WAKA KOTAHI
NZ TRANSPORT AGENCY

THE SELECTION AND USE OF NON-PERMANENT MATERIALS FOR PILOT PROJECTS

Design guidance note

7 APRIL 2021

REVISION A

New Zealand Government

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Preface

In Aotearoa, our cities need tools to adapt their streets to support mode shift at a pace that matches the scale of the challenges of climate change, road safety and public health.

Street changes can be challenging to deliver as space is constrained and road space reallocation can create anxiety and stress. Cities and towns are finding that testing changes can help people re-imagine their streets, build understanding and participation in the change, and ultimately expedite project implementation. Tactical Urbanism enables such experimentation. As a design method and engagement strategy, it involves implementing 'tactical demonstrations' and 'pilot interventions' to test and adapt living, breathing versions of designs with communities in real time.

This new approach to street changes can require new skills, new processes, and new materials. Until recently, materials used in the roadway for non-permanent changes have been part of temporary traffic management for roadworks. Tactical urbanism is different in that it is used to create new street layouts that have strong community buy-in, and are testing future permanent designs, as opposed to protecting road workers and the public during temporary works. Tactical urbanism has strong roots in urban design and place-making, so the visual aesthetics of pilots are often a key success factor. Unlike temporary traffic management, tactical urbanism is only utilised in areas where vehicles speeds are, or are being made through the pilot, lower. Procurement of materials often involves creativity and collaboration. Rather than relying solely on purchased materials, tactical urbanism provides an opportunity for social procurement[1] and community participation by leveraging partnerships to access existing materials wherever possible.

This design note is part of a suite of guidance for tactical urbanism, including the Tactical Urbanism Handbook and the Roadway Art Guidance. These documents may be refined and consolidated as the state of practice develops.

[1] Social procurement means sourcing materials or making elements for a project through the community in contrast to typical commercial sources. For example, school children making signs or volunteers building seating benches out of recycled materials.

Contents

1. INTRODUCTION

1.1. Purpose

The purpose of this document is to provide manufacturers, suppliers, councils, designers, buyers, community members and installers of materials with summary guidance and references to further information. The aim is to ensure a safe road environment consistent with national legislation and best practice, visually sensitive to the surrounding context, with opportunities for community participation and the incorporation of local identity.

Community participation is a foundation of tactical urbanism and often directly contributes to a pilot project's success. Choosing materials can involve communities in a tangible way and help reflect local identity. Allowing for this within the parameters of maximising safety can further support a positive outcome and save costs.

While street pilots are installed and removed under a Traffic Management Plan, and may initially require signalling of a new layout, they generally create a new 'normal' operation of the road and are not considered roadworks. Orange roadworks materials can create visual pollution and may contribute to public rejection of a pilot, if used for long. This note seeks to address a gap in national technical guidance regarding materials used for pilots. It supports the Tactical Urbanism Handbook, Traffic Control Devices Rule and TCD Manual.

1.2. Pilot projects and materials

Tactical urbanism pilot projects may be demonstrations or interim installations, testing a design or building community support for possible permanent change (Figure 1).

Figure 1: demonstrations or interim installations are a pathway to possible permanent change

Examples of materials used in non-permanent projects are shown in Figure 2. A longer list of materials for demonstration events and interim pilots may be found on pages 87 and 92 of the Tactical Urbanism Handbook.

Figure 2: examples of materials used in non-permanent pilot projects

1.3. What is a TCD?

As implied by the name, a traffic control device (TCD) is defined in the TCD Rule as *"a device used on a road for the purpose of traffic control; and includes any sign, signal, or notice; or traffic calming device; or marking or road surface treatment; but does not include roadway art installed in accordance with*" the rules around this.

Elements and their constituent materials should not amend or be confused with existing TCDs. This is critical for consistency within the transport environment and the safety of all users.

Examples include:

- The words "NO ENTRY" and "STOP" are used on traffic signs and could be mistaken for a traffic sign if used on a customised sign. Any sign that is not an approved traffic sign must not be used if it could be mistaken for a traffic sign. Page 17 provides more information on their application.
- The use of planter boxes to denote a new roadside edge constitute a TCD as they control the positioning of traffic. When a tree placed is placed in the middle of a road (perhaps in a pot or temporary island) for the purposes of traffic calming, the elements that surround that tree are TCDs and must be illuminated or have reflective delineators or reflective signs appropriate to the situation.

1.4. Where does this guidance apply?

This guidance is about the spaces where people and vehicles interact, not the design of plazas and other public areas where vehicles can't normally access. The **roadway** is defined in legislation as *"that portion of the road used or reasonably usable for the time being for vehicular traffic in general"*. Typically, parts of the road corridor behind kerbs or other roadside delineators are not considered part of the "roadway" – this includes separated cycleways, berms, and paths. There are some differences in rules and safety specifications for devices used on the roadway (or at its boundaries) compared with devices not used in the roadway.

Temporary installations are especially appropriate for (or to deliver) lower risk environments e.g. where the operating speed is 30 km/h (similar to the definition developed for roadway art, TCD Rule 5.6(2)) . They may also be used to pilot interventions like protected cycleways on higher speed roads.

1.5. What isn't covered by this guidance

What is **not covered** by this technical note:

1. standard applications of permanent TCDs covered in the TCD Rule and TCD Manual
2. markings used for roadway art covered by the TCD Amendment 2020 and associated guidance
3. formal trials of new TCDs covered in section 3.4 of the TCD Rule and in Traffic Note 10: Trials of traffic control devices
4. Temporary Traffic Management (TTM) used for roadworks covered in Code of Practice for Temporary Traffic Management and the Register of TTM equipment approved for use on the NZ roading network

For elements not in the trafficable roadway (including within traffic islands and roundabout central islands) refer also to the Tactical Urbanism Handbook and the Cycling Network Guidance.

2. GENERAL GUIDANCE

2.1. Basic principles for features and their component materials

1. Convey a clear message and maximise safety

This principle is aided by meeting the requirements of the TCD Rule and consistent with the best practices in the TCD Manual. This design note aims to summarise (but does not replace) the legal requirements of the TCD Rule and best practice guidance contained in the TCD Manual. The full documents should be consulted if in any doubt. If the materials don't seem to be covered, contact Waka Kotahi for assistance.

When applying the TCD Rule and other applicable legislation referred to in this note, the verbs of most sentences will prohibit something (**must** not), require something (**must** do), or enable something (**may** do). The TCD Manual includes **must** where there is a requirement under the legislation and **should** to indicate recommendations and desirable outcomes.

2. Sufficient to test ideas while being cost effective

The features should represent the idea of the permanent design solution, and not just random items placed on the road. At the same time, they should be low cost or reusable items to meet the intent of tactical urbanism. Maintenance is important not just for safety but also to ensure that the goals of the pilot are not undermined.

3. Appropriate for the speed environment and pilot duration

The durability of materials and their fixings to the road surface is less critical for shorter duration projects in lower speed (operating speeds of 30 km/h or less) environments.

For example, hay bales and wooden furniture may be fine for demonstration events where people are on site to manage the installation and remove materials at the end of the day (Figure 3). Firmly anchored plastic, concrete or metal elements are typically used for higher speed environments or longer duration projects.

Figure 3: material selection by duration

4. Visible so they are not trip or crash hazards

A key theme throughout this document is the need for materials to be conspicuous at all times of day or night and all weather conditions. They need to have contrast to the surrounding environment, including the pavement they are situated on. Features should be placed to minimise hazard to vision impaired persons or detectable by cane. Consider various movement angles, low light and wet weather conditions during materials selection and all other phases of the project. Elements need to be maintained so that they remain conspicuous throughout the duration of the pilot project. For example, elements can become grimy, partially displaced/lost, or obscured by other materials (including temporary signs, billboards, or landscaping).

5. Are not a hazard if struck by vehicles (including bicycles)

On a street where once the pilot has been installed, vehicles are predicted to travel over 30 km/h, the consequences of features being struck become increasingly important. Elements should be 'frangible' (readily broken or flexible) so that the kinetic energy in an impact is absorbed or diffused rather than transmitted to the road user, or should be positioned outside of the 'clear zone' adjacent to the vehicle lane so that the likelihood of them being struck is reduced. For example, a heavy concrete or concrete-filled material may present more of an injury risk to occupants of vehicles that might collide with it. As an alternative to moving the material outside the clear zone, the element can be heavy at the base but frangible higher up (i.e. vehicle bumper height). Consider whether the element is one of a series and drivers are informed as to their presence (low risk) or placed in isolation with little warning (higher risk).

2.2. Surface attachment methods and removal

The first thing to consider is whether the material needs to be fixed to the surface on which it is placed. Heavy delineators such as concrete cubes, well pipes, large planter boxes, stacked tyres, and water filled objects may stay in place through weight alone. Consider factors such as the location of the element in relation to the traffic stream, the safety implications if the element is displaced, and the surface friction of the road (e.g. a smooth material base on a smooth asphalt surface mean that an vehicular impact will likely dislodge the element).

Figure 4 illustrates how separation elements can be dislodged (probably by a vehicle) and become a hazard to road users. Two or more elements could be linked together to provide additional resistance to displacement. Some rubber kerb elements are supplied with linking brackets that would reduce the risk of dislodgement and can be easily repaired.

Figure 4: concrete separators dislodged, Auckland

Precast concrete and other materials come in a variety of heights and weights. For example, repurposed wooden fruit boxes can be weighted with sand bags.

Methods to attach materials to the road surface include pin installation, epoxy resin, bolt down systems and posts mounted onto rubber traversable islands. Designers should confirm the acceptability of any proposal with the appropriate Road Controlling Authority.

Some devices have a 100 mm metal threaded pin and socket (Figure 5) that is epoxy glued into the ground, allowing for temporary or permanent application. Permanent application methods such as gluing or bitumen fixing directly to the ground or expanding wedge bolts may cause more damage resulting in water penetration; removal will likely require repairs to seal. This may be acceptable if the benefits of the project outweigh the repair costs.

Figure 5: flexible post with 100 mm pin & socket (O. McLean, Vanguard)

Experience with posts used within temporary traffic management worksites suggests that it is prudent to consider more than one method for fixing the post / footing to the road surface in locations that may experience high attrition rates. The appropriate method for fixing the posts will be determined to a large degree by the road surface material on which the fixing is placed. Secure attachment is likely to be required for any of the following situations:

- if the device is long and therefore has the potential to be spun into the path of travel
- where vehicles are reversing, speeds are higher, and/or heavy vehicles are common
- if the device could become a projectile, cause a sudden stop (i.e. is not frangible), or can shatter

The attachment may also need to consider surface drainage. Elements can be on ‘feet’ to allow drainage below or to level camber, but this increases rotational force of impact and therefore is more prone to dislodging. Footing pads commonly seen on timber wheel stops may mitigate dislodging risk.

The effects of removing the item from the road surface should also be considered. In general, any device that requires significant road reconstruction after its removal, it is generally not a viable temporary option. However, if road reconstruction is planned to coincide with the removal of the interim feature(s) or it will be in place for a number of years, then the benefits could outweigh the cost of road rehabilitation.

Most of the delineation separators presented in the Cycling Network Guidance separator selection matrix (except for cast-in-place concrete) could be considered temporary. In addition, other products could be used, for example temporary fencing can use connectable units with heavy metal bases that don’t need to be attached to the road surface.

Delineator posts can be attached to the road surface using a fixed base or can be attached to a continuous footing, which is ordinarily attached to the road surface. Using a continuous footing can be beneficial for longer installation lengths or for longer term solutions (TCD Manual Part 5).

3. GUIDANCE FOR DIFFERENT TYPES OF MATERIALS

3.1. Delineators

Definition

The term separators is often used, including in the CNG guidance on separators. All separators are elements that guide road users, and therefore are traffic control devices of a broad class of features known as delineators. The TCD Rule defines delineators:

> *Delineator means a traffic control device including a guide post, chevron board, bollard, barrel or barrier, that is placed on or beside a roadway to guide road users. Delineators, if used to provide road users with an indication of the travel path to follow, must be installed:*
>
> *(a) at regular intervals on substantially straight sections of roadway; and*
>
> *(b) at intervals based on the degree of curvature or lateral movement where there are curves or changes in direction.*

Delineators can be regulatory (when used to supplement or as a substitute for markings), warning (to advise of hazards on a roadway or give advance notice of features on or near the roadway), or advisory (provide road users with information and guidance in using a road more effectively and safely).

The TCD Manual reflects TCD Rules and includes guidance about delineators such as edge marker posts, bridge end or width marker posts but not about all delineator elements. This section and the summary table at the end includes information to help apply the Manual to a variety of delineators commonly used for pilot projects.

Application

Based on the list of applications in the Manual section 2.9.1, delineators may be used as a physical barrier to:

- protect a cycle lane, shared path, footpath, or urban space
- create “modal filters” that block motorists but permit people walking and cycling to pass (Figure 1)
- clarify to drivers where they can or cannot drive (and where other road users may be); this includes kerb extensions (buildouts) that narrow a roadway

A temporary delineator is intended as an interim solution and may have a relatively short design life at a specific site. They are not necessarily disposable; some types of delineators may be transferred to other sites and used multiple times, for a variety of purposes. Temporary devices could be installed, for example, to be in place for 2 to 5 years until a major road upgrade is conducted and permanent separated cycleways are installed, or they could be part of a pilot or interim treatment to illustrate to the public what separated cycleways might look like[2].

Delineator posts

Delineator posts (including the products known as “flexi-posts”) are often used for separation or in conjunction with another element. They are usually to supplement a road marking.

Figure 6: delineator posts (L to R): T-profile, tubular, ‘flag’ panel with cycle logo (TCD Manual Fig 2-28, 2-29)

[2] The delineator supplements the cycle lane markings – effectively, a separated cycle lane formed by a marking and a delineator. This may be a pilot or even last for years before the street is fully reconstructed with new kerb alignments.

Delineator posts **should** be 800 mm – 900 mm high, as this is below most bicycle handlebars and therefore doesn't present a 'snagging' risk.

Particular consideration should be given to how conspicuous delineator posts are. This is particularly important for pilots where vehicles will generally be travelling over 30 km/h or cyclists may crash into them. For example, delineator posts with poor contrast to the pavement are known to have caused serious injury crashes involving people on bicycles in New Zealand. This is especially the case if many or all flags (panels) are dislodged, leaving behind only a low separator footing (kerb). Even if equipped with retroreflective panels, a low footing component can become grimy and inconspicuous.

Black and yellow panel delineator posts installed on interlocking yellow kerbs are commercially marketed for cycle lane separators. However, black and yellow (Figure 7) may not be used on the left side of the road and may be confused with an existing TCD used for another purpose (bridge end marker posts). Similar products with compliant colours used in Christchurch on the Quarryman's Trail have not been durable when used near driveways and intersections, but may be suitable for other locations.

Edge marker posts (Figure 8) are only to be used on rural roads; they are not delineator posts and are not appropriate for tactical urbanism projects.

Figure 7: incorrect colours for this use

Figure 8: edge marker post (G. Koorey)

See page 9 of this note and section 2.9 of the Manual for more information on delineator post dimensions, reflectivity and colours.

Where delineator posts are used to create a new kerb line to narrow the roadway or tighten corner radii (Figure 9), they are still functioning as delineator posts. Other types of materials that more closely emulate the shape of a kerb are covered in section 3.2 of this design note.

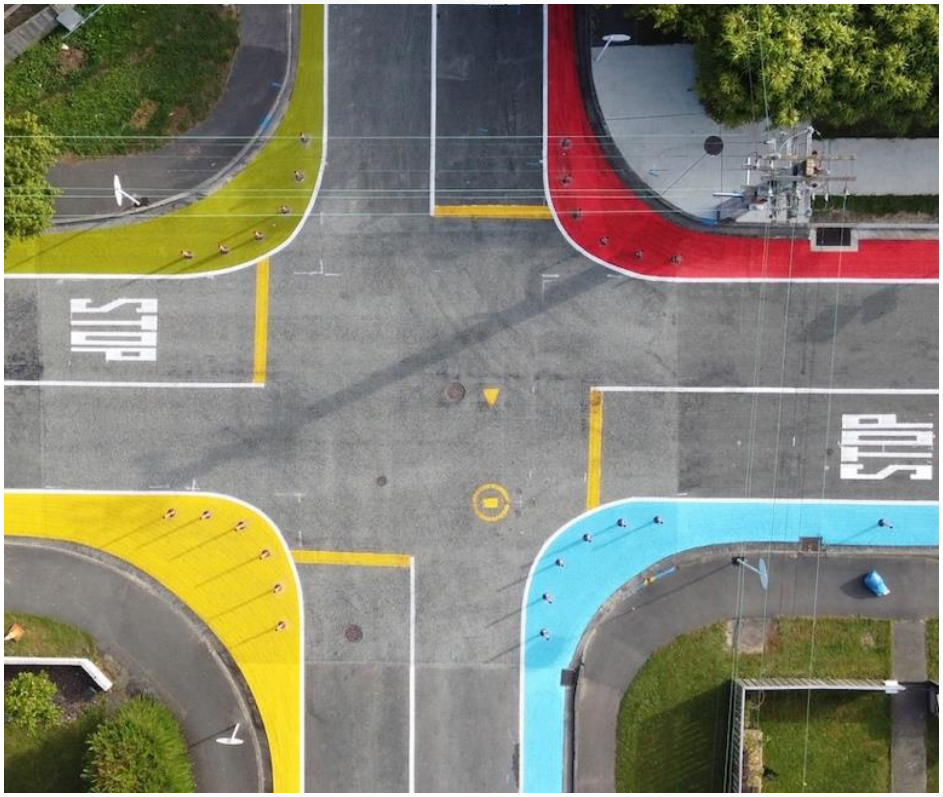

Figure 9: delineator posts and paint tighten corners (Nelson City Council)

Delineator barrels or cubes

Barrels (Figures 10, 11 and 12) and cubes (Figure 4) can be used to create modal filters that permit walking and cycling through movements but not cars and trucks, narrow a carriageway, separate user types within a carriageway, or delineate new public spaces.

Precast concrete materials can be designed as planters or seating. Concrete or wooden barrels are suitable for painting, but keep in mind that concrete may absorb a lot of primer paint. Stacked tyres can also be painted to add colour to a space, and are easily relocated. If plantings are included, talk to an arborist or landscape architect about means of addressing watering needs. Refer to section 2.2 regarding surface attachment considerations.

Figure 10: barrel delineators used for seating and a 'modal filter', Thames (Thames-Coromandel District Council)

Figure 11: tyre barrel planters used for delineation, Karangahape Road, Auckland (Resilio)

Figure 12: concrete barrel planters used for delineation, narrowing the carriageway, Christchurch (G. Dioni)

Other delineators

Bearing in mind the safety requirements relating to vehicle impacts, there is a vast array of materials that could be used for separation. If placed to form a barrier, they could be considered delineators but not delineator posts. Some examples follow:

- timber – easy to procure and work with; marginal slip resistance on slopes and in wet conditions; easy to paint for high contrast; likely to require pinning to the road surface but may cause pavement damage on chip seal roads if struck
- railway sleepers – heavy enough to stay in place for short durations and on low volume streets with few heavy vehicles, especially if more than one is connected together
- concrete “Jersey” barriers – very durable and permits stormwater flow through channels along the bottom edge; commonly available but requires specialised heavy equipment to move; very safe when properly laid out; can be painted to adapt a highway feature for placemaking purposes
- plastic or rubber speed humps and planter boxes made of plastic or wood (Figure 13 and Figure 14)
- bollards are similar to delineator posts but have a wider diameter, a wider range of materials, are generally not frangible, and are sometimes used for modal filters. Bollards used for access control devices on paths should be delineated as per the access control standard details. If used for lane delineation (Figure 17) they should have additional delineation on the general traffic side of their placement.

If used for the purposes of slowing traffic, the installation **must** be illuminated or have reflective delineators or reflective signs installed so that the structure is visible.

Figure 13: rubber speed humps, paint and plastic planter boxes delineate space, Auckland

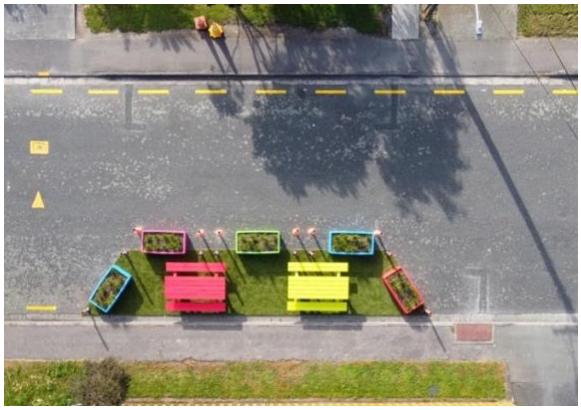

Figure 14: posts and planters kerb extension (Nelson City Council)

Low plastic armadillos lane delineators (Figure 15) and other similar devices should be carefully considered – they may be trip hazards for pedestrians and can cause a loss of control for people cycling. If used, they should have high visual contrast and consideration for pedestrian desire lines.

Continuous linear barriers (Figure 16) may be used to create separated cycleways, shared paths or footpaths on higher speed, volume and/or multi-lane roads. However, if they create severance for pedestrians trying to cross the street they should only be used if there are well-spaced crossing points. The flexible white plastic wave separator has twin retroreflective panels facing oncoming traffic.

Figure 15: armadillo cycle lane delineator (ViaStrada)

Figure 16: a 700 mm high flexible white plastic "wave" delineator, Christchurch (J. Lieswyn)

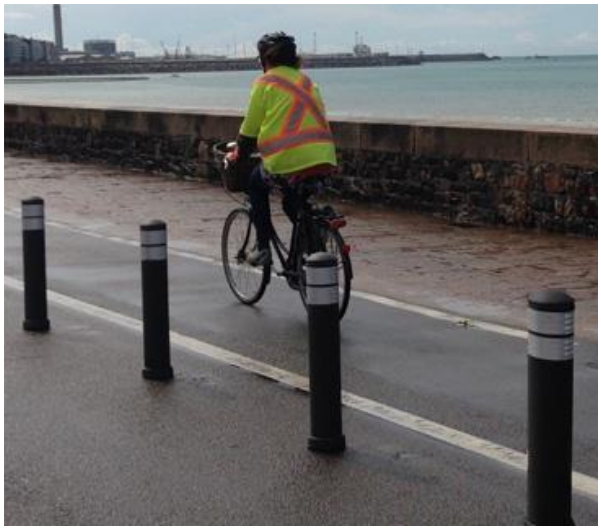

Figure 17: delineator bollards not placed on a lane line

Delineator dimensions

Delineators such as kerbs may be as narrow as 150 mm (the width of a standard kerb) or two kerbs back to back totalling 300 mm. Wider delineation provides space for bins, vehicle doors, or signage. If used to delineate a cycling facility, the profile of the delineator can minimise shy space requirements. For example, a chamfered (angled) kerb face provides more effective cycleway width than a vertical kerb face.

The leading delineator needs to be prominent so that road users do not run into the device – especially in the tactical urbanism context where the material will just appear where none was previously. This may be achieved by any combination of:

- tapered road markings or other surface level delineators (studs, profiled line markings) leading drivers and people cycling to align with the intended direction of travel
- a higher vertical delineator such as a flexible post, sign, or other element. A leading post **should** be 800 mm – 900 mm high, as this is below most bicycle handlebars and doesn't present a 'snagging' risk.
- for longitudinal delineators, there is no minimum height requirement[3] if it is used at regular intervals. Refer to Configuration later in this design note for more information.

Reflectivity and colours

Although the TCD Rule does not mandate colour or retroreflective characteristics if the road is illuminated, the Manual provides guidance on colours. For example, red **should** not be used on the right side of road. Similarly, green is typically associated with cycle lanes, so green is not recommended to delineate a space that is not intended as a cycleway. Orange **should not** be used for a longer term installation as it is associated with temporary traffic management and CoPTTM (roadworks). For delineator posts, the colour should be harmonised (match) the colour of any adjacent roadmarking line, and the post should be adjacent or near the line (rather than on top of it) to improve contrast.

Delineator posts **should** have retroreflective panels attached as per TCD Manual Part 5 section 2.9.5. Panels should be white on the left side of the road and yellow on the right side of the road (refer to the Manual for full details). The Manual recommends a 150 mm upper panel (650 mm from the ground) and a 100 mm lower panel (400 mm from the ground).

As previously noted, these specifications are very important if the posts are to be located along a traffic lane (i.e. in the carriageway, not behind the kerb) and are the only materials delineating the lane. Safety can be improved by using more elements with retroreflective features (i.e. interspersing posts with planters) and installing road markings. Consider also the level of ambient streetlighting during the design process.

Configuration

For any delineator, take into account the need to maintain access to utility service covers.

Generally place delineators at least 100 mm away from line markings to improve contrast and minimise damage to materials (Figure 18).

For paths and cycleways, posts can be installed on continuous low separator footings (Figure 19). These can be beneficial for longer installation lengths or longer term solutions, but can be a trip hazard. Careful consideration of pedestrian desire lines is therefore important.

Figure 18: planter boxes set about 100 mm from adjacent line markings, Cambridge

Figure 19: spacing of posts on a continuous low separator

While highway spacing of posts is typically 12 m to minimise the possibility of loss of vehicular control if the line of posts is traversed, in lower speed environments or when segregating walking or cycling facilities spacing should be more frequent (recommended maximum: 5 m). Post spacing on curves may also need to be adjusted. For modal filters (see Figure 1, where a diagonal diverter is shown as a type of modal filter) to prevent car and truck access, elements should be no more than 1.6 m apart – slightly narrower than the typical small car. For kerb extensions (buildouts), the spacing needs to be much closer together e.g. 1.0 m or less.

[3] Edge marker posts typically used in open speed environments (TCD Rule, Schedule 1, W20-3.1 and W20-3.1A) have a specified height of 900 mm. The TCD Manual states that delineator posts **should** be 800 mm to 1000 mm high.

Table 1: design for delineators

Aspect		Rules and recommendations
Safety	Frangibility/moveability	In low-speed environments and/or for demonstrations, it **may** be acceptable for the element to be moveable
	Visibility	If used to slow traffic, **must** be illuminated or have reflective delineators or reflective signs installed so that the structure is visible. **Should** have retroreflective panels attached. If placed in the centre of a road, such as a tree in a planter barrel, **should** be appropriately signed with keep left signs and markings
		Consider that if increased lighting requires new mains power, the lead time can be up to 3 months for power companies to attend
		May not block intervisibility between road users
	Trip hazards and universal design	Any use of objects in the carriageway **should** be done in a way that does not compromise accessibility for any person with a mobility impairment; gaps and step-free access needs to be provided at formal and informal crossings. Refer RTS 14
Durability	Removal	Temporary elements **should** not cause damage or alteration to the existing built- and natural environment. In case of minor damage, this **should** be fixed at removal or the pilot project may be timed to coincide with a renewal or capital project. For longer term installations, some damage may be acceptable – particularly if the street is due for renewal in the same timeframe.
	Colour and shape	Retains colour and shape during the design life of the product, or there is a maintenance plan. Resists UV degradation.
	Fixing methods	Item could be heavy (or installed on a heavy base) and thus difficult to shift.
		Stays in place during the period of installation, with evidence that the fixing method is suitable to a range of pavement types and resists loosening due to environmental factors, vibrations and loading from expected traffic volumes and composition. Could use asphalt to achieve desired shape.
	Maintenance and weather resistance	Design so that the community can maintain the installation without the need for a TMP, or maintenance can be incorporated into existing maintenance contracts. Ensure that temporary landscaping will not create a hazard or obstruct visibility as it grows or is affected by weather. Resists wind forces.
Installation	Sustainability & environment	Elements can be re-used, recycled or are biodegradable (example: hay bales used in demonstration events)
	Colours	Red should not be used on the right side of road. Green should not be used to delineate a space that is not intended as a cycleway. Orange should not be used for a longer-term installation as it is associated with temporary traffic management and CopTTM (roadworks).
	Signs and markings	The TCD Manual Part 5 section 8.1.2 sets out cycle lane markings; the CNG designing cycle lanes section covers aspects such as broken yellow lines, signage, coloured surfacing, etc.
	Dimensions and layout	Height 800 mm to 1000 mm (may be lower but the leading element **should** be in this range, refer to discussion text); if cyclists will ride immediately adjacent then no more than 900 mm high Delineator posts **must** be installed at regular intervals according to the road alignment and should be no more than 5 m apart (TCD Manual Part 5 section 8.1.2); for modal filters designed to prevent the passage of cars and trucks, space the elements no more than 1.6 m apart.

3.2. Kerbs, islands, and ramps

Delineators described in the previous section can be used to create islands such as kerb extensions. This section discusses other types of kerbs and islands. The two element groupings have some overlap, so judgement needs to be applied when it comes to achieving successful outcomes and compliance with rules.

Types of materials

Temporary kerbs and islands are commercially available in plastic or rubber. The leftmost image that follows shows a demonstration project where a landscaped kerb extension has been formed from rolls of hay typically used for mitigating runoff associated with construction. Orange roadworks cones have been used due to ready availability but another delineator would be preferable if the project duration were longer.

Figure 20: demonstration kerb extensions using hay rolls (left), interim roundabouts using rubber humps (centre) or rubber islands (right)

Figure 21: traffic islands made of interlocking rubber elements (left, centre) and separator kerbed islands with speed cushions (right)

Figure 22: temporary ramps may be made of rubber, wood or asphalt (latter not pictured); must be slip resistant

Legislation

> *TCD Rule 7.7(2): When providing a raised traffic island, a road controlling authority must: (a) install, on the traffic island, reflectorised traffic signs complying with section 4 that the road controlling authority considers are necessary to guide drivers around the traffic island; and (b) place markings*

or delineators on the roadway beside the traffic island to inform drivers of the presence and extent of the traffic island.

TCD Rule 7.9(3): A road hump, chicane, slow point or other channelling device, on or adjacent to a road, that is intended to reduce the travelling speed of vehicles must be illuminated or have reflective delineators or reflective signs installed so that the structure is visible.

TCD Rule 7.9(4): Permanent growth, or a traffic control device or other object placed on a structure in 7.9(1), must not impair visibility.

Design

Table 2: design for kerbs and islands

Aspect		Rules and recommendations
Safety	Frangibility/moveability	In low-speed environments and/or for demonstrations, it may be acceptable for the element to be moveable
	Visibility	If used to slow traffic, **must** be illuminated or have reflective delineators or reflective signs installed so that the structure is visible. **Should** have retroreflective panels attached. If placed on the right side of a traffic lane, **should** be appropriately signed with keep left signs and markings
		If increased lighting requires new mains power, lead time can be up to 3 months
		May not block intervisibility between road users
	Trip hazards and universal design	Any use of objects in the carriageway should be done in a way that does not compromise accessibility for any person with a mobility impairment; gaps and step-free access needs to be provided at crossings (RTS 14).
Durability	Removal	Temporary elements should not cause damage or alteration to the existing built- and natural environment. In case of minor damage, this should be fixed at removal or the pilot project may be timed to coincide with a renewal or capital project. For longer term installations, some damage may be acceptable – particularly if the street is due for renewal in the same timeframe.
	Colour and shape	Retains colour and shape during the design life of the product, or there is a maintenance plan. Resists UV degradation.
	Fixing methods	Item could be heavy (or installed on a heavy base) and thus difficult to shift.
		Stays in place during the period of installation, with evidence that the fixing method is suitable to a range of pavement types and resists loosening due to environmental factors, vibrations and loading from expected traffic volumes and composition. Could use asphalt to achieve desired shape.
	Maintenance and weather resistance	Design so that the community can maintain the installation without the need for a TMP, or maintenance can be incorporated into existing maintenance contracts. Ensure that temporary landscaping will not create a hazard or obstruct visibility as it grows or is affected by weather. Resists wind forces
Installation	Sustainability & environment	Elements can be re-used, recycled or are biodegradable (example: hay bales used in demonstration events)
	Colours	White is more conspicuous at night, don't use red on the right side of the road
	Signs and markings	A keep left arrow should be used for islands in the roadway, refer to TCD Manual Part 5 section 6.2.1
	Dimensions and layout	Pedestrian islands – refer TCD Manual Part 5 section 7.3. Should have a minimum width of at least 1.2 m to enable wheelchair access. Refer to the *Pedestrian Planning and Design Guide* for more information. Local RCAs may also have local design requirements. Cycle lane separator kerb – min. width 150 mm; wider separators provide space for bins, vehicle doors, signs etc., refer CNG – Choice of separator or protection

3.3. Raised features

Types and uses of raised products to create raised features

Raised features (platforms, humps, cushions, etc) are designed to reinforce lower speed environments and may also be used to support a priority (zebra) or non-priority (courtesy) crossing point.

Opposition to their installation generally comes from experience with steeper ramps. Recent research shows that appropriately designed and sited features can achieve the desired safe system operating speeds while keeping vertical acceleration within the vehicle (a measure of occupant comfort) within the acceptable range (Blewden, Mackie et al. 2020). Temporary raised platforms for crossings (priority or non-priority) work better with full height kerbs (i.e. no kerb ramps) as wheeled pedestrians can traverse the installation. Therefore, if the pilot project aims to test a raised product at an existing crossing point with dropped kerbs, a 'filler' element might be needed to provide a level surface (as shown in Figure 23).

Asphalt can be an economical way to achieve a speed cushion or platform (Figure 26) and may be applied directly on existing road surfaces, although an experienced contractor is needed to form a consistent and correct ramp gradient.

Figure 23: a platform with fillers at the kerb; markings not compliant with TCD Rule (O. McLean)

Figure 24: rubber speed hump and child crossing figure; speed limit sign non-compliant (J. Lieswyn)

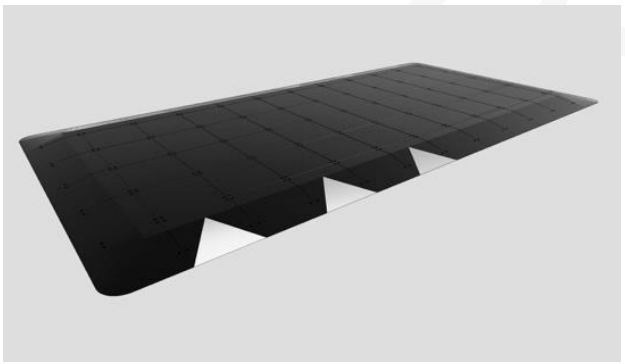

Figure 25: a rubber element that can be specified in different lengths for speed cushion or platform use, with compliant hump markings. Commonly 1:6 gradient, other gradients possible (O. McLean)

Figure 26: temporary asphalt zebra platform with 1:20 gradient, Takaka (P. Kortegast)

Legislation

The TCD Rule section 7.9 on kerbs, slow points, chicanes, and other structures states:

> *7.9(1) A road controlling authority may provide a traffic control device, including a kerb, road hump, chicane, or slow point, on or adjacent to a road, as appropriate, to:*
>
> *(a) channel traffic movement; or*
>
> *(b) restrict the speed of traffic; or*

(c) discourage the use of the road by through vehicles in general or by vehicles of an inappropriate design or size, and for which alternative routes are available; or

(d) provide a continuation of a pedestrian or cycle route and alert drivers to the presence of pedestrians or cyclists.

7.9(2) A road controlling authority may use signs, markings or delineators in conjunction with a structure in 7.9(1).

7.9(3): A road hump, chicane, slow point or other channelling device, on or adjacent to a road, that is intended to reduce the travelling speed of vehicles must be illuminated or have reflective delineators or reflective signs installed so that the structure is visible.

7.94(4): Permanent growth, or a traffic control device or other object placed on a structure in 7.9(1), must not impair visibility.

Design

The speed management efficacy of a single device along a road should be considered in context with the rest of the environment e.g. spacing of elements, street width, and land use context. Any device should have a reasonably comfortable negotiation speed. A sharp rise in the profile of the road may cause considerable discomfort to car passengers, may cause load to shift, or may deflect a vehicle from its course with loss of control when crossed at speed. The comfortable crossing speed should be no more than 20 km/h less than the approach speed.

Speed bumps are typically 300 mm to 1000 mm long and negotiated by each axle separately. Generally used in car parks and driveways, where approach speeds are already low. As speed increases the discomfort increases rapidly with speed to a plateau above which the effect may reduce, but the comfort is strongly influenced by how well the vehicle suspension absorbs the bumps, which is as affected by how heavily the vehicles is loaded. It is particularly uncomfortable in unladen heavy vehicles. To accommodate heavy vehicles and forklifts yet maintain crossing speeds for cars, consider increasing both length and height proportionately to maintain the same comfortable crossing speed - but high speeds are affected more severely. Heavy vehicle versions of these humps for industrial sites are about 1 m long.

Speed control humps are generally circular arc and similar in length to the wheelbase of a car. The front wheels are going down the far side while the rear wheels are still rising on the approach side. The whole body of the vehicle gets pitched, and the suspension of the vehicle has less effect on its effectiveness. They are the most effective speed control devices. The longer humps are recommended where there are heavy vehicles but at the expense of higher crossing speeds for passenger cars. If there is insufficient room, hump heights can be reduced to a minimum of 75 mm and length reduced proportionately.

Table 3: speed hump profiles (Watts 1973)

	Target speed (km/h)	Length	Height
Speed bumps	< 8	400 mm	75 mm – may snag vehicle body or suspension
	< 16	400 mm	50 mm
	< 25	500 mm	30 mm – may be ineffective at higher speeds as most car suspensions can absorb the bump
Speed control humps	< 25	3.7 m	100 mm
	< 33	5.5 m	100 mm
	< 40	5.9 m	100 mm

Raised platforms (including speed tables, pedestrian platforms and raised safety platforms) have an approach ramp a departure ramp and a flat platform in the middle. The central platform is usually longer than the wheelbase of a car, so the approach ramp is negotiated by the wheels of both axles before the departure ramp is reached. The effect is achieved by a combination of suspension and pitching on the approach ramp, so for one-way situations, the departure ramp can be eased to improve comfort for vehicles with longer wheelbases, where it would act like a hump. Platforms are more comfortable than humps when negotiated at speeds above their target speed, so have a larger speed variation.

Ramp profiles are given in Table 4, based in part upon VicRoads and Austroads guidance.[4] As noted previously, the approach operating speed should be no more than 20 km/h higher than the comfortable crossing speed at the device; if this cannot be achieved then additional traffic management treatments may be needed to progressively slow approaching motorists.

At the time of writing, temporary rubber products are available or can be sourced in New Zealand for gradients no shallower than 1:12, which may elicit more negative community reactions than the permanent installation would. This should be considered when preparing for community engagement and monitoring of the pilot.

Table 4: raised safety platforms on an undivided carriageway (VicRoads 2019, Blewden, Mackie et al. 2020)

Pedestrian / cyclist activity	Heavy vehicle activity	Speed advisory (km/h)	Min. platform length (m)+	Height (mm)	Slope*
High (e.g. town or activity centre)	Low (e.g. mostly buses)	20	0.5	75	1:6
		25	1.0	100	1:10
		25	1.0	80	1:12
		30	1.5	100	1:15
Medium (e.g. urban arterial)		40	2.0	100	1:20
Low	Medium-high (e.g. truck route)		2.5	100	1:25
	High	50		100	1:30

*for a divided carriageway or one-way road, use a 1:35 departure ramp to minimise discomfort and noise effects
+platform length can be longer; in permanent installations the entire intersection can be raised

More information on traffic calming may be found in the BCA Strategic Options Toolkit (NZ Transport Agency 2014) and in Guide to Traffic Management Part 8: Local Street Management (Austroads 2020).

Table 5: design for raised products

Aspect		Rules and recommendations
Safety	Frangibility/moveability	Needs to be fixed in place, refer to durability > fixing methods in this table
	Visibility	Should have adequate reflectivity to be seen in low or no light conditions
		Consider that if increased lighting requires new mains power, the lead time can be up to 3 months for power companies to attend
		Must be illuminated or have reflective delineators or reflective signs installed so that the structure is visible. TCD Rule 7.9(3)
		Permanent growth, or a TCD or other object placed on a kerb, slow point, chicane and other structures must not impair visibility. TCD Rule 7.9(4)
		Limit line should not be hidden behind a vertical element
	Skid and slip resistance	Skid and slip[5] resistance values must be met.
	Trip hazards and universal design	Any use of objects in the carriageway should be done in a way that does not compromise accessibility for mobility impaired persons; gaps and step-free access needs to be provided at formal and informal crossings, refer RTS 14.
	Cyclist considerations	A hump or platform should either extend to the kerb or provide a clear cyclist bypass; do not have a steep device-end side slope

[4] Some values are interpolated or based on stakeholder input to this design note

[5] AS/NZS 4586:2004 Slip resistance classification of new pedestrian surface materials would apply if the surface is to be used by pedestrians (and should apply for cyclists as well, if expected)

Aspect		Rules and recommendations
Durability	Removal	Temporary elements should not cause damage or alteration to the existing built- and natural environment. In case of minor damage, this should be fixed at removal or the pilot project may be timed to coincide with a renewal or capital project. For longer term installations, some damage may be acceptable – particularly if the street is due for renewal in the same timeframe.
	Colour and shape	Retains colour and shape during the design life of the product, or there is a maintenance plan. Resists UV degradation. Any device should withstand perpendicular heavy vehicle movement independent of the road construction.
	Fixing methods	Should not deform or lose shape otherwise safety impacts are lost.
		Stays in place during the period of installation, with evidence that the fixing method is suitable to a range of pavement types and resists loosening due to environmental factors, vibrations and loading from expected traffic volumes and composition. Could use asphalt to achieve desired shape.
	Maintenance and weather resistance	Design so that the community can maintain the installation without the need for a TMP, or maintenance can be incorporated into existing maintenance contracts. Should not deform or substantially fade for expected pilot duration.
Installation	Sustainability	Elements can be re-used, recycled or are biodegradable
	Colours	Black for zebras (under the stripes) and speed humps (under the white hump ramp markings) For a courtesy crossing, it is preferable that a colour other than red, yellow or green (e.g. roadway art) is used. This means that the crossing point is clearly not the road and not the footpath.
	Signs and markings	A hump sign **should** be installed adjacent to the hump where approaching drivers have at least 60 m visibility (urban areas). Between intersections, if a road section has frequently spaced devices, consider a sign at only the first hump. Others **must** have either illumination, reflectorised delineator or signs. According to rule 4.2(4), a permanent warning sign must be installed if the RCA considers a reduced speed is appropriate. Permanent warning signs other than a hump sign can fulfill this requirement. For any vertical deflection device, the face visible to approaching drivers **should** be marked with reflectorised white 750 mm wide hump ramp triangle markings as per TCD Manual Part 5 section 14.1.1 Consider approach markings to ensure that speed control devices are not out of context on collector roads. Zebra crossings **must** be signed and marked – refer TCD Rule 8.2 and TCD Manual Part 5 figure 7-11; this includes the hump ramp markings. Courtesy crossings do not need to be signed, subject to compliance with visibility requirements outlined in 7.9(3) of the Rule.
	Dimensions and layout	Platforms can be up to 100 mm high, with ramp gradients between 1:6 and 1:25; gradients less than 1:20 will not be as effective in controlling speeds. Speed humps **should** be consistent with Speed Management Guide Vol 2: toolbox (NZ Transport Agency 2016) or the Auckland TDM.

3.4. Signs, markings and surface treatments

Information boards, billboards, and other signs that are not traffic signs

The TCD Rule section 3.2(5) prohibits the installation of any sign that is not a TCD but can be mistaken for one, or may prevent another TCD from being effective as defined in section 3.1(a) to (d). Boards and signs that do not look like a traffic sign may be useful for a pilot project. Examples of such signs include:

- public safety messages encouraging slower/more courteous driving behaviour
- information and guidance about the pilot project

For all signs that are not traffic signs, apply the principles underpinning the Manual to protect public safety. For example, securely mount them so that they do not become a hazard if blown away by wind, and take care that they do not dazzle, distract or mislead road users.

Consult the Advertising guidelines (Waka Kotahi NZ Transport Agency 2019) for more information on creating an effective campaign.

Figure 27: project information board, Auckland (T. Fitzpatrick)

Figure 28: child art message banner, Davis, California (J. Lieswyn)

Figure 29: road safety promotion billboard, Rotorua (W. Lloyd)

Road markings and surface treatments

Various surface treatments (such as roadway art) are relatively low cost and common elements of many pilot projects.

- Standard road markings are easily applied but removal can damage the pavement surface if there is a need to refine the layout or remove them at the end of the pilot. This may not be an issue if the end of the pilot coincides with a road surface renewal.
- Pavement marking tape is more easily removed but may not adhere well (or last long) if the surface is coarse or dirty.
- Chalk is a great way to simulate road markings or as a medium for street art, but test the product durability to match it to your intended project duration. Some spray chalk products can last several months and be somewhat difficult to remove.
- Patterns or art can be designed digitally (including by school children) and then produced as pavement decals. This can reduce installation time and brings the power of the digital realm to the community. However, in-person painting has social benefits as many more people can be involved in the implementation.

All surface treatments are more durable if the surface is water blasted first. Unlike removal of paint markings, cleaning can be done at a lower pressure that is less likely to damage the surface.

Figure 30: clean the surface, apply white primer, finish coat. Standard paint with grit mixed in is used as the surface is not going to be trafficked, Christchurch (C. Piper)

There are other surface treatments such as synthetic turf that can define spaces. Turf needs to be fixed down so that the edge does not present a trip hazard. Glue and carpet nails or screws are common methods, depending on the surface type and condition. In some cases a strip along the edge can be screwed down to prevent uplift. Sand is often applied to permanent synthetic turf surfaces, but this may be undesirable if there is an intention to re-use the turf elsewhere or to minimise clean-up effort during removal.

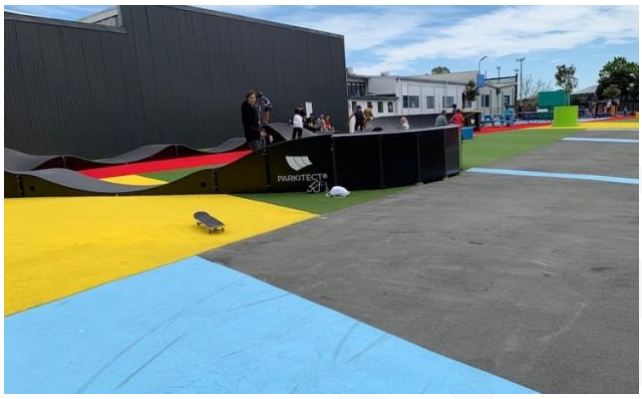

Figure 31: synthetic turf and blue paint transform a former carpark at the Riverside Youth Pop-Up Park, Nelson

Figure 32: synthetic turf transforms a former vehicular space into a central city playground, Nelson

Figure 33: glue and screws used on asphalt provides for heavy skateboard and pedestrian traffic, Nelson

Figure 34: not all edges are traversed by pedestrians - glue may be sufficient, Nelson

Table 6: design for road marking and other surface treatments

Aspect		Rules and recommendations
Safety	Frangibility/moveability	Pavement marking tape may be installed as it can be removed more easily than paint if the markings need to be moved Synthetic turf can be moved within the space or to another site; this is easier if sand is not applied and glue is used only where necessary
	Visibility	**Should** not dazzle or distract road users
		Should have adequate reflectivity to be seen in low or no light conditions
		Must have anti-skid properties if in an area used by vehicles and anti-slip properties elsewhere
	Trip hazards and universal design	**Should** not confuse users or emulate a TCD (e.g. a zebra crossing). Synthetic turf needs to be firmly attached along the edges to prevent trip hazards; consider screwing down an edge strip.
Durability	Removal	Paint: waterblasting (care must be taken not to damage road surface) Synthetic turf: if the surface the turf was attached to are pavers and the glue cannot be removed easily, the pavers could be uplifted and reversed; fixing strip holes can be plugged with a matching filler
	Colour and shape	Retains colour during the design life of the product, or there is a maintenance plan. Resists UV degradation.
	Fixing methods	Item could be heavy (or installed on a heavy base) and thus difficult to shift.
		Spray chalk (landscaping material) is suitable for demos, but it can stay in place for months Decals have the advantage of not being flowable so are less of a risk of waterway pollution
	Maintenance and weather resistance	Design so that the community can maintain the installation without the need for a TMP, or maintenance can be incorporated into existing maintenance contracts. Clear coat may extend life
Installation	Sustainability & environment	Must be non-toxic to avoid runoff issues. If it is a flowable material, add to hazard register
	Colours	Avoid green and red unless used for their intended purposes (green is cycle and bus lanes, red is for speed reduction thresholds). Reference Roadway Art clauses 5.6 to 5.9 in the Rule and associated guidance, P33 specifications for coloured surfacing
	Signs and markings	TCD Rule section 3.2(5) prohibits the installation of any object that is not a TCD but can be mistaken for one, or may prevent another TCD from being effective as defined in section 3.1(a) to (d).
	Dimensions and layout	**Should** be consistent with the dimensions specified in existing rules and guidance, e.g. do not pilot a cycleway that is too narrow for effective and safe use Refer also: Roadway Art Guidance, TCD Manual Part 5, and the CNG.

3.5. Temporary lighting

Any required lighting needs to be designed by a suitably qualified professional and the RCA may require an assessment to ensure compliance with the standards.

For pedestrian (zebra) crossings

Pedestrian crossing points need more intense lighting than footpaths to ensure they are conspicuous to pedestrians and that approaching drivers can see pedestrians clearly. Lighting **must** comply with AS/NZS 1158.4:2009 Lighting for Roads and Public Spaces, Part 4: Lighting of Pedestrian Crossings.

Temporary lighting might be achieved by locating the crossing where the existing lighting is sufficient or the light fixture upgraded to comply. Note that the height of a compliant luminaire is typically 6 m for a two-lane road. Permanent lighting is relatively costly and often has substantial lead times for design and procurement. If lighting is not feasible or affordable, it may be necessary to trial a courtesy crossing instead, which has a lower lighting requirement. The choice of crossing type should be informed by Waka Kotahi pedestrian guidance.

For all other roadway features, including courtesy crossings

It is important to have appropriate lighting or ambient light from an amenity and personal security viewpoint. AS/NZS 1158.3.1: 2020 outlines lighting requirements for pedestrians on local roads, intersections, pedestrian refuges, local area traffic management devices, pathways for pedestrians and cyclists, public activity spaces, connecting elements and car parks.

A raised platform is a device intended to “regulate traffic” in terms of AS/NZS 1158.3.1 clause 4.5.2.1 and therefore an illumination of not less than 3.5 lux over the relevant design area **must** be provided. This is a lower light level than what a zebra crossing must have, and often can be achieved with existing street lighting.

Temporary lighting types and considerations

Accent or feature lights can improve amenity and personal security. For example,

- festoon (also known as fairy) lights are strings of small white or multi-coloured lighting as used for holiday, event and public space lighting; available in mains power or solar variants
- solar bollard or stake lights; some models have sensors that can increase output when triggered by the proximity of a person, preserving energy for long winter nights
- solar streetlights or generator powered work lights such as used for construction sites can be hired or purchased; consider noise, emissions and security (as many pilot projects are not fenced off or continuously monitored)

For all lights, consider ways to counter vandalism, theft, and trip hazards. For example, run strings of lights or power leads overhead. The minimum vertical clearance above a trafficable roadway to the lowest point of any light strings or power leads **must** be at least 4.9 m for truck clearance purposes. If over-dimension vehicles are expected, then the minimum vertical clearance is 6.0 m.

Figure 35: temporary lights (L to R) - overhead pole, concrete base mount (Auckland), cage mount (Tauranga)

4. CHECKLIST

Question	Response
Material name:	
Provide a description of the purpose and logic for the proposed material:	
What is the speed environment, and is the material suitable for that environment?	
Who have you engaged in developing the material design?	
Have you considered local sourcing to engender community buy-in and avoid supply chain issues and lead times?	
What is the consequence of the material being struck by a driver, a cyclist, and a pedestrian?	
Can people with vision impairment notice the material?	
Is the material easy to maintain? How long would it take to repair or replace if damaged?	
What is the risk and consequence of vandalism to the material?	
If the pilot project deployment is longer than expected, will the material continue to be suitable/durable?	
How will the material be removed at the end of the pilot, and can it be recycled or re-used?	

5. FREQUENTLY ASKED QUESTIONS

Q: What's the difference between a delineator and a separator?

A: None! A delineator is "a traffic control device including a guide post, chevron board, bollard, barrel or barrier, that is placed on or beside a roadway to guide road users" (TCD Rule Part 2 Definitions). All devices that are called separators are included in the definition of a delineator.

Q: Does my delineator post need to be a certain height?

A: The Rule specifies only regular spacing, but not height. The Manual says that delineators (e.g. posts and barriers) **should** be 800 mm to 1000 mm high. This provides some flexibility. For example, you might use a 700 mm continuous plastic delineator (such as the wave, Figure 16) and achieve the intent of the Manual by installing 800 mm high posts at the ends of the series of delineators.

Q: Can we "yarn bomb" a delineator post? Does it have to be white or yellow?

A: Delineator posts have to be conspicuous and support (match the colour of) adjacent road markings. If you are looking to improve the aesthetics of delineation, consider other types of delineators, compliant with the Rule and Manual.

Q: Do I HAVE to have a speed hump sign at each hump or platform? This quickly leads to clutter on the berm/footpath.

A: Clause 4.2(4) of the Rule requires a permanent warning sign at any place where it considers special care or reduced speed is appropriate. Therefore any relevant permanent warning sign in advance of the place where the device is located within meets the requirement (e.g. a school children sign). Clause 7.9(2) says that a road controlling authority **may** use signs, markings or delineators in conjunction with a structure in 7.9(1), while 7.9(3) of the Rule says that humps or other structures **must** be illuminated or have reflective delineators or reflective signs installed so that the structure is visible.

The Manual says a hump sign **should** be installed for humps and platforms. This warns drivers and gives them time to slow down. If there are several devices along a given street length then signposting the leading one may be sufficient, as long as subsequent ones are illuminated or have reflective delineators.

Q: I want to install a hump or platform; how wide across the road should it be?

A: Full span devices should have a cycle lane bypass (with adequate tapers and no-parking restrictions) or take the device all the way to the kerb. Avoid steep side slopes in the cyclist space (temporary asphalt devices are probably less of an issue than more angular rubber devices). If motorists are aiming their left wheels for the same space that cyclists use, consider installing posts to channelise motorists.

Q: If the TCD Rule permits in low-risk environments the use of roadway art and markings that do not conform to the TCD Rule, can I also install signs or traffic signals that do not conform to the Rule in these locations as well?

A: No.

Q: Is an information board about my project, a school-child drawn "SLOW DOWN" placard or road safety billboard a traffic control device subject to the Rule?

A: Information boards, placards and billboards that are not traffic signs are covered by the Rule insofar as they cannot distract or confuse drivers. They might be considered advertising signs covered in the TCD Manual Part 2. In any case, use judgement and apply the principles underpinning the Manual to protect public safety.

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