PARALLAX

Practice Note

Practice Note & Best Practice Guide for Land Surveying

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1.1. DOCUMENT CONTROL

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Document History and Status

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Revision	Details
Rev 0	For peer review
Rev 1	Action of peer review
Rev 2	Feedback added from main client contact for industry

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This surveying practice note has been complied using all reasonable care based on the experience and knowledge of experts across the temporary traffic management and surveying industry. Relevant literature, legislation and regulations were reviewed and applied throughout the development of this document.

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2. GLOSSARY OF TERMS

<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>AADT</td><td>Annual average daily traffic</td></tr>
<tr><td>CARRIAGE WAY</td><td>The part of a road, sealed or unsealed, and including any shoulder areas, where a normal wheeled vehicle can traverse. Two carriageways are deemed to exist where the carriageways are divided longitudinally by a physical island, median or barrier.</td></tr>
<tr><td>CADASTRAL SURVEY</td><td>Cadastral surveying is the discipline of land surveying that relates to the laws of land ownership and the definition of property boundaries.</td></tr>
<tr><td>CADASTRAL SURVEY DATASET</td><td>A cadastral survey dataset (CSD) provides an authoritative source of information as to where a boundary is located, where a parcel of land is located, and the attributes of that parcel and boundary. This information enables the correct and unambiguous allocation and management of land rights and the correct re-establishment of the boundaries in the future.</td></tr>
<tr><td>CAT A ROAD</td><td>60km/h and less</td></tr>
<tr><td>CAT B ROAD</td><td>70km/h and more two-way two-lane roads (including passing lanes)</td></tr>
<tr><td>CAT C ROAD</td><td>70km/h and more, multi-lane roads</td></tr>
<tr><td>CoPTTM</td><td>Code of Practice for Temporary Traffic Management</td></tr>
<tr><td>CSD</td><td>Clear Sight Distance:
The distance a road user can clearly see along the road. Minimum CSD is expressed in terms of metres based on the permanent speed limit or operating speed.

Minimum CSD is expressed in terms of metres based on the permanent speed limit (PSL) or operating speed.

Rear CSD – the clear sight distance required by drivers travelling in the same direction as a inspection activity.

PSL of 50kph and under local roads = 75m
PSL of 60kph & over & all State Highways = 3xPSL

<table><tr><td>30 40 50</td><td>75m (Non-SH)
3xPSL (SH)</td></tr><tr><td>60</td><td>180m</td></tr><tr><td>70</td><td>210m</td></tr><tr><td>80</td><td>240m</td></tr><tr><td>90</td><td>270m</td></tr><tr><td>100</td><td>300m</td></tr><tr><td>110</td><td>330m</td></tr></table></td></tr>
<tr><td>EED</td><td>Engineering exception decision - A written decision made following consideration of all factors, including the safety of all concerned, to vary a code of practice(s), standard(s) and/or guideline(s), to suit a particular situation. The decision must be included with the traffic management plan (TMP)</td></tr>
<tr><td>EDM</td><td>EDM (Electronic/Electromagnetic Distance Measurement) is a method of distance measurement using electromagnetic waves emitted from a stationary instrument.</td></tr>
<tr><td>GPS BASE STATION</td><td>GPS (Global Positioning System), otherwise known as GNSS (Global Navigation Satellite System) in this context is a surveying instrument used to take measurements based on satellite signals. GPS base stations are set up in a stationary position. GPS rovers are typically mounted to a pole and are handheld so can be carried around a work site.

  </td></tr>
<tr><td>HSWA (2015)</td><td>Health and Safety at Work Act, 2015</td></tr>
</table>

INSPECTOR	Waka Kotahi qualified inspector, previously known as traffic controller inspector (TCi)
LEVEL LV	A low volume road with annual average daily traffic (AADT) counts of less than 500 vehicles per day (vpd).
LEVEL 1 ROAD	Annual average daily traffic (AADT) counts of less than 10,000 vehicles per day (vpd) on rural roads and less than 15,000vpd on urban roads.
LEVEL 2 ROAD	Annual average daily traffic (AADT) counts of 10,000vpd or more on rural roads and 15,000vpd or more on urban roads
LEVEL 3 ROAD	Annual average daily traffic (AADT) greater than 10,000 vehicles per day (vpd).
LIVE LANE	A lane available for use by a class or classes of vehicles.
NZGTTM	New Zealand Guide to Temporary Traffic Management
PPE	Personal protective equipment
PSL	Permanent speed limit
RCA	Road controlling authority
ROAD RESERVE	The area of land between the legal boundaries, usually fence line to fence line and including any safety run-off areas, which is dedicated to allow the passage of road users. The road reserve also includes an airspace of six metres directly above the road surface. The terms road and road reserve have the same meaning in the NZ Transport Agency's Traffic Control Devices Manual
ROADSIDE	Roadside is an area on the non-traffic side of the kerb or edge of seal, usually consisting of a berm and sometimes a footpath
SH	State highway
SHOULDER	A sealed or unsealed part of the road outside the edgeline, or an inferred edgeline, which is trafficable and flush with the pavement.
SIGN VISIBILITY DISTANCE	The minimum distance over which the driver of an approaching vehicle must be able to see the first advance warning sign. Where necessary, moving the sign further away from the work vehicle is permitted in order to achieve visibility distance.
SPOTTER	A spotter primary role is to be the lookout for the surveyor operating near or on the live lane in high-risk environments as set out in this practice note. Therefore, the spotter must be able to maintain adequate attention to approaching traffic. It is not advised that the spotter undertakes any other duty when fulfilling this role. The spotter must be placed in a position where CSD can be attained by the spotter and be able to give verbal instructions to the inspector.
STMS	Site traffic management specialist (CAT A, B, C)
SURVEYOR	Industry qualified professional who carries out land or cadastral and/or other precise measurement and inspection tasks.

	50m
	60m
	70m
	80m
	90m
	100m
	110m

SURVEY PRISM TARGET	Survey prisms are used by surveyors and engineers to measure the change in position of a target that is assumed to be moving. 
TCD Manual	Traffic Control Devices Manual
TMC	Traffic management coordinator
TMD	Traffic management diagram
TMP	Traffic management plan
TOC	Traffic operations centre
ROBOTIC TOTAL SYSTEM	A robotic total station (RTS) is a high precision surveying instrument that is set up on a tripod to measure bearings and distances (using EDM). A RTS is operated remotely from a roving controller. This means you only need one operator and can perform far more calculations and inspections in less time than with a traditional total station. 
TSL	Temporary speed limit
TTM	Temporary traffic management
VPD	Vehicles per day
WAKA KOTAHI	Waka Kotahi - New Zealand Transport Agency
WAP	Works access permit
WORKSAFE	Work Safe – Mahi Haumaru Aotearoa

3. ACTIVITY DESCRIPTION

3.1. INTRODUCTION TO LAND SURVEYING

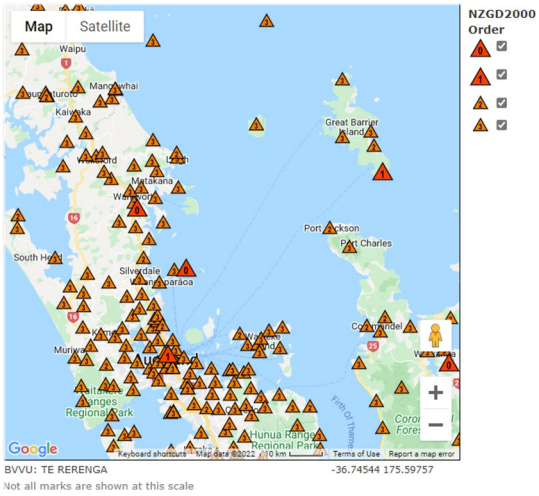
Who are Survey and Spatial New Zealand

Survey and Spatial New Zealand (S+SNZ, legally incorporated as the New Zealand Institute of Surveyors) represents surveyors and spatial professionals. We are a stakeholder across a wide range of government policy areas and the sector including housing development, land subdivision, construction, infrastructure, spatial information, and resource management. Our members are professionals responsible for the preparation of Cadastral Surveys in accordance with the rules made by the Surveyor General (currently Rules for Cadastral Survey 2021).

Why do Surveyors work within the Road Reserve?

At its most basic, surveying is taking measurements to determine the position of a survey mark, or other feature. A significant proportion of all survey work is undertaken within the road corridor and with the assumption that it must be for some road construction activity. This is correct in a number of cases, as surveyors are called upon to define the legal extent of the road, as well as giving spatial certainty to the physical roads and the other assets that occupy space within the corridor. However, overall, this type of survey is a very small proportion of a surveyor's work.

It is much more likely that a surveyor is accessing the survey network, a very important but inconspicuous layer of infrastructure. Part of this countrywide network of survey marks is contained within the LINZ Geodetic Database. This is the control layer and it comprises approximately 130,000 geodetic survey marks that are mostly contained within the road network. In addition to these marks, there are many more cadastral survey marks that are recorded on old cadastral survey plans.



Example of geodetic survey marks taken from LINZ Geodetic database - spatial view

Much of this network of survey marks is contained within the road reserve because;

- **it is an area that is currently publicly accessible,**
- **it is likely to remain that way,**
- **the space is clear of any major obstructions,**
- **there are even grades necessary for public movement,**
- **permit longer sightlines than are generally possible on private land.**

So, a surveyor's primary purpose in accessing the road reserve is not to execute road works, but to access the survey network. The geodetic part of this network is owned by the NZ government, and it is maintained by an annual programme of geodetic surveys.

The Cadastre and Cadastral Surveys

While there are many different types of survey, one that is common and is worth mentioning is the cadastral survey.

"The cadastre is the official record of cadastral surveys that define the location of boundaries of land interests under various tenure systems, including freehold, leasehold, Māori and Crown land. It includes official survey plans, information about boundary marks, survey measurements, and other supporting information provided by surveyors.

Cadastral surveys are carried out by licensed cadastral surveyors in accordance with standards set by the Surveyor-General and are lodged with Land Information New Zealand for approval. Once approved, surveys of private land can be used for the issue of new titles."

Source: Cadastre 2034 | Toitū Te Whenua Land Information New Zealand (linz.govt.nz)

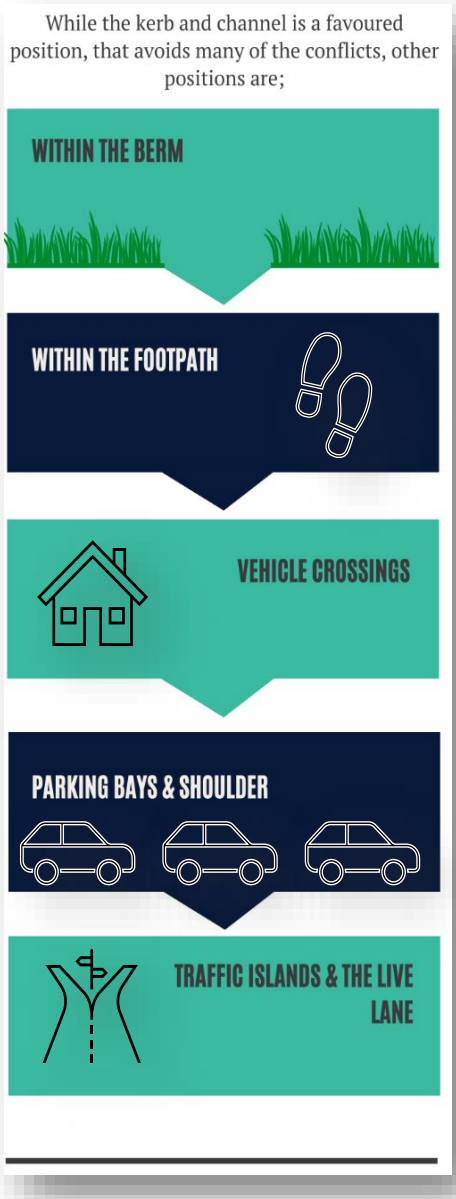
New Zealand's cadastral system is based on the evidential proof of finding existing survey marks to confirm a survey fits within the verified framework. Therefore, a surveyor is required to locate and observe old survey marks to define the position of a boundary. The best available definition of the boundary is required and so the observations should be made to the nearest and most reliable of the existing survey marks that remain. Therefore, the search for old marks generally progresses outwards from those most relevant. Since it is not possible to predict whether a mark that was placed years earlier still remains, and is in its original position, it is also not possible to know where a search may lead in advance. Older survey marks were often buried in the berm and so to locate and observe to them it is necessary to dig a small hole with hand tools such as a spade or metal bar to expose the mark. Typically, these would be approximately 200mm deep, so they would be exposed, observed and covered over again within a few minutes.

When looking for marks from older surveys in areas where the road has been upgraded, the search can be extensive; often covering many kilometres of the road corridor. The movement over this distance can occur quite rapidly, as the search for one mark may only take a few minutes and marks many be hundreds of metres apart. With such a dynamic and highly unpredictable degree of movement, a cadastral survey is very different to the survey for a construction project, with this in mind, it becomes difficult to pre-plan any site-specific working areas and locations details. Similarly, dates can be unpredictable, as either the site conditions, or the weather can be unfavourable. Things as mundane as a vehicle parked in the wrong location, blocking visibility or obstructing survey marks may affect the survey. Due to the unpredictable nature of cadastral surveying, it is imperative that surveyors can operate under a reusable, flexible traffic management strategy.

A Space for Surveyors

Surveyors have been undertaking these surveys in NZ, since its first exploration by Europeans. Over this time they have developed a fundamental background knowledge of how to operate safely within the road corridor. As a reaction to the invention and rise in the number of motor vehicles, surveyors have looked for safer locations to place new survey marks. Additionally, procedures have continued to evolve with the arrival of each new advances in technology, such as electromagnetic distance measurement (EDM) and GPS.

Surveyors consider the road to be their natural working environment, where they can mitigate the risks to work safely. Over the years, with the increasing use of the road corridor for vehicles and more underground services, the available space for surveyors to operate has reduced. To avoid conflict with vehicles, services and pedestrians, surveyors have adapted to placing a number of marks in the concrete kerb or channel. Additionally, these areas are usually stable and often last longer than footpaths.



The one drawback of setting up a tripod over a mark in the kerb or channel is the need to place one or two tripod legs in the edge of the carriageway. This has often been problematic when referring to the CoPTTM, as the location of work activity quickly move this type of operation into a static closure, often taking more time to install than it takes to collect the data.

On residential urban, low-speed roads with parking lanes or shoulders, this practice has proved to present minimal risk to normal traffic operations. Although, on busier roads, particularly where traffic lanes are close to the kerb, we identify this is not a safe option without lane closures, or similar measures.

Survey Mark Locations

In selecting the position of a new survey mark, surveyors must balance the safety aspects with the requirements of the survey.

For example, survey marks are often placed to meet a specific need, such as;

- line of sight to place a boundary mark or
- survey existing features

For GPS work, an unobstructed skyline is the optimal situation to gain non-compromised satellite signals to ensure that both survey accuracy and spatial certainty is achieved.

The road environment is continually changing, and surveyors continue to evolve with it. An example, particularly in and around central city areas, is the number of new cycle lanes that are being created within existing road corridors removing the ability to park a work vehicle alongside the kerb line or similarly, a survey mark that was in a shoulder is now in a marked cycle lane which could dramatically increase the type of TTM required.

Typical Survey Equipment

Most survey equipment is either mounted on a surveyor's tripod or a pole, which is either hand-held or braced for a short period with small supporting legs. Usually this will be attended in order for it to be operated and if required it can be relocated at short notice. This description would include a non-robotic total station, a theodolite or a level on a tripod as well as a reflective prism or GPS rover on a pole.

However, some equipment is more automated, and it may be only partially attended after it has been set up. This would include equipment such as a robotic total station, a survey prism target, a laser scanner, or a GPS base station, which would all typically be mounted on a surveyor's tripod.

Modern equipment is light weight and while it is often expensive, it can be described as frangible. While surveyors prefer to remain separated from pedestrians, this is to prevent disturbance or damage to the equipment once it has been setup. In contrast to the majority of construction work, there is minimal danger to a pedestrian walking too close to survey equipment.

4. ROAD ENVIRONMENTS

Section 4 is designed to help determine the road environment before selecting an operation based on the following factors:

4.1 Road layout and recommended safe parking areas

4.2 Lane widths (arterial and non-arterial)

4.3 Mobile Road website for road characteristics

4.1. ROAD LAYOUTS

The following road layouts are a resource to refer to as a reminder of location terminology and where it is situated with in the road reserve. The glossary provides further commentary on each of the location terms.

There are 8 typical road layouts to consider from rural and urban/non-arterial through to rural and State Highway/arterial environments *(please note these layouts are not exhaustive and other road layouts exist)*.

These layouts assist with safe and preferred parking options when it is recommended or required to have a work vehicle onsite. The TMDs found in this practice note will not show each activity across all 8 layouts, rather a simplified version of *Roadside* and *Carriageway* will be used. Therefore, please refer back to this section to assist with vehicle parking and activity locations.

Figure 1. Road layouts 1 -2

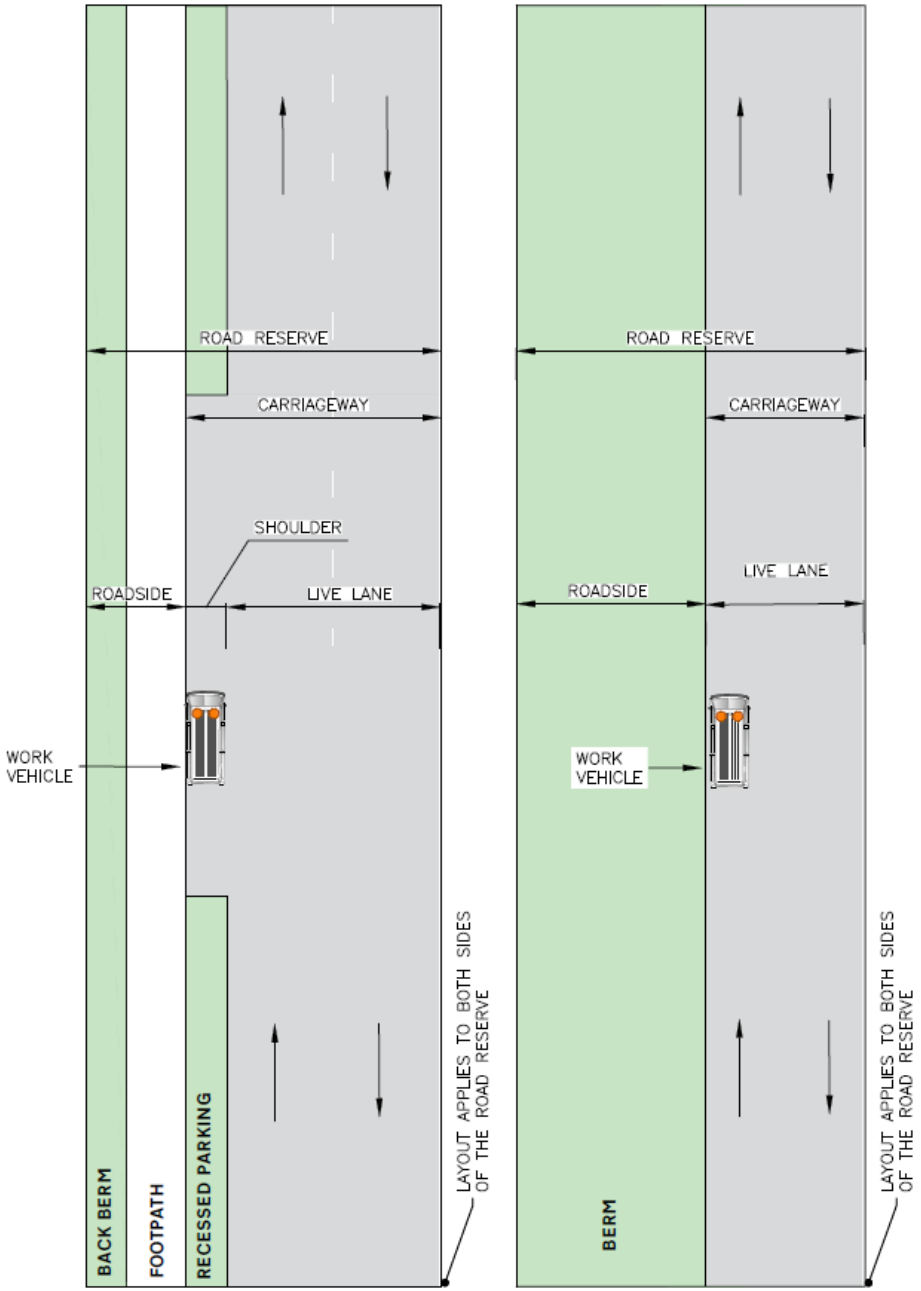


Figure 2. Road layouts 3-5

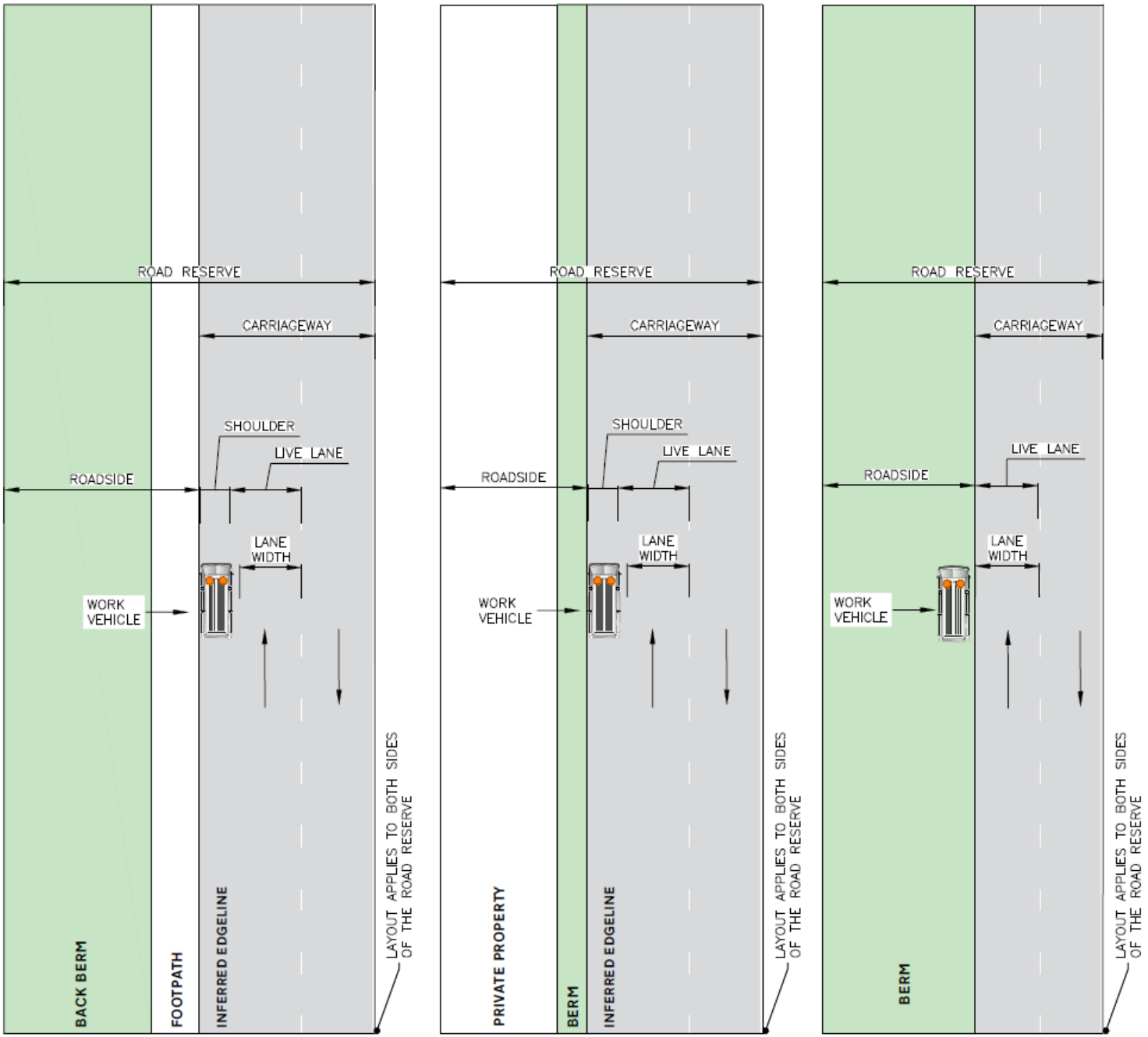
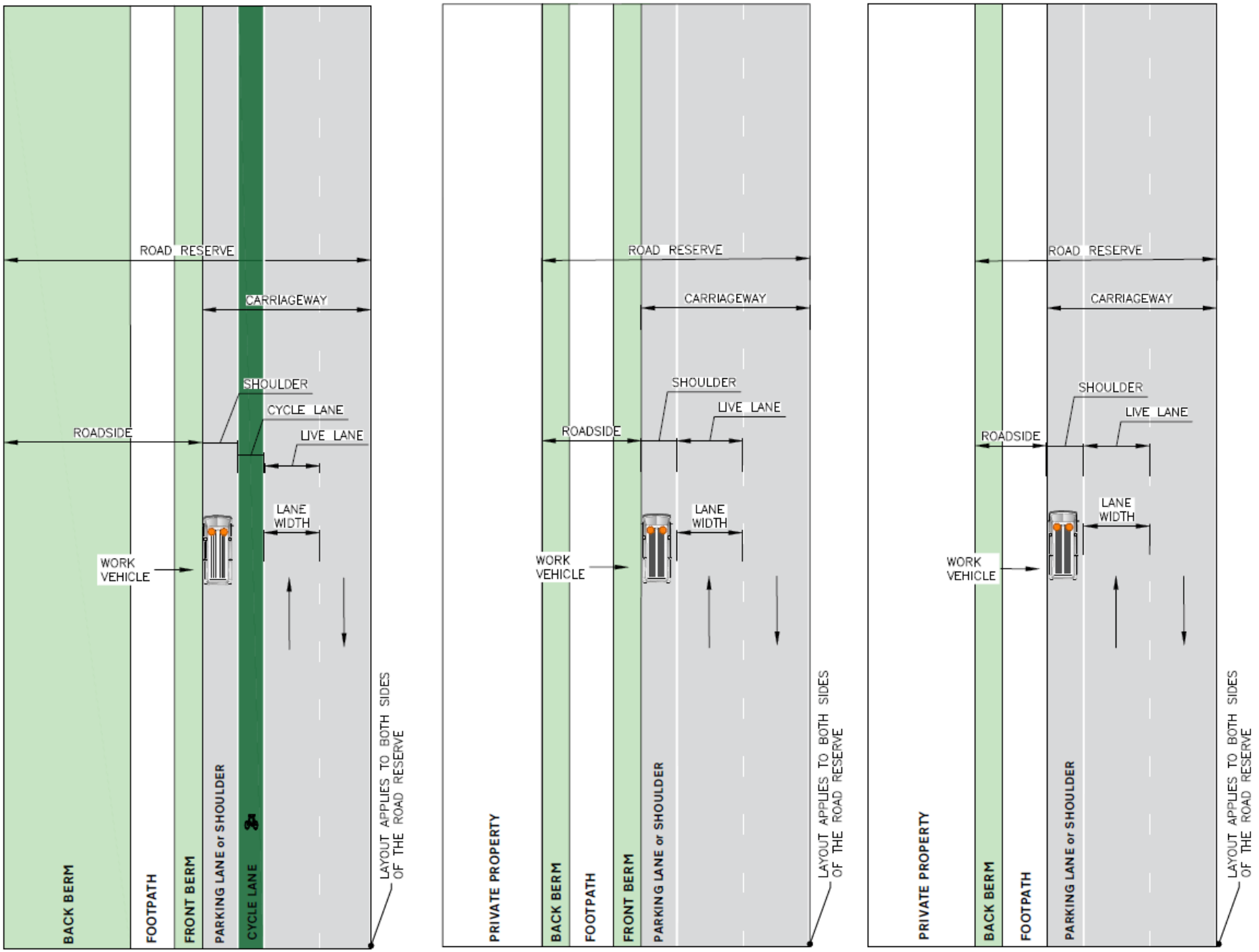


Figure 3. Road Layouts 6-8



4.2. ROAD CLASSIFICATION CATEGORIES

The following requirements for maintaining lane widths past a parked work vehicle will be split in to two categories, arterial roads and non-arterial roads.

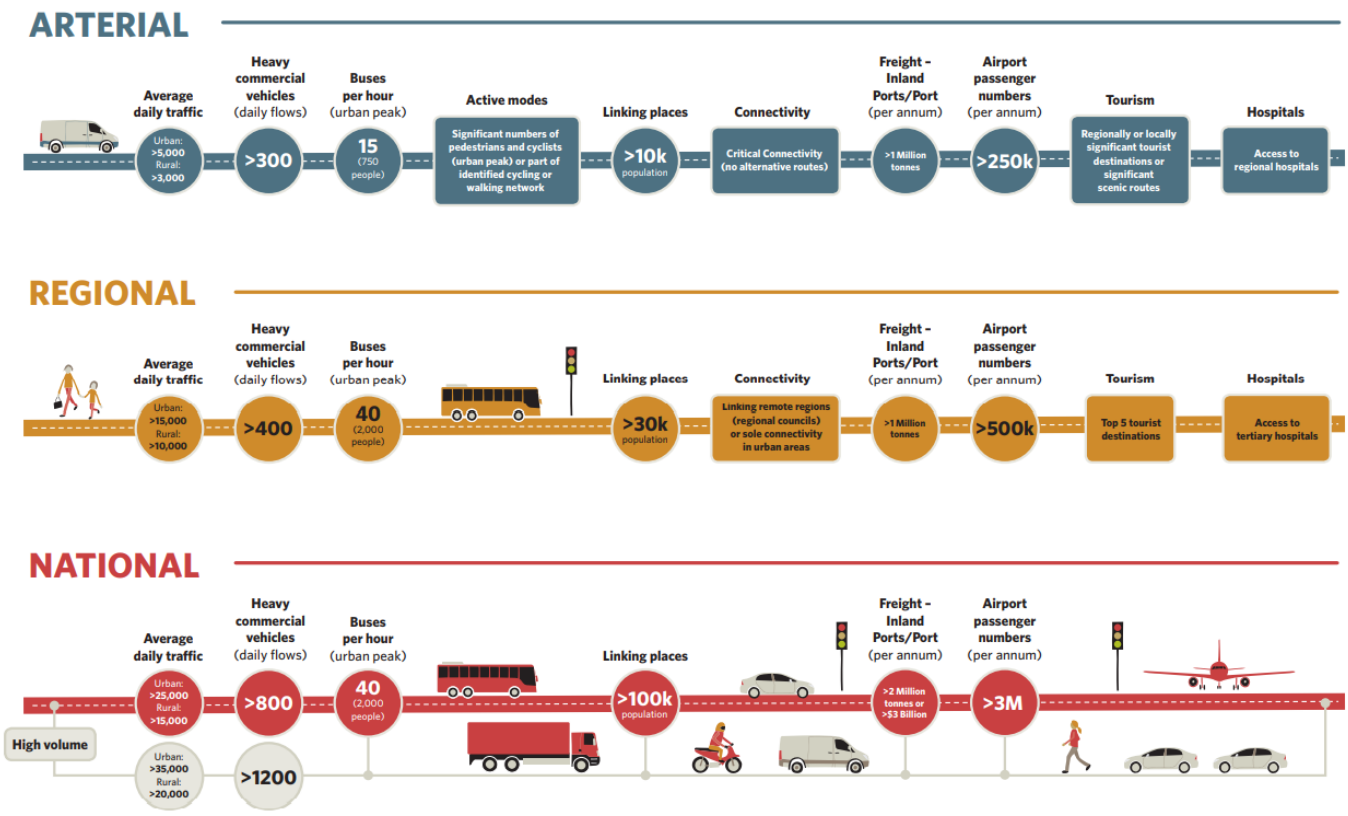
This approach takes into consideration the following standards, guides and publications:

- Auckland Transports Road Classification,
- Waka Kotahi's One Network Road Classification (ONRC),
- Austroads Guide to Road Design Part 3: Geometric Design as well as
- NZS4404:2010 (Land Development and Subdivision Infrastructure Standard)

Arterial roads can be sub-divided into the following sub-categories:

- Motorways
- Strategic Routes
- Primary Arterials
- Secondary Arterials

This practice note will apply the Austroads guide to road design to the lane width requirements for arterial roads.

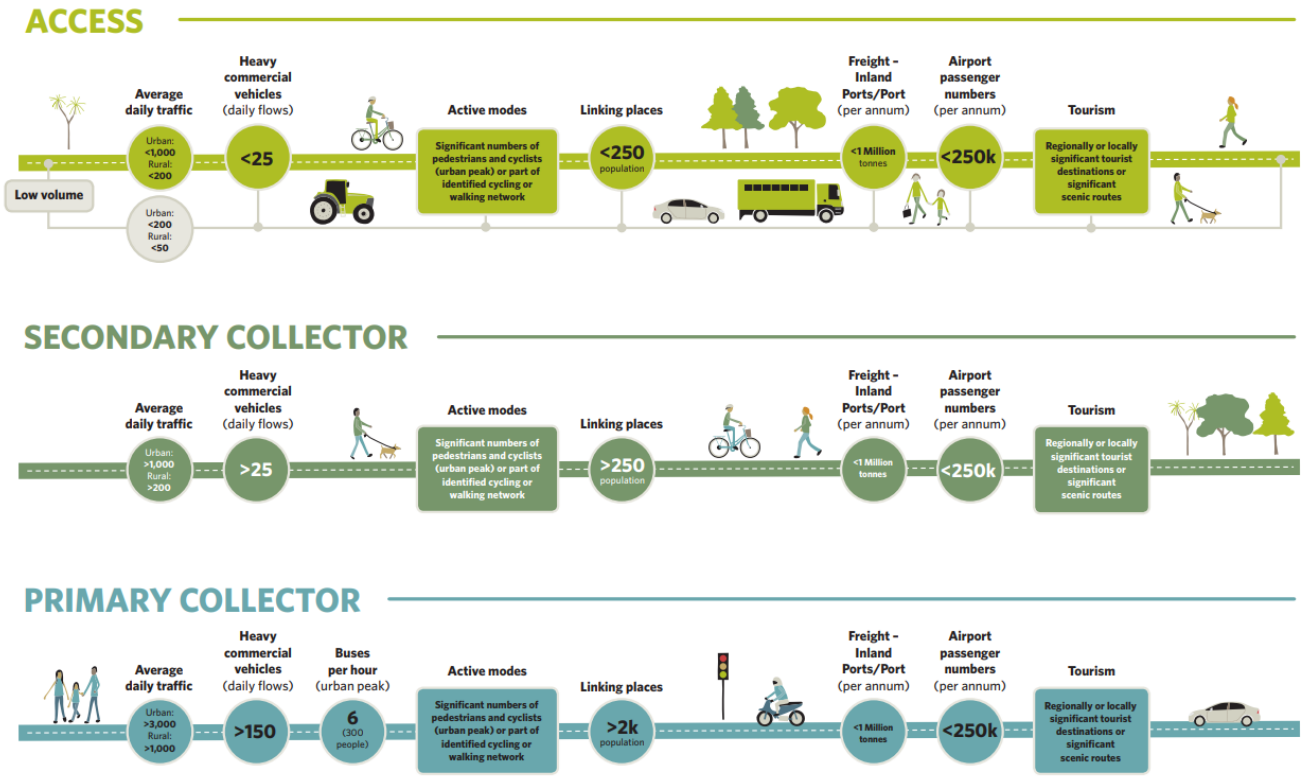


Examples of arterial roads from Waka Kotahi's One Network Road Classification

Non-arterial roads can be sub-divided into the following sub-categories:

- Collector Roads
- Local Streets
- Lanes and Service Lanes
- Shared Space / Shared Zones

This practice note will apply the NZS 4404:2010 : Standards New Zealand to the lane width requirements for non-arterial roads



Example of non-arterial road from Waka Kotahi's One Network Road Classification

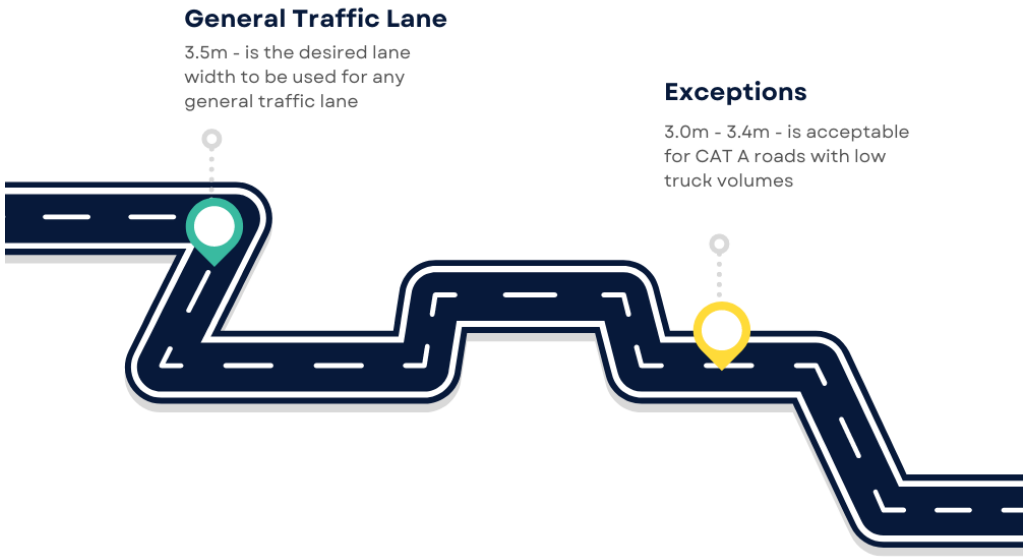
4.3. LANE WIDTH

ARTERIAL ROADS:

This practice note will align with the desired lane width for general traffic lanes on arterial roads, as set out in Austroads Guide to Road Design Part 3: Geometric Design. The provision of standard lane widths of 3.5 m allows for large vehicles to pass or overtake, without either vehicle having to move sideways towards the outer edge of the lane.

There are however exceptions to this guideline.

1. On urban roads narrower lanes of 3.0m – 3.4m may be considered where any of the following apply:
    - The road is in a low-speed environment (CAT A).
    - There is little or no truck traffic.



NON-ARTERIAL ROADS

This practice note will align with the design standards set out in NZS4404:2010 (Land Development and Subdivision Infrastructure Standard) for non-arterial roads. With further guidance around parking in the movement lane and where parking in these areas is already permitted.

- New subdivisions have carriageway widths of 5.5-5.7m. As such, maintaining a 3m wide lane is not feasible, as the roads are not designed to this standard.
- In addition, parking on local roads up to 2,000vpd is permitted and anticipated within the movement lane.

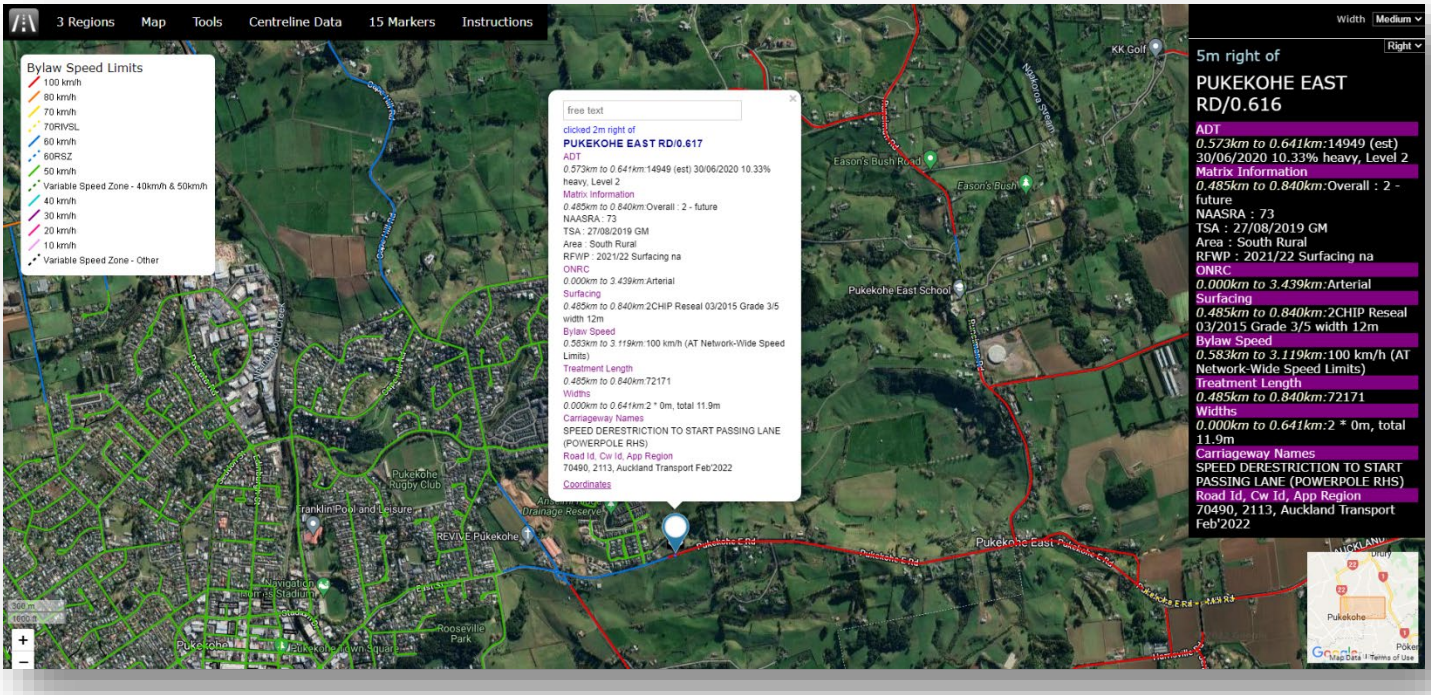
General locality	Domestic units serviced	Target operating speed (kph)	Pedestrians	Passing, parking, loading and shoulder	Cyclists	Movement lane	Classification
Rural – access to housing	1-150 domestic units	70	Shared (on shoulder and berm)	Total shoulder 1.0m	Shared (in movement lane)	5.5-5.7m total	Local road (approx. 1000vpd)
Rural – access to office and education	1 to 200 lots	Up to 60	1.5m footpath each side	Parking and loading may occur in movement lane. Total shoulder 1.0m	Shared (in movement lane)	5.5-5.7m total	Local road (approx. 1000vpd)

Rural – primary freight access	Rural activities	Up to 100	1.5m footpath each side	Total shoulder 1.0m	On sealed shoulder where defined as cycle route	5.5-5.7m total	Local road (approx. 1000vpd)
Suburban – access to housing	1 to 200 domestic units	40	1.5m footpath each side	Shared parking in movement lane up to 100 units, separate parking if more than 100 units	Shared (in movement lane)	5.5-5.7m total	Local road (approx. 2000vpd)
Suburban – access to housing	Up to 800 domestic units	50	2m footpath each side	Parking is separate & recessed	Separate provision where defined as cycle route	8.4m total (2x 4.2m)	Connector/collector road (approx. 8000vpd)
Urban – access to housing	1 to 200 domestic units	30	1.5m footpath each side	Parking may occur in the movement lane	Shared (in movement lane)	5.5-5.7m total	Local road (approx. 2000vpd)
Urban – access to housing	All	50	2m footpath each side	Parking is separate & recessed	Separate provision where defined as cycle route	8.4m total (2x 4.2m)	Connector/collector road (approx. 8000vpd)

Table 3.2 of NZS4404:2010 (Land Development and Subdivision Infrastructure Standard)

4.4. ADDITIONAL CHECKS AND RESOURCES

Mobile Road is a great resource that can be used to check the level of the road, PSL, lane widths, percentage of heavy vehicles and overall environment before heading to site. This will enable the surveyor to narrow down the TMD that will be most applicable for the site location.

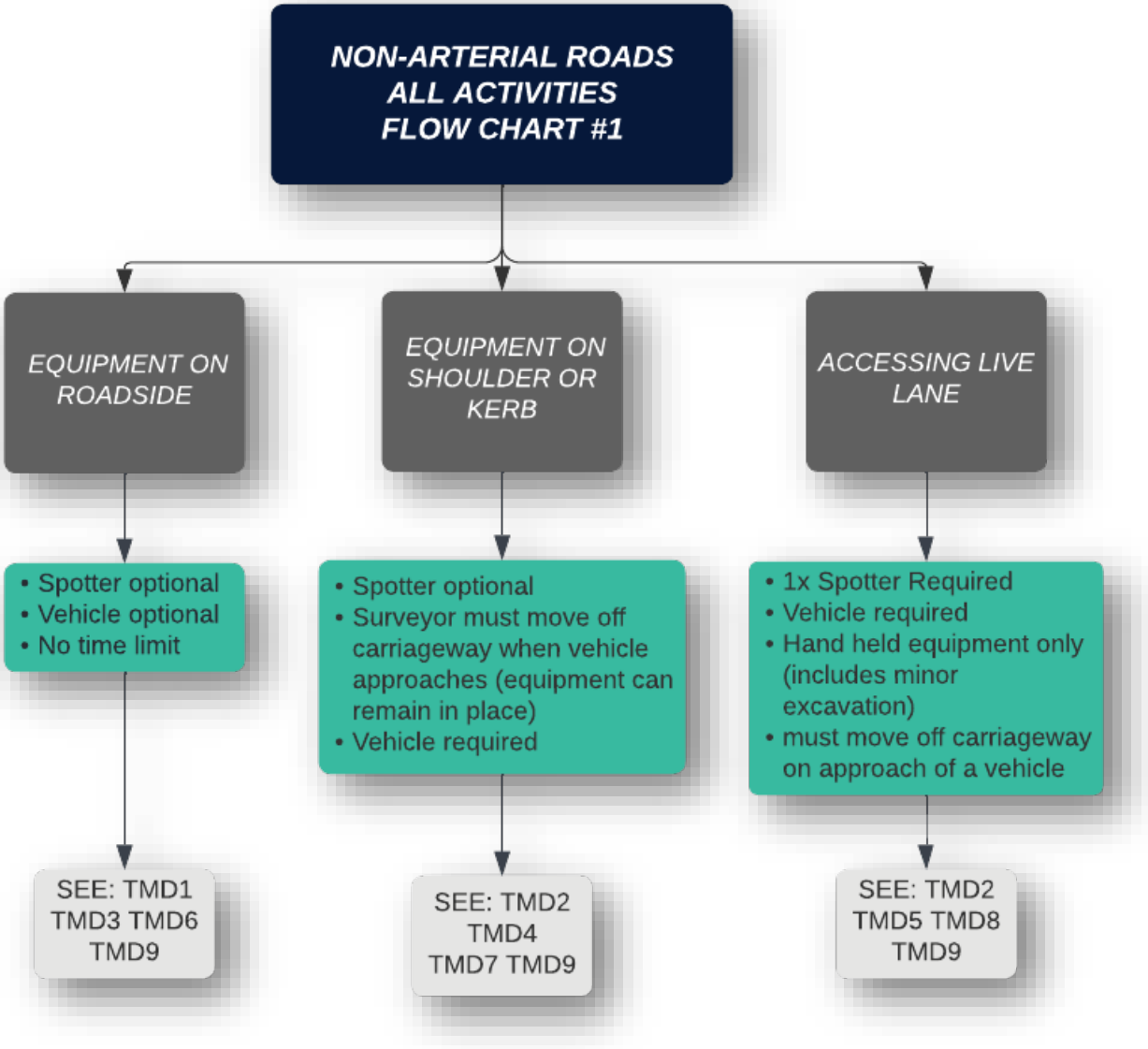


5.1. CATEGORY EXCLUSIONS

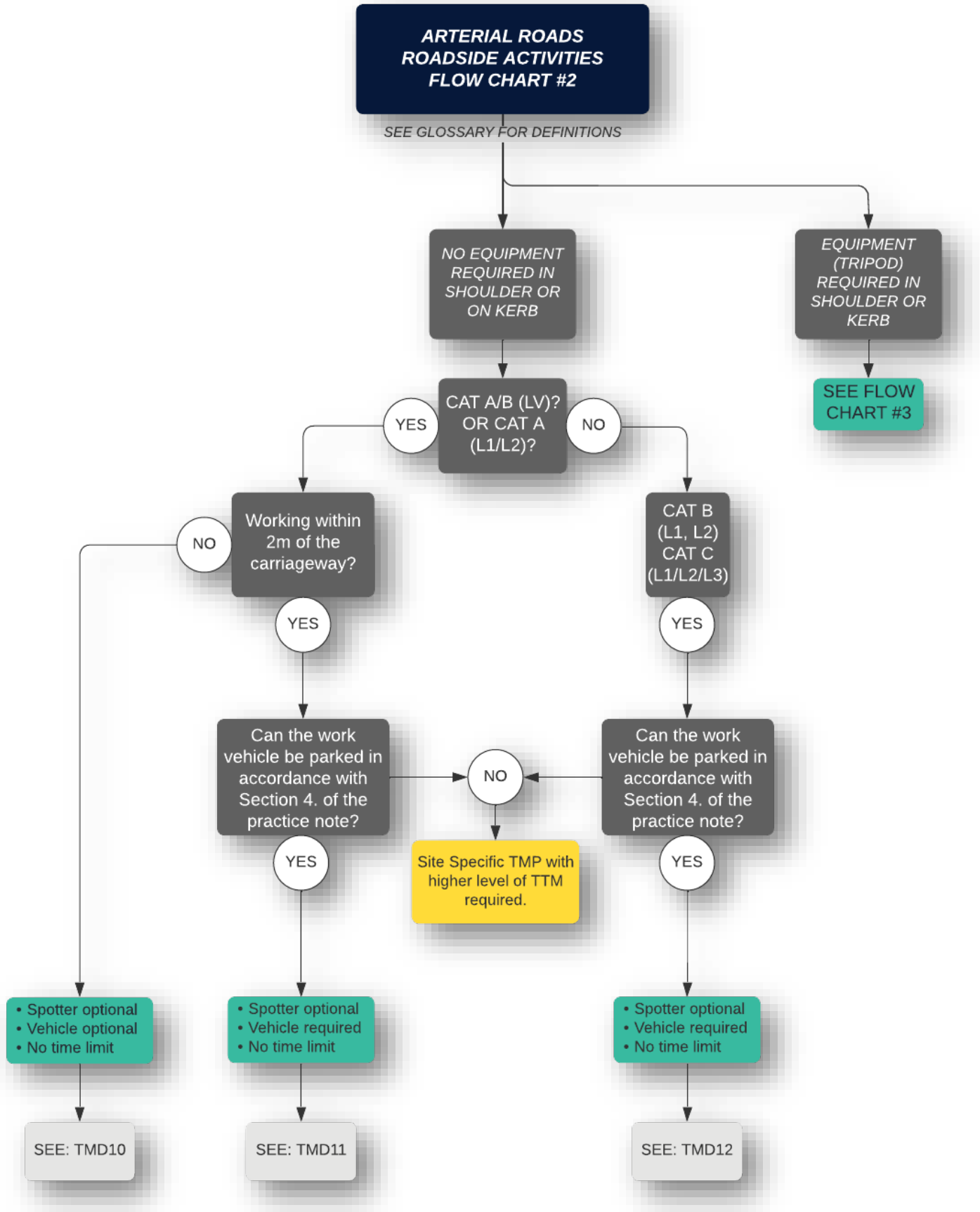
Surveyors have identified that there are some scenarios where a higher level of TTM is required in order to maintain safety in relation to the road environment and activity type. The following are therefore excluded from this practice note.

Please see the two flow charts on the following pages as a visual aid in selecting the best operation type.

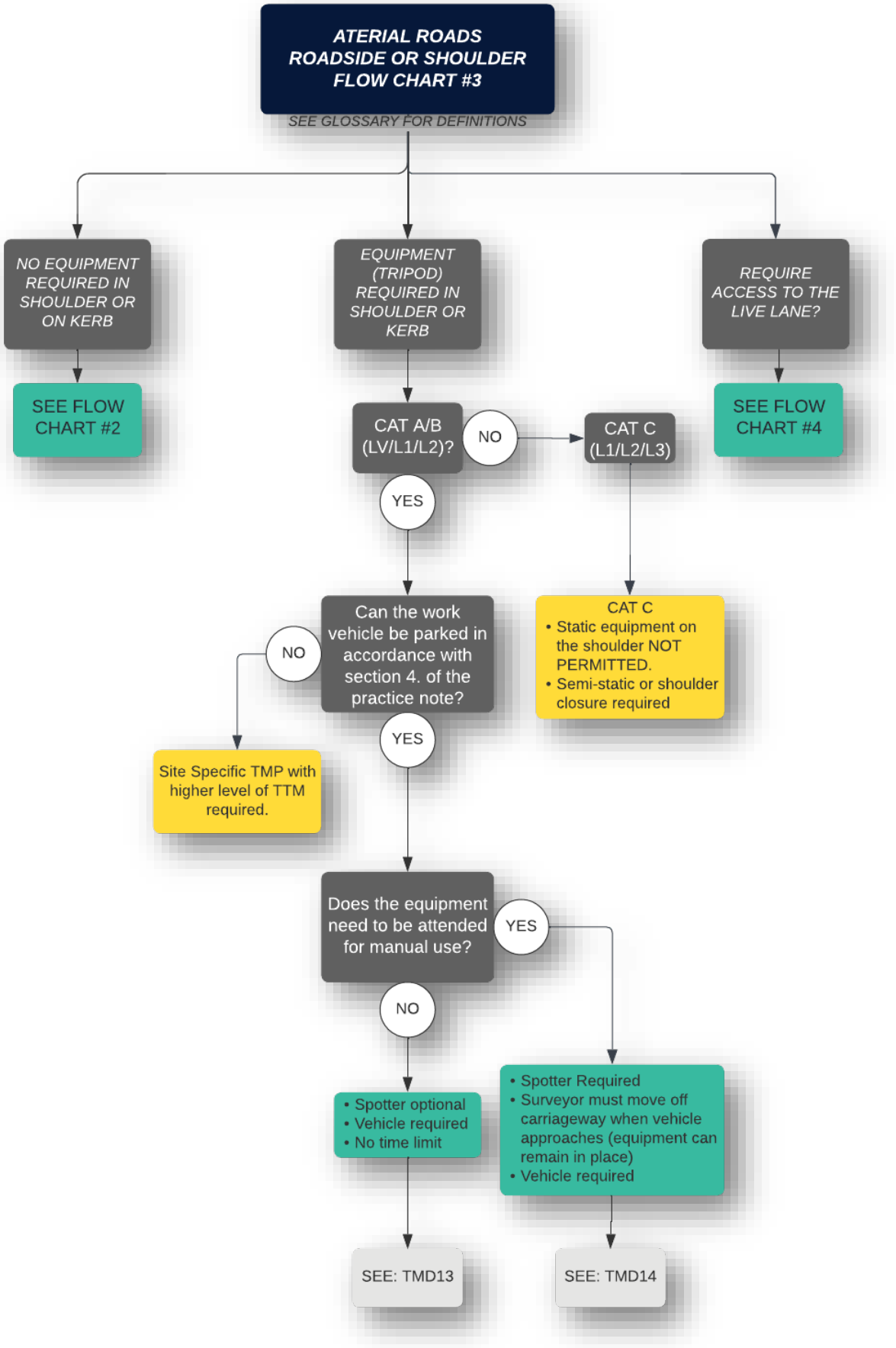
5.2. NON-ARTERIAL ROADS - OPERATION SELECTION FLOW CHART #1



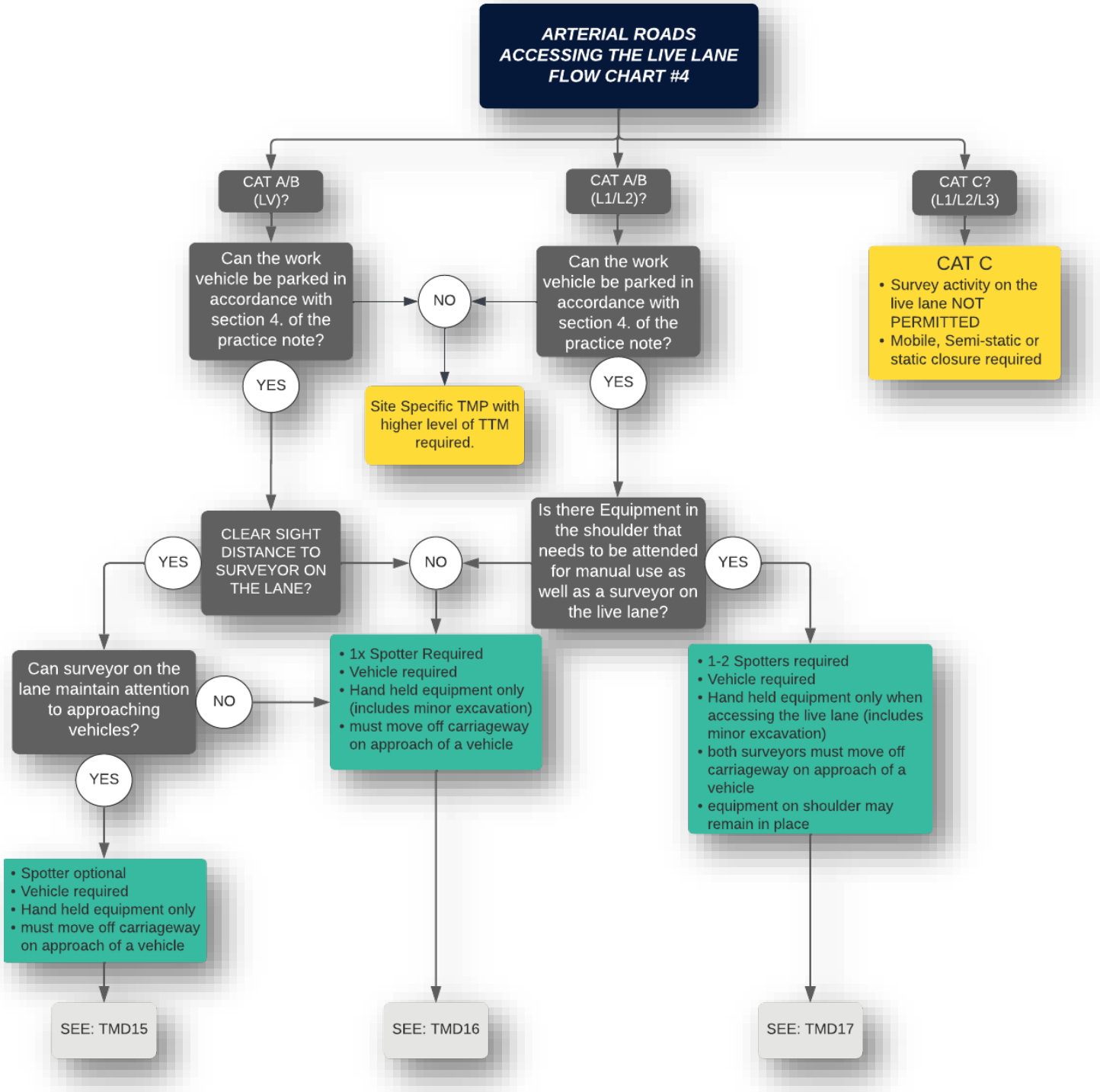
5.3. ARTERIAL ROADS - OPERATION SELECTION FLOW CHART #2



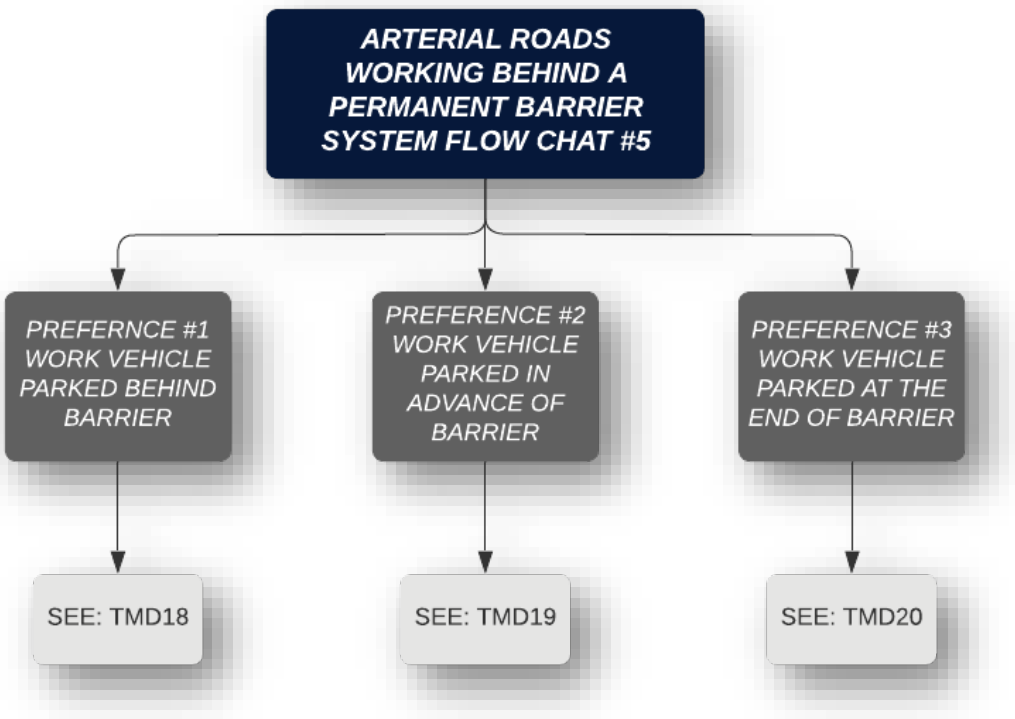
5.4. ARTERIAL ROADS OPERATION DECISION FLOW CHART #3



5.5. ARTERIAL ROADS OPERATION DECISION FLOW CHART #4



5.6. ARTERIAL ROAD – WORKING BEHIND A PERMANENT BARRIER SYSTEM



6.RISK ASSESSMENT

6.1. INTRODUCTION TO RISK ASSESSMENT REQUIREMENT FOR MOBILE OPERATIONS

A challenge for many surveyors has been the introduction of the interim changes to temporary traffic management requirements for tasks where a mobile operation requires out of vehicle activities on level 1 state highways. A short summary to this notice:

> *"Where out of vehicle work is being conducted within 5 metres of the edge-line or in the lane, where permanent speed limits are over 65km/h, the following site-specific temporary traffic management (TTM) controls are to be implemented":*
>
> *Interim TMD 1: Static worksite led by a Level 1 STMS is required incorporating the following:*
>
> - *Advance warning signs to be gated*
> - *50km/h TSL must be installed*
> - *Positive traffic management must be used to encourage the road users to slow down*
> - *Install T144 supplementary plates on all approaches*
> - *Install cones from the TSL to the taper (or hazard area) at 5m centres on approach to the working space*
> - *Other forms of positive traffic management to be installed if required to lower speeds*
> - *If traffic likely to cross the centreline, place cones on the centreline with RD6L signs at each end*
>
> - *See CoPTTM Advisory Note dated 16 April 2019 here*

Waka Kotahi has since identified work activities and associated work environments that, for reasons of practicality, risk management, or physical constraint do not require the interim TTM controls to be implemented as set out in the Interim requirements for TTM on state highways [PDF, 169 KB]

The three activity types proposed in this practice note fall within the exception guideline with the following considerations:

- The location within the road reserve and time required to undertake the activity is less than the time it would take to install a static worksite. Thus, exposing worker during the install, maintenance, and removal of the site.
- Short term, non-invasive work, mean that the controls are not reasonably practicable to implement.

Surveying meets the activity description and durations set out in the notice requirements. They are of a nature and duration determined by Waka Kotahi as suitable for work under mobile risk controls, and a documented, environment-based risk assessment will be completed prior to the commencement of any work activity.

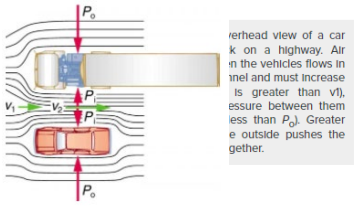
The table below in *6.2 Risk Matrix* details the initial risk assessment that can be completed at the planning phase. This risk assessment will consider the road environment, activity required, location of activity, what the hazards are and the risk profile of those hazards causing potential harm. If a higher level of control is required once the onsite risk assessment has been completed, this should supersede the below controls.

6.2. RISK MATRIX

Workers on foot on Roadside

TMD1 | TMD6 | TMD9 | TMD7 | TMD8 | TMD18 | TMD19 | TMD20

Category	Hazard	Risk	Risk Assessment	Combined Risk Score	Control
Road users	*Vehicular traffic in the live lane*	Vehicle vs Worker collision	Exposure – Low Likelihood – Low Severity – High	6/12	Admin No access to the live lane permitted under the TMDs referenced above, no static equipment in carriageway. Isolation Working behind a permanent barrier system where available Roadside berm elevated above the carriageway PPE Surveyor to be wearing compliant HI-VIS garment.
	Distracted Drivers	Errant vehicle leaves live lane and collides with surveyor or equipment.	Exposure – Low Likelihood – Low Severity – High	6/12	Isolation Working behind a permanent barrier system where available Roadside berm elevated above the carriageway Admin Work vehicle required to provide advanced warning and better visibility to the activity ahead. CSD to the work vehicle must be achieved *Only exceptions is work vehicle not required when working more than 2m outside of carriageway on a LV or CAT A Road.* Limit forward working distance as per TMDs
	Cyclists/eScooters/scooters	*Cyclist/eScooters/scooters* using footpaths and roadside as	Exposure – Low Likelihood – Low	3/12	Apply the above and: Admin

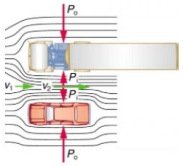
		travel path collides with surveyor or equipment. *(Especially in school zones)*	Severity – Low		No static equipment in carriageway under these layouts. All equipment is contained to the roadside, tri-pod to be attended in areas where there is increased footpath use to bring attention to the piece of equipment.
					PPE Surveyor to be wearing compliant HI-VIS garment.
	Large Vehicles	Larger vehicles creating air pressure changes destabilising equipment, falling into carriageway.  erhead view of a car k on a highway. Air n the vehicles flows in nel and must increase is greater than v1), essure between them ess than P_0). Greater e outside pushes the gether.	Exposure – medium Likelihood – Low Severity – Low	5/12	Apply the above and: Admin All static equipment to be kept away from the carriageway by at least the height of the equipment, or ballasted in a way that still maintains frangibility.
Road Profile	*High speed traffic*	Faster moving vehicles increases the severity and likelihood (less peripheral vision) of incidents and accidents.	Exposure – Low Likelihood – Low Severity – High	6/12	Apply the above and: Substitute Avoid peak flow times on these roads Admin Risk assess need for Spotter
	Increased Traffic volume	Increased volume of traffic increases the likelihood of an incident or accident occurring	Exposure – Low Likelihood – Medium-High Severity – Low		

Workers on foot on Roadside and Shoulder (with static equipment extending into carriageway)

TMD2 | TMD4 | TMD7 | TMD9 | TMD13 | TMD14

In addition to the above the additional hazards are noted for this environment:

Category	Hazard	Risk	Risk Assessment	Combined Risk Score	Control
Road Users	*Vehicular traffic in the live lane*	Vehicle vs Worker collision	Exposure – Low Likelihood – Low Severity – High	6/12	Admin No access to the live lane permitted under the TMDs referenced above. Equipment not permitted to extend into the live lane, only shoulders/parking lanes or within inferred edge lines and situated between 10m – 15m in front for the work vehicle. Surveyor to step off carriageway on approach of vehicle. Spotter required if equipment is attended PPE Surveyor and spotter to be wearing compliant HI-VIS garment
	Errant Vehicles	Errant vehicle enters roadside and collides with surveyor or equipment.	Exposure – Low Likelihood – Low Severity – High	6/12	Apply the above and: Admin Work vehicle MUST be used for increased road user warning and visibility of activity. Limit forward working distance as per TMDs CSD must be achieved to work vehicle
	Cyclists/eScooters/scooters	*Cyclist/eScooters/scooters* using footpaths and roadside as travel	Exposure – Low Likelihood – Low	4/12	Apply the above and: Admin

		path collides with surveyor or equipment. *(Especially in school zones)*	Severity – Low		Cone only to be placed on the footpath side of equipment if proves to be a trip hazard
	Large Vehicles	Larger vehicles creating air pressure changes destabilising equipment, falling into  ure 1. An overhead view of a car ising a truck on a highway. Air ising between the vehicles flows in arrower channel and must increase speed (v_2 is greater than v1), ising the pressure between them drop (P_1 is less than P_o). Greater ssure on the outside pushes the and truck together. carriageway.	Exposure – medium Likelihood – medium Severity – Low	5/12	Apply the above and: Admin Cone must be place on traffic side of the equipment and on the footpath if present. Extra ballasting recommended if the road is identified as a high frequency heavy vehicle route. PPE Surveyor and spotter to be wearing compliant HI-VIS garment
Road Profile	*High speed traffic*	Faster moving vehicles increases the severity of incidents and accidents.	Exposure – Low Likelihood – Low Severity – High	7/12	Apply the above and: Substitute Avoid peak flow times on these roads Admin Spotter requirement to be risk assessed if not explicitly required as per TMDs
	Increased Traffic volume	Increased volume of traffic increases the likelihood of an incident or accident occurring	Exposure – Low Likelihood – Medium-High Severity – Low	6/12	

Workers on foot accessing the live lane

TMD2 | TMD5 | TMD8 | TMD9 | TMD15 | TMD16 |TMD17

Category	Hazard	Risk	Risk Assessment	Combined Risk Score	Control
Continuing to apply the above controls, these additional mitigations are required when surveyors require intermittent access to the live lane					
Road Users	*Operating in a live traffic lane*	Moving vehicles in close proximity to workers. Excessive speed Road users that are distracted, fatigued, or impaired.	Exposure – Medium Likelihood – Low Severity – High	7/12	Apply the above and: Admin Minimum of 1x spotter is required Only hand held equipment can be used, for example rover pole or pinch bar to unearth survey mark. Surveyor/s must exit the carriageway on approach of a vehicle from all directions If multiple surveyors require spotting as stated for the TMDs above, a spotter should be used for each surveyor. *The only exception is on CAT A/B (LV) if the surveyor accessing the lane can maintain attention to approaching traffic and there is CSD to the surveyor accessing the lane.* PPE Surveyors and spotters to be wearing compliant HI-VIS garment
	Cyclists/eScooters/scooters	*Cyclist/eScooters/scooters* using live lane as travel path collides with surveyor.	Exposure – medium Likelihood – Low Severity – Low	4/12	
Road Profile	*High speed traffic*	Faster moving vehicles increases the severity of incidents and accidents.	Exposure – Medium Likelihood – Low Severity – High	7/12	

6.3. RESIDUAL RISKS & RISK COMMENTARY

List and assess all risks that remain after each.

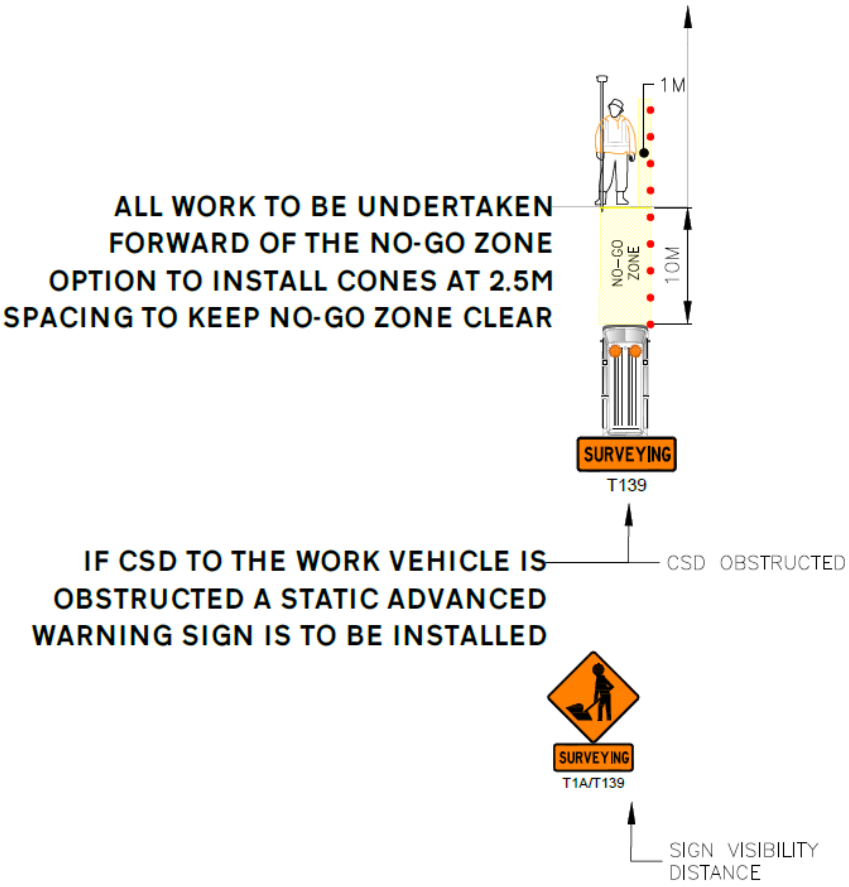
The purpose of this section is to capture any key risk decision points, for example the trade-off between different risks, effects on different parties, lowest total risk. It is vitally important that this information is captured as it helps users determine if practice note is applicable to a future activity.

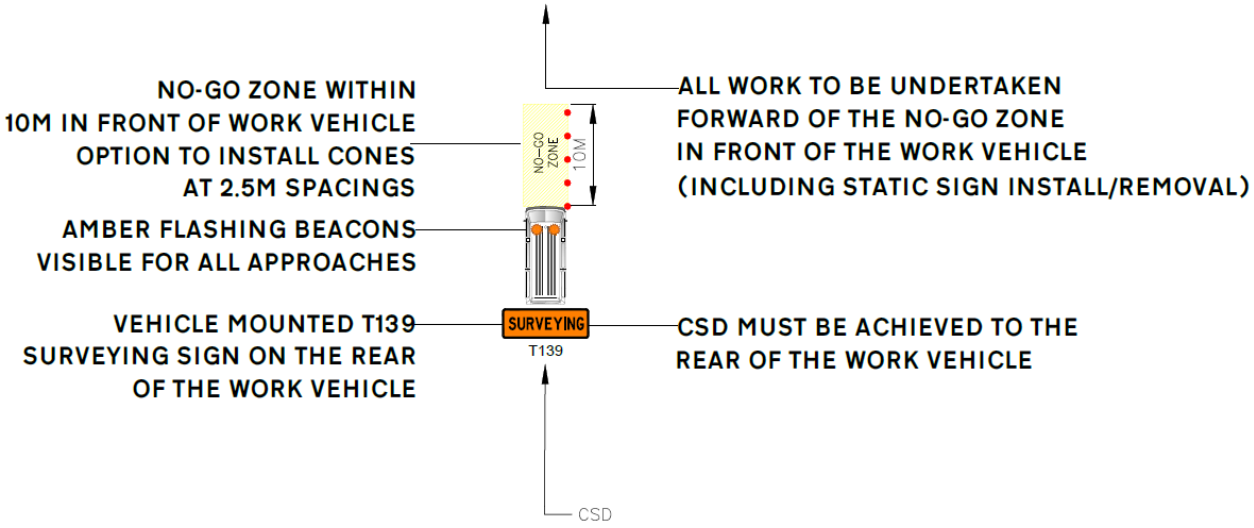
Hazard	Residual Risk	Risk Commentary
Vehicular Traffic in Live Lane:	As none of the hazards are being eliminated or isolated across any of the proposed operations, there is residual risk of these hazards causing potential harm to the surveyors. To eliminate or isolate these hazards a control such as a full road closure and/or barrier system would be required. Eliminating or isolating surveying activities is not reasonably practicable due to the dynamic and highly unpredictable degree of movement required, as well as the short duration of time needed to undertake the work.	As described in section in section 3.1 of this document surveying is dynamic, fast moving and highly unpredictable. The operation is often completed within 10min with the surveyors moving on to the next location. A higher administrative control such as a static closure is not always an appropriate mitigating control. It introduces more personnel into the carriageway (The TTM crew), the TTM crew are exposed to the hazards more directly and for a longer period in comparison to the nature of operations being undertaken by the surveyors. Needing to install, maintain and remove static sites for such a short-term operation, in unknown locations is also not reasonably practicable. Therefore, the highest level of controls, that are reasonably practicable and result in the lowest total risk have been applied to the three operation types within this practice note. The use of work vehicles, beacons, vehicle mounted advanced warning signage, spotters, clear site distance and PPE will be the risk mitigation controls in ensure safety on site.
Errant Vehicles:		
Cyclists/eScooters/scooters:		
Large Vehicles:		
High speed traffic:		
Increased Traffic volume:		
Topography of roadside:	It has been identified that the topography of the roadside can either increase or lower the risk of the activity being undertaken.	The surveyors incorporate topography into their onsite risk assessment, noting that this risk increases if the roadside is lower than the carriageway. Therefore in contrast the risk level lowers when the roadside it higher than the carriage way as there is a lesser risk of errant vehicle colliding with the activity.

Permanent barrier systems:	Lowering the risk of the activity by working behind a permanent barrier system.	The surveyors identify the lower risk to their activity by parking and/or operating behind a barrier system. Barrier deflections have been explained and therefore a spotter is recommended when working within 2m of the rear face of the barrier.

7. TRAFFIC MANAGEMENT DIAGRAMS

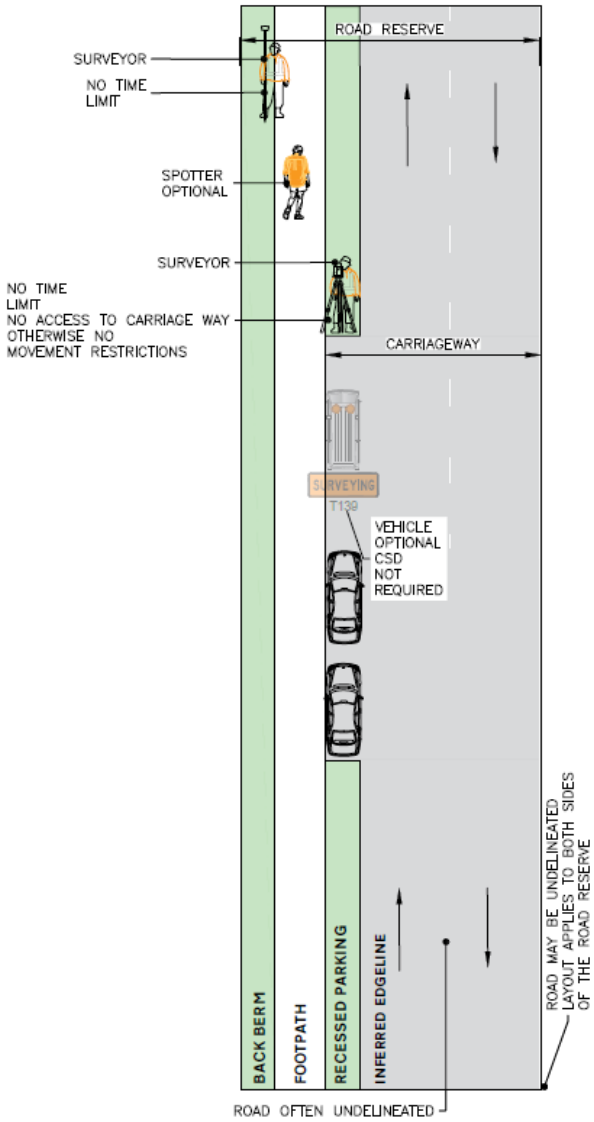
7.1. WORK VEHICLE REQUIREMENTS



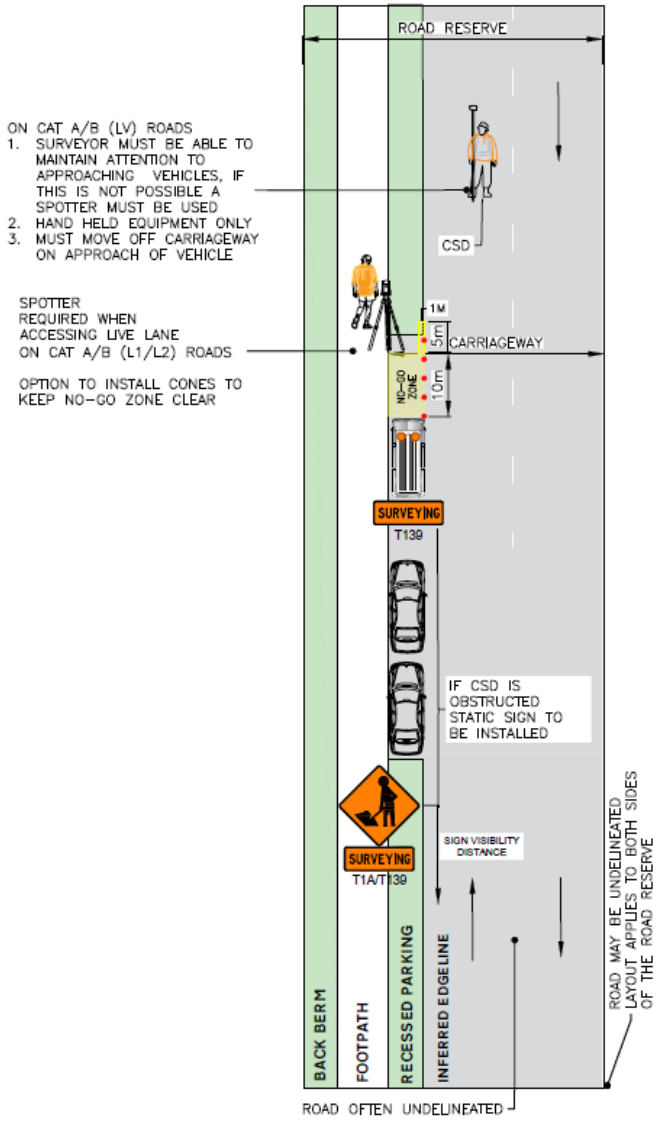


7.2. NON-ARTERIAL ROADS - ALL ACTIVITIES - (TMD1, TMD2, TMD3, TMD4 & TMD5)

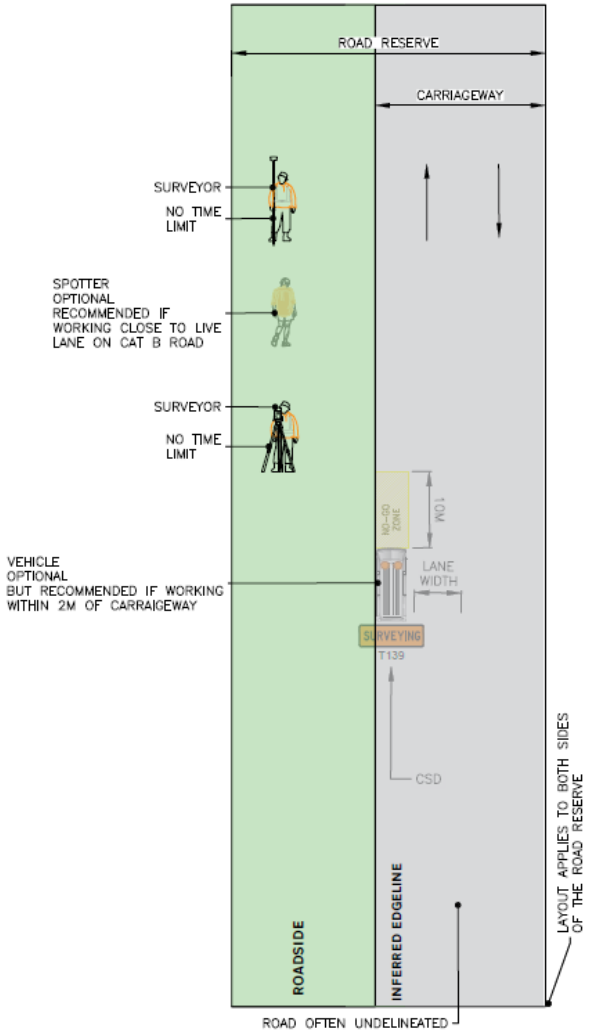
TMD1
NON-ATERIAL
CAT A/B (LV/L1/L2)
ROADSIDE WITH RECESSED
PARKING



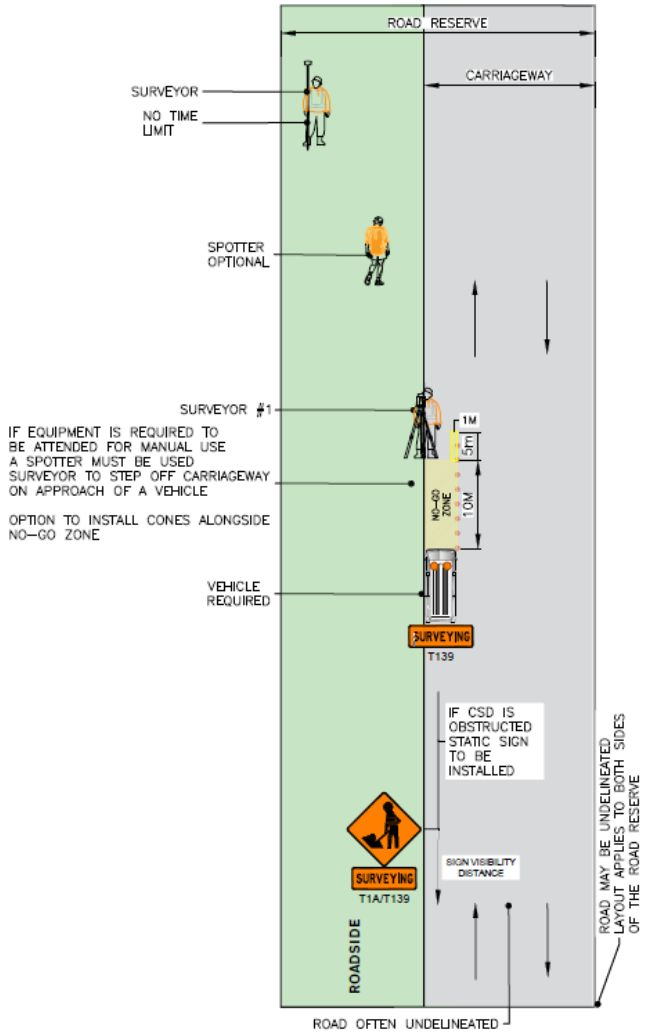
TMD2
NON-ATERIAL
CAT A/B (LV/L1/L2)
ACCESSING LIVE LANE WITH
RECESSED PARKING



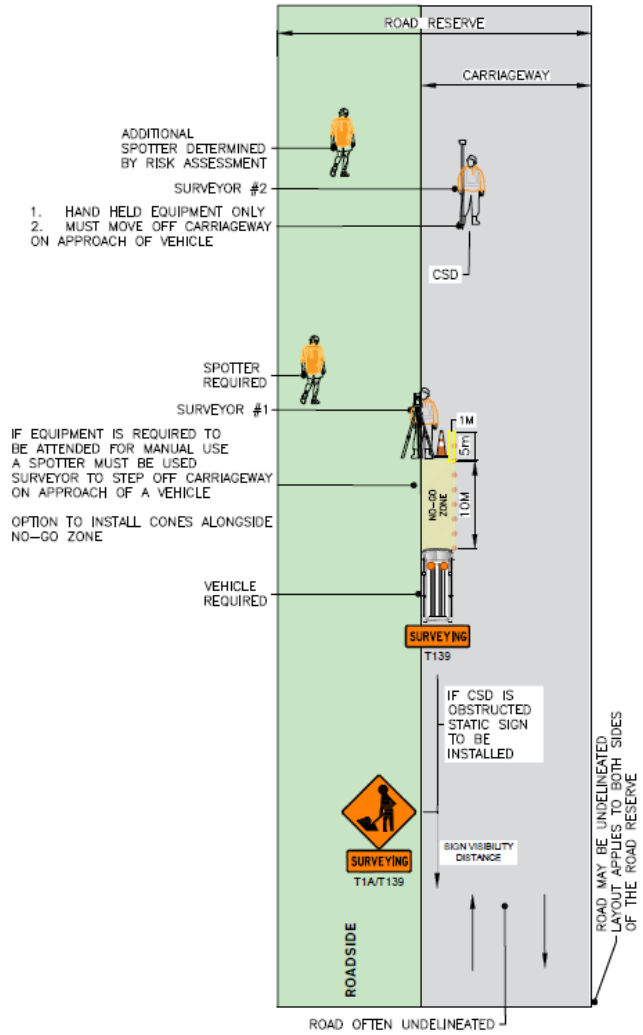
TMD3
NON-ARTERIAL RURAL ROADS
ROADSIDE
CAT A/B (LV/L1)



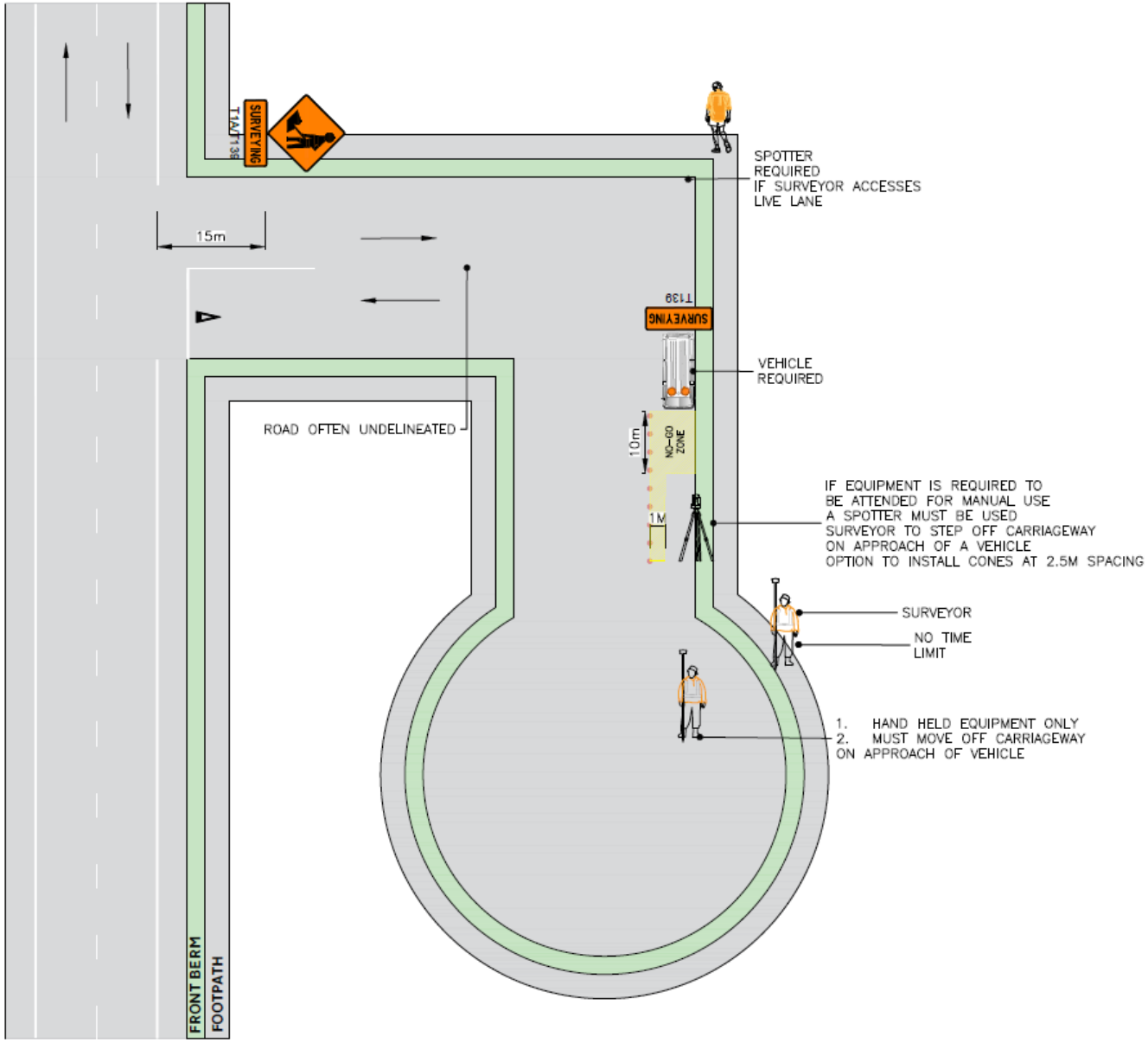
TMD4
NON-ATERIAL RURAL ROADS
CAT A/B (LV/L1/L2)
ROADSIDE & SHOULDER



TMD5
NON-ATERIAL RURAL
CAT A/B (LV/L1/L2)
ACCESSING LIVE LANE

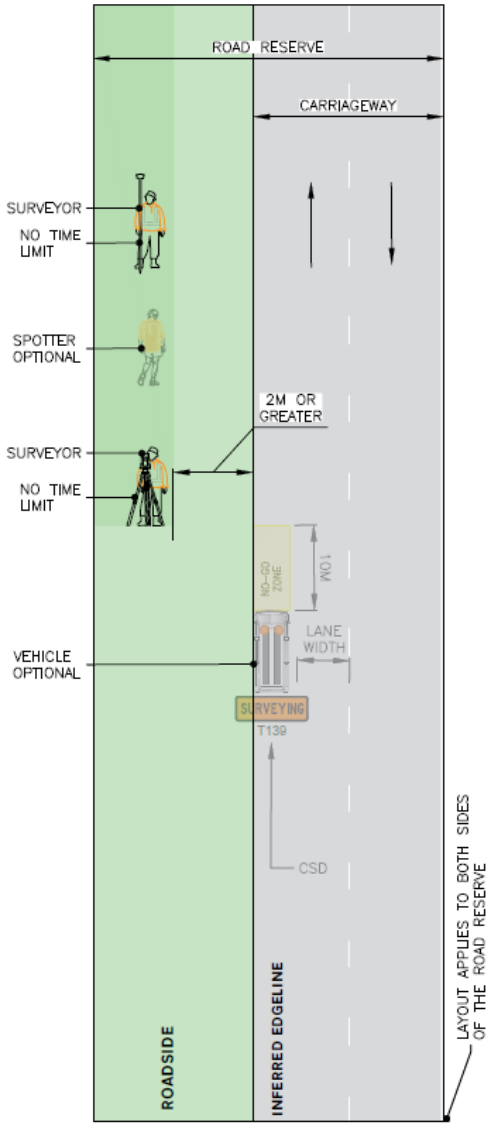


TMD9
NON-ATERIAL
CAT A/B (LV/L1/L2)
CUL-DE-SAC

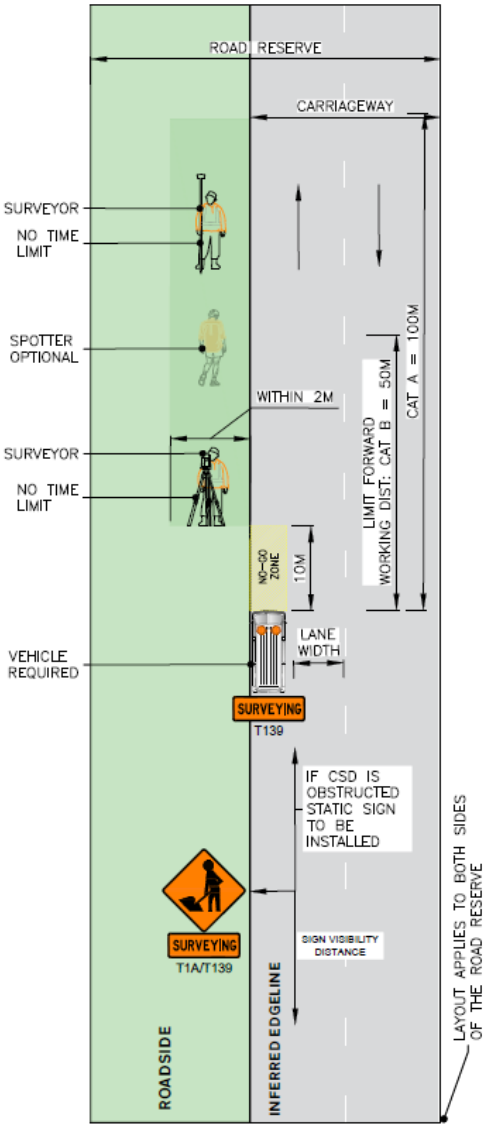


7.3. ARTERIAL ROADS – ROADSIDE ACTIVITIES (TMD10, TMD11, TMD12)

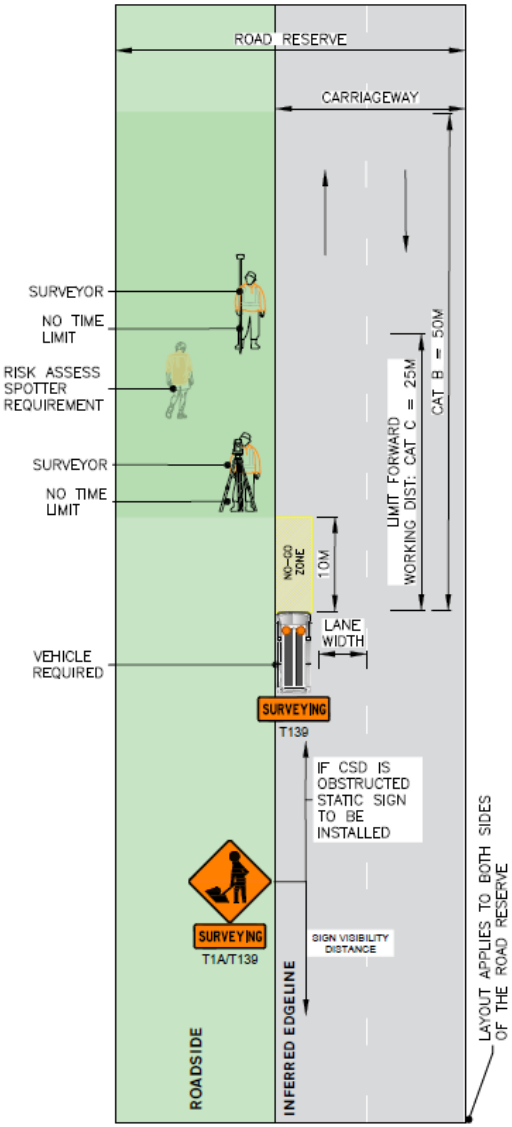
TMD10
ARTERIAL ROADS
ROADSIDE
CAT A/B (LV) OR CAT A (L1/L2)
GREATER THAN 2M FROM CARRIAGEWAY



TMD11
ARTERIAL ROADS
ROADSIDE
CAT A/B (LV) OR CAT A (L1/L2)
WITHIN 2m OF CARRIAGEWAY

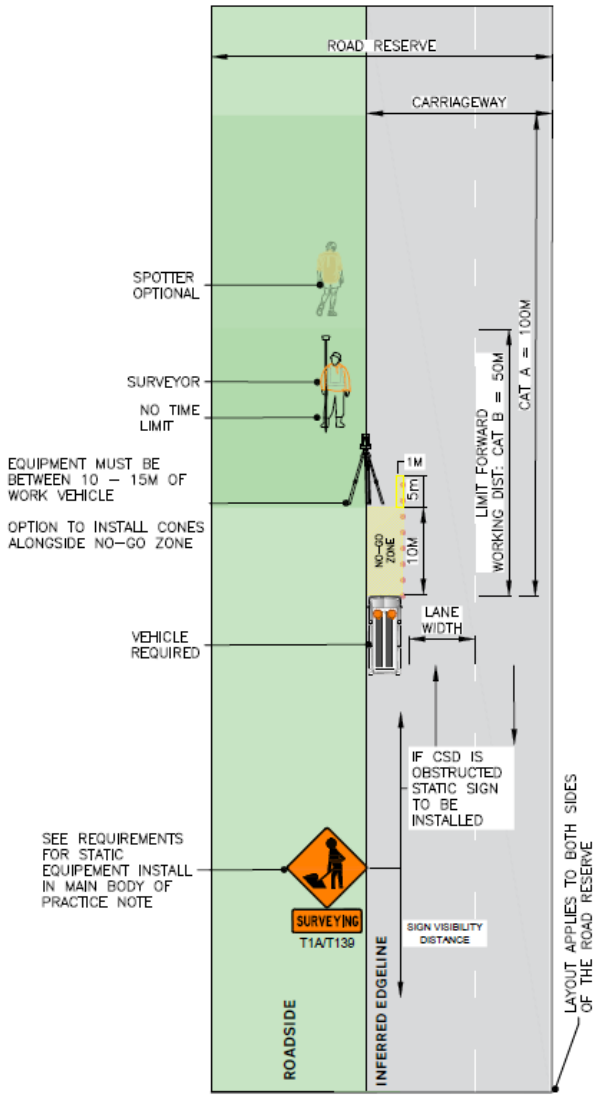


TMD12
ARTERIAL ROADS
ROADSIDE
CAT B/C (L1/L2/L3)

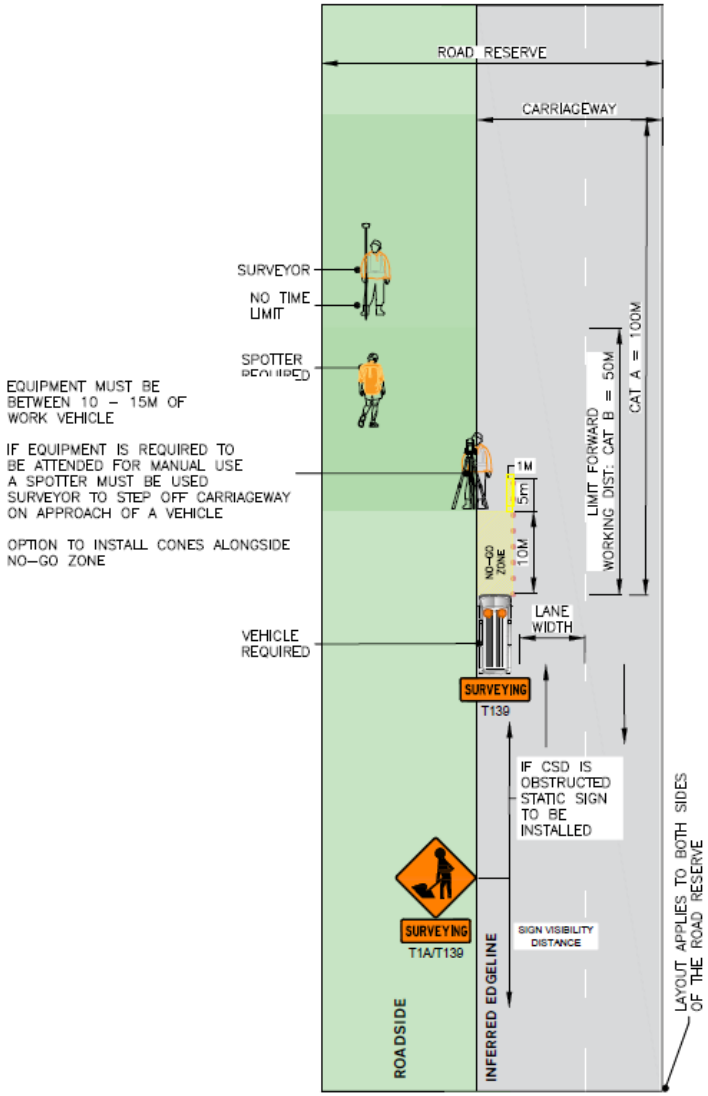


7.4. ARTERIAL ROADS - ROADSIDE & SHOULDER ACTIVITIES (WITH EQUIPMENT) - (TMD13, TMD14)

TMD13
ARTERIAL ROADS
ROADSIDE & SHOULDER
CAT A/B (LV/L1/L2)
(WITH UNATTENDED EQUIPMENT)

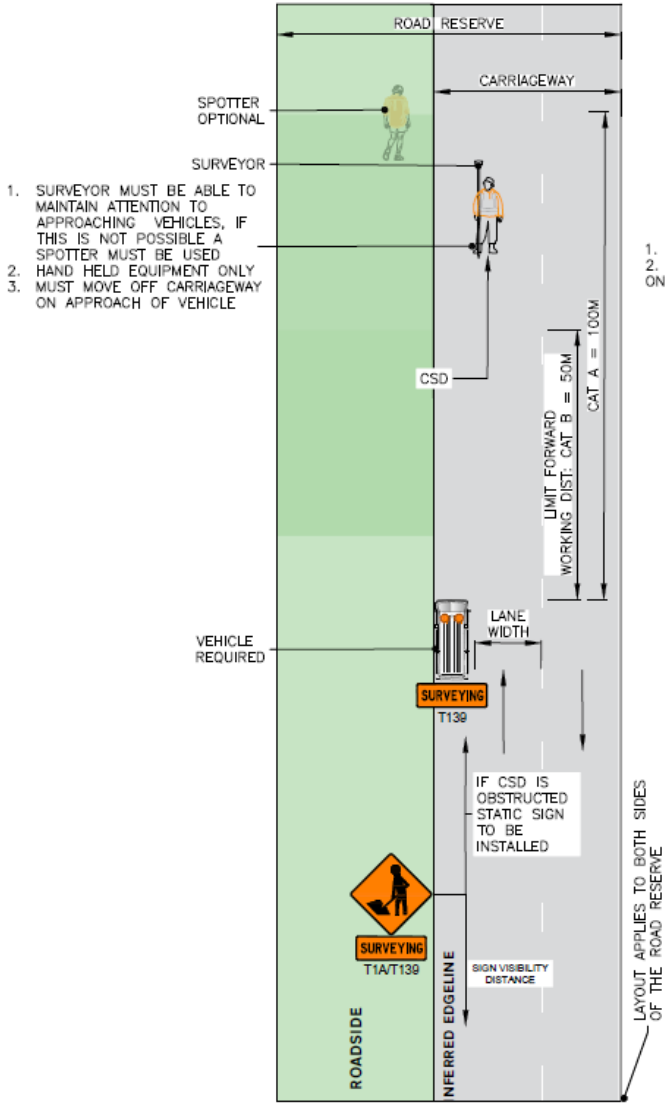


TMD14
ARTERIAL ROADS
ROADSIDE & SHOULDER
CAT A/B (LV/L1/L2)
(WITH ATTENDED EQUIPMENT)

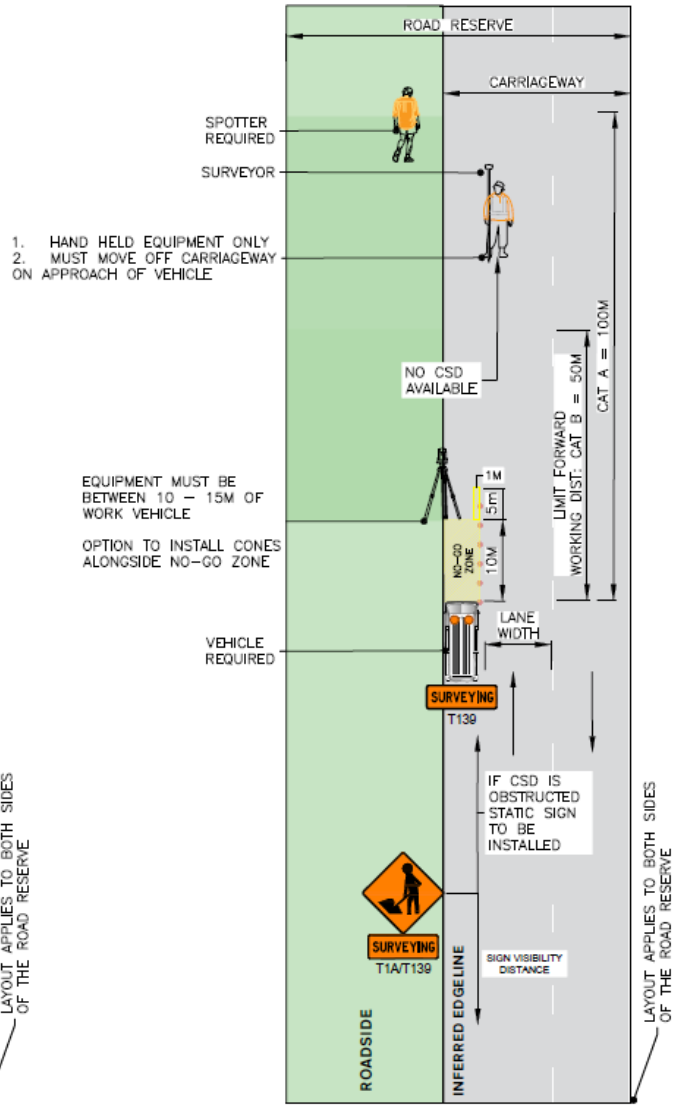


7.5. ACCESSING THE LIVE LANE (TMD15, TMD16, TMD17)

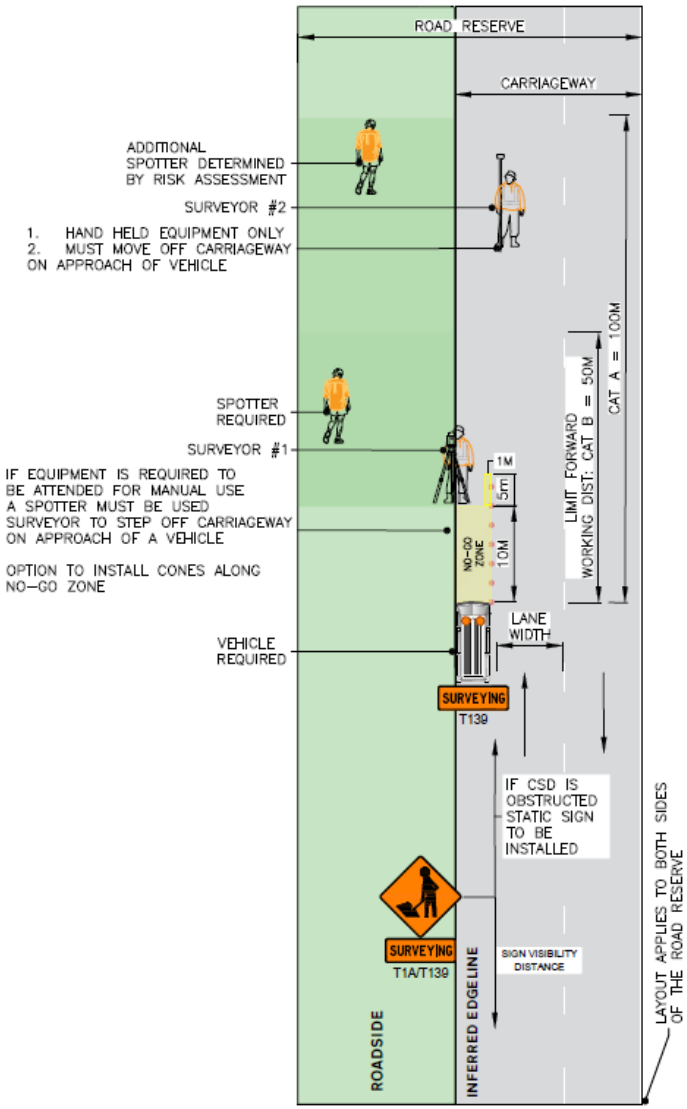
TMD15
ARTERIAL ROADS
ACCESSING LIVE LANE
CAT A/B (LV)CSD
SPOTTER OPTIONAL



TMD16
ARTERIAL ROADS
ACCESSING LIVE LANE
CAT A/B (LV/L1/L2)
SPOTTER REQUIRED

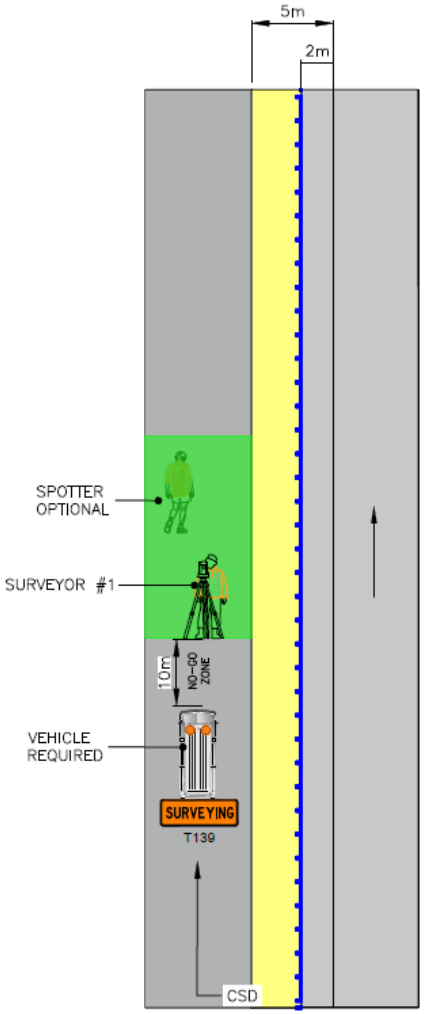


TMD17
ARTERIAL ROADS
ACCESSING LIVE LANE
CAT A/B (L1/L2)
1-2 SPOTTER REQUIRED

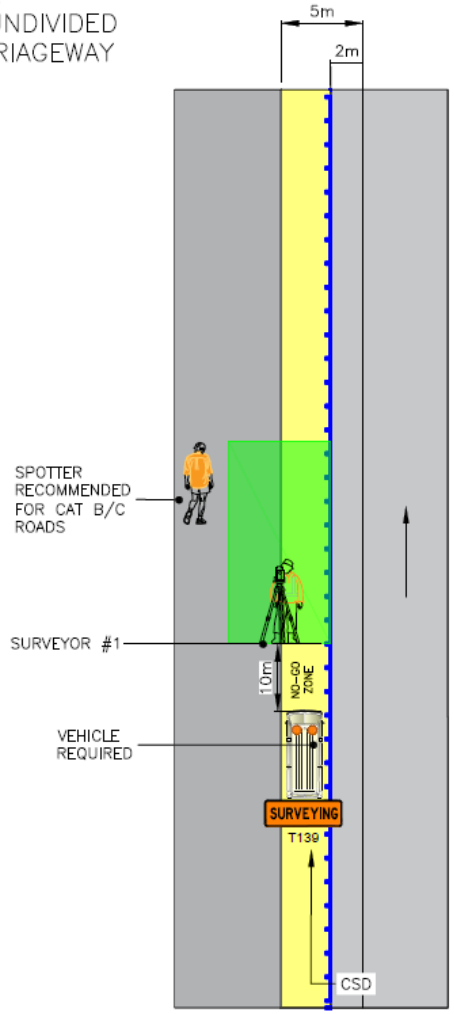


7.6. ARTERIAL ROADS – WORKING BEHIND A PERMANENT BARRIER SYSTEM (TMD18, TMD19, TMD20)

TMD18
SURVEYING ACTIVITY BEHIND PERMANENT BARRIER, WORK VEHICLE PARKED BEHIND THE BARRIER
ALL CATEGORIES, TWO–WAY UNDIVIDED OR MULTI LANE DIVIDED CARRIAGEWAY

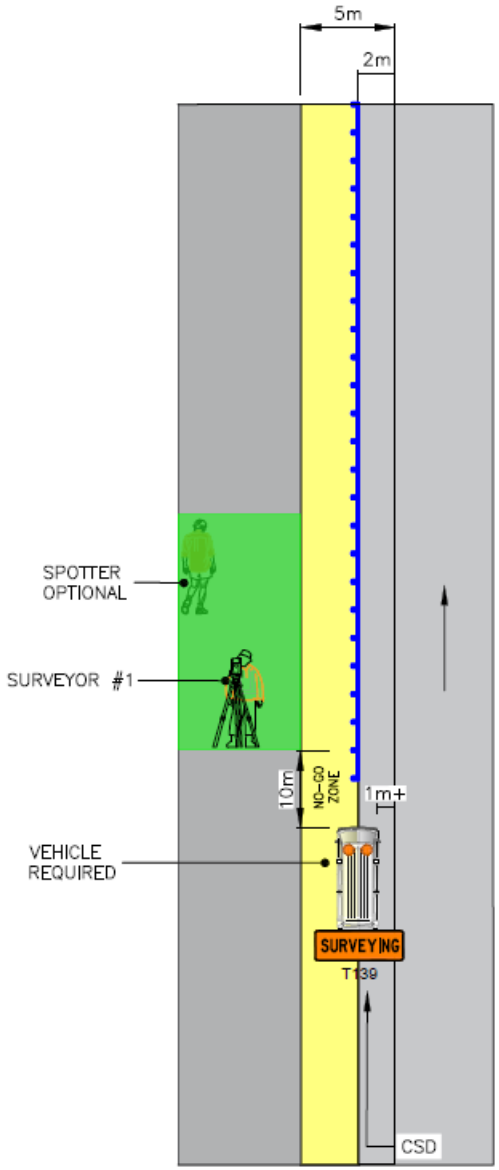


OVER 5M FROM EDGELINE OR FACE OF BARRIER SYSTEM

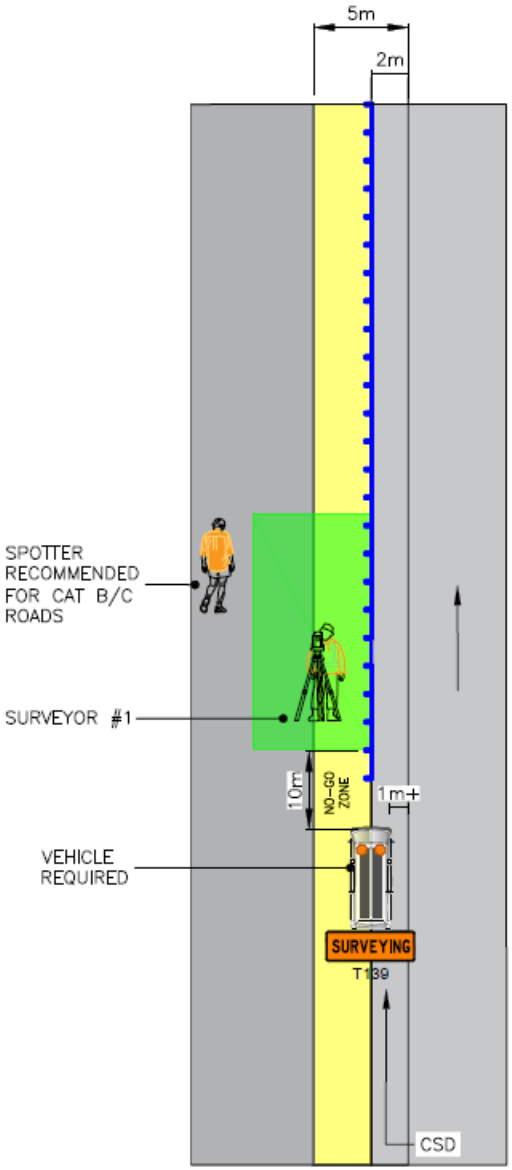


WITHIN 5M OF EDGELINE OR FACE OF BARRIER SYSTEM

TMD19
SURVEYING ACTIVITY BEHIND PERMANENT BARRIER, WORK VEHICLE PARKED IN ADVANCE OF THE BARRIER ALL CATEGORIES, UNDIVIDED OR DIVIDED CARRIAGEWAY

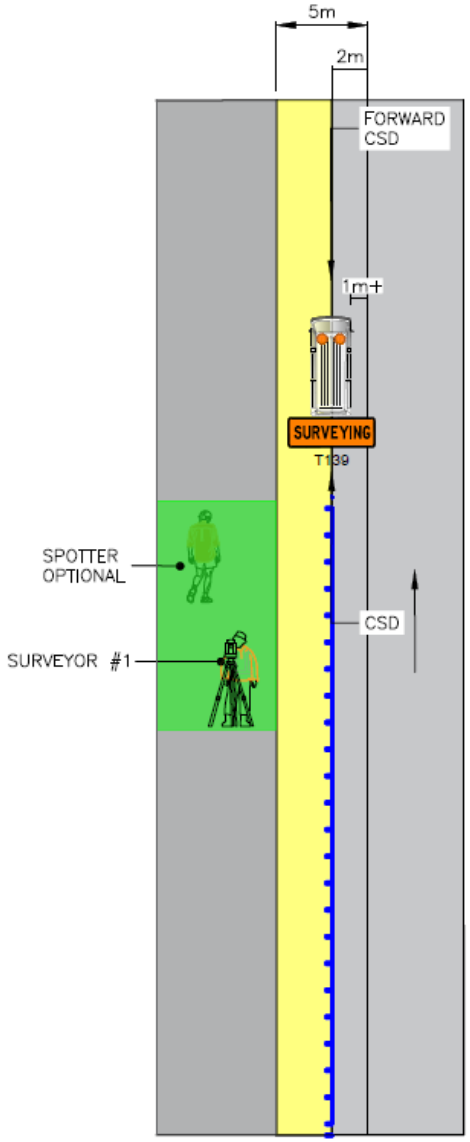


OVER 5M FROM EDGELINE OR FACE OF BARRIER SYSTEM

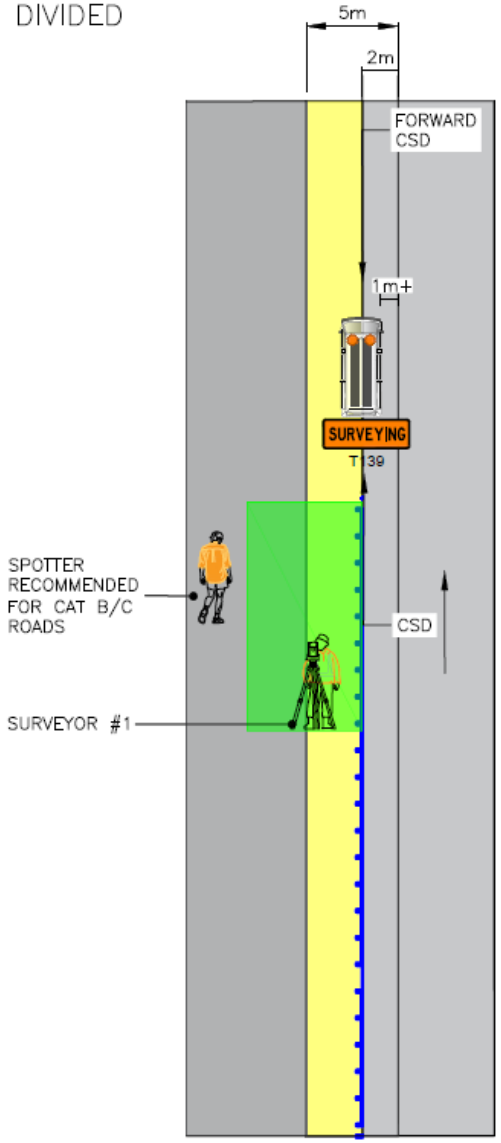


WITHIN 5M OF EDGELINE OR FACE OF BARRIER SYSTEM

TMD20
SURVEYING ACTIVITY BEHIND PERMANENT BARRIER, WORK VEHICLE PARKED AT THE END OF THE BARRIER
ALL CATEGORIES, UNDIVIDED OR DIVIDED CARRIAGEWAY



OVER 5M FROM EDGELINE OR FACE OF BARRIER SYSTEM



WITHIN 5M OF EDGELINE OR FACE OF BARRIER SYSTEM