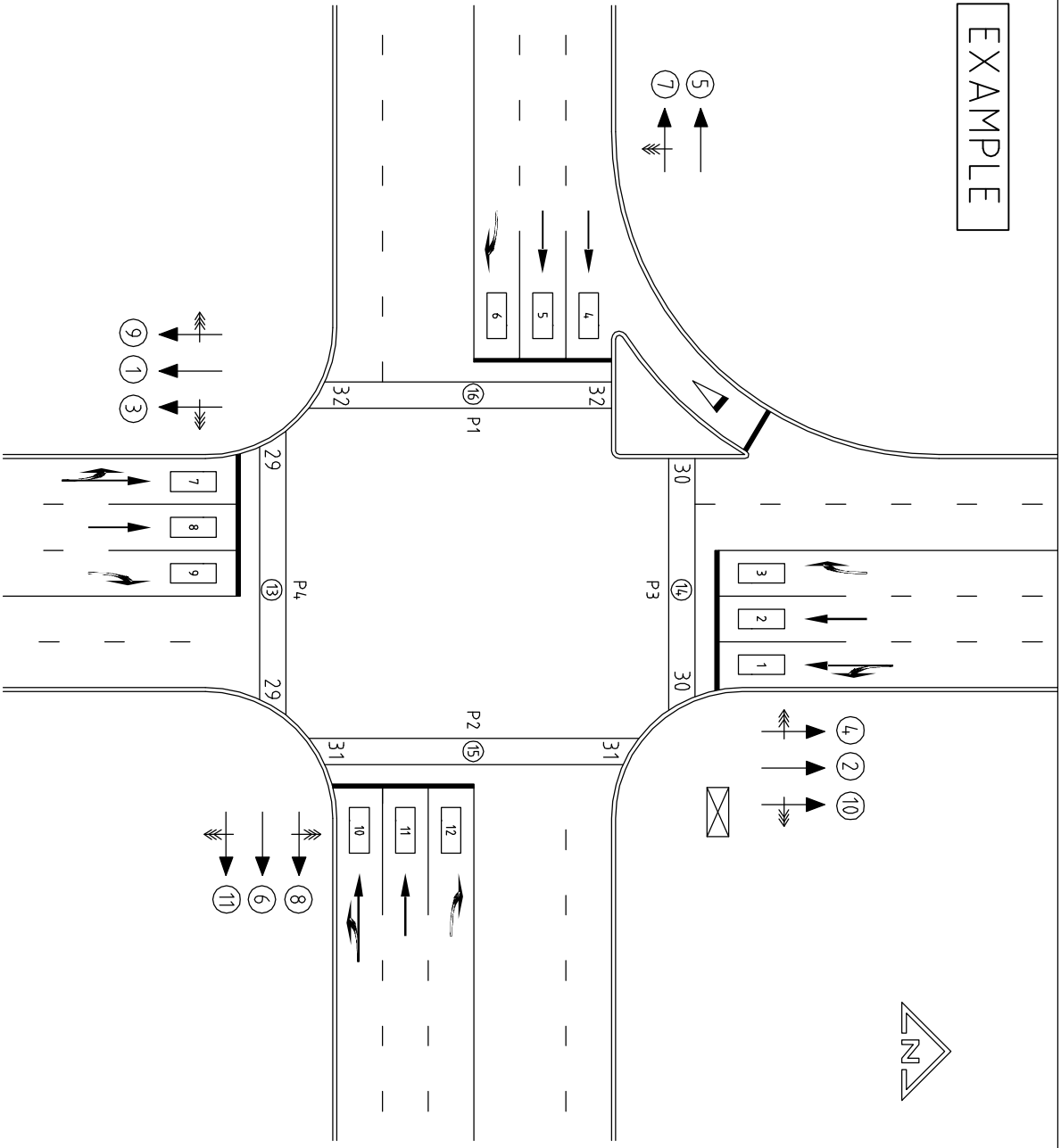
PHASE	A	D	E
SIGNAL GROUPS	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ B Z+ C Z-	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑬ ⑭ ⑮ ⑯	③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ E1 E2

PHASE SEQUENCE A : D : E
 PEDESTRIAN PROTECTION PROVIDED FOR THE PERIOD OF WALKTIME

AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU) TRAFFIC SIGNAL STANDARDS

STANDARD SIGNAL GROUP NUMBERING SINGLE DIAMOND OVERLAP WITH COMBINED SIDE ROAD PHASES NOT TO SCALE Figure 7

EXAMPLE



PHASE	A	D	E	G
SIGNAL GROUPS	<p>(2) (16) (15) (1) (16)</p> <p>(7) (8) (9)</p>	<p>(10) (8) (9)</p> <p>(14) (7) (5) (11) (9)</p>	<p>(14) (13) (6) (5)</p> <p>(10) (8) (6) (11) (13)</p>	<p>(4) (11) (3)</p> <p>(16) (11) (1) (3)</p>
	<p>B Z+</p> <p>(16) (11) (1) (3)</p>	<p>D1</p> <p>(14) (7) (5) (11) (9)</p>	<p>F1 XSF5</p> <p>(14) (13) (6) (5)</p> <p>(10) (8) (6) (11) (13)</p>	<p>G1</p> <p>(4) (11) (3)</p> <p>(16) (11) (1) (3)</p>
	<p>C Z-</p> <p>(4) (2) (15)</p>	<p>D2</p> <p>(10) (8) (6) (11) (13)</p>	<p>F2 XSF6</p> <p>(10) (8) (6) (11) (13)</p>	<p>G2</p> <p>(4) (2) (15)</p>

IF ADDITIONAL FACILITIES ARE REQUIRED THEN A SPECIAL CONTROLLER WITH ADDITIONAL SG IS NECESSARY

PHASE SEQUENCE A : D : E : G
PEDESTRIAN PROTECTION PROVIDED FOR THE PERIOD OF WALKTIME

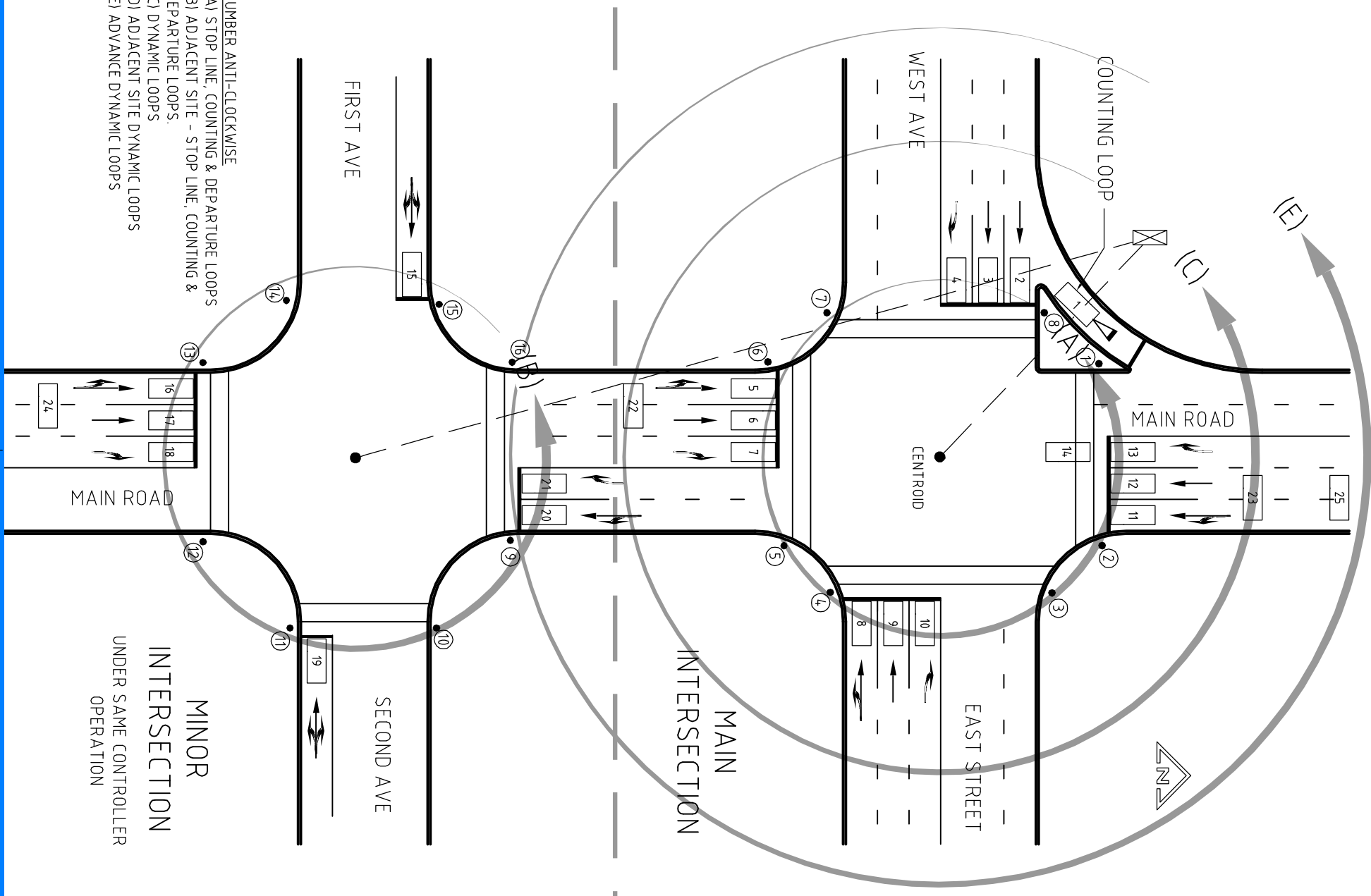
AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU)
TRAFFIC SIGNAL STANDARDS

NOT TO SCALE

STANDARD SIGNAL GROUP NUMBERING
DOUBLE DIAMOND OVERLAP
Figure 8

Appendix E

Examples of Standard Detector Numbering



- NUMBER ANTI-CLOCKWISE**
- (A) STOP LINE, COUNTING & DEPARTURE LOOPS
 - (B) ADJACENT SITE - STOP LINE, COUNTING & DEPARTURE LOOPS
 - (C) DYNAMIC LOOPS
 - (D) ADJACENT SITE DYNAMIC LOOPS
 - (E) ADVANCE DYNAMIC LOOPS

**AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU)
TRAFFIC SIGNAL STANDARDS**

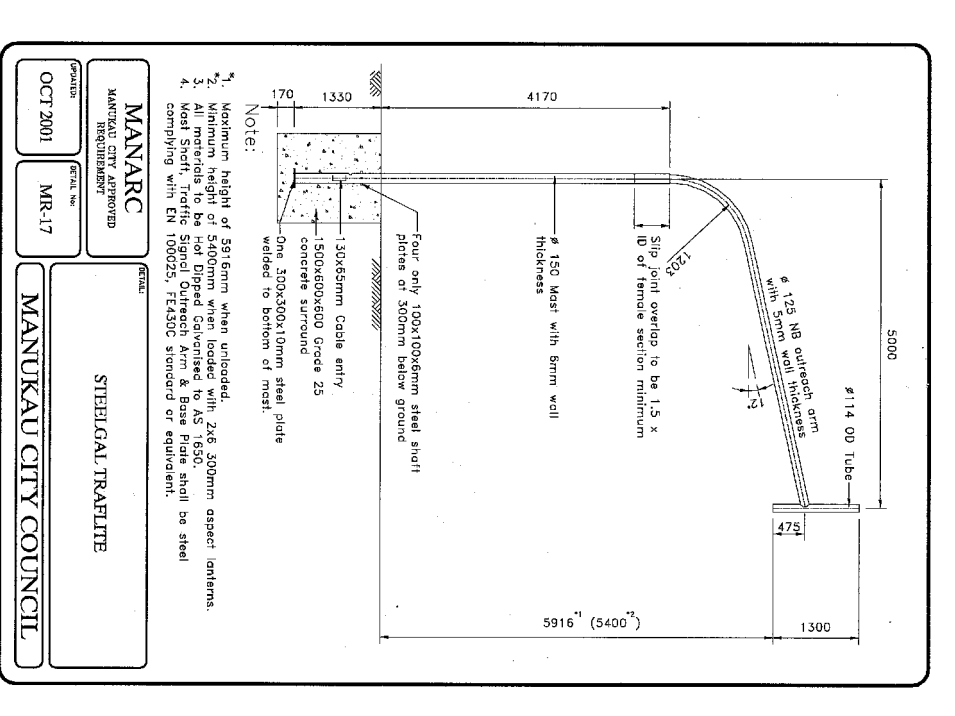
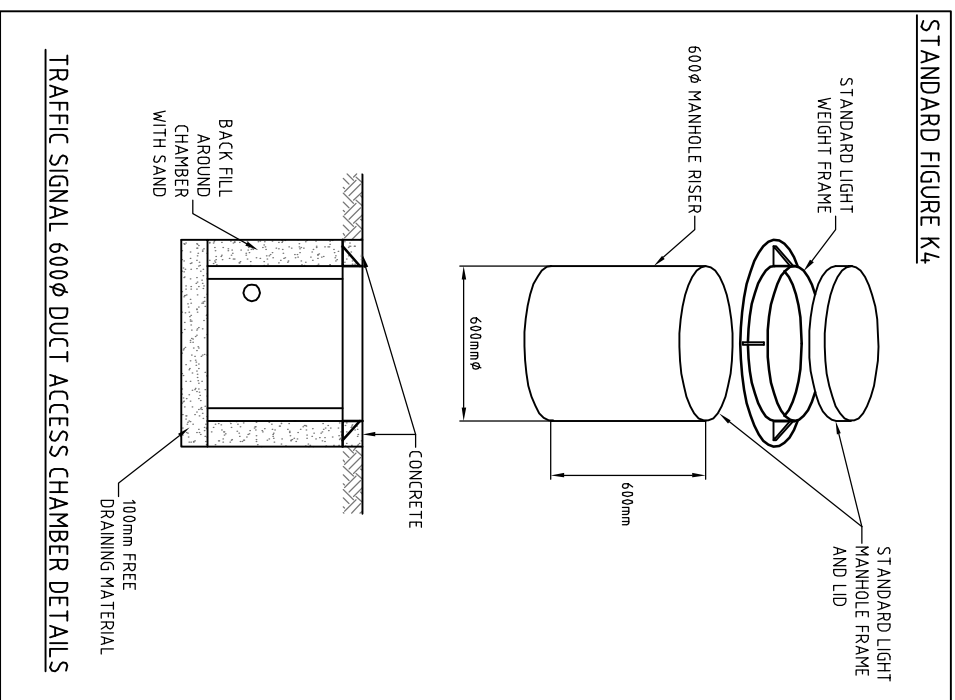
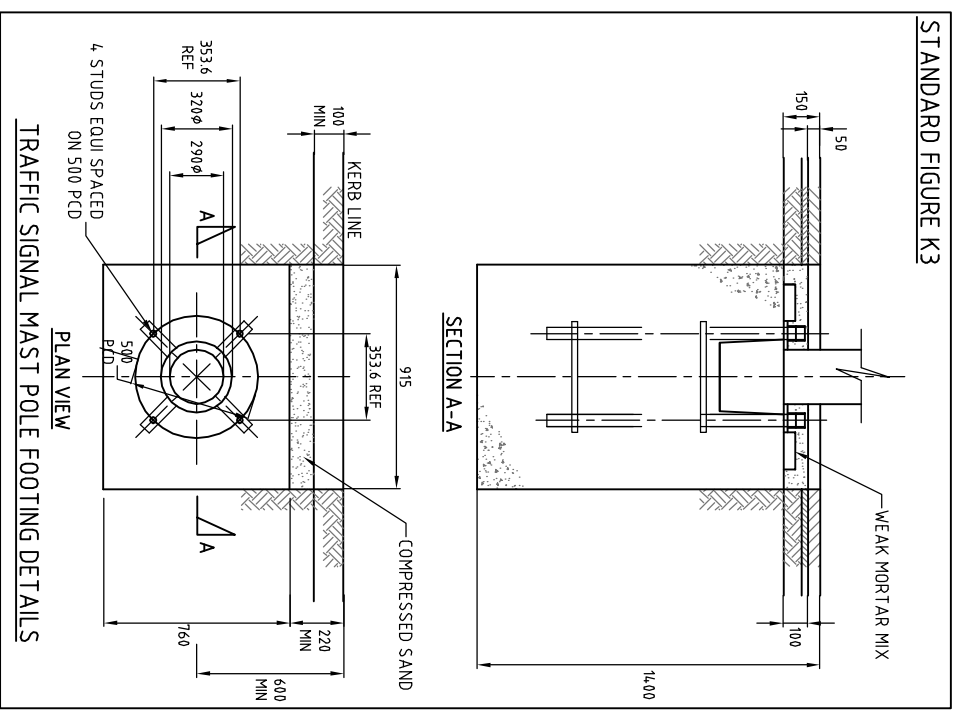
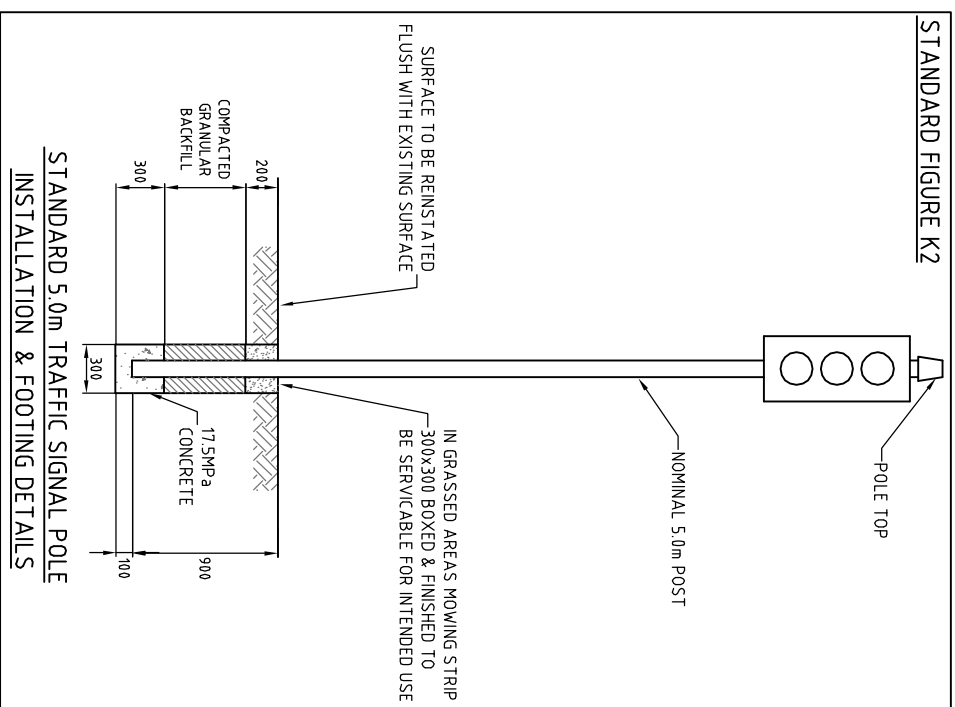
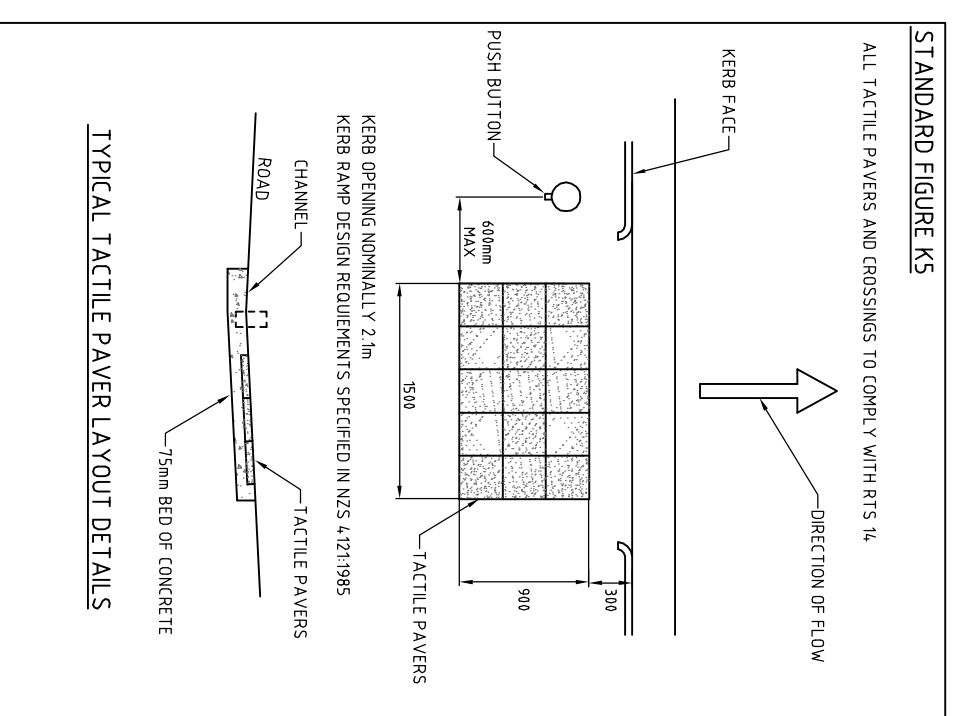
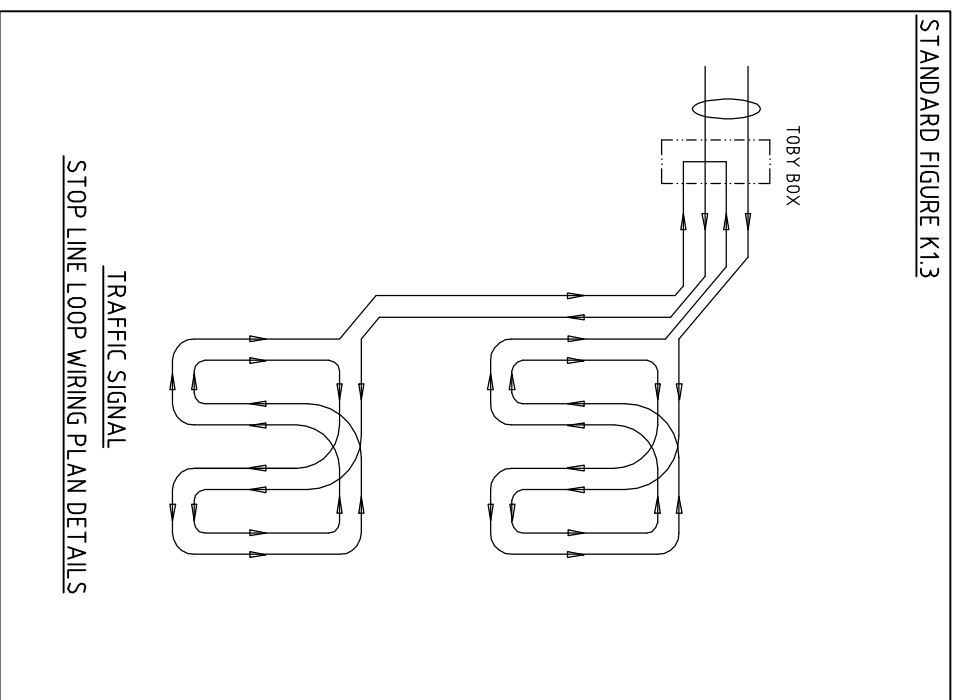
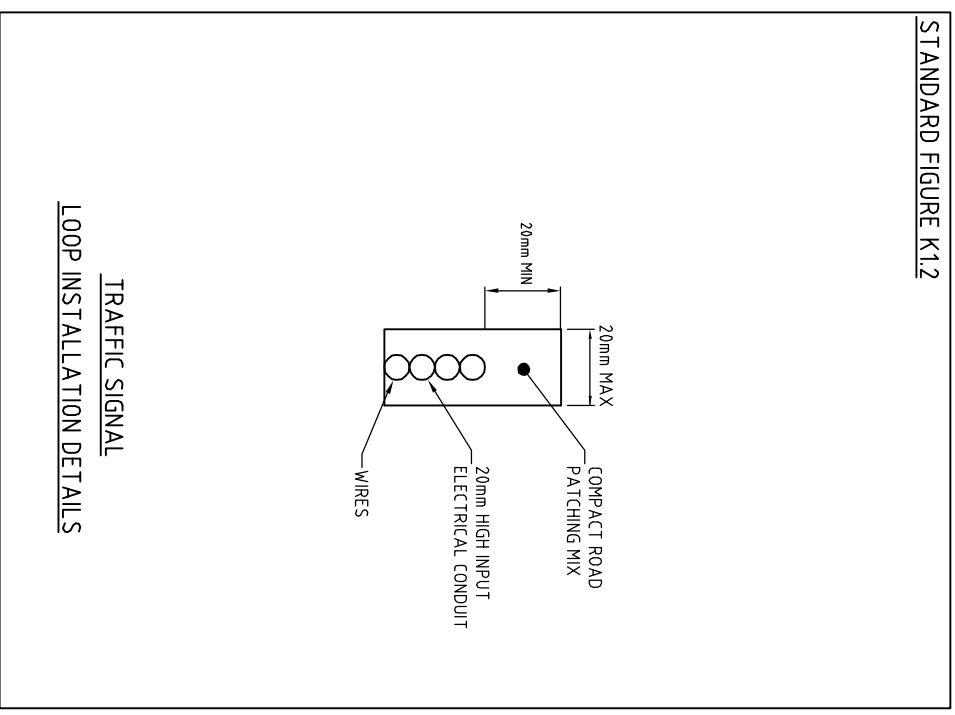
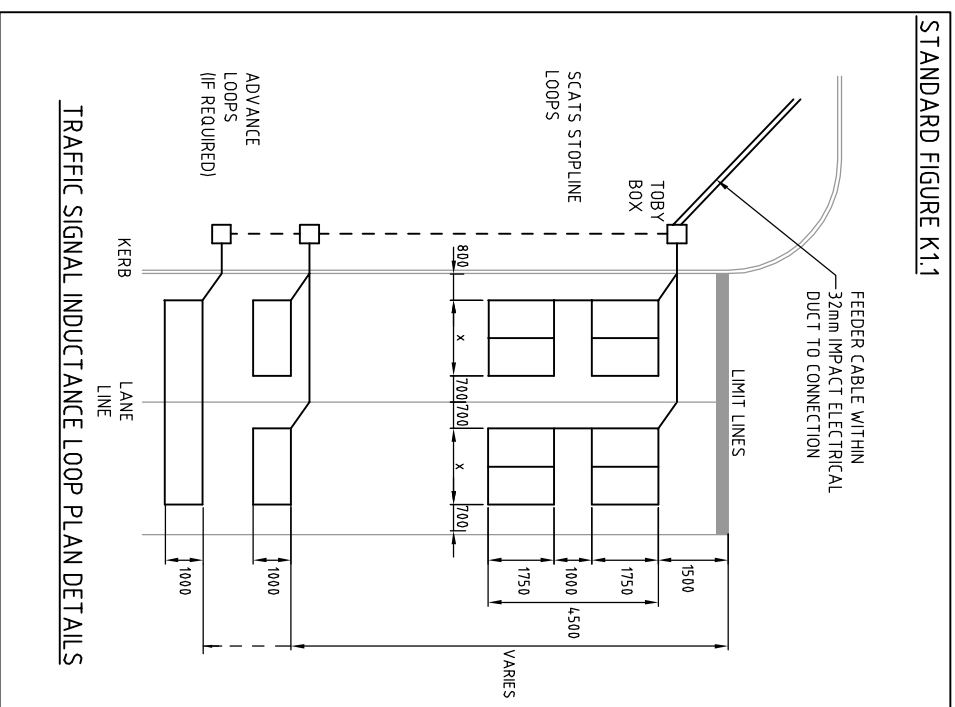
NOT TO SCALE

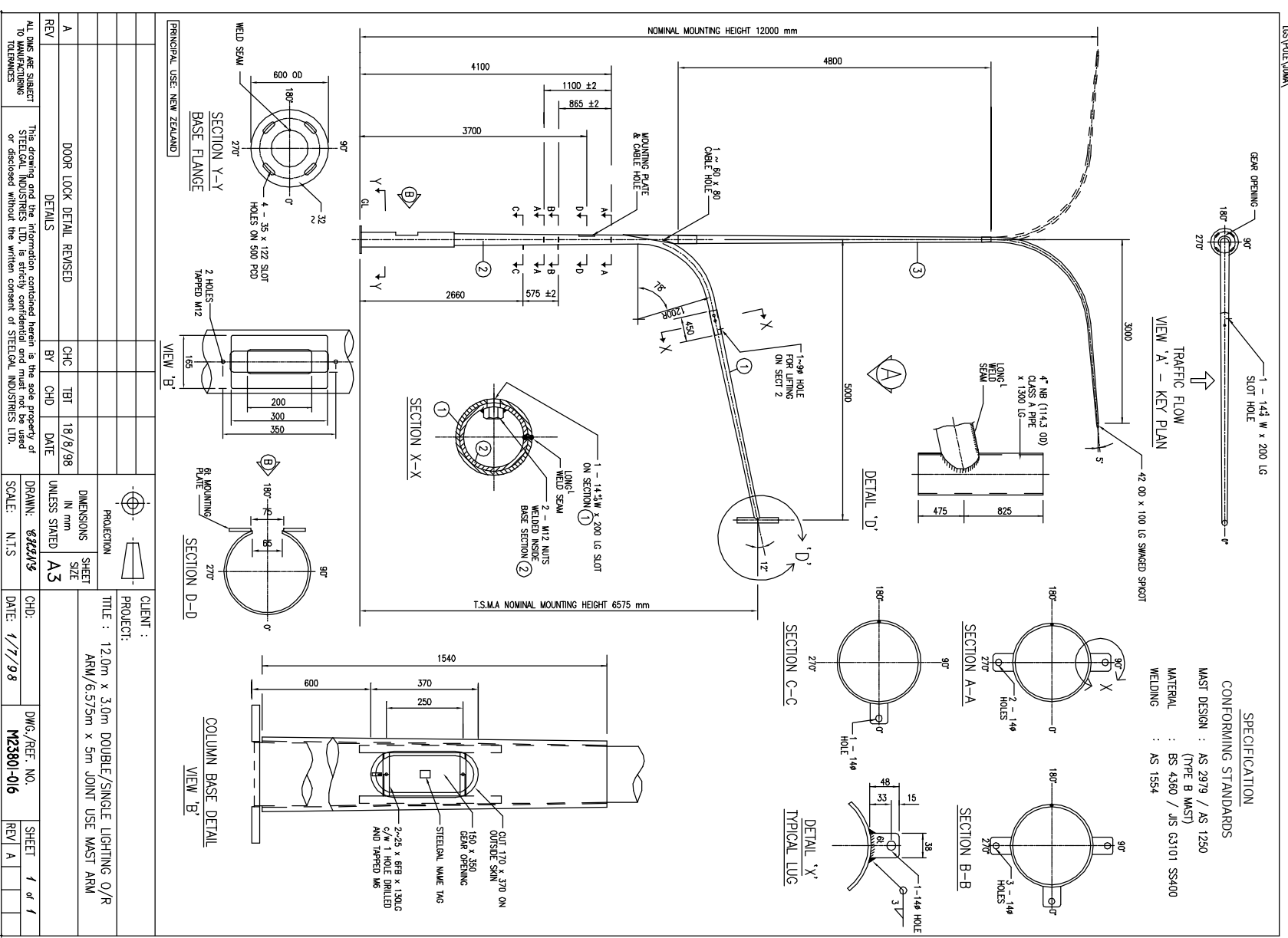
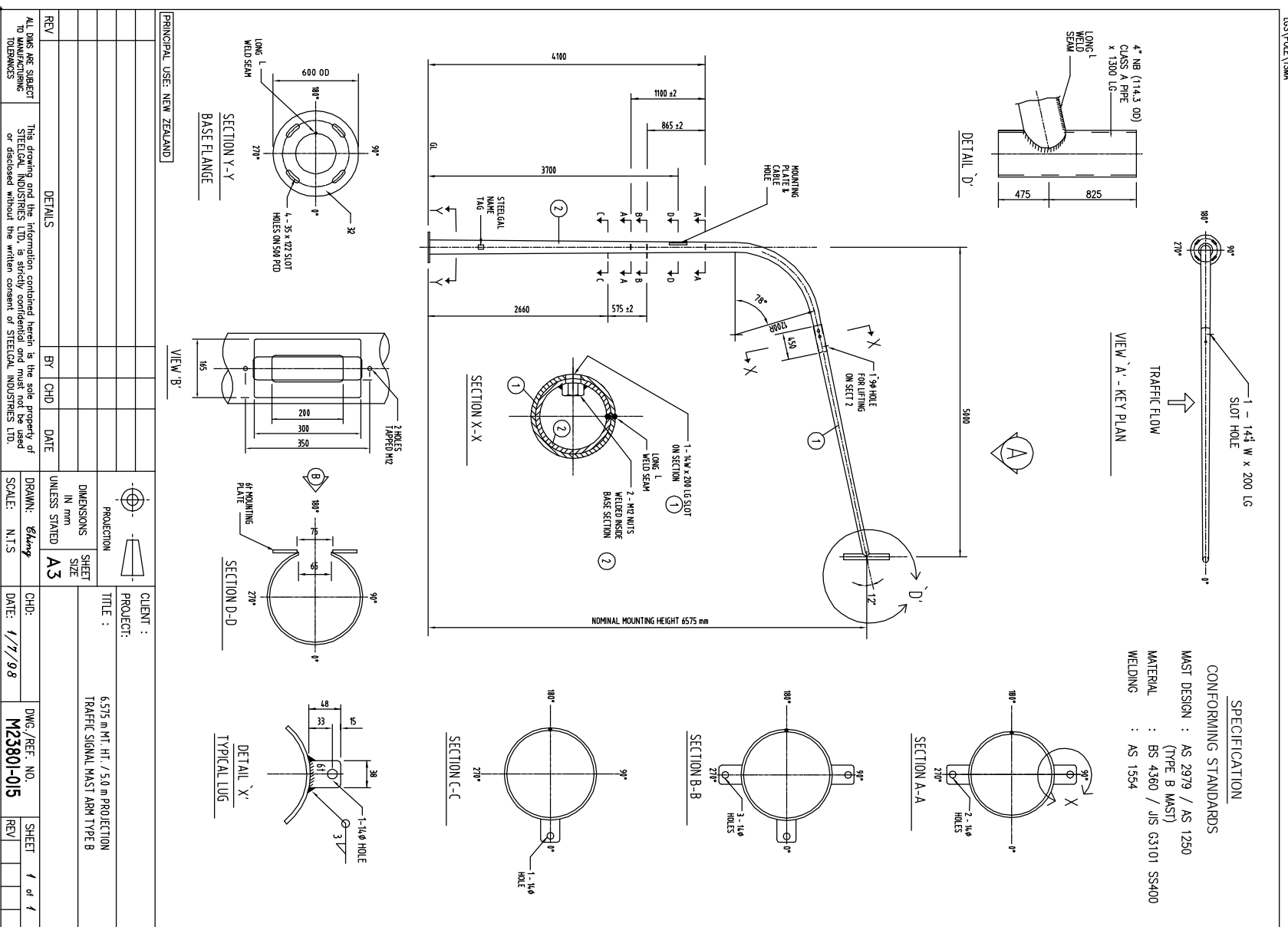
STANDARD DETECTOR NUMBERING

Figure 2

Appendix F

Examples of Standard Signal Details



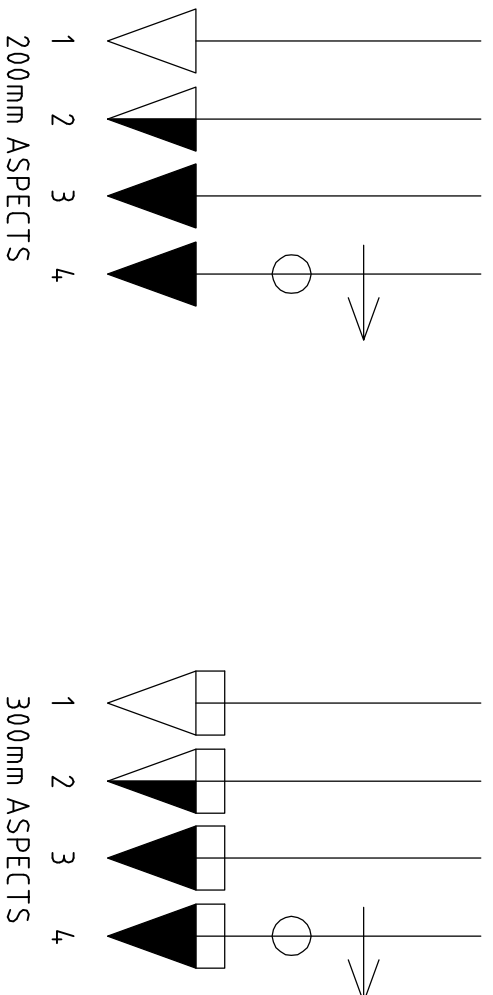


AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU)
 TRAFFIC SIGNAL STANDARDS

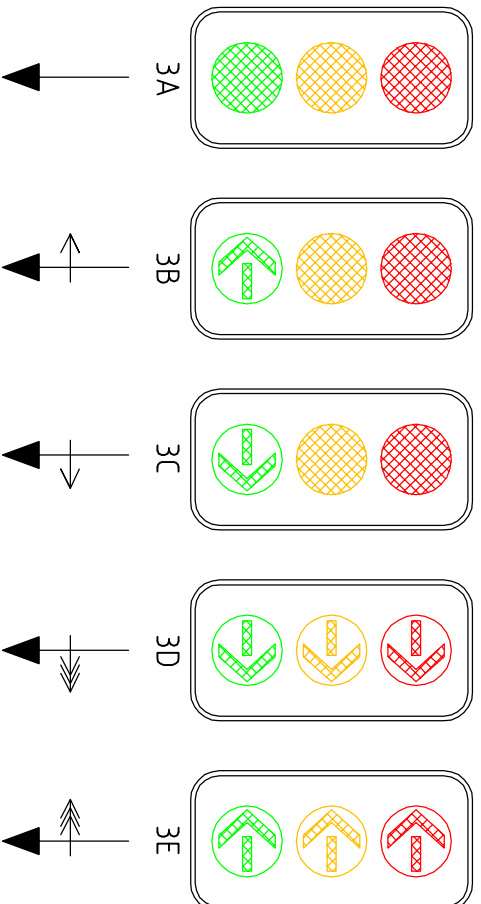
STANDARD DETAILS 2
 Figure 10

Appendix G
Standard Traffic Signal Lantern Display
Symbols

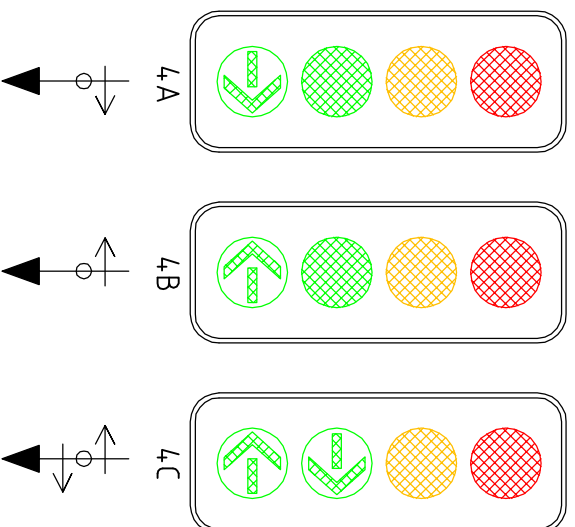
TYPICAL SYMBOL OPTIONS

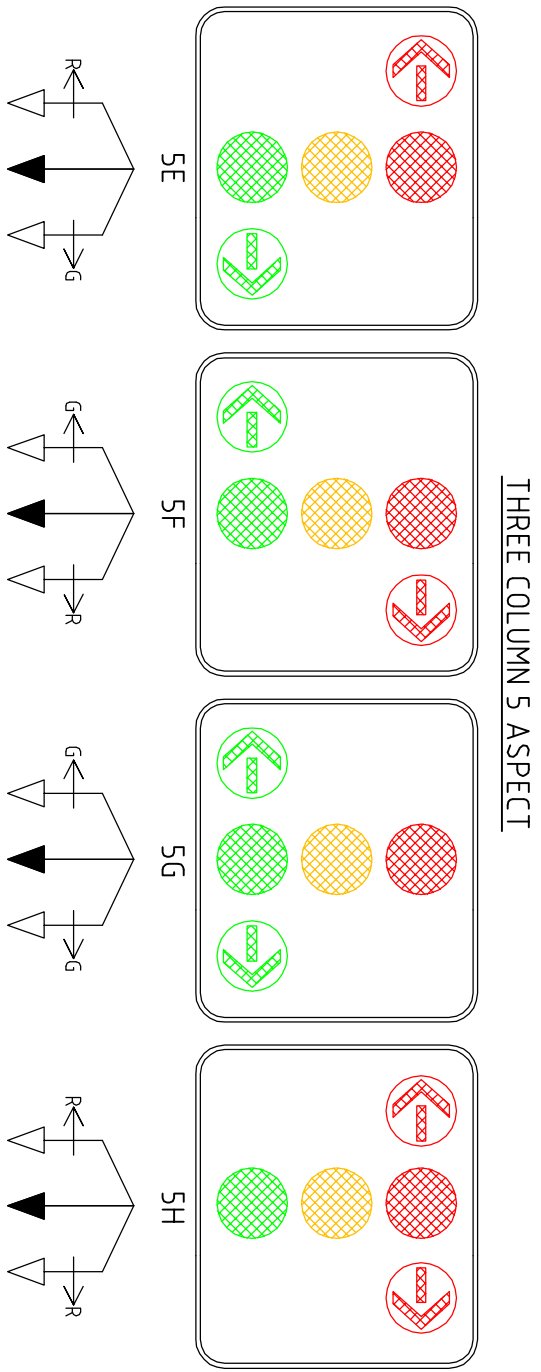
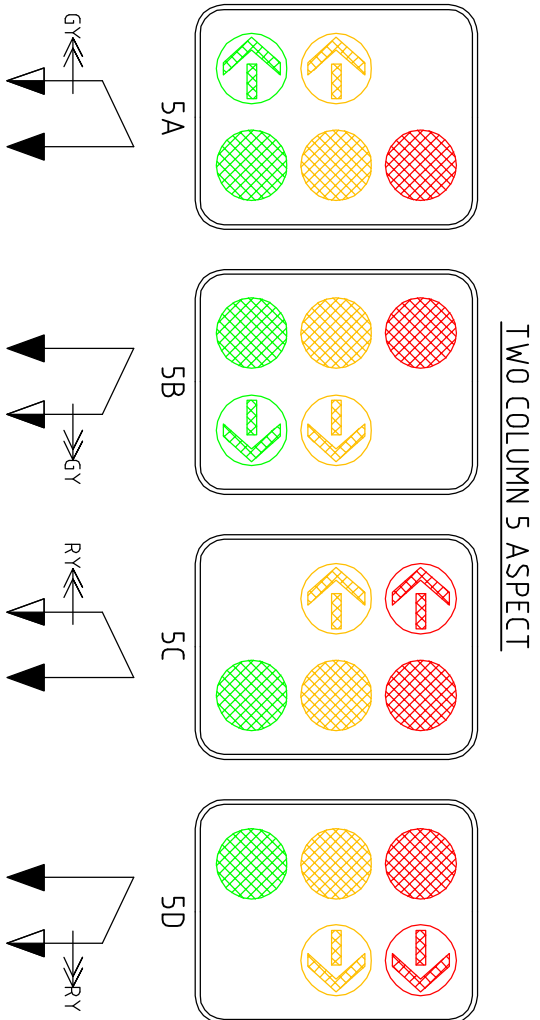
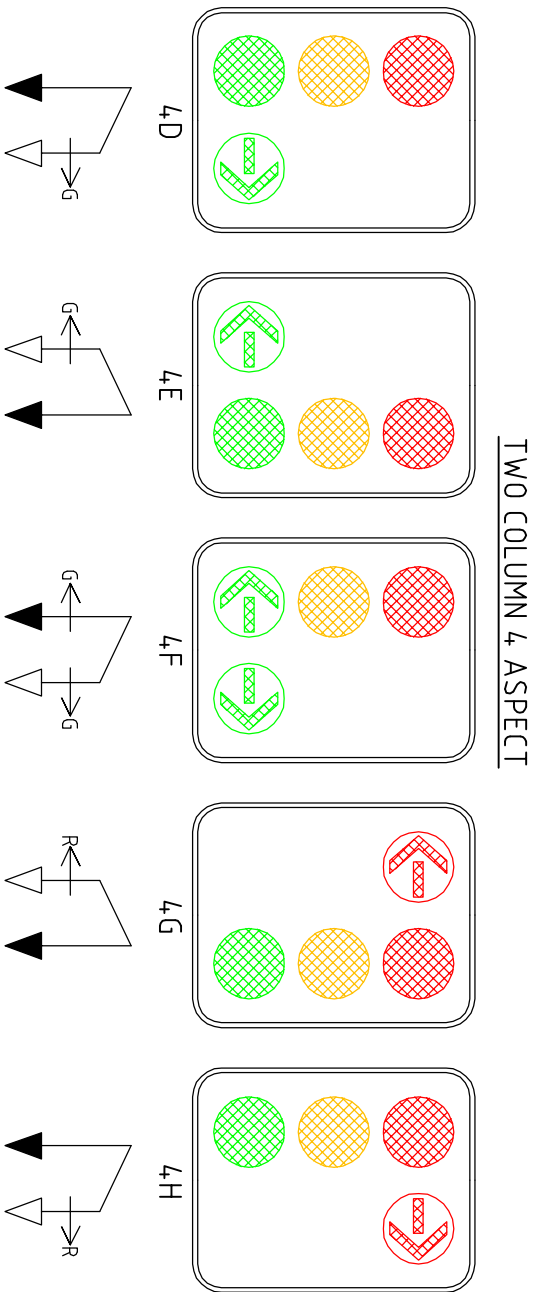


SINGLE COLUMN 3 ASPECT



SINGLE COLUMN 4 ASPECT





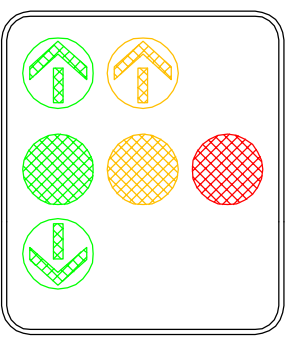
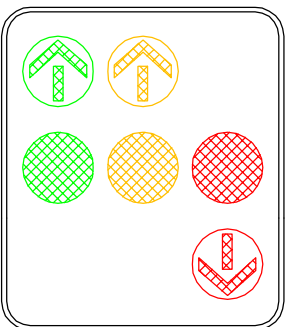
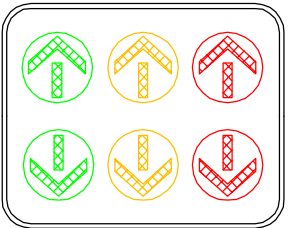
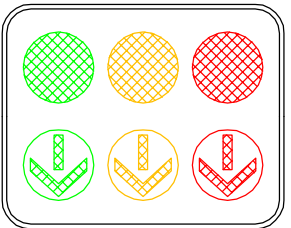
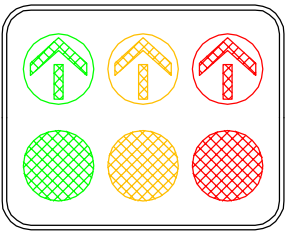
**AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU)
TRAFFIC SIGNAL STANDARDS**

STANDARD LANTERN DISPLAY & SYMBOLS

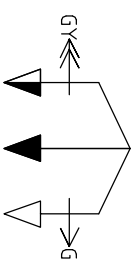
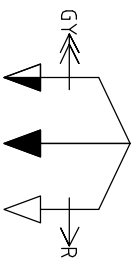
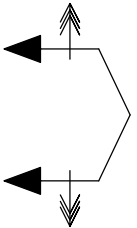
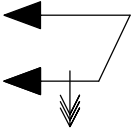
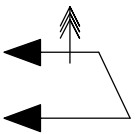
NOT TO SCALE

Figure 2

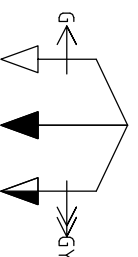
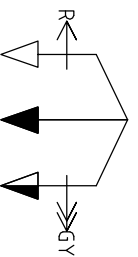
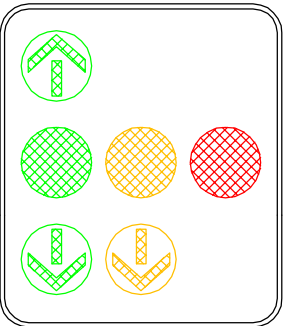
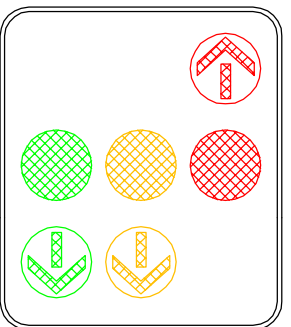
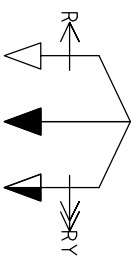
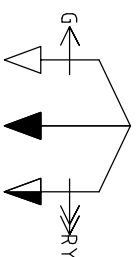
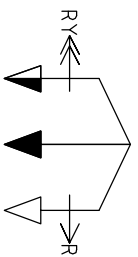
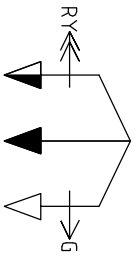
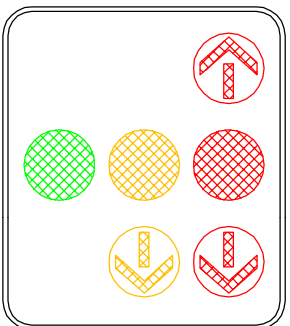
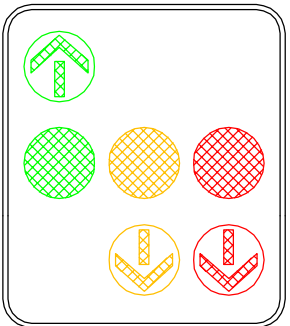
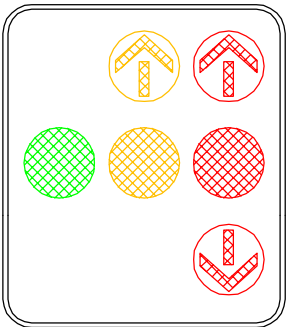
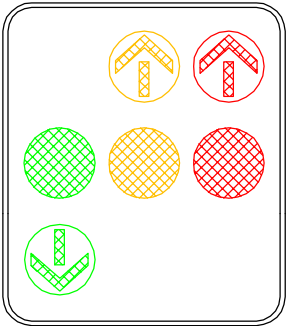
TWO COLUMN 6 ASPECT



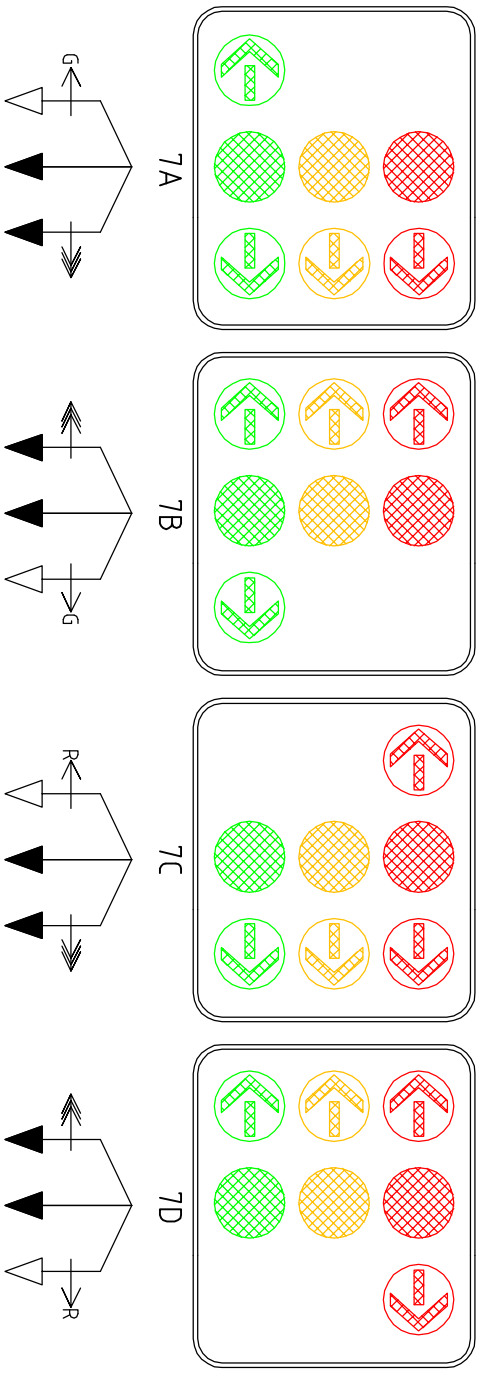
THREE COLUMN 6 ASPECT



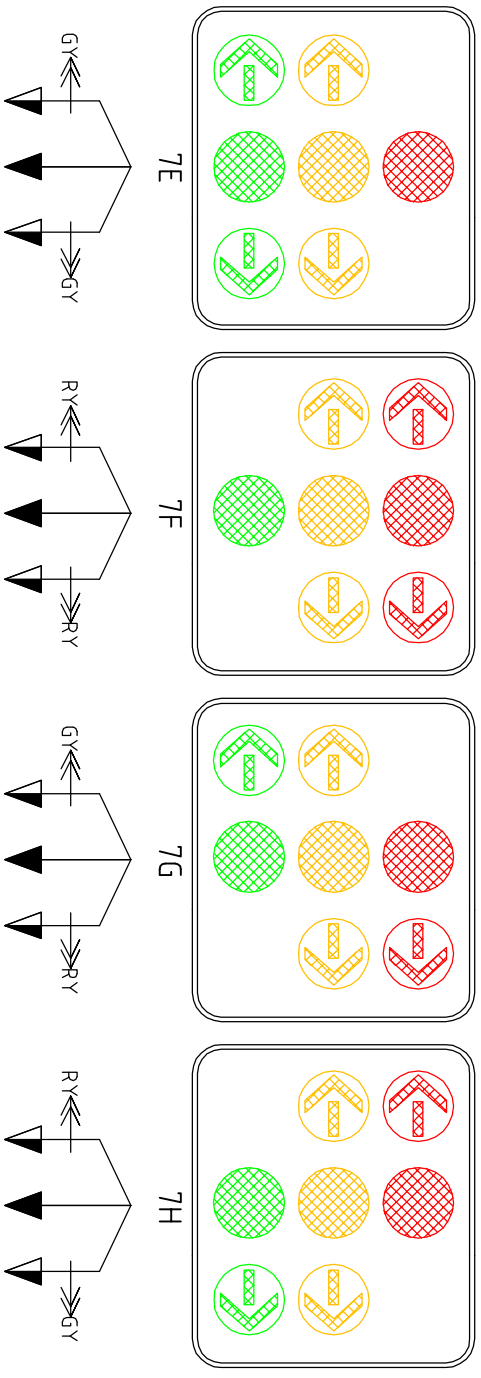
THREE COLUMN 6 ASPECT



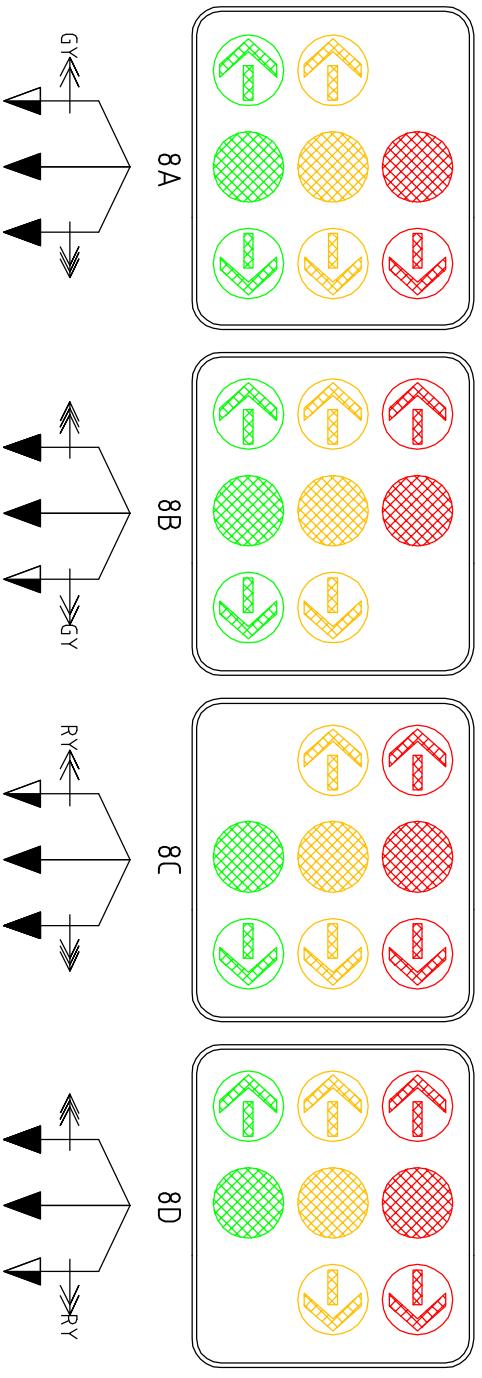
THREE COLUMN 7 ASPECT



THREE COLUMN 7 ASPECT



THREE COLUMN 8 ASPECT



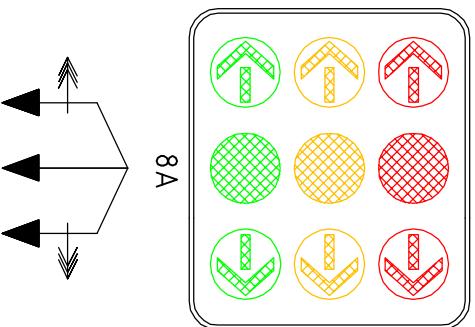
AUCKLAND TRAFFIC MANAGEMENT UNIT (TMU)
TRAFFIC SIGNAL STANDARDS

STANDARD LANTERN DISPLAY & SYMBOLS

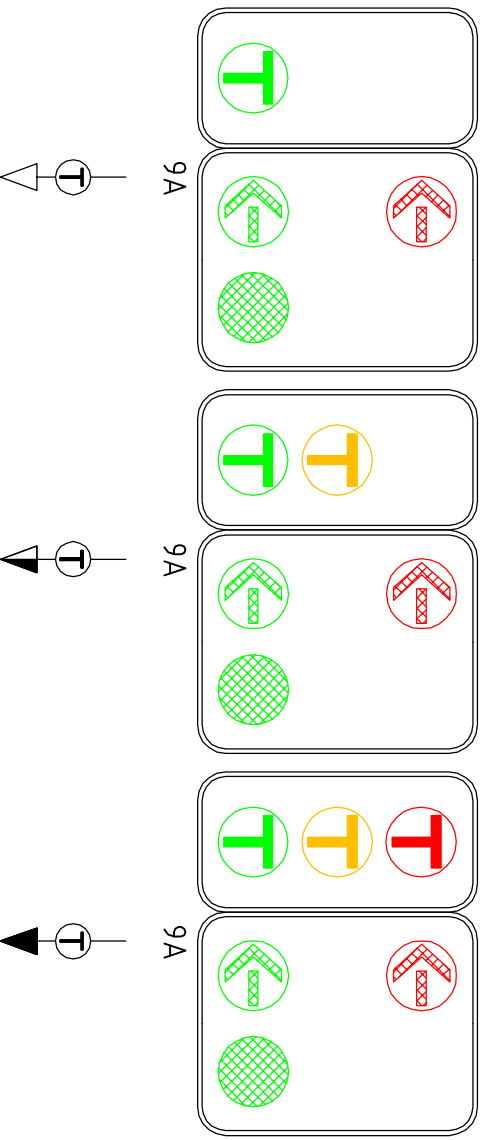
NOT TO SCALE

Figure 4

THREE COLUMN 9 ASPECT



SPECIAL VEHICLE DISPLAYS



<u>SYMBOL</u>
(T) FOR LIGHT TRAM
(B) FOR BUSES
(C) FOR CYCLES

NOTE:

SPECIAL VEHICLE DISPLAYS ARE INSTALLED ALONGSIDE THE APPROPRIATE SINGLE, TWO COLUMN OR THREE COLUMN LANTERN.

