HIGHWAYS AGENCY

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Generic Safe Method for placing TTM on MM-ALR

Summary

1. This paper describes a generic safe method for setting up and taking down Temporary Traffic Management (TTM) on Managed Motorway – All Lane Running (MM-ALR) schemes.
2. An understanding of how the task of setting up and taking down TTM within MM-ALR has been gained through consultation with the first MM-ALR schemes (Mouchel and Connect Plus). The method relies upon several elements, which can be categorised into two areas:

   i. *Design Features:*

   The key elements being:

   - *Fixed Taper Positions* (FTP) - For each carriageway, identify fixed points at which a cone taper can safely be installed. The FTP will be used as the datum for lane closures to enable safe maintenance at any point downstream of the fixed taper datum (and upstream of the next FTP).
   - *Signing* - For each FTP the scheme should design advance signs in accordance with the current Chapter 8 guidance .

   ii. *Working method for setting up and taking down TTM*

   The general elements being:

   - Follow the ERIC principles to group and pre-plan maintenance activities and book occupancies through the SRW.
   - For each FTP, pre-plan the relevant upstream scheme sign settings with the local RCC.
   - Consider guidance in the Installation of Static Traffic Management as detailed in Chapter 8 Part 2 O3.6.

This method reflects the state of knowledge and requirements for traffic management at this time and has been developed with the intention as providing a starting point for the Agency, scheme designers and maintainers in relation to providing a safe method of placing TTM on MM-ALR. It has also been developed as far as possible to facilitate future refinements and techniques to Chapter 8 guidance as being led by the Aiming for Zero programme and the Road Worker Safety Forum (RoWSaF).

Generic Safe Method for placing TTM on MM-ALR

1. Introduction

The objective of this document is to demonstrate a generic safe method for setting up and taking down Temporary Traffic Management (TTM) on Managed Motorway – All Lane Running (MM-ALR) schemes. This supports the over arching Aiming for Zero objective *"Our aim is that as an employer, designer and leading client, nobody comes to harm as a result of their work for us".*

In addition, there are two specific drivers for this work:

- Reducing the risks to the road worker population on MM-ALR as set out by the *Demonstration of Meeting the Safety Objective Report*. This report identifies the hazards and risk that the road worker is exposed to and the measures required to ensure that the road worker safety objective (and health and safety legal requirements) can be met.
- Meeting the challenge set by the Health and Safety Executive - to work with the industry and demonstrate that maintenance operations may be safely carried out on an MM-ALR scheme, specifically that works can be safely set up and taken down.

This document has been written following consultation with the first MM-ALR schemes:

M1 **J28 to J31 and J32 to J35a**	Designer: Mouchel Maintainer: Area 7 and Area 12 MAC (both AOne+)
M25 **J5 to J7 and J23 to J27**	Designer and Maintainer: ConnectPlus M25 (DBFO Co.)

An understanding of how these early schemes are approaching the design for maintenance challenge with regards to the TTM set up and take down activity has been gained through consultation with the scheme teams. Knowledge of the approaches nominated for the M1 and the M25 has informed the generic method detailed here.

It is important to emphasise that road worker safety is an area of fast paced change, as stakeholders seek to reduce risks to those working on the network. There is a portfolio of Aiming for Zero projects which are driving developments, which focus in particular on the area of temporary traffic management requirements.

There is a strategic aim to eliminate the need for road workers to be on foot in the live carriageway by the end of December 2016[1]. The Road Worker Safety Workstream is currently undertaking a series of trials to fully realise this aspiration (see section 7 Future Developments). The generic method described herein removes the need for road workers to be in the live carriageway (on foot or in vehicles) in order to place advance signs. And provides a safety benefit over the current MM-ALR baseline

This document has been written in autumn 2012 and reflects the state of knowledge and requirements for traffic management at that time. It has been written as far as possible to facilitate future developments and refinements to the method. Scheme designers and stakeholders referring to this document must satisfy themselves that they are adhering to the latest version of all requirements relating to temporary traffic management and in accordance with Chapter 8 Traffic Signs Manual.

[1] Over-Arching Aiming for Zero Strategy

2. Design Features

This section outlines scheme infrastructure requirements which support the safe method of working according to the principles of design for maintenance.

2.1. Fixed Taper Positions (FTP)

For each carriageway, identify fixed points at which a cone taper can safely be installed. The FTP will be used as the datum for lane closures to enable safe maintenance at any point downstream of the fixed taper datum (and upstream of the next FTP).

The fixed taper should have the following characteristics:

a) Be suited to close off lanes in any foreseeable combination.
b) Positioned so that approaching vehicles have an appropriate line of sight and space to move from closed to open lanes. Consideration should be given to junction diverge / merge locations, and Sight Stopping Distances in TD9. This includes consideration of sight lines to all advance signs (see 2.2). Current maintainers should be consulted.
c) Positioned to provide a downstream overlap to the next fixed taper position so that maintenance required within the area of the taper or advance signs can be achieved by lane closures safely placed by the next fixed taper immediately upstream (see Figure 2).
d) In addition to the requirements set out in IAN 161/12, due consideration should be given to positioning an MS4 (or VMS and AMI-equipped gantry) 1500m (±10%) upstream of each FTP, where practicable. This would align the MS4 and FTP such that the MS4 could provide the 1 mile advance sign under a future operating regime.
e) The distance between each fixed taper datum should be a nominal maximum of 4km (based on maximum length of work site in Chapter 8 D3.5.1). However this length may be flexibly interpreted in order to best suit local characteristics such as merge, diverge or infrastructure positioning.

2.2. Signing

For each FTP the scheme should design advance[2] signs in accordance with the following:

a) Each FTP has an associated set of advance signs which specifically warn road users of lane closures ahead.
b) Advance signs are provided in appropriate number and location to facilitate any combination of lane closures (currently to achieve this, signs are required 1 mile, 800, 600, 400 and 200 yards upstream of the fixed taper datum on both the nearside and the offside)[3].
c) Advance signs are able to display a blank aspect when not in use and are also able to display any combination of open / closed lanes ahead. The aspect of the sign is able to be set remotely and individually, by an operative situated in a safe place (i.e. away from the running lanes)[4].
d) Advance signs have aspects compliant with Chapter 8 requirements when in use, and ground level signs are consistent in their appearance throughout the scheme (e.g. a single scheme should not offer a mixture of LED and mechanical advance signs at ground level)[5].

[2] Advance signs provide advance warning of roadworks.
[3] Developments in Aiming for Zero projects are expected to reduce the requirements for advance signing (see below). The signs specified here achieve any combination of lane closures under Chapter 8 Relaxation requirements at autumn 2012.
[4] Individual setting of signs will allow certain signs to be omitted under certain lane closure configurations, as allowed under IAN150/11.
[5] Aiming for Zero project 1.U is developing a specification for variable signs.

e) Advance signs are specified to minimise their own maintenance liability. The scheme specifically considers a method for maintaining these signs in the Maintenance and Repair Strategy Statement (MRSS).
f) Advance signs are sized and positioned such that they do not encroach on trafficked areas and / or pose a significant risk of vehicle strikes. The set back between the signs and the carriageway must be in accordance with DMRB standards and Chapter 8 safety clearances. The dimensions of the sign faces must be as specified in TSRGD and the Traffic Signs Manual.
g) Departures from Standard shall be required for any signing solution that is non-compliant with current standards.
h) Any product which is specified will require Type Approval.

3. Generic working method for setting up and taking down TTM

Certain activities should be incorporated into safe operations when setting up and taking down TTM equipment from an FTP.

In general:

a) Consider guidance in the Installation of Static Traffic Management as detailed in Chapter 8 Part 2 O3.6
b) Follow the ERIC principles to group and pre-plan maintenance activities and book occupancies through the SRW.
c) For each FTP, develop with the local RCC COBS plans for setting upstream MS4 and AMI signals. These plans should enable all foreseeable combinations of lane closures and lengths of works to be supported by local MS4 and AMI signals.

For each occasion when TTM is to be deployed[6]:

d) TTM operatives contact the RCC to request setting of MS4s and AMIs to notify that road works are being set out. MS4 and AMI aspects will be set according to current policy[7].
e) TTM operatives in a place of safety remotely set advance signs to display the appropriate lane closure aspects.
f) TTM operatives visually check that all signs and signals (both advance and any MS4s or AMIs) are displaying appropriate and non-conflicting aspects (for example, by driving through or from a safe vantage point).
g) With all advance signing confirmed in place, a works vehicle fitted with a lorry mounted crash cushion (and TM vehicle as required) proceeds to the fixed taper datum in either Lane 1 or Lane 4 as appropriate, and the TTM operatives commence coning of the taper.
h) TTM operatives cone longitudinal section to 90m beyond the last point at which lane closure is required, and, from within the cones, place a temporary A-frame ‘end’ board in accordance with Chapter 8 requirements. The last 90m of cones is then walked back from the end board.
i) TTM operatives contact the RCC to notify that works are set out. RCC then sets MS4 and AMI signals for works in situ, with aspects set as per current policy[7].

[6] Assuming all pre TTM deployment requirements have been met; e.g. road works authorised through SRW, traffic count undertaken from a safe location etc.
[7] This is currently described within Traffic Officer Service Procedure: The Use of Signals, VMS and MIDAS at Short Duration Static Roadworks – Applicable to Motorways and APTRs.

j) When works are complete, TTM operatives contact the RCC to re-set MS4s and AMI signals as per set out. RCC to confirm that signals are set and operatives to commence take-down of worksite[7].
k) When worksite is taken down and TTM operatives are clear of live lanes, TTM operatives remotely set advance signs to display a blank aspect.
l) TTM operatives contact RCC to deactivate all MS4 and AMI signalling associated with works[7].

Figures 1, 2 and 3 in section 6 provide an indication of a possible signing set-up for MM-ALR. The functionality of MS4 and AMI signals are currently being improved to support road worker safety in conjunction with the Department for Transport. Further work shall be required to refine the figures in section 6 once the MM-ALR road worker signing rules and aspects are finalised.

4. Risk Scoring: Generic method for setting up and taking down TTM

This approach uses the Highways Agency's methodology[8] to derive an indicative risk score for operatives setting up and taking down road works in accordance with the generic safe method outlined here. It is calculated for a one year period, assuming that maintenance will take place five nights per week on a generic 10 mile long MM-ALR scheme.

State Hazard	Assumption	Generic Safe Method
Likelihood Classification (the likelihood that the hazardous state is present)	**Advance signs** Assume advance sign solution that does not require operatives to be on the live carriageway to install.	No requirement for operatives on the carriageway to place / set advance signs. 0 minutes per year per motorway mile.
	Coning (assuming an average closure length of 3km, with cones placed and taken in at 5km/h[9])	Coning takes place for 3,482 minutes per year per motorway mile. **Likelihood Index Value = 3.82**
State Collision Probability (the rate at which incidents occur if the hazardous state is present)	Although reduced probability of collisions is expected since no advanced signing activities take place in live lanes, no evidence is available to quantify. Hence a conservative assumption is made to maintain the classification in Generic MM Risk Assessment for H52.	*Occasionally causes a collision* **Collision Probability Index Value = 2.0**
State Severity (the severity of the incident)	Although temporary mandatory speed limits should reduce traffic speed, pedestrian collisions are still expected to be severe when they occur. Hence maintain classification in Generic MM Risk Assessment for H52.	*Severe* *The proportion of collisions that are fatal is expected to be higher than average by at least a factor of 10.* **State Severity Index Value = 2.0**
		Total Risk Score = 7.82 Native risk score: 66,191,299

Note that this generic safe method completely eliminates the need for operatives to be on the live carriageway to set or remove advance signs regardless of whether nearside or offside closures are required. The remaining activity is coning out, which currently commences from a live lane but with advance signs and MS4 and AMI signals set to warn approaching drivers. This is as per the current approach to offside coning on D3M. Placement and take-in of the 'end' board happens from within the longitudinal coning hence imposes negligible additional road worker risk (compared to that in the assessment above).

[8] Highways Agency: *Managed Motorways: All Lanes Running Demonstration of Meeting the Safety Objective Report*, 2012; Appendix C.
[9] TRL: *Development of the Measurement of Injury Risk (MIRi) Index*, 2011; Appendix E.

The above risk scoring would not be valid if a scheme nominated an alternative method, which required any operative to be on the live carriageway to place advance signs.

The total risk score used in the *Demonstration of Meeting the Safety Objective Report* was 8.1 for *maintenance workers setting up and taking down worksite* on MM-ALR. A score of over 8 is regarded as a high risk activity, whilst scores of over 7 are regarded as medium risk. The generic safe method may therefore be regarded as a medium scoring hazard when the total risk is scored using the above assumptions.

5. Maintenance Liability

It is accepted that additional maintenance liabilities are introduced with the advance sign infrastructure which supports maintenance utilising FTPs. Applying the ERIC principles the following mitigations are identified:

- Eliminate: Specifying sequential advance signs which can be set remotely eliminates the risks to operatives from advance sign positioning on the live carriageway.
- Reduce: reduce the number of advance warning signs so far as practicable, i.e use A-frame type signs to denote works end.
- Inform: Aiming for Zero projects are actively considering and reporting on a robust specification for these items of equipment.
- Combine: maintenance visits for variable advance signs may be combined with other activities and protected from the upstream taper. ‘Swap out’ type maintenance is particularly well suited to this approach.

Using combined visits to maintain variable advance signs will minimise additonal risks by reducing any additional time required on the network to maintain these signs (i.e. negligible additional time is foreseen for planned maintenance over and above existing MM-ALR maintenance requirements).

Additional time and visits required for reactive maintenance (i.e. fault rectification) will, however increase risk through operative exposure. However, since upstream FTPs provide a safe method of access it may be said that this risk is ALARP.

6. Figures

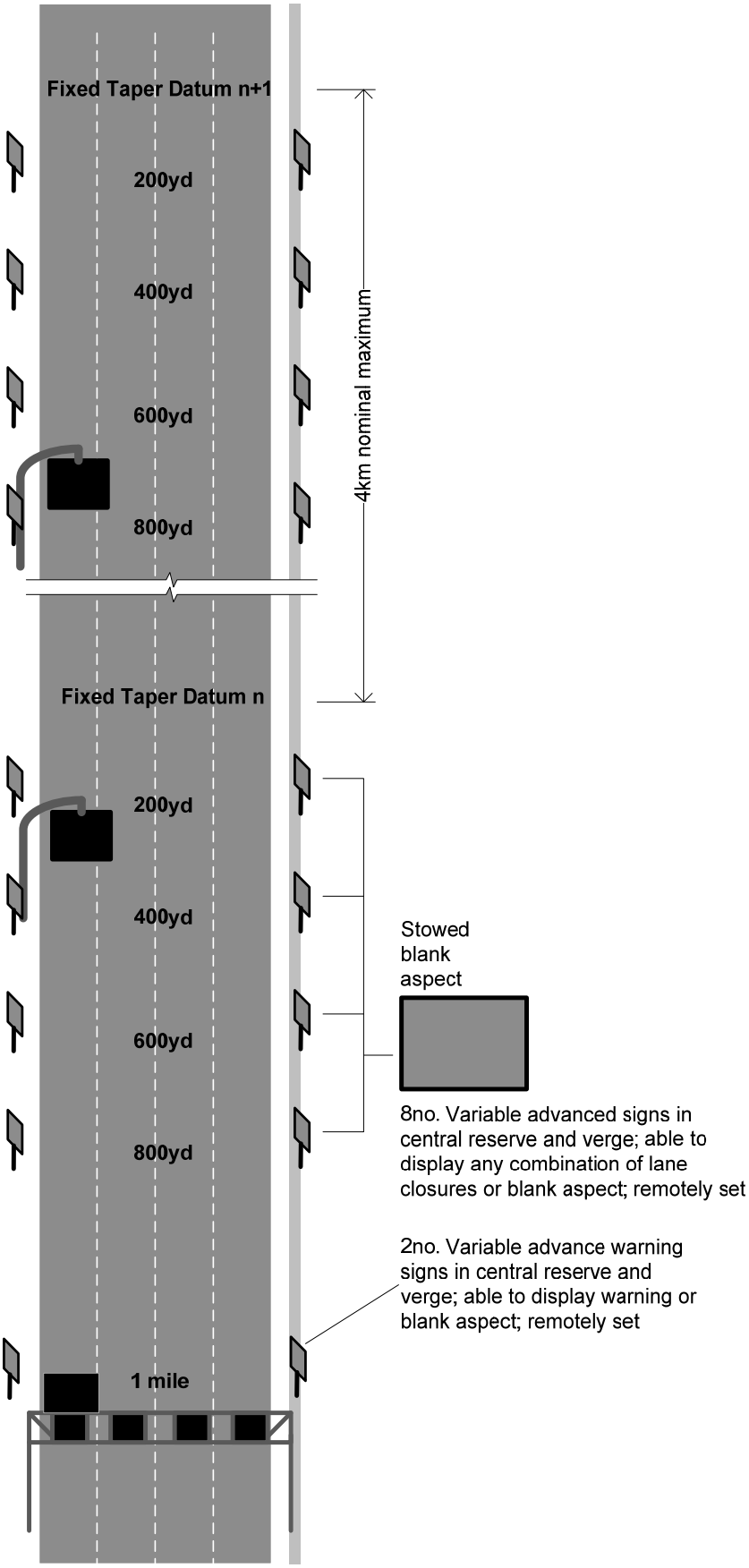

Figure 1: FTP and advanced signs - stowed / not in use

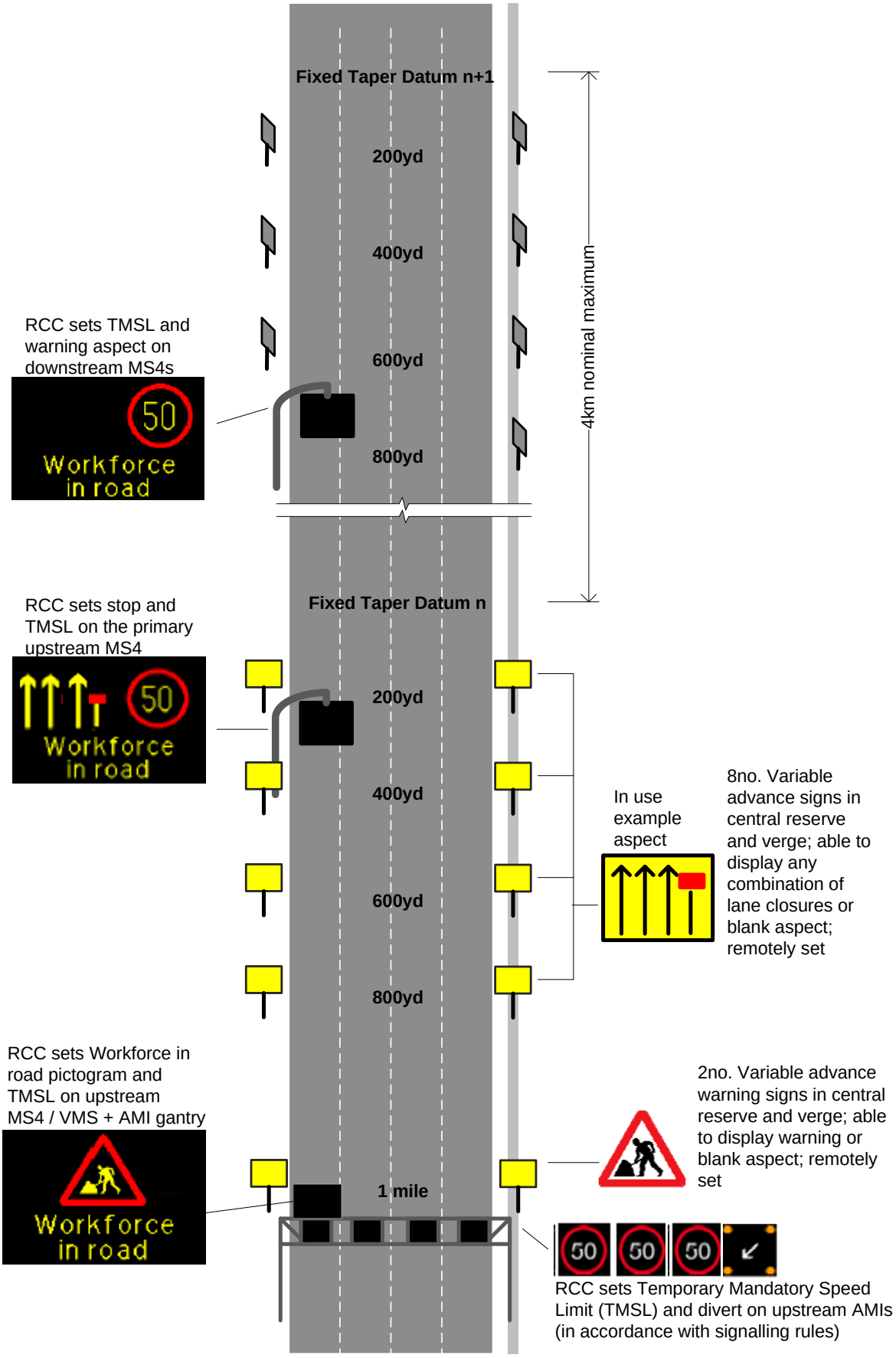

Figure 2: FTP and advance signs set ready for coning to commence for maintenance in Lane 4, 400yd upstream of FTP datum n+1. Note that aspects depicted on electronic scheme signals are indicative only.

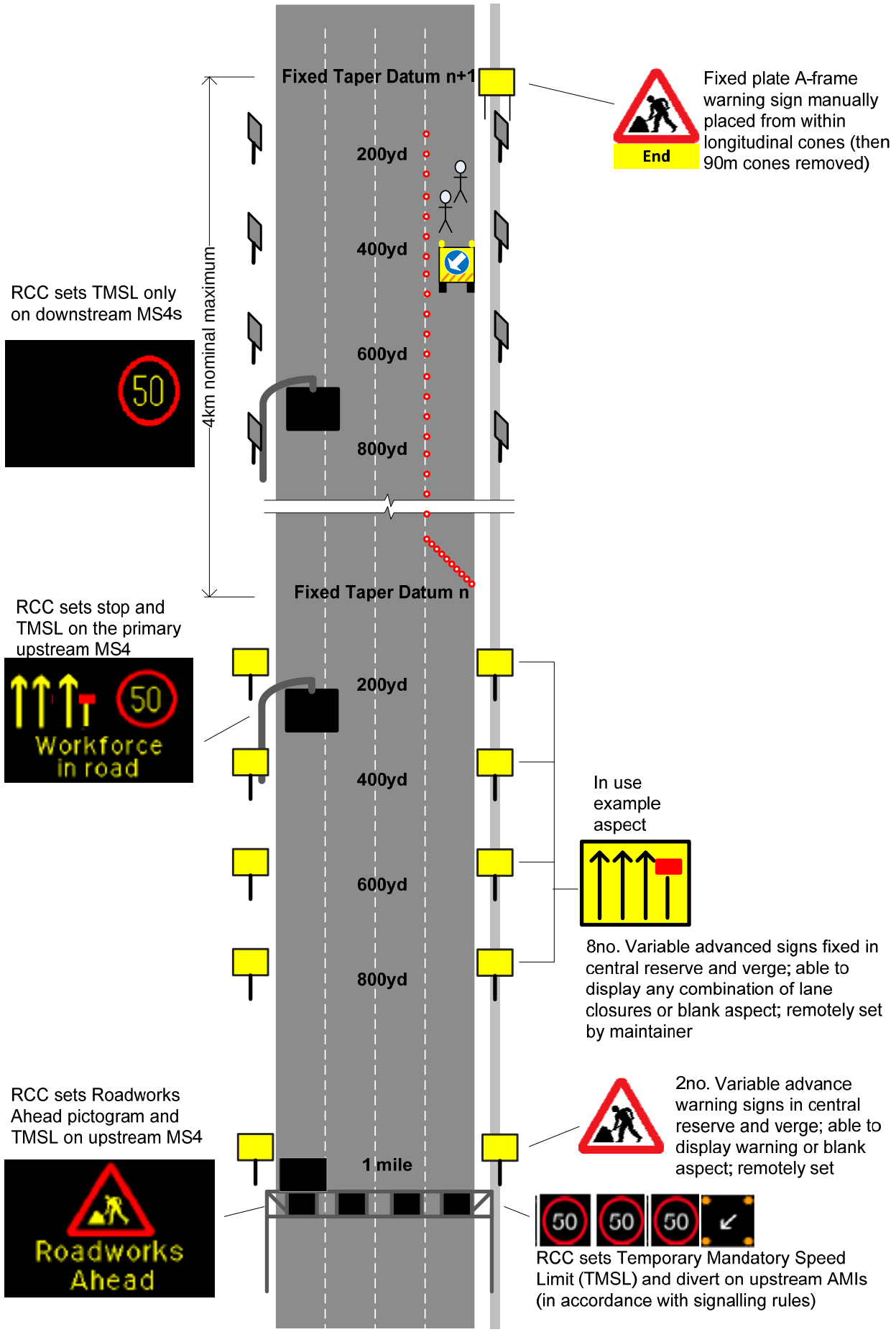

Figure 3: Works in progress in Lane 4 400yd upstream of FTP datum n+1. Note that aspects depicted on electronic scheme signals are indicative only.

7. Future Developments

Aiming for Zero is anticipated to drive significant developments in TTM design and advance signing provision in the next three years. Project delivery milestones which are relevant to the generic method for safe setting up and taking down of TTM on MM-ALR are identified in Table 1 and scheme delivery dates are indicated Figure 4 below.

Table 1: AfZ Initiatives of potential relevance to the MM-ALR generic safe method for maintenance

Aiming for Zero project	Summary	Anticipated impacts on MM-ALR
1.C1	Variable signs and AMIs for temporary mandatory speed limits at roadworks	An evidence based policy on the use of scheme signing is likely to facilitate speed limit use during set up / take down, and whilst works are underway. MM-ALR infrastructure will allow full advantage of this, realising a safety benefit to road workers.
1.C3	Variable signs and signals for advanced warning of road works	An evidence based policy for use of scheme signalling, potentially in place of separate advance warning signs. This would remove maintenance and placement liabilities.
1.H	Mechanisation of the TTM process	Potential to establish a mechanised alternative to cone tapers, which would remove workers from the live carriageway environment.
1.S12	Offside signs removal at nearside closure (IAN150/12)	Reduced requirement for offside advance warning signs where nearside closures required. [Note that offside advance signs still required to enable offside closures].
1.S23	Removal of offside signs on all relaxation works	Removal of requirement for offside variable advance signs upstream of fixed taper position. This would have a capital and maintenance cost benefit.
1.U	Post-mounted remote controlled signs	An evidence base will drive specification for variable advance signs and bring consistency across schemes.
1.X	Impact Protection Vehicles – elimination of collisions	An evidence base will inform maintainers of best practice in use of impact protection vehicles when setting out or taking in TTM.
3.G	Variable signs and signals at roadworks policy and procedures	A coherent set of policies and procedures to enhance communications with RCCs.

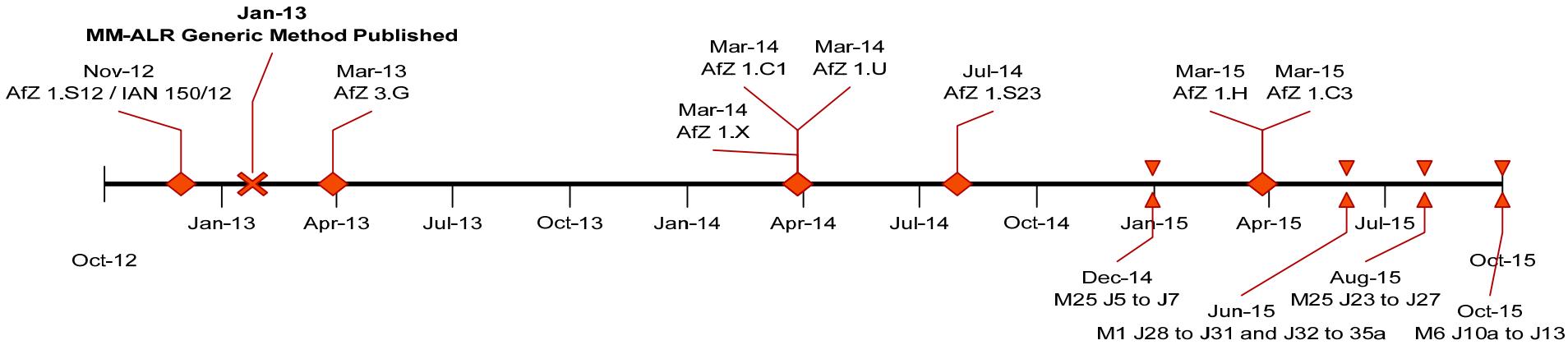

Figure 4: Timeline of AfZ initiatives and other MM-ALR milestones