

# **New Zealand guide to temporary traffic management:**

## **Design guide diagrams**

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The diagrams included in this section are adaptations of the diagrams included in Austroads Guide to TTM part 9 (2019). They have been adapted to include references to the NZGTTM.

The diagrams included cover the fundamental TTM methodologies. These are:

- Go round the site - design guides 1 and 2
- Go through the site - design guide 3
- Go past the site - design guides 4, 5, 6, 8
- In the gaps - design guide 7

These guides are prompts only - they are not to be used for operational work.

Refer to NZGTTM Part 2 the temporary traffic management system, the TTM planning process for more information.







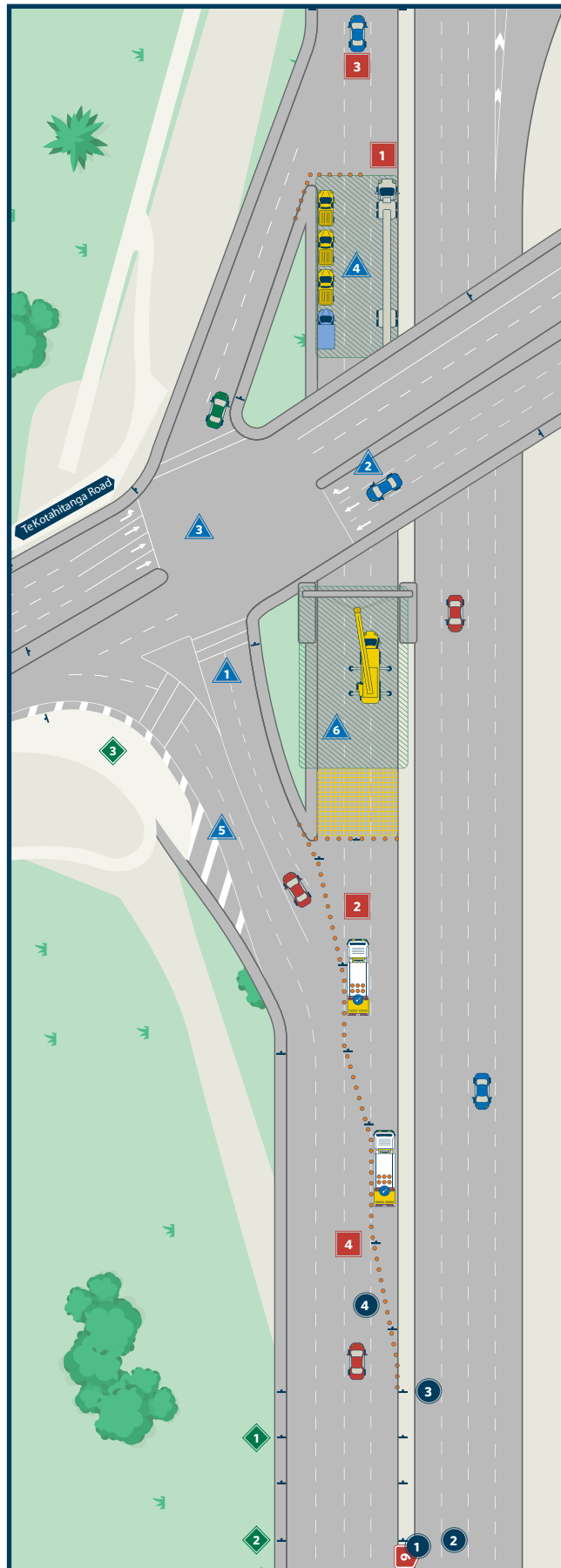
# Design guide 1 - motorway closure

## Scenario

To put up new gantry signs right by the Te Kotahitanga Road overbridge, a road maintenance contractor for State Highway 9 needs a full road closure diversion using the on and off ramps.

## Disclaimer

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## NZGTTM notes

See the NZGTTM Part 3 the toolbox for guidance on:

- 1 advanced warning, guidance, return to normal sign spacing and spacing increase due to queue lengths.
- 2 for appropriate sight distances to a work zone
- 3 temporary speed limit to reduce potential harm to workers and the public
- 4 temporary tapers or curves, which may be necessary if horizontal geometry needs to be changed.

## Risk considerations

- 1 Various heavy vehicles will leave the site in the same direction as the diversion and on-ramp traffic. There's a big risk of vehicle incidents because of differing speeds. The designer should think about the management of heavy vehicle speed in and out of the worksite.
- 2 As the nature of the works is high risk, the designer should consider the risk of non-compliance with the motorway closure - closure breach.
- 3 Contingency plans should ensure the road can be reopened even if works are delayed. However, if this isn't possible, strategies should be developed to manage peak traffic times.
- 4 When designing multi-lane merges on high-speed roads, the risks of a chicane arrangement, to avoid left-to-right merging and improve speed compliance, also increases workers exposure to high-speed traffic.

## Designer considerations

- 1 Consider the detour's physical limitations. Are there mast arms limiting over height vehicles or any limited load capacities on bridge structures? Can oversized vehicles go another way?
- 2 Can construction movements be kept to one lane so only one direction of traffic needs to be controlled? Discuss with the project manager and foreman to clarify expectations.
- 3 Will traffic signal timings need to be changed? Consult with the traffic signal system operator. Will the traffic move through the intersection safely or will there be big queues causing upstream intersections to block and safety issues?
- 4 How will construction vehicles enter and exit the work zone safely? Access should be clearly signed and managed to prevent public traffic following construction traffic into a work zone.
- 5 Contingency plans may be needed for a number of reasons such as a vehicle breakdown, debris on the road or a crash. These scenarios should be pre-planned so they can be quickly put in place.
- 6 Designers should consult with those doing the work to get an understanding of the physical space required for construction activities.

## STMS considerations

- 1 STMS's will need guidance on appropriate procedures for setting up signage on a high-speed motorway. They'll also need a separate mobile operation methodology and risk assessment to safely install and remove the signage and closure.
- 2 As there's permanent signage nearby, the designer should advise which signage is to be modified or covered and consider using overhead VMS and other digital signs where possible.
- 3 The authority controlling the signal timing should be contacted and advised of the works before the temporary traffic management plan is implemented.

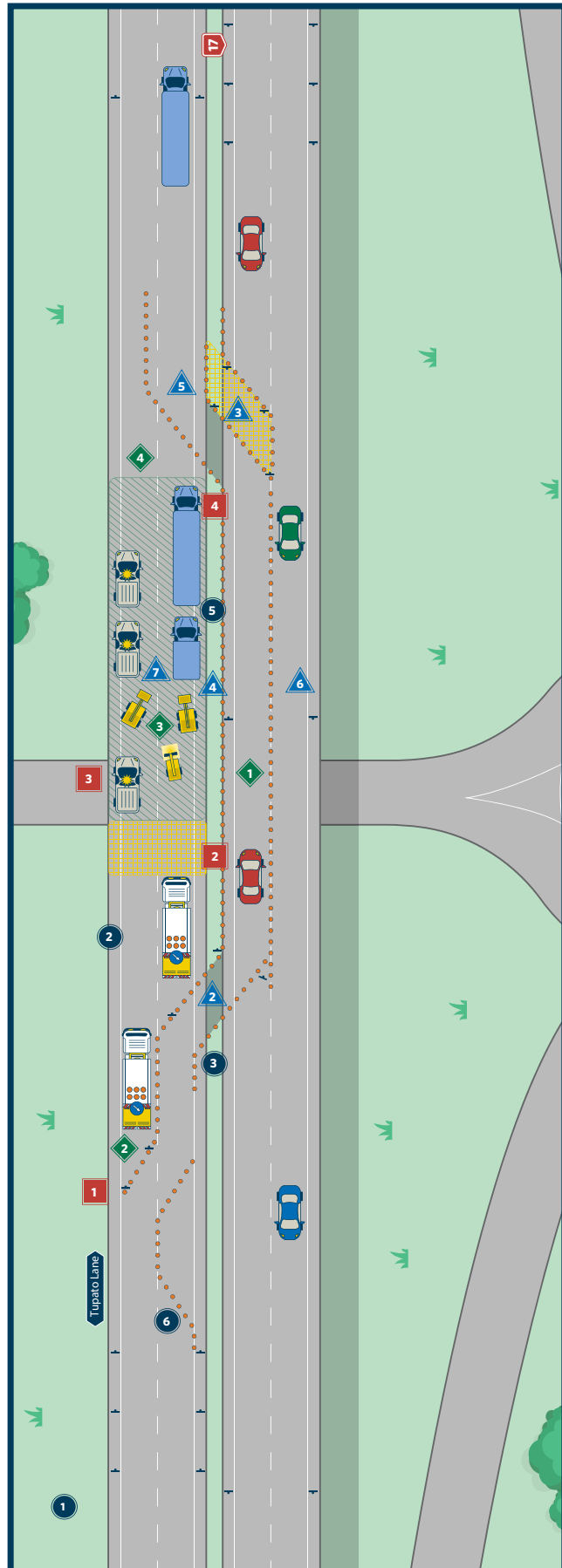
# Design guide 2 - motorway contraflow

## Scenario

Bridge structural work is needed on the expansion joints of State Highway 17 Tupato Lane over bridge's northbound lanes. The work is expected to take 2 weeks working at night and using a large amount of machinery. Contraflow gates (crossovers) have been constructed by Waka Kotahi to divert traffic to the opposing road.

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## NZGTTM notes

See the NZGTTM Part 3 the toolbox for guidance on:

- 1 advanced warning, guidance and return to normal sign spacing and spacing increase due to queue lengths
- 2 safety zones and advanced warning areas for 'around' work zones
- 3 horizontal geometry changes including successive temporary tapers
- 4 temporary speed limit to reduce potential harm to workers and the public
- 5 detours and sidetracks
- 6 a temporary chicane used to limit speed and prevent left-to-right merging.

## Risk considerations

- 1 Failure to reopen the road before peak traffic times could increase the risk of crashes due to queuing and congestion.
- 2 Contingency plans should ensure the road can be reopened even if works are delayed. However, if this isn't possible, strategies should be considered to manage peak traffic times.
- 3 Risks to traffic or pedestrians using the underpass could include the distractions of over height construction equipment or dust and debris that may be dangerous to pedestrians.
- 4 During contraflow operation some barriers may be exposed differently to how they are designed. Consider this as part of the risk assessment process.

## Designer considerations

- 1 Are there any height restrictions along the contraflow route that might differ from the original roadway? Consider diverting high vehicles before to the work zone.
- 2 Does the median crossing have any load restrictions that might keep heavy vehicles from using the site? Consider having heavy vehicle detours before the work zone.
- 3 Consider the need to manage headlight glare from opposing traffic flows.
- 4 Does the contraflow arrangement allow for oversize vehicles that may use the highway during off-peaktimes?
- 5 Aftercare for the crossovers may be needed, including temporary barrier systems designed and certified by an appropriately qualified person.
- 6 Separation between opposing traffic should be considered if a suitable shoulder and pavement is available.
- 7 Designers should consult with those doing the work to get an understanding of the physical space required for construction activities.

## STMS considerations

- 1 Detailed instructions need to be given on how to safely apply the switch to a contraflow arrangement. For complex contraflow arrangements, a pre-switch methodology and separate TMP may be needed to allow the safe application of the contraflow.
- 2 Consider the use of rolling block vehicles to manage traffic while the final traffic cones and signage are installed.
- 3 Radio protocols should be given to make sure construction traffic or workers on foot don't enter the work zone until the contraflow is completely set up.
- 4 Designers should give clear guidance on the works needed to be complete before the road is opened, for example temporary barriers may need to be installed at the crossovers, which may require altered traffic management for access or temporarily stopping traffic.

# Design guide 3 - traffic through rural work area

## Scenario

Maintenance work on a roadside culvert on the southern side of Haumaru Road is needed. Trucks will need to reverse in to the site from the southbound lane, so a short-term hold of one direction of traffic is needed. Traffic can go back to normal once the trucks are in or out of the site.

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## NZGTTM notes

See the NZGTTM Part 3 the toolbox for guidance on:

- 1 advanced warning, guidance and return to normal sign spacing and spacing increase due to queue lengths
- 2 lane widths – these should be based on needs of the public including heavy vehicles, cyclists, pedestrians, and the needs of the works crews such as truck turning curves. There might be conflicting needs, so make decisions carefully.
- 3 temporary speed limit to reduce potential harm to workers and the public
- 4 temporary tapers or curves may be necessary – if horizontal geometry needs to be changed.

## Risk considerations

- 1 Consider the possibility of debris falling onto workers below the level of the road, including a vehicle that loses control. How is this risk managed?
- 2 If site access is steep, there's a risk of vehicles becoming stuck or rolling over. Plans for managing this situation should be prepared in advance.
- 3 There's a risk of the TTM system failing if communications systems fail, such as losing radio communications lost. How will site entry and exit be managed if this happens?
- 4 How long will the queue of held traffic be? Will the advanced warning signs be upstream of the end of the queue? Also, if the queues likely to be large, will they clear before the next movement?
- 5 What will the lane widths be at the site and how will cyclists and other non-motorised road users be accommodated?
- 6 Safety zones should be built in to areas where there's a risk of failure to follow controls, or room for error should be given in case something does go wrong.

## Designer considerations

- 1 The position of the manual traffic controllers should consider several factors including approach sight distance, escape routes for the traffic controller and communication method with the worksite
- 2 Can construction movements be done successfully from one lane meaning only one direction of traffic needs to be controlled. Discuss with the project manager and foreman to clarify expectations.
- 3 How long might the queue of traffic extend and will the queue impact on sight distances, sign spacing, upstream intersections?
- 4 What existing signage may need covering while the worksite is in place?
- 5 What is the process for installation and removal? What should be done to protect the TTM teams during these phases?
- 6 Have plans in place for a number of situations such as a vehicle becoming stuck, debris on the road or a crash. Pre-plan these so they can be quickly implemented if needed.
- 7 Is this a unique scenario and should the STMS be given detailed operational instructions? It may be possible that only one direction of traffic is stopped with the other continuing past the site at all times.
- 8 Designers should consult with those doing the work to get an understanding of the physical space required for construction activities.

## STMS considerations

- 1 Have any risks identified during the planning phase changed such as weather conditions reducing visibility, truck turning circles increase and change the lane widths, cyclists, over-dimensional vehicles or stock on the road? Has a farmer started harvesting their crop nearby? How might the plan need to change? Does this mean the risk assessment needs to be updated and traffic management plan changed?
- 2 Has the operational detail been agreed with the works crew? Have truck drivers been briefed on procedures to enter the site, such as notify the manual traffic controller before approaching the site. Also notify the manual traffic controller and ask to leave the site and receive an all-clear instruction before leaving.
- 3 Have a clear and agreed plan with the works crew for a course of action if there's an incident. Ensure clear communication between works foreman and STMS. This also includes work crew providing more staff to manage traffic, under instruction of the STMS, during this time.

# Design guide 4 - traffic past worksite

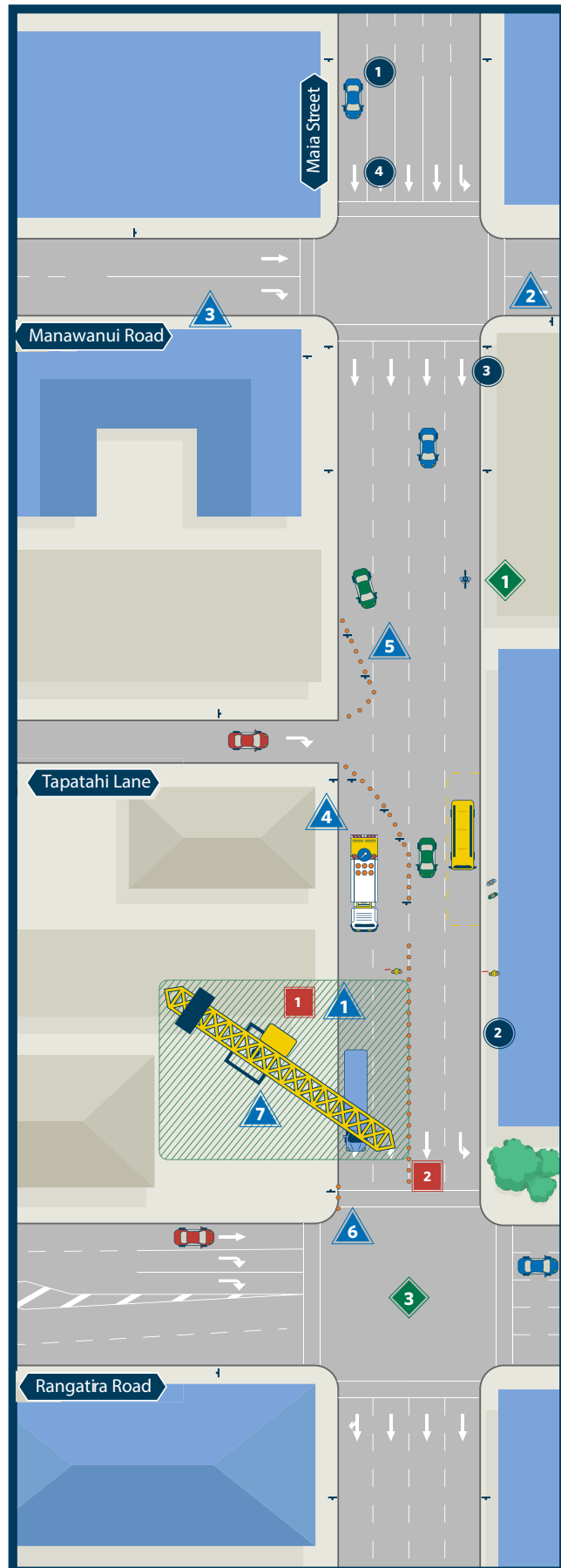
## - urban, multi-lane

### Scenario

During the final stages of the Taroaroa Tower construction, a crane is needed to load and unload materials from delivery vehicles in Maia Street. The clear zone of the crane spans 2 of the 4 lanes of traffic. The 2 lanes need to be closed for delivery vehicles, material unloading and operational safety.

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## NZGTTM notes

See the NZGTTM Part 3 the toolbox for guidance on:

- 1 advanced warning, guidance and return to normal sign spacing and spacing increase due to queue lengths
- 2 safety zones and advanced warning areas for 'past' work zones
- 3 temporary speed limit to reduce potential harm to workers and the public
- 4 horizontal geometry changes including sight distances
- 5 temporary taper considerations and lengths.

## Risk considerations

- 1 Where the movement of plant and equipment requires exclusion zones to be set up, the risk of vehicles and pedestrians entering the exclusion zone by mistake should be assessed. Pay careful attention to all potential points of access such as building entries and driveways.
- 2 When overhead risks are present, the full swing and drop radius should be considered as part of the TTM methodology, including the impact of weather (wind).

## Designer considerations

- 1 Designers should consult with those doing the work to get an understanding of the physical space required for construction activities. Activities like crane lifts may need extra space to secure loads or transfer materials from delivery vehicles into hoisting containers.
- 2 When working out where the advance warning signage should go, designers should consider all potential approaches to a work zone.
- 3 Where footpath closures near a pedestrian signal crossing, advanced warning signage should be provided to encourage pedestrians to use the crossing.
- 4 Physical barriers or temporary fencing may be needed to close footpaths near the exclusion zone. These should always be put as close as possible to locations where pedestrians can go another way or cross the road safely.
- 5 When designing a merge taper after a signalised intersection, make sure adequate separation distance is provided after the traffic signals so that drivers have enough time to react.
- 6 Entry and exit of delivery vehicles should be considered to ensure any conflicting movements with general traffic can be managed.
- 7 Designers should consult with those doing the work to get an understanding of the physical space required for construction activities.

## STMS considerations

- 1 Where traffic controllers are used to provide a temporary exclusion zone for public safety, they need to be mindful of all road users, such as cyclists, who may attempt to pass stopped traffic.
- 2 Additional spotters may be needed to watch low volume access points, such as driveways, and potential pedestrian access points such as building doorways or signal crossings.
- 3 The traffic signal operator should be notified of the works before the implementation of the temporary traffic management plan.



## NZGTTM notes

See the NZGTTM Part 3 the toolbox for guidance on:

- 1 advanced warning, guidance and return to normal sign spacing and spacing increase due to queue lengths
- 2 safety zones and advanced warning areas for 'past' work zones
- 3 sight distances to a work zone
- 4 delineation requirements of shuttle flow operations
- 5 temporary speed limit to reduce potential harm to workers and the public
- 6 horizontal geometry changes including temporary tapers.

## Risk considerations

- 1 When doing works near a school or sports facility, risk assessments should consider the pedestrian diversions with respect to small children as well as the potential for increased traffic during school pick up and drop off times.
- 2 The risk of vehicles continuing to travel on the wrong side of the road after passing the work zone needs to be considered.

## Designer considerations

- 1 When working out the position of traffic controllers, portable traffic signals or other devices, designers should consider a range of factors including the approaching sight distance, available queuing space between the controller and any intersections, and an escape route for traffic controllers.
- 2 Traffic analysis may be needed to work out the timing of the closure.
- 3 Advance warning signs should be placed on all side streets where vehicles are expected to approach the work zone.
- 4 The placement of machinery and traffic control vehicles should be considered to make sure sightlines for vehicles exiting driveways are maintained.
- 5 Designers should consider the possibility of queues going into the surrounding intersections and consider the need for advance warning signage to suit the risk.
- 6 On roads with high cyclist or pedestrian presence, the designer should consider the need for cycling or pedestrian specific signage to help with compliance.
- 7 If a bus stop is affected, consider closing and putting in a temporary stop designed in consultation with the public transport operator.
- 8 Designers should consult with those doing the work to get an understanding of the physical space required for construction activities.

## STMS considerations

- 1 STMS's will need guidance on the right way to install signage on a busy urban street and will need a separate mobile operation methodology and risk assessment to safely set up and remove the signage and closure.
- 2 Additional spotters may be needed to watch low volume access points, such as driveways, and potential pedestrian access points such as building doorways or signal crossings.
- 3 Designers should provide clear instructions on the minimum road widths that must be maintained at all times.
- 4 Consultation with residents is required when works will impact on driveway access. STMS's should be made aware of any specific arrangements that have been agreed in advance.



# Design guide 6 - traffic past worksite

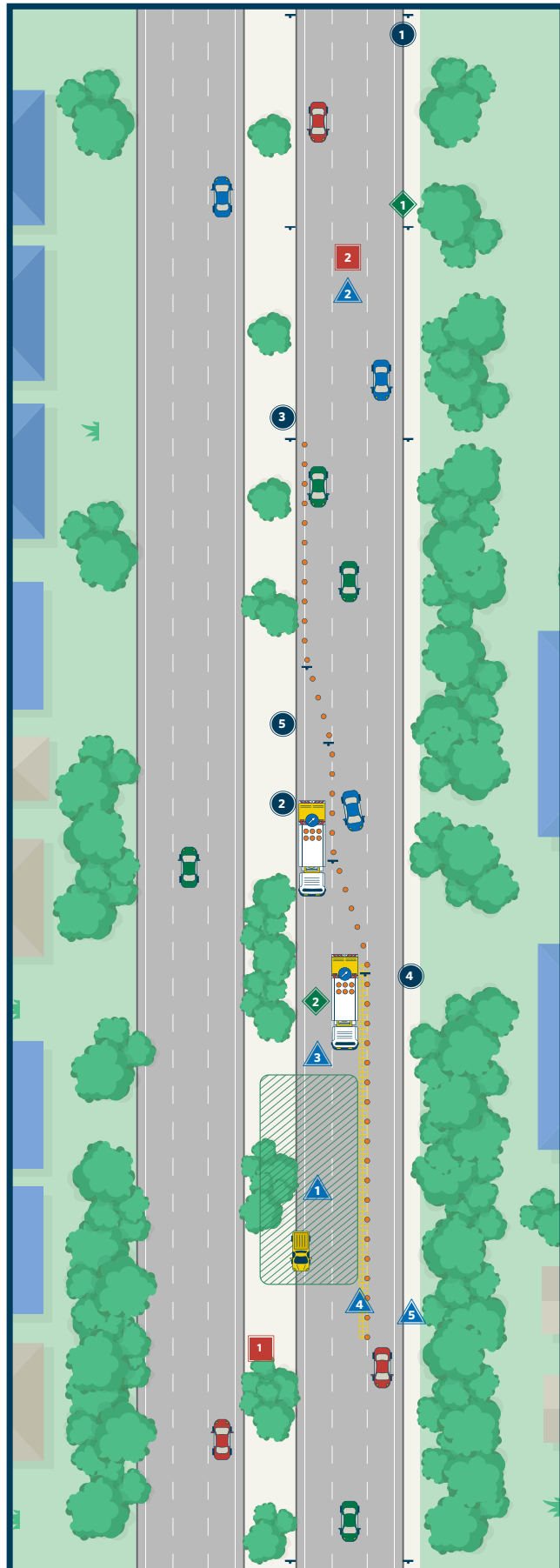
## - multi-lane closure on multi-lane divided motorway

### Scenario

Vegetation control works are needed on the verge of a 6-lane divided motorway. 2 lanes need to be closed in one direction to remove some large tree branches. Works are done at night with lanes closed using successive merge tapers with traffic passing the work zone in the left hand lane.

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## NZGTTM notes

See the NZGTTM Part 3 the toolbox for guidance on:

- 1 advanced warning, guidance and return to normal sign spacing and spacing increase due to queue lengths
- 2 safety zones and advanced warning areas for 'past' work zones
- 3 sight distances to a work zone
- 4 temporary speed limit to reduce potential harm to workers and the public
- 5 horizontal geometry changes, including temporary tapers

## Risk considerations

- 1 Various heavy vehicles will leave the site in the same direction as the motorway traffic. There's a big risk of vehicle incidents because of differing speeds. The designer should think about the management of heavy vehicle speed in and out of the worksite.
- 2 Failure to reopen the road before peak traffic times could increase the risk of crashes because of queuing and congestion.

## Designer considerations

- 1 Designers should consult with those doing the work to get an understanding of the physical space required for construction activities.
- 2 Traffic analysis may be needed to work out the timing of the closure. Consider the impacts to traffic flow and safety and the increased risk of crashes.
- 3 How will construction vehicles enter and exit the work zone safely? Accesses should be clearly signed and managed to prevent public traffic following construction traffic into a work zone.
- 4 Where work zone speed limits need a minimum separation distance from live traffic to the work area, the use of devices to define the separation exclusion zone should be designed in consultation with the contractor.
- 5 When working out a temporary speed limit, the designer should think about compliance and driver merge behaviour, including merge safety and capacity.

## STMS considerations

- 1 STMSs will need guidance on appropriate procedures for installing signage on a high-speed motorway, and may need a separate mobile works traffic guidance scheme to safely implement the signage and closure.
- 2 For closure of motorways lanes or off-ramps for long periods, designers should consider providing STMSs with instructions on 'staying within' vehicles such as truck mounted attenuators (TMA).

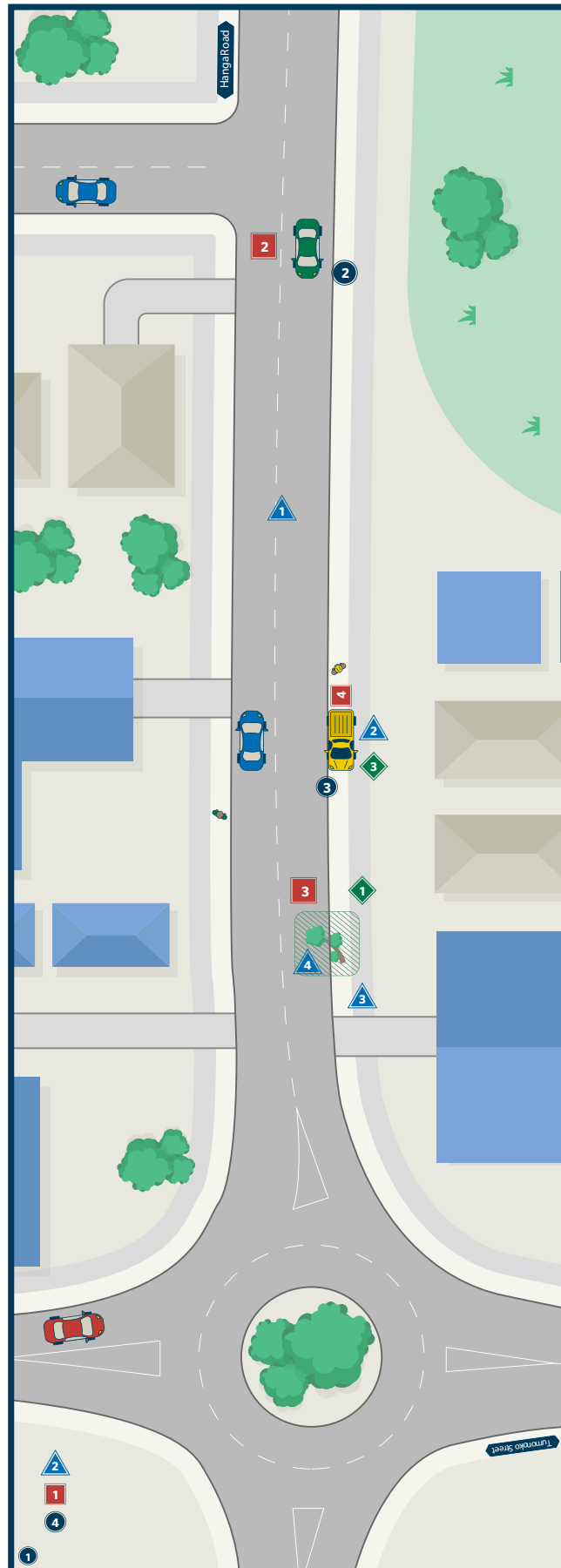
# Design guide 7 - in the gaps - working next to an urban road

## Scenario

Part of ongoing road maintenance requires periodic arborist inspections of roadside trees. The work is inspection-based only and is conducted in gaps in traffic on local roads.

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## NZGTTM notes

See the NZGTTM Part 3 the toolbox for guidance on:

- 1 design of works in gaps between traffic
- 2 sight distances to a work in gaps in traffic
- 3 installing traffic control devices for work in gaps in traffic
- 4 installing work zones and the pre-installation processes.

## Risk considerations

- 1 Before starting these work activities, a risk assessment must be done to ensure the selected TTM controls are the safest controls reasonably practicable and result in the lowest total overall risk.
- 2 The risk assessment should confirm that things like traffic volume and speed, road geometry and width, and the general behaviour of road users are considered when working out the right traffic management plan, and whether working in gaps in traffic is suitable.
- 3 When working out if gaps in traffic are suitable, it's important to consider if the person doing the work will be able to hear the lookout person. Loud machinery or noise from nearby property may mean that gaps in traffic isn't a suitable option, even if traffic volume and speeds are low.
- 4 The location of the parked work vehicle should consider any existing driveways and intersections to make sure the sight lines for exiting vehicles is not blocked.

## Designer considerations

- 1 Works must be short enough to be completed in the gaps in live traffic. This is typically only suited to a single worker with basic tools and materials, accompanied by a lookout person.
- 2 Some traffic management vehicles may be able to display a variable message. The designer should consider an appropriate warning message to display.
- 3 The safest reasonably practicable method should be used to ensure safe working in the gaps. Consider things like risk, road volume (size of the gaps) and nature of the work. The worker must be aware of the approaching vehicles within the distance if there's no spotter.
- 4 Designers should consult with those doing the work to get an understanding of the physical space required for construction activities.

## STMS considerations

- 1 The lookout person must always be next to the worker on the side of the road. This makes sure a warning can be immediately given to the worker. If a vehicle is used, it should be parked clear of traffic lanes.
- 2 Equipment and materials brought into the work area should be unloaded from the non-traffic side of a stationary work vehicle, or the rear of a stationary work vehicle with a lookout person or shadow vehicle in place.
- 3 The best location of the work vehicle is to be next to the works while maintaining worker escape routes at all times. If this isn't possible, the vehicle must still be close to the worker and display a flashing light.

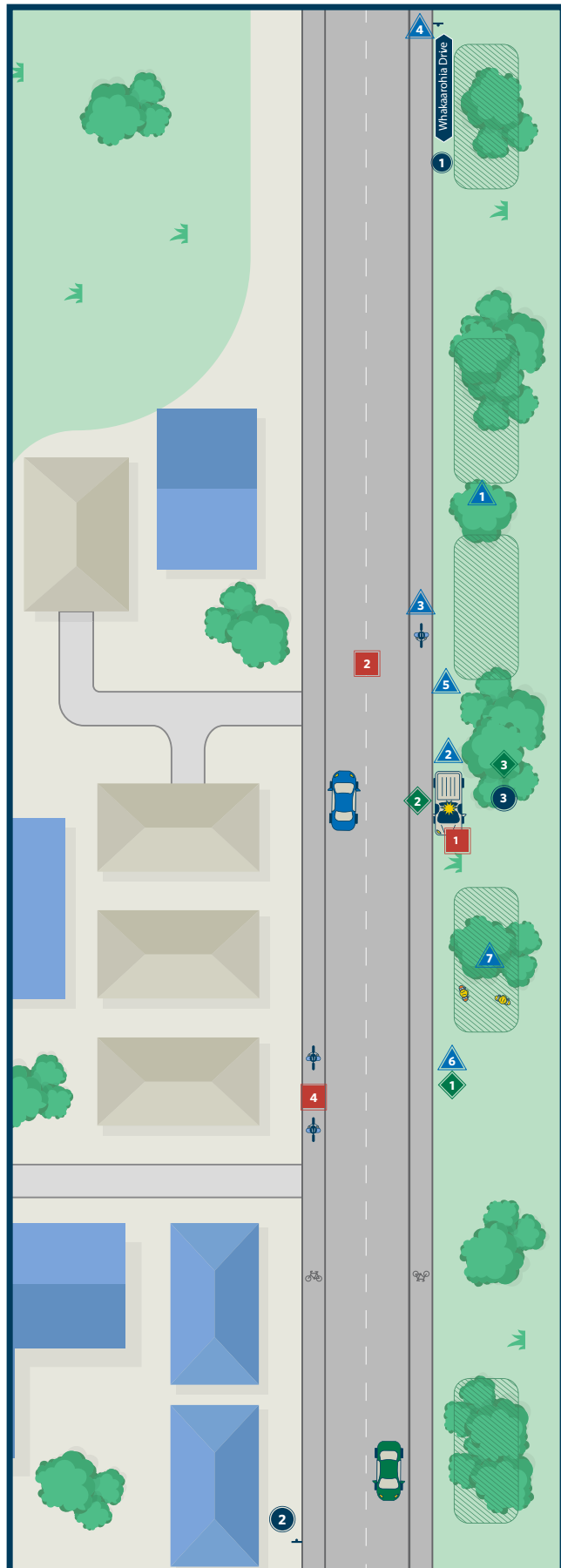
# Design guide 3 - traffic through rural work area

## Scenario

Survey work is required along the roadside of Whakaarohia Drive to gather information for future road widening activities. This will require staff on foot to work in the berm for short periods of time with handheld equipment.

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## NZGTTM notes

See the NZGTTM Part 3 the toolbox for guidance on:

- 1 For required sight distances when operating a frequently changing work area outside of a traffic lane (without a lookout person).
- 2 For traffic control device considerations for operating a frequently changing work area outside of a traffic lane (without a lookout person).
- 3 Prior to installing work zones, pre-installation processes should be carried out in accordance with 1.4.5 Toolbox Talks.

## Risk considerations

- 1 Prior to undertaking these work activities, a risk assessment must be undertaken to ensure the works can be safely completed. Risk considerations are outlined in the NZGTTM Part 3 the toolbox, TTM risk process.
- 2 Risk assessment should confirm that factors such as traffic volume and speed, road geometry and width, and the general behaviour of road users are considered when determining the appropriate traffic management arrangement, and whether working in gaps in traffic are suitable.
- 3 The location of the parked work vehicle should consider any existing driveways and intersections to ensure the sight lines for egressing vehicles is not impeded.
- 4 All road users in the road reserve need to be considered (including more vulnerable users like pedestrians and cyclists). The edge of the traffic lane is not the edge of the carriageway and as such, consideration of risks to users on the edges of the road are important.

## Designer considerations

- 1 Frequently changing work areas are similar to short term works in traffic but frequently move between successive locations in one shift. Each work site is considered as a specific area (i.e. work site is not continuously moving).
- 2 As the work areas progressively move so do the shadow vehicle, work vehicle and lookout person.
- 3 The placement of any works zones, workers and signs should consider the impact on vulnerable road users, and in particular the impact on cyclists.
- 4 Ensure the distance between advance warning signs for opposing directions of travel is not excessive at any time by progressively changing their location as the work location changes.
- 5 The designer should consider the condition of the existing verge and its suitability for parking work vehicles.
- 6 The safest reasonably practicable method should be used for ensuring safe working in the gaps taking into consideration things such as risk, road volume (size of the gaps) and nature of the work. The worker is required to be aware of the approaching vehicles within the distance if no spotter is used.
- 7 Designers should consult with persons undertaking the works to ensure understanding of the physical space required for construction activities.

## STMS considerations

- 1 At any time when conducting these activities, the spotter should be adjacent to the worker on the side of the road. This will ensure any warning provided can be immediately conveyed to the worker.
- 2 If a vehicle is used it should be parked clear of traffic lanes and any impact to the path of other road users (pedestrians and/or cyclists). Vehicles used to install signage and equipment should have amber beacons that are visible to all approaching road users.
- 3 Before any equipment or materials are brought onto the work area, it is recommended that a drive through check of the work site traffic management set up be made in all directions, including all side roads if required. This is to confirm that the work area is safe for all workers and road users, and signs and devices are placed so as to not create a hazard for any road users.



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