Requirements for the use of Truck Mounted Attenuators in WA – Code of Practice

December 2021

Document Control

Owner	Executive Director Planning and Technical Services
Custodian	Road Safety Policy Manager
Issue Date	December 2021

Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page No.
0	July 2017	Original	All
1.0	December 2021	Title Change	Whole document
		Adoption of the Austroads Guide to Temporary Traffic Management and AS1742.3-2019	Whole document
		Mandatory use of TMA – during TM set up / pack up for scenario 1 and 2	Section 4.1
		Mandatory use of TMAs on High-Speed Grade Separated roads	Section 4.1
		New section – MASH TL-2 TMAs	Section 4.4
		Mobile works to be in accordance with AGTTM and the Traffic Management for Works on Roads Code of Practice. Removal of Diagrams 8, 9, 10 and 11	Section 5
		Update to IPPV requirements	Section 7.1.1
		New section – MASH TL-2 Host Vehicle Specifications	Section 7.1.2
		MASH adoption	Section 7.2
		15 tonne GVM for TL-3 TMAs; available TMAs updated	Appendix A
		Diagrams updated, removal of mobile works diagrams	Appendix C
		Metropolitan Region Map updated	Appendix E

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1. INTRODUCTION

Main Roads has adopted the Safe System approach to the management of the road network, recognising that humans make mistakes which can lead to death or serious injury. Truck Mounted Attenuators (TMAs) accommodate for human error by protecting road workers and preventing road trauma by reducing crash forces to survivable limits.

This Code of Practice (previously referred to as a guideline) has been produced for the deployment of TMAs in Western Australia to protect worksites on or beside active roads against errant vehicle intrusion. TMAs may be deployed to protect short to medium term maintenance or construction works where it is not practical to close the road or deploy temporary safety barriers for the protection of workers. They may be deployed as 'barrier' or 'shadow' vehicles depending on the static or mobile nature of the works.

A TMA is defined as a combination of Host Vehicle (Truck) and Impact Attenuator Unit, mounted on the Host Vehicle to protect road workers. The Impact Attenuator Unit, also known as a crash cushion or crash attenuator, is a device intended to reduce the damage done to structures, vehicles and motorists resulting from a motor vehicle collision. Impact Attenuator units are designed to absorb the vehicles' kinetic energy and/or redirect the vehicles away from the hazard, and from roadwork machinery or workers.

TMAs are used for the protection of works on or adjacent to high-speed roads with high traffic volumes. Their major application is for the set up or short-term protection of works on or adjacent to Freeways or High-Speed Multilane Carriageways (where they are mandatory, see section 4).

The following Acts, Regulations, Standards and Code of Practice are applicable to this work: Occupational Safety and Health Act 1984, Occupational Safety and Health Regulations 1996, Main Roads Act 1930, Road Traffic Code 2000, Australian Standard 1742.3, Austroads Guide to Temporary Traffic Management (AGTTM) and the Traffic Management for Works on Roads Code of Practice.

This Code has been prepared following extensive consultation with Local Government, industry and other stakeholders through Advisory Group meetings and the TMA Operation Working Group meetings.

We also acknowledge the VicRoads Guidelines for the use of Truck Mounted Attenuators – TMAs and the National Guidelines for the Use of Truck and Trailer Mounted Attenuators (National TMA Guidelines).

2. PURPOSE

The primary objective of this Code is to improve the safety of road workers through providing physical protection via TMAs against errant vehicle intrusion into worksites when road closure or temporary safety barriers are not reasonably practicable. TMAs also protect the occupants of errant vehicles through attenuating an impact that would otherwise be absorbed by a works vehicle. The secondary objective is to provide standardised guidance for planning works involving TMAs including training and education of TMA operators and a consistent approach to the use of TMAs in Western Australia.

3. DEFINITIONS

Term	Description / Explanation
AGTTM	Austroads Guide to Temporary Traffic Management.
AIB	Automatic Impact Brake. A system that, in the event of an impact with the rear of the Impact Attenuator Unit, will apply the brakes of the TMA host vehicle automatically. The system must apply brakes on all wheels of the rear axle/s of the host vehicle.
AS1742.3	Australian Standard 1742.3 – 2019, Traffic Control Devices for Works on Roads.
Barrier Truck	Refers to the TMA host vehicle.
Blocker Vehicle	Vehicle parked in closed lanes to prevent errant vehicles entering the worksite (see diagrams 5 and 7).
Competent Person	Person who has, through a combination of training, qualification and experience, acquired knowledge and skills enabling that person to correctly perform the specified task.
Grade Separated Road	A road that is separated so that all crossing movements, which would otherwise conflict, are at different elevations.
GVM	Gross Vehicle Mass. The maximum loaded mass of a vehicle: (a) Stated on the vehicle's compliance plate; or (b) Stated in a way prescribed under a regulation.
High Speed Road	Posted speed limit of 90 km/h or more.
Impact Attenuator Unit	An Impact Attenuator Unit, also known as a crash cushion or crash attenuator, is a device intended to reduce the damage done to structures, vehicles and motorists resulting from a motor vehicle collision. Impact attenuator units are designed to absorb the vehicles' kinetic energy and/or redirect the vehicles away from the hazard, and from roadwork machinery or workers.
IPPV	Impact Protected Push Vehicle (see section 7.1.1).
MASH	Manual for Assessing Safety Hardware.
Metropolitan Area	Means the Main Roads WA Metropolitan Region, see map in appendix E
Multilane	Two or more running lanes in one direction.
NCHRP	National Cooperative Highway Research Program.
TARE Mass	The unladen mass of the vehicle only, i.e. not carrying a load.
TL2	Test level 2. Applies to Impact Attenuator Units that meet either NCHRP or MASH Test level 2 (basic) requirements (TL2) 70km/h (see section 7.2).

Term	Description / Explanation
TL3	Test level 3. Applies to Impact Attenuator Units that meet either NCHRP or MASH Test level 3 (basic) requirements (TL3) 100km/h (see section 7.2).
TMA	Truck Mounted Attenuator. A combination of Host Vehicle and Impact Attenuator Unit, mounted to the Host Vehicle to protect road workers. The combination must meet the requirements of this document.
Traffic Lane	Portion of the roadway allotted for single line of moving vehicles.
Very Short Term	Not longer than 5 minutes, as is described in AGTTM Part 5.
VMS	Variable Message Sign

4. PARAMETERS FOR WHEN TO USE TMAS

4.1 Mandatory use of TMAs

TL-3 TMAs must be used when all the criteria are met in any of the below scenarios:

Scenario 1: Works on a Freeway in a Live Traffic Lane (including TM set up / pack up)

Criteria	Yes/No
1. The works occur on a Freeway (includes mobile works)	
2. The work area is within a traffic lane	
3. The work area has not been separated or protected by a full road closure or road safety barrier	

Scenario 2: Work on Freeway not within live traffic lane (including TM set up and pack up)

Criteria	Yes/No
1. The works occur on a Freeway (includes mobile works)	
2. Work area is within 3 m of the traffic lane	
3. The works will take longer than 20 minutes (even if mobile)	
4. The work area has not been separated or protected by a full road closure or road safety barrier	

Scenario 3: Frequently Changing Work Area on Freeway

Criteria	Yes/No
1. Activities that involve slow moving vehicles* and/or a frequently changing work area that occurs on more than 1 km total length of the named road (e.g. litter collection).	
2. The activity occurs on a Freeway	
3. Work area is within 3 m of the traffic lane	
4. The work area has not been separated or protected by a full road closure or road safety barrier	

*a slow moving vehicle is a vehicle traveling more than 20 km/h below the speed limit (e.g. 70 km/h in a 100 km/h speed zone).

Scenario 4: Works on High-Speed Grade Separated Roads

Criteria	Yes/No
1. The posted speed limit prior to road works is 90 km/h or more	
2. The road is a grade separated road with 20,000 vpd or more	
3. The work area is within a traffic lane (includes mobile works)	
4. The work area has not been separated or protected by a full road closure or road safety barrier	

Scenario 5: Works on High Speed Multi-lane Roads in the Metropolitan Area

Criteria	Yes/No
1. The posted speed limit prior to road works is 90 km/h or more (or a section of these roads where the speed limit is reduced due to traffic signals).	
2. The road is a multilane road in the metropolitan area with 15,000 vpd or more	
3. The work area is within a traffic lane (includes mobile works)	
4. The work area has not been separated or protected by a full road closure or road safety barrier	

Example diagrams have been included in Appendix C to indicate the appropriate positions of TMAs and work/shadow vehicles.

Implementation of Traffic Guidance Schemes (TGSs) must comply with AGTTM and the Traffic Management for Works on Roads Code of Practice, unless otherwise stated.

4.2 Incident Response and Emergency works

When responding to incidents and/or emergencies there are many different risks to consider compared with planned works.

TMAs or Impact Protection Push Vehicles (IPPV) shall be used to respond to emergencies/incidents on freeways and high-speed multilane roads (90km/h or more) in the Metropolitan Area. However, if the speed of traffic has been significantly reduced (to less than 60km/h) due to an incident within a trafficable lane, then work vehicles are permitted to be positioned in advance of the incident without the use of a TMA or IPPV provided the following conditions are met:

	Question	Yes	No
1	Is the incident a danger to road users and if **left untreated**, has the potential to cause serious harm?	Proceed to question 2.	No action required
2	Has traffic speed been reduced to **less than 60km/h** due to the incident? (This can be measured by travelling in the traffic stream on approach to the incident)	Proceed to question 3.	TMA or IPPV required
3	Is the lane to be blocked one of the **outermost trafficable lanes*** (far left or far right) where traffic will not be travelling on both sides past the workers?	Proceed to question 4.	TMA or IPPV required
4	Is a **lookout person** available to watch for dangerous vehicles?	Proceed to question 5.	TMA or IPPV required
5	Is the work vehicle fitted with a **flashing arrow board**?	Vehicle can be positioned in advance of the incident without the use of a truck mounted attenuator.	TMA or IPPV required

**Incidents occurring in the emergency lane shall require TMA protection.*

4.3 Other use of TMAs

In addition to the mandatory requirements for the use of TMAs as prescribed above consideration should be given to the use of TMAs when all the criteria described below exist at a work site:

- The work area occupies the travel path; and
- The work area will not be separated or protected by a full road closure or road safety barrier; and
- The posted speed limit prior to road works is 100 km/h or more; and
- The road is a multilane road.

When the above criteria are met, a decision not to use a TMA must be supported by a documented risk assessment conducted by a person with Advanced Worksite Traffic Management (AWTM) accreditation and approved by the person who is responsible for the work activity. The risk assessment must include consideration of traffic volumes.

4.4 MASH TL-2 TMAs

Approved TL-2 TMAs are NOT permitted:

- on roads with permanent speed limit greater than 80 km/h; or
- on Freeways or other high speed multi-lane roads, where TL-3 TMAs are mandatory (refer section 4.1).

When using a TL-2 TMA the following must apply:

- the use of the TL-2 TMA is supported by a risk assessment[1]
- if the permanent speed limit exceeds 60 km/h:
    - the TMA must be within a temporary speed limit of 60 km/h or less; or
    - the TMA may be used during traffic management set up and pack up with a 60 km/h temporary regulatory speed limit displayed on the TMA variable message sign.

Due to the departures in host vehicle requirements (refer section 7.1.2), TL-2 TMAs are not recommended to be used in the following situations, where TL-3 TMAs are preferred:

- roads with a high percentage of heavy vehicles (greater than 10%), or
- roads with a permanent speed limit of 80 km/h, or
- for mobile work operations.

The TMA driver should exit the vehicle, if safe to do so, once the TMA is deployed, this should be based on a risk assessment.

The TL-2 TMA host vehicle must have the unloaded mass and GVM of the vehicle and its test level rating clearly marked on some conspicuous part of the right-hand side of the vehicle, in letters at least 50 millimetres high and 25 millimetres wide.

Note: only Main Roads approved MASH TL-2 TMAs are permitted for use in Western Australia, the host vehicle requirements are specified in 7.1.2 of this document.

5. TRAFFIC MANAGEMENT ARRANGEMENTS

This section provides suggestive TMA Deployment Diagrams which illustrate various static work site situations and circumstances. The diagrams are included as Appendix C. The diagrams indicate the appropriate positions of TMAs and works/shadow vehicles.

Temporary speed zones may be required if workers are on foot and close to traffic (see section 5.5 of AGTTM Part 3). Speed limit signs may be displayed on vehicles for advance warning including tail vehicles which may have a TMA.

When working in live traffic lanes it is vital a risk assessment is conducted to determine the advance warning and taper lengths that will be required for the road environment. For some short-term worksites, it may be determined that a traditional merge taper will not be used due to the risks involved with implementing and removing the taper at high-speed high-volume locations.

There have been instances where vehicles have entered a worksite via the emergency lane or shoulder. As a result, static worksites on the Freeway that meet the criteria of scenario 1 in section 4 must have a blocker vehicle with TMA to prevent vehicles entering the work area from the off-road side when only closing a single traffic lane (see diagram 5 of Appendix C).

[1] If a risk assessment determines the use of the TL-2 TMA is considered appropriate the roll-ahead distance must be considered to ensure the safety of workers.

A blocker vehicle is not required when closing more than one lane of traffic for the following reasons: increased advanced warning, increased available stopping distance to the work area and reduced travel speed of road users (see diagrams 4 and 6 of Appendix C).
It is also recommended to use a second blocker vehicle (does not have to be TMA) adjacent to the worksite to prevent worksite intrusion by errant vehicles on the roadside (see diagram 7 of Appendix C).

At other locations a risk assessment shall be conducted to determine if a vehicle entering the work area is a significant risk.

Mobile works general
The provisions of AGTTM Part 4 and section 6.12 of the Traffic Management for Works on Roads Code of Practice apply for the deployment of TMAs for mobile works, as well as section 4 of this document.

Example Diagrams
No one standard Traffic Guidance Scheme can operate for every work site or for different operations at a particular site. Work site situations should be considered by the project manager during the planning stage of a project. A Traffic Management Plan prepared by a person with AWTM accreditation should be adapted to allow for site specific requirements.

Diagrams in Appendix C include use of the TMA for the following situations:

Diagram 1
TMA Deployment in Emergency Lane or Verge. Multilane one-way carriageway.

Diagram 2
TMA Deployment in shoulder or verge. Two-lane two-way road.

Diagram 3
TMA Deployment in Traffic Lane. Single lane closure (not Freeway).

Diagram 4
TMA Deployment in Traffic Lanes. Two lane closure

Diagram 5
TMA Deployment in Traffic Lane with Blocker Vehicle. Single lane closure on Freeway.

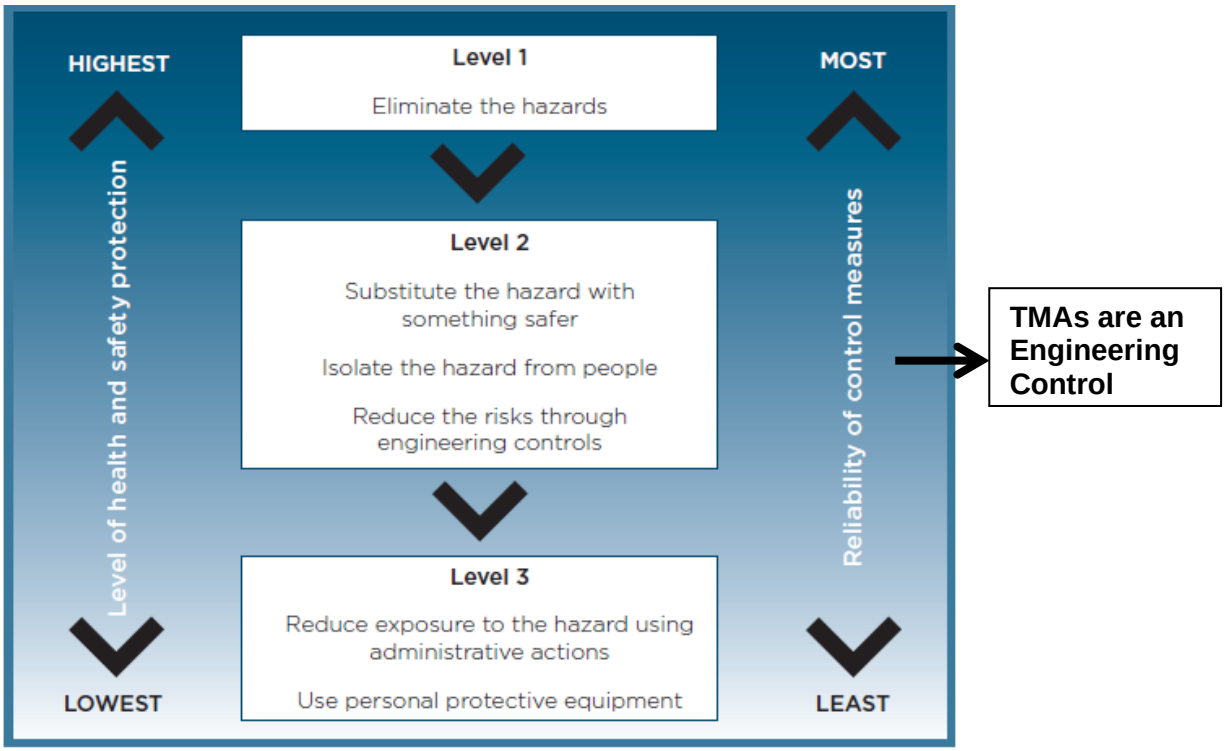
Diagram 6
TMA Deployment in Traffic Lanes with Blocker Vehicle. Three lane closure on Freeway.

Diagram 7
TMA Deployment in Traffic Lanes with Second Blocker Vehicle. Freeway.

Advance Warning VMS
On high-speed high-volume roads such as Freeways it is recommended an advance warning VMS (either TMA, vehicle or trailer mounted) is used, with Lane Status sign, should works vehicles block traffic lanes, subject to a risk assessment. This VMS is to warn drivers of the lane closure and the need to merge right or left. If using a vehicle mounted sign, if stationary for longer than 10 minutes consideration should be given for the driver to be removed from the vehicle if safe to do so, based on a risk assessment.

6. RISK MANAGEMENT

For works where it is not practicable to close the road (due to unacceptable traffic congestion or unsuitability of alternative routes) the positive physical protection provided by a TMA is both a practical short-term control and a proven level 2 safety control. TMAs are used in most states of Australia and have prevented fatalities and serious injuries during their deployment.



Limitations of TMA use

TMAs are useful on high-volume high-speed roads. However, where works are long term in nature, additional protection for workers and road users (such as road safety barriers) is often more appropriate. This is to ensure the risk of lateral worksite intrusion by errant vehicles is mitigated.

7. TECHNICAL SPECIFICATIONS

7.1 Host Vehicle

This section provides standard functional specifications for the host vehicle. This includes areas such as seating, seatbelt harnesses, masts, visibility of the host vehicle and standard control panel arrangement.

The host vehicle must conform to the following requirements (except as allowed for at clause 7.1.1 and 7.1.2):

a) In some cases, a full engineering analysis by a suitable qualified person, supported by testing where applicable, will be necessary before the modified vehicle is accepted. This testing may include determination of front axle loading when the impact attenuator unit is deployed.

b) Be approved for on road use by the Department of Transport (DoT).

c) Be a minimum of 15 tonnes GVM. (Refer to Appendix A).

d) Be a single cab truck with an automatic transmission.

e) The mounting of any fixtures are to be engineered to 20 times the weight of the fixture.

f) Be painted a distinctive bright colour. The colour should contrast with the colour of high-visibility clothing used by personnel. The vehicle should also be fitted with retro-reflective rear marking plates in line with DoT requirements.

g) Be fitted with an Automatic Impact Brake (AIB) system that, in the event of an impact with the rear of the Impact Attenuator Unit, will apply the brakes of the TMA host vehicle automatically. In the event of such incidents, it is critical to have an isolation switch or system which will allow the AIB system to be deactivated, this will allow for the impacted TMA vehicle to be removed from positions or locations that could cause an unnecessary obstruction or blockage to the roadway.

As a minimum, the AIB System must apply the brakes on all wheels of the rear axle/s of the host vehicle. It is recommended, that the AIB system be fitted, so activation of the system is automatic when the Impact Attenuator unit is fully deployed, and the host vehicle is travelling at a speed no greater than 40 km/h The AIB system must only be activated when the Impact Attenuator unit is fully deployed.

Note: *Modification of the braking system will affect ADR compliance and require approval through the DoT.*

h) Be fitted with an AS /NZS 4192 'Illuminated flashing arrow signs' approved size "C" arrow-board. The arrow board assembly must be positioned on the truck in accordance with the requirements of AS1742.3 (it is recommended the arrow board be two sided to allow the vehicle to be used for mobile works on two-lane two-way roads).

i) The arrow board and its mountings must be engineered to a standard:

- That will allow for them to withstand the forces applied during forward travel motion based on maximum speed environment for heavy vehicles when travelling to site i.e. 100km/h; and
- To withstand a force of 20 times the total weight of the arrow board and its mountings; and
- If the arrow board assembly is designed to lift and lower it must lift or lower within 15 seconds.

j) Have an 'in-cabin' control panel placed in close proximity to the operator and illuminated at night. The panel shall include methods of control for, but not limited to, the following:

- Activation of communication equipment
- Activation of Warning lights
- Activation of Arrow Board
- Raising and lowering of Arrow board if applicable
- Activation of rear-view camera
- Raising and lowering of the Impact Attenuator Unit.

k) Have cabin controlled Variable Message Signs (VMS) to further warn drivers of potential hazards and work zones in line with the TMA Work instructions. VMS displays may be pictorial and/or descriptive.

l) All seating within the TMA host vehicle that will be occupied while the TMA is deployed shall be fitted with an approved four-point harness seatbelt and mountings. Four-point harnesses are only to be used when the host vehicle is being used in attenuator mode and must be used in conjunction with the vehicle's standard seatbelts.

All new vehicles must be fitted with seats equipped with an integrated harness.

m) Prevention of Rearward Seat Collapse.
To reduce the likelihood of rearward seat collapse in the event of a substantial rear impact:

1. The driver's seat (and any other seat that will be occupied) and seat mountings must be of sufficient strength to prevent rearward seat collapse when subjected to a loading of 740 ± 20 daN (*daN - decanewton, a metric unit of force equal to 10 newtons*) supplemented by a force equal to 6.6 times the mass of the complete seat

Note: *This loading must be applied horizontally rearward through the centre of mass of the seat/occupant combination and must be sustained for at least one second,*

Or;

2. An engineered and certified device, designed to restrict rearward seat collapse when the driver's seat and seat mountings are subjected to the loading described in sub clause 1) *see above*, must be installed behind the driver's seat.

Note: *The device should not increase the likelihood of injury to the seat occupant.*

Reference Appendix B for further information on rearward seat collapse.

n) Be fitted with high strength headboards to prevent debris from crashing through the cabin in the event of an impact.

Where a headboard is not practical other cab protection that has been engineered and certified to protect occupants from debris is acceptable.

o) Loose objects are not to be carried on the back of the attenuator while it is in attenuator mode unless they are secured in lockers or so that the engineered attachments are capable of safely restraining 20 times the weight of the object.

This particularly applies to 1000 litre bulk paint containers carried for line marking works. We discourage water as ballast and bulk paint containers being consumable are not suitable for ballast.

p) The seat is to be fitted with an adjustable headrest to prevent operator whiplash during an errant vehicle impact.

q) Be fitted with a minimum of two flashing yellow lamps positioned on the vehicle in accordance with the requirements of AS1742.3.

r) Have mounting facilities for signs to be mounted to the tailgate or headboard that are secure and safe; that will not create dangerous projections, obscure lighting or registration plates, or cause the vehicle to exceed statutory dimension limits.

s) As a minimum be fitted with communication equipment that will enable simultaneous and independent communication to all relevant personnel, e.g. - 2 (two) 5 watt 41 channel UHF radios, operating on separate channels.

t) Be equipped with an air horn of sufficient intensity and volume to be easily heard by workers carrying out their normal duties to warn of a vehicle approaching at a dangerous speed or on the off road side of the TMA.

u) Have an independent power back up system installed that will adequately cater for all auxiliary equipment associated with use of the host vehicle as a TMA. For example, this may include the installation of auxiliary batteries or power packs.

v) Be fitted with a camera to allow the TMA operator to observe traffic approaching from the rear.

Note: *Consideration should be given to the use of cameras suitable for both day and night operations, and installation of an associated data recording device to record vehicles approaching from potential impact areas.*

7.1.1 Special Build Incident Response Vehicles

The Main Roads Incident Response Service (IRS) deploys specially trained, mobile road crews on Perth's freeways to assist with the quick and safe removal of broken down vehicles, debris and other obstructions, helping to restore normal traffic conditions as quickly as possible. As part of this service Main Roads uses a special build Impact Protected Push Vehicles (IPPV).

To protect the occupants of the IPPV, Main Roads will mount an Impact Attenuator Unit to these vehicles. They will only be designed and built with MRWA approval and the approval from the DoT. A risk assessment was undertaken on TMAs and found that they were not suitable for the IRS role due to:

- Inadequate manoeuvrability on site at incidents.
- Inability to respond within designated response times.
- Inability to maintain a Cold side exit (may be dual cab where required).
- Inability to travel to incident site in Emergency Lane (width restrictions).

Having an IRS vehicle that met all of the TMA host vehicle requirements would not allow the incident response service to be delivered with an impact attenuator unit, thereby putting the occupants, as well as road users, at more risk of incidents.

Therefore, these special build IPPV are required to meet all the Host Vehicle requirements of 7.1 with the following exemptions:

- Will not be required to have 15 tonne GVM, however must be at least 9 tonnes tare;*
- The vehicle can be a dual cab;
- Do not require an air horn to be fitted;*
- Do not require independent power back up (as unlike normal TMAs for roadworks, an IPPV will not be required to remain off and stationary for long periods of time).

**Items not exempt for IPPV's licenced after publication of this Code.*

These vehicles will not be referred to as a Truck Mounted Attenuator (TMA) but will have some characteristics of a TMA. When requiring these special build vehicles, the builder and designer shall be made aware of the requirements in this Code, and they will be referred to as IPPVs. The unit shall be marked 'NOT A TMA' in letters at least 50 mm high.

Note: Operators of IPPVs must obtain accreditation in Operate Truck Mounted Attenuator (see section 8).

7.1.2 MASH TL-2 Host Vehicle Specifications

TL-2 TMAs must meet all Host Vehicle requirements outlined in section 7.1; however, the Host Vehicle is exempt from the following:

- Is not required to have 15 tonne GVM. The host vehicle must be a heavy vehicle, with GVM of 4,501 kg or more (rerated light vehicles or ballast is not permitted). The combined mass of the TMA host vehicle (including all host vehicle requirements detailed above) and attenuator unit must be at least 3,300 kg (no additional ballast is permitted);
- Is not required to have automatic impact brakes;
- Is not required to have seat mountings engineered to prevent rearward seat collapse, as per section 7.1 (m).
- May be fitted with an Illuminated flashing arrow signs approved size "B" for lower speed environment, i.e. C size not required.

TL-2 TMAs are only used:

- Under the conditions outlined in section 4.4, and
- In accordance with the operational procedures in section 7.6 below.

7.2 Impact Attenuator Unit Certification

Impact Attenuators Units shall meet all mandatory and optional testing requirements of the following:

- NCHRP 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features (1993) for Impact Attenuator Units built before the introduction of the following standard.
- AASHTO Manual for Assessing Safety Hardware (MASH) for all other Impact Attenuator Units.

Typical form of evidence for compliance would be or may include United States of America Federal Highway Administration (FHWA) acceptance letter report of that particular make and model.
As of April 2018, all new Impact Attenuator Units shall be submitted to the Austroads Safety Barrier Assessment Panel (the Panel). All submissions received by the Panel must be in accordance with AASHTO's MASH guidelines or an equivalence rating to MASH in accordance with AS/NZS3845 Parts 1 and 2.

Impact Attenuator Units that do not meet the MASH guidelines will no longer be accepted by the Panel after 31 December 2020.

Main Roads will work with relevant stakeholders to determine an appropriate transition period to the MASH requirements and allow current approved Impact Attenuator Units to continue to be used after 31 December 2020 to ensure current TMA owners are not financially disadvantaged.

TMAs that have not previously been licenced by the Western Australian Department of Transport must have impact attenuator units that have met MASH guidelines and been approved for use by Main Roads.

7.2.1 Impact Attenuator Unit Test Level Ratings:

The following table indicates Impact Attenuator Unit ratings.

Rating	**Speed**
TL2	70 km/h
TL3	100 km/h

Impact Attenuators Units shall have their test level rating clearly displayed on both side panels of the unit. The display shall be made up of a panel with black lettering (e.g. TL3) on a white 210mm x 300mm background.

7.3 Truck Mounted Impact Attenuator Unit

Host vehicle shall be as detailed in section 7.1.

a) Impact Attenuator Units shall be assembled and fitted to the host vehicle in accordance with the manufacturer's specifications.

b) All units to be fitted with flashing beacons that will be visible from all angles, the lights should have a variable flashing pattern. The objective being to ensure the TMA is visible to vehicles approaching from behind or in front of the TMA.

c) The rear surface of the Impact Attenuator Unit when deployed must consist of Class 1W retro reflective red diagonal striping at least 100 mm wide, on a white **non**-retro reflective background.

7.3.1 Truck Mounted Impact Attenuator Unit Configuration

In addition to the requirements above the following apply:

a) Dedicated yellow flashing light to automatically provide notice of the Impact Attenuator Unit being raised or lowered.

b) Automatic Impact Brake micro-switch is to be fitted to the rear of the Impact Attenuator Unit to activate the host vehicle brakes in the event of an impact.

c) In cabin and external audible alarms to automatically provide notice of the Impact Attenuator Unit being raised or lowered.

d) Travel lock system installed that prevents inadvertent deployment of the Impact Attenuator Unit.

e) When not deployed an adhesive type (black on yellow) warning sign stating: 'Caution keep clear this unit may lower at any time' must be visible from the rear of the Impact Attenuator Unit.

7.4 Trailer Mounted Attenuators

Due to issues such as the potential for gating into adjacent traffic lanes, the difficulty of correctly attaching them and issues with manoeuvrability Trailer Mounted Attenuators are not permitted in WA.

7.5 TMA Repairs, Modifications and Inspections

a) After an impact or crash that may affect the integrity of the host vehicle and/or impact attenuator, TMAs and attachments must be inspected by a competent person.

b) All repairs and/or modifications to TMAs and attachments must be carried out by a competent person.

c) Following repair or modification TMAs and attachments must be inspected and have certification documentation prepared by a competent person.

d) TMAs and attachments must be inspected at least once each year and have certification documentation prepared by a competent person.

e) TMAs must be inspected for fatigue cracking in the mounting brackets at suitable intervals or as specified in the manufacturer’s manual by a competent person. These inspections must be recorded in the unit’s maintenance logbook

7.6 Operational Procedures

The following shall be observed when operating a TMA:

a) When performing the duties of the TMA all occupied seating must have the same level of occupant protection as the driver’s seat.

b) The attenuator may be lowered into operational position while stationary and clear of traffic lanes or once in moving convoy at a maximum speed of 40km/h (the operator must ensure no vehicles are in the lowering area of the attenuator)

c) While TMAs are deployed, and the host vehicle is occupied all occupants must use the four-point harness seat belt. At longer term stationary work sites operators may exit the host vehicle when the TMA has been deployed and the site is set up. Operators exiting the vehicle must do so in a safe manner, i.e. ensure it is safe to exit using the rear camera and/or mirrors, ensure gaps in traffic, move away from the vehicle as soon as possible, limit entering and exiting the vehicle as much as possible, etc.

d) When the Impact Attenuator Unit is in the deployed or lowered position, the vehicle may only travel within its own lane or carry out lane-changing manoeuvres in the same direction. The Impact Attenuator Unit must be raised when carrying out all other manoeuvres.

e) TMAs deployed as stationary barrier vehicles are to be parked with brakes on and with wheels directed straight ahead. Directing the steering to one side can result in the TMA rolling when impacted or being directed into adjacent traffic lanes.

f) The Impact Attenuator Unit must only be in the deployed/lowered position when the TMA is engaged at an approved road work site, event or incident. This must include the preparation and disassembly of an approved Traffic Management Plan.

7.7 Traffic Control Devices

All traffic control devices are to conform to the requirements of AS1742.3 and the Traffic Management for Works on Roads Code of Practice.

7.7.1 Vehicle Mounted Signs and Devices

All vehicle mounted warning devices must be in accordance with the requirements contained in AS1742.3 and Traffic Management for Works on Roads Code of Practice. This includes all signs, illuminated flashing arrow sign and flashing yellow lamps.

- Illuminated Flashing Arrow Sign

Flashing yellow lamps may be used in conjunction with this sign provided that the lamps are either appropriately shielded or laterally or vertically displaced from the edge of the sign to avoid visually corrupting the arrow shape or its directional effect.

It is recommended to have an arrow on both sides of the vehicle so it can be used for mobile works on two-way two-lane roads.

- Variable Message Sign

All Portable Variable Message Signs must meet relevant Australia Standards, comply with applicable DoT requirements such as ADR, meet registration requirements and be approved for on road use.

7.7.2 Advance Warning Vehicles

Advance Warning Vehicles warn and inform of changes to traffic conditions ahead and give motorists time to adjust their driving patterns.

Advance warning vehicles shall have 'B' size arrow board or variable message board. All signs must be securely fixed to the advance warning vehicle.

8. QUALIFICATION CRITERIA FOR TMA OPERATORS

It is mandatory to conduct training in TMA operation with a MRWA approved training provider and gain an Operate Truck Mounted Attenuator accreditation before operating a TMA.

Mandatory prerequisites:

- an Australian Qualification Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIICOM201D – Communicate in the workplace, or equivalent (or the replacement unit of competency if and when applicable);
- an Australian Qualification Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIIRTM301D – Operate a truck or trailer mounted attenuator, or equivalent (or the replacement unit of competency if and when applicable);
- hold a current and valid heavy vehicle licence of a suitable class to operate the TMA;
- documentary evidence of at least 80 hours experience operating heavy vehicles in the last 6 months;
- hold a valid Work Safe WA Construction Safety Awareness Training card;
- hold a current MRWA Basic Worksite Traffic Management Accreditation;
- documentary evidence of at least 50 hours practical experience in traffic management in the last 6 months.

Note: Operators of IPPV will be required to hold the accreditation but may be offered exemptions for traffic management experience and/or heavy vehicle operation experience. Exemptions shall be obtained from the Main Roads WA Road Safety Branch.

APPENDIX A

15 Tonne Gross Vehicle Mass (GVM) Requirement for TL-3 TMA Host Vehicle

Critical to the development of a TMA that affords protection to the public, the road workers and the TMA operator, is the selection of the host vehicle. The vehicle must be appropriate for the use intended and also comply with all legislative requirements.

There are a number of requirements that affect the selection of the host vehicle. A discussion of critical requirements follows.

Minimum Tare Mass
For acceptable impact performance, minimum tare mass requirements for host vehicles are set by the manufacturers of impact attenuator units. The four currently available impact attenuators have minimum host vehicle tare mass requirements of:

- 7.3 tonnes (Safe Stop)
- approximately 9.07 tonnes (20,000 lbs) (Scorpion).
- 8.5 tonnes (Verdegro Blade)
- 6.804 tonnes (Scorpion II)

The host vehicle tare mass is the mass of the truck with all the components necessary for operation as a TMA.

Weight Distribution
To enhance the effectiveness of the Automatic Impact Braking System (AIB) the rear axle/s should carry a significant proportion of the total TMA mass.

Use of Ballasting
The use of ballasting is discouraged. The mounting points of all attachments to a TMA host vehicle are required to withstand a force of twenty times the mass of the attachment. While the attachment of the ballasting to the truck body may meet this requirement, the attachment of the body with ballast to the chassis is unlikely to meet the twenty times mass requirement without significant modification to the mounting points on both the body and to the truck chassis.

Chassis Size and Strength for Impact Attenuator Unit Mounting
Under impact the loads imposed on an impact attenuator unit are transferred through the mounting assembly into the chassis of the truck. The truck chassis must be of a size that allows mounting of the impact attenuator unit in accordance with the manufacturer's specifications. The truck chassis must also be of sufficient strength to absorb applied loads without significant failure or distortion.

Conclusion
It is likely that TL-3 TMA host vehicles with a manufacturer's gross vehicle mass (GVM) rating of at least 15 tonnes will meet the above critical requirements.

Vehicles with a lesser GVM rating are not as likely to meet the above critical requirements and must be engineered and certified to meet the requirements listed above.

APPENDIX B

Prevention of Rearward Seat Collapse.

Background

Qld Transport and Main Roads experienced a TMA incident where the driver's seat failed in a rearward direction. The drivers head hit the rear of the cabin and the driver also suffered back injuries which have permanently prevented his return to work.

Rearward Seat Collapse

The purpose of this requirement is to reduce the likelihood of rearward seat collapse in the event of a substantial impact to the rear of a TMA. This will reduce the likelihood of injury to a TMA occupant.

The purpose of this requirement may be achieved by either of two methods:

1. By design or testing, determine that the seat and mountings are of sufficient strength to withstand in the rearward direction, similar loading to that applied to the seat and seat mountings in a forward direction for Australian Design Rules (ADR) compliance.

2. By fitting a device behind the seat to restrict rearward seat collapse when the same loadings are applied in a rearward direction.

The rearward loading requirements are based on ADR 5/05 requirements.

ADR 5/05 relates to seat belt anchorage strength required to restrain an occupant in a frontal impact. In a rear impact the seat belt has no effect and rearward movement of the occupant is restrained by the seat structure and seat mountings only.

The TMA Code requirement is intended to afford a seat occupant a similar level of protection in the event of a rear impact that the ADRs provide in a frontal impact.

ADR 5/05 requires that for heavy goods vehicles (GVM > 12t) with lap belt anchorages located wholly within the seat structure the seat and the belt anchorages must withstand the following loading in the forward direction:

A test load of 740 ± 20 daN supplemented by a force equal to 6.6 times the mass of the complete seat.

The TMA Code requirement imposes the same loading in a rearward direction to simulate the effects of a rear impact.

Evidence of compliance with these rearward loading requirements can be either by design verification or by representative test results. This evidence would give blanket cover (type approval) to that seat/vehicle combination and the vehicle/seat supplier or verifying engineer would supply certification of same.

If evidence of compliance with additional rearward loading requirements is not available, a device to prevent rearward seat collapse would be fitted.

***Note**: ADRs require that to test seat and seat anchorage strength, a rearward longitudinal deceleration of 20g is applied to the whole shell of the vehicle, without an occupant.*

Given this requirement and that the seat assembly is certified to withstand applied loads in a forward direction, the original equipment seats may meet the TMA Code requirements.

APPENDIX C
TMA DEPLOYMENT EXAMPLE DIAGRAMS

APPENDIX C
TMA DEPLOYMENT EXAMPLE DIAGRAMS

Diagram 1: Static Works - TMA Deployment in Emergency Lane or Verge
Multilane one way carriageway

The TMA, works vehicles or works personnel shall not intrude trafficked lanes.
Diagram does not include all required signs and devices (e.g. speed reduction)

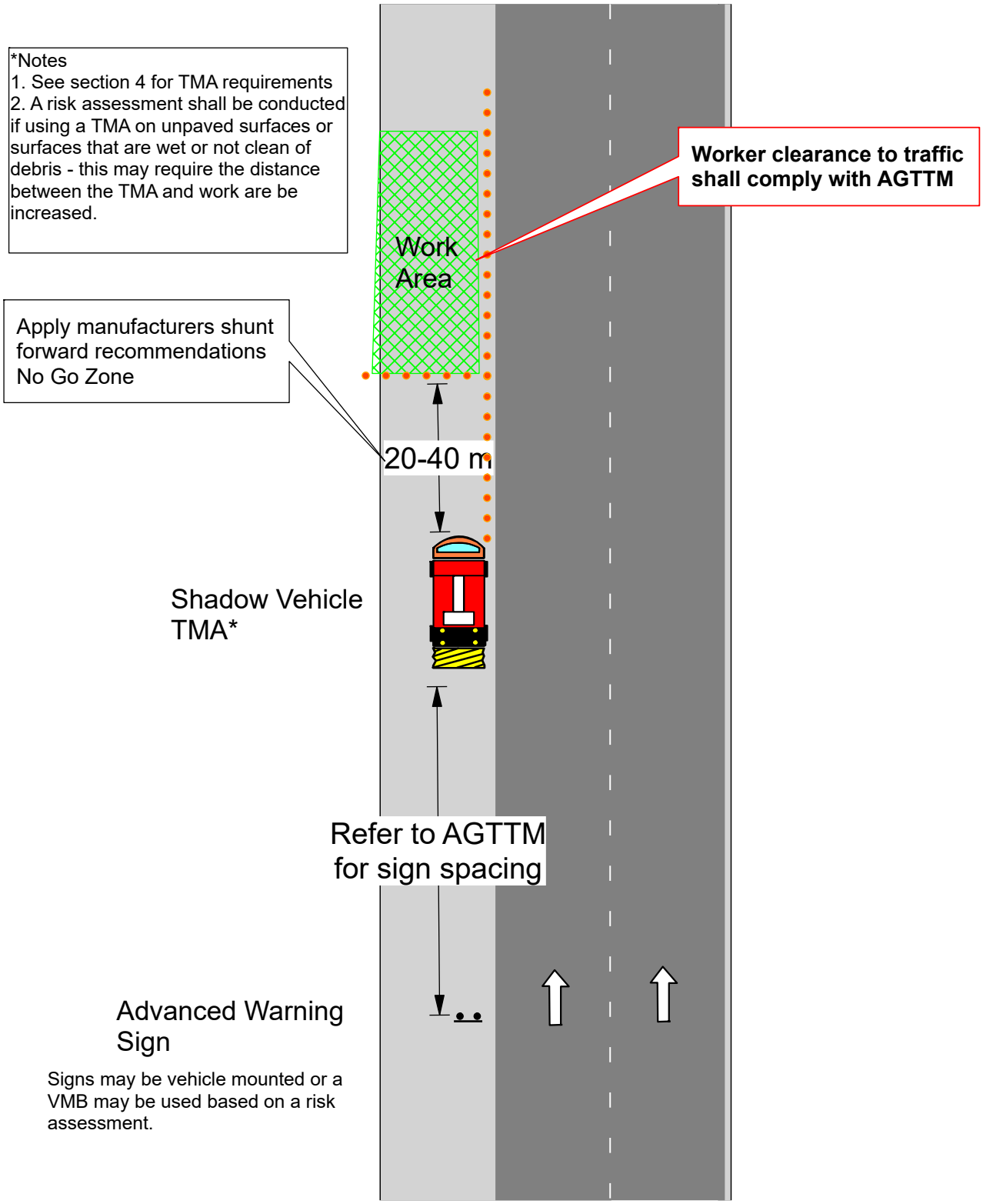


Diagram 2: Static Works -TMA Deployment in Shoulder or Verge Two lane two way road

The TMA, works vehicles or works personnel shall not intrude trafficked lanes.
Diagram does not include all required signs and devices (e.g. speed reduction)

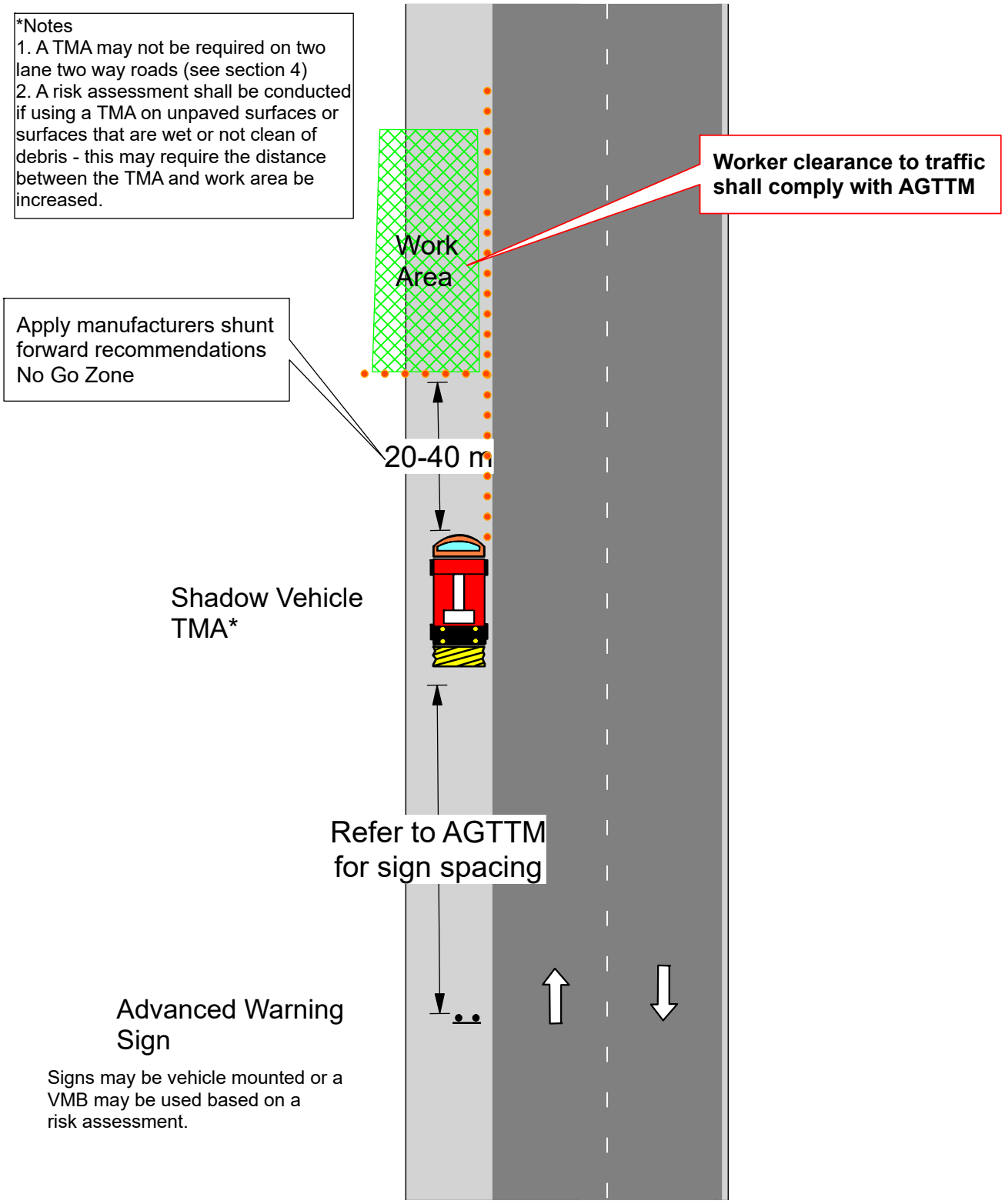


Diagram 3: Static Works - TMA Deployment in Traffic Lane Single lane closure (not Freeway)

Diagram does not include all required signs and devices (e.g. speed reduction, merge taper, etc.)

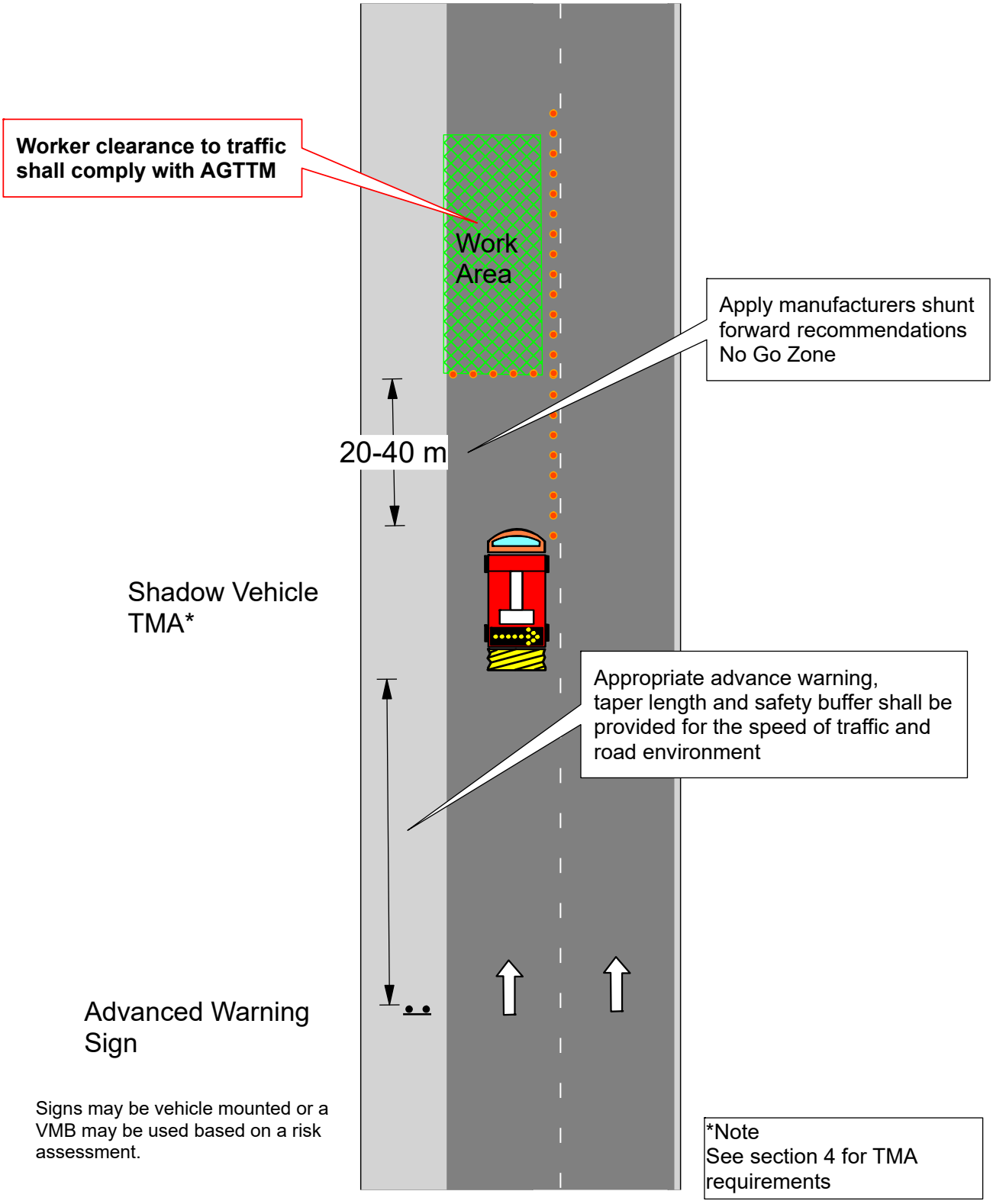


Diagram 4: Static Works - TMA Deployment in Traffic Lanes
Two lane closure

Diagram does not include all required signs and devices (e.g. speed reduction, merge taper, etc.)

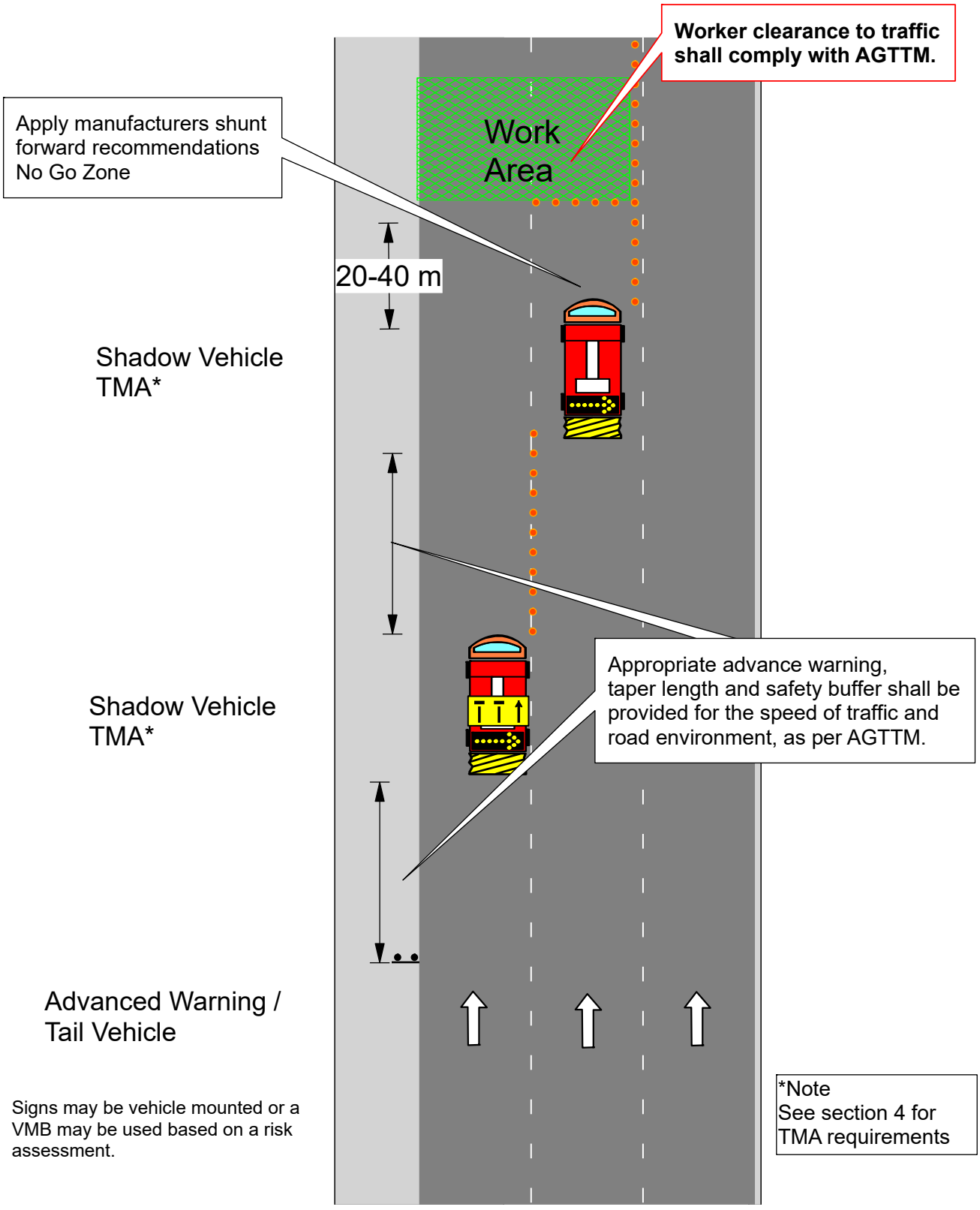


Diagram 5: Static Works - TMA Deployment in Traffic Lane with Blocker Vehicle
Single lane closure on Freeway

A blocker vehicle shall be used when closing a single lane to help prevent road users from cutting down the off-road side of the TMA and entering the worksite.
Diagram does not include all required signs and devices (e.g. speed reductions, merge taper, etc.)

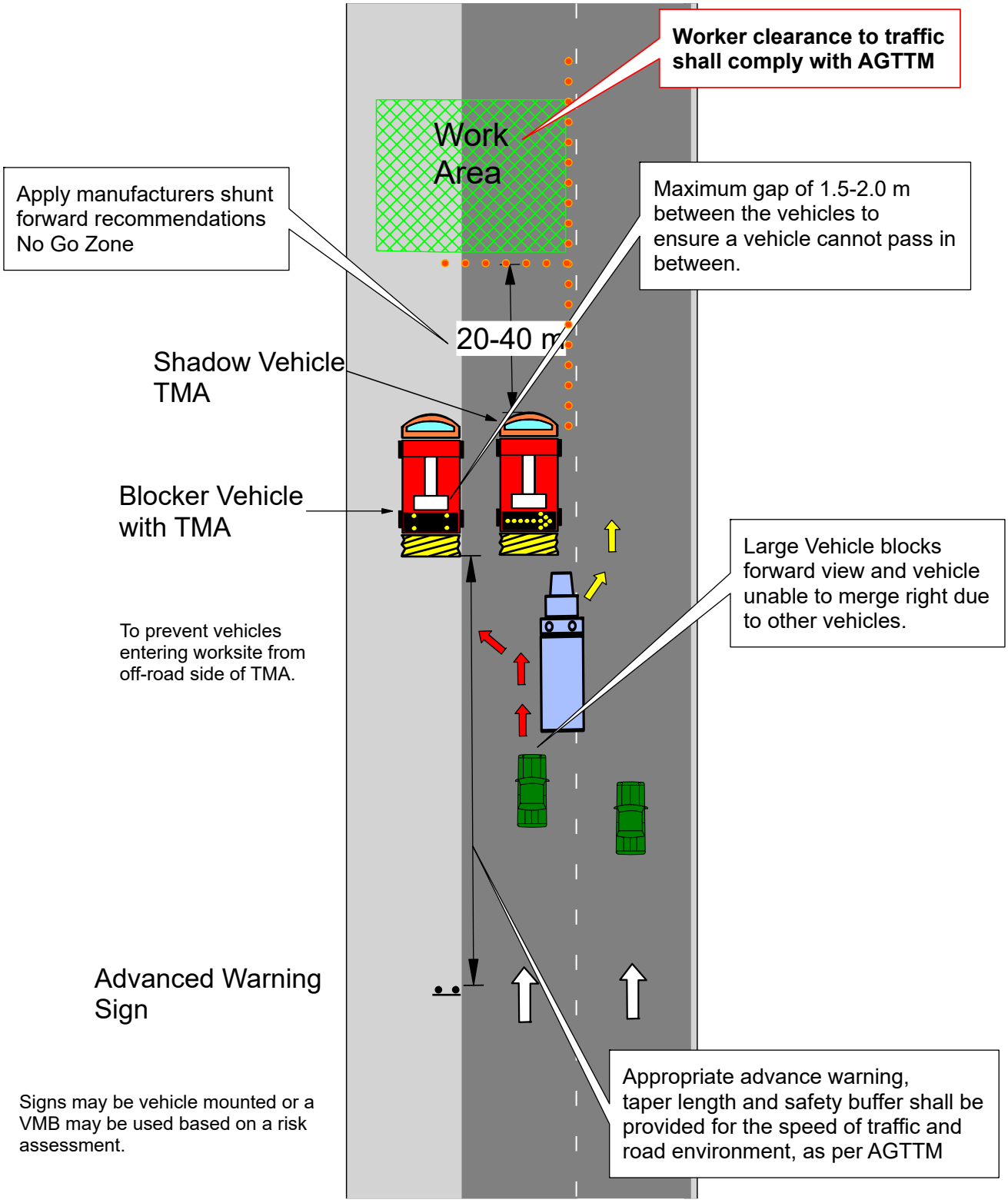


Diagram 6: Static Works - TMA Deployment in Traffic Lanes
Three lane closure on Freeway

Diagram does not include all required signs and devices (e.g. speed reduction, merge taper, etc.)

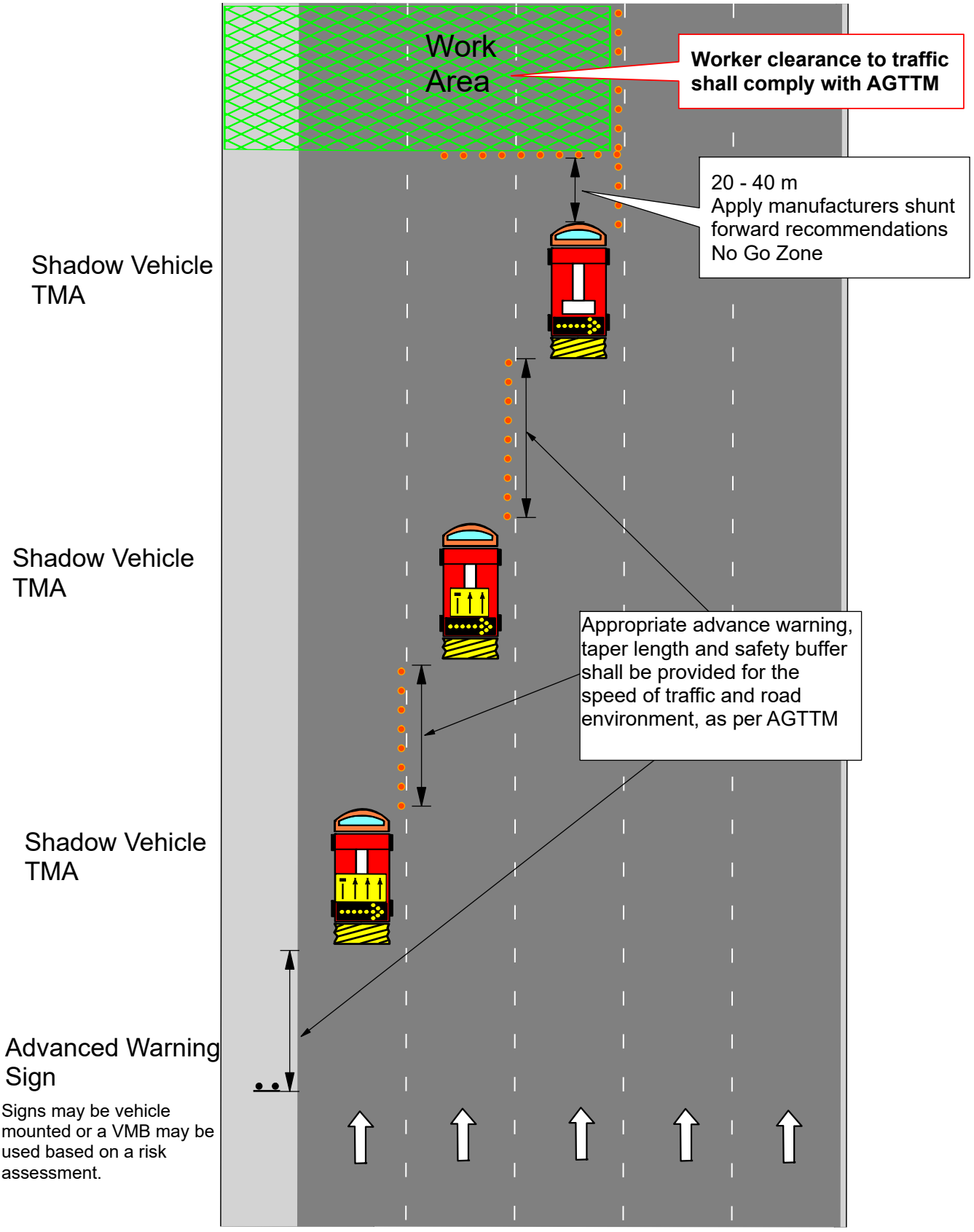
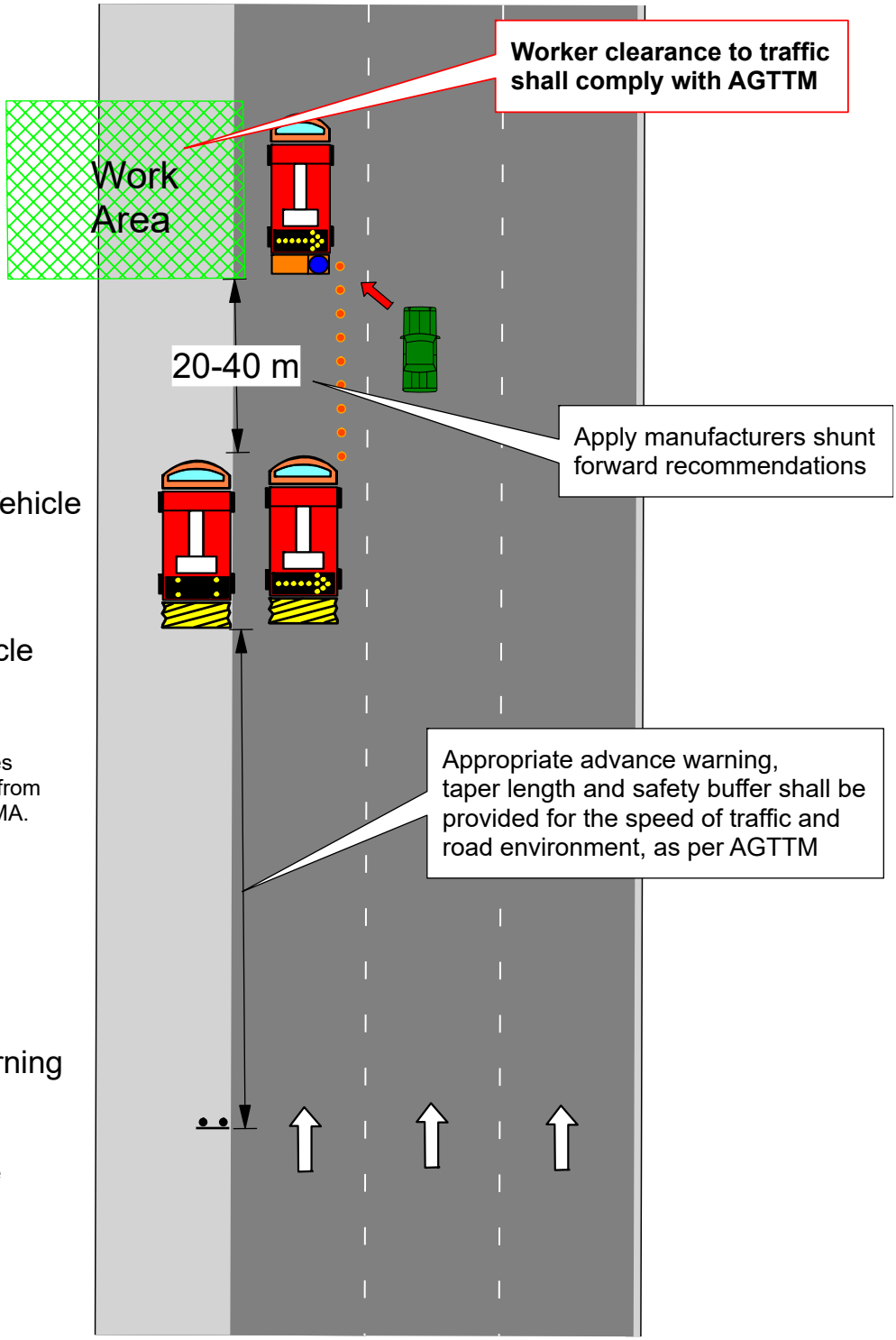


Diagram 7: Static Works -TMA Deployment in Traffic Lane with Second Blocker Vehicle - Freeway

In addition to the blocker vehicle used to help prevent road users from cutting down the off-road side of the TMA an additional vehicle may be used to prevent errant vehicles entering from the road side.
Diagram does not include all required signs and devices (e.g. speed reductions, merge taper, etc.)



Appendix D - Indicative Safe Work Method Statements for TMA Operation
Example Work Instruction

Using Impact Attenuator to set up Lane Closure on Multi Lane Road

Steps	Hazard	Additional PPE	Notes/Controls
• Consider potential hazards and control measures. • Undertake and complete a risk assessment.	Hit by fast moving vehicle		• No work to be undertaken during rain periods or poor visibility • Undertake mandatory daily pre-start meeting prior to commencing. • Do not allow personnel to cross the road on foot • Consider the speed and road environment. • Consider lane closure restrictions • Consider police attendance and/or speed enforcement
Ensure plant has been serviced and adjusted	Defective plant		• Perform pre-start check of vehicle and fittings as (lights, attenuator, horn, oil, water, etc.) • Complete defect notice • Fill in log book
Specify appropriate traffic control strategy to suit work area.		High Visibility Garments	Refer to TMP
All vehicles shall have a reliable communication system	Comms system not working		All vehicles fitted with UHF radios, test communication at the time of pre-start check.
Notes specific to Barrier Truck and driver • While the attenuator is deployed and the host vehicle is occupied all occupants shall use the four point harness seat belt. • At longer term worksites when the site is set up and the TMA is deployed the driver may exit the vehicle. Operators exiting the vehicle shall do so in a safe manner, i.e. ensure it is safe to exit using the rear camera and/or mirrors, use gaps in traffic, move away from the vehicle as soon as possible, limit number of times exiting and entering vehicle, etc. • No personnel are to remain behind, beside or within the No Go of the barrier truck. • The barrier truck driver shall use air horns fitted to the truck to highlight a dangerous situation to warn personnel in the work zone. • Once the procedure commences the driver of the barrier truck in consultation with the site supervisor has the authority to order all vehicles off the road if the driver believes the situation has become dangerous.	Struck by vehicle		Ensure correct buffer distance
Determine the work area from works order or supervisors instructions			Consider the site risk assessment including inclement weather, traffic flow, speed environment and poor visibility etc.
Preparation for Lane Closure • Work vehicles to be positioned in front of barrier vehicle a suitable distance before work site • All vehicles shall activate beacon lights and/or arrow boards • The attenuator may be lowered into operational position while stationary and clear of traffic lanes or once in moving convoy at a maximum speed of 40km/h (the operator shall ensure no vehicles are in the lowering area of the attenuator)	Vehicle crash and lowering attenuator onto vehicle		• Flashing beacon lights and/or arrow boards to be used. • All vehicles to stay in constant contact via UHF radio. • Barrier truck driver to use discretion when lowering attenuator.

Establish traffic control • Traffic control is to be in accordance with Traffic Management Plan. • Barrier Truck to shadow traffic control vehicle while approach signs are being erected. This may include temporarily positioning the barrier vehicle in the traffic lane to protect the workers erecting signs. • Barrier Truck to shadow traffic management personnel by being positioned in the traffic lane while traffic cones in the taper are being placed. • Barrier Truck then follows in the closed lane as the traffic cones are placed along the lane line.	Struck by passing vehicles Hit by debris	High visibility garments	• Traffic control as per TMP • Barrier vehicle with attenuator in position • Beacon lights and/or arrow boards in operation • All vehicles to stay in constant contact via UHF radio • Barrier truck driver to sound air horn if unsafe traffic situation arises • Ensure that approaching traffic has minimum 200m sight distance to the barrier truck • Consider police attendance and/or speed enforcement • Do not allow personnel to cross the road on foot
Do the work • When the lane has been closed the barrier truck may be positioned in the closed lane. • Within a lane closure the barrier truck driver may safely exit the vehicle to work with the crew ensuring they exit in a safe manner.	Struck by vehicle		Refer to site risk assessment
Remove Traffic Control • Traffic control devices shall only be removed when the work area has been packed up. • To remove a taper the barrier truck should drive around to the start of the taper as with setup. • Barrier truck protects the closed lane while the taper is removed. • When re-entering traffic the vehicles shall accelerate in the lane, deactivate beacon lights and arrow boards and continue as part of general traffic. • The attenuator may be raised at a maximum speed of 40 km/h	Vehicle crash		All vehicles to stay in constant contact via UHF radio

Using Truck Mounted Attenuator in Mobile Works on Multi Lane Roads

Steps	Hazard	Additional PPE	Notes/Controls
• Consider potential hazards and control measures • Undertake and complete a risk assessment.	Hit by fast moving traffic		• No work to be undertaken during rain periods or poor visibility • Undertake mandatory daily pre-start meeting prior to commencing • Consider the speed and road environment • Consider lane closure restrictions • Do not allow personnel to cross the road on foot • Consider police attendance and/or speed enforcement
• Ensure plant has been serviced and adjusted	Defective plant		• Perform pre-start check of vehicle and fittings as per PHS Total Fleet Management requirements (lights, attenuator, horn, oil, water, etc.) • Complete defect notice • Fill in log book
• Specify appropriate traffic control strategy to suit work area.		High Visibility Garments	Refer to TMP
• All vehicles shall have a reliable communication system	Communication system not working		All vehicles fitted with UHF radios Test communications at the time of pre-start check

Notes specific to Barrier Truck and driver • The barrier truck driver shall not exit the vehicle while in open traffic lanes. • No personnel are to remain behind, beside or within the No Go of the barrier truck. • The barrier truck driver shall use air horns fitted to the truck to highlight a dangerous situation to warn personnel in the work zone. • Once the procedure commences the driver of the barrier truck in consultation with the site supervisor has the authority to order all vehicles off the road if the driver believes the situation has become dangerous.	Struck by vehicle		Ensure correct buffer distance
• Determine the work area from works order or supervisors instructions			Consider the site risk assessment including inclement weather, traffic flow, speed environment and poor visibility etc.
Preparation for Lane Closure • Work vehicles to be positioned in front of barrier vehicle a suitable distance before work site. • All vehicles shall activate beacon lights and/or arrow boards. • Proceeding to work site all vehicles to remain as a convoy. • The attenuator may be lowered into operational position while stationary and clear of traffic lanes or once in moving convoy at a maximum speed of 40 km/h (the operator must ensure no vehicles are in the lowering area of the attenuator)	Vehicle crash Lowering attenuator onto vehicle		• Flashing beacon lights and/or arrow boards to be used. • All vehicles to stay in constant contact via UHF radio. • Barrier truck driver to use discretion when lowering attenuator
Establish traffic control • Traffic control is to be in accordance with the Traffic Management Plan. • One person is to act as the team leader co-ordinating the traffic control. They are to take the leadership role for all aspects associated with traffic control. • Impact Attenuator and work vehicle to slow down gradually to a stop as they approach the work site and if all tail vehicles are in position work may commence. • If parked on the shoulder, once tail vehicle is in position the Impact Attenuator is to move out into the trafficked lane. • Once the Impact Attenuator is positioned in the trafficked lane the work vehicle and workers may move into the closed lane. • Note that a minimum distance of 20 metres (depending on manufacturer shunt forward recommendation) is to be maintained between the work zone and the shadow vehicle. • The handbrake is to remain off when the Impact Attenuator is acting as the tail vehicle. • The barrier truck driver shall not exit the vehicle. • The work crew shall carry out works as per the appropriate works procedure	Struck by passing vehicles Hit by debris	High visibility garments	• Traffic control as per TMP. • Barrier vehicle with attenuator in position • Beacon lights and/or arrow boards in operation. • All vehicles to stay in constant contact via UHF radio. • Barrier truck driver to sound air horn if unsafe traffic situation arises. • Ensure that approaching traffic has minimum 200m sight distance to the barrier truck • Consider police attendance and/or speed enforcement • Do not allow personnel to cross the road on foot
Remove Traffic Control • All vehicles in the traffic lanes are to move away onto the shoulder or accelerate to combine with the passing traffic. • Work vehicles and barrier truck are to accelerate in their lane. Work vehicles	Vehicle crash		All vehicles to stay in constant contact via UHF radio

deactivate lights and arrow-boards. Barrier truck operator lifts attenuator before deactivating lights and arrow-board.			

APPENDIX E
MAP OF METROPOLITAN REGION

STATE ROAD NETWORK
Metropolitan Region
RESPONSIBILITY AREA MAP

STATE ROADS
IN RESPONSIBILITY AREA
METROPOLITAN REGION

H001 ALBANY HWY
H002 MELVILLE-MANDURAH HWY
H004 BRAND HWY
H005 GREAT EASTERN HWY
H006 GREAT NORTHERN HWY
H009 SOUTH WESTERN HWY
H012 LEACH HWY
H013 CANNING HWY
H014 STIRLING HWY
H015 KWINANA FWY
H016 MITCHELL FWY
H017 TONKIN HWY
H018 ROE HWY
H019 GREAT EASTERN HWY BYPASS
H020 GRAHAM FARMER FWY
H021 REID HWY
H022 WIMBLEDON-RUPERT STREET LINK
H023 ARMADALE RD
H025 COCKBURN RD
H026 GUILDFORD RD
H027 RIVERVALE-WATTLE GROVE LINK
H028 KARRINYUP-MORLEY HWY
H029 MARMION AV
H030 PORT BEACH RD
H031 QUEEN VICTORIA ST
H032 SOUTH ST
H033 TOODYAY RD
H034 TYDEMAN RD
H035 WANNEROO RD
H036 WEST COAST HWY
H037 GARRATT ROAD BRIDGE
H038 THOMAS RD
H039 STEPHENSON HWY
H052 BROOKTON HWY
H056 BEACH ST
H065 HORRIE MILLER DR
H066 AIRPORT DR
H068 KWINANA BEACH RD

M010 CHIDLOW-YORK RD
M026 TOODYAY RD
M045 INDIAN OCEAN DR

1. LG:111
2. LG:127
3. LG:122
4. LG:115
5. LG:121
6. LG:117

LG:110 LG:131 LG:109 LG:112 LG:125 LG:128 LG:124 LG:113 LG:129 LG:126 LG:119 LG:114 LG:118 LG:104 LG:103 LG:105 LG:107 LG:108 LG:101 LG:102 LG:106

METRO REGIONAL OPERATIONS
DON AITKEN CENTRE
HEAVY VEHICLE OPERATIONS
MATERIALS ENGINEERING

LGA LGA

LEGEND

Existing Future
- Highway (State Road)
- Main (State Road)
- State Road Outside Responsibility Area
- Local Road
- Regional Boundary
- SHIRE OF KULIN — Local Government Boundary
- Main Roads Office / Local Government Centre / Other Town/Locality — Town/Locality
- 300 — SLK Hatch/Measure

0 5 10 15
Kilometres

MAP INFORMATION
The focus of this map is the pictorial representation of State Roads in each Main Roads' Regional Responsibility Area.
This information is sourced from IRIS (Integrated Road Information System).

All other features on this map are included for pictorial representations only and should not be used where accuracy is a consideration.

Geographic Coordinate System: Geocentric Datum of Australia 1994 - Projection MGA Zone 50
Original Page/Map Size A3
Project: ...GIS_projects\annual\StateRoadNetworkMaps\MRWA_Online_Maps_2019

THE GOVERNMENT OF WESTERN AUSTRALIA
mainroads WESTERN AUSTRALIA

Drawing No: MRWA_Online_Maps_2019_RA
Data Source: IRIS (C2441)
Data Currency: January-2021 Date of Print: 06-Jan-2021
Name: DWG1221-0184-00 - Metro - No Local Rds