Traffic Signal Faces

Operational Instruction 14.2
Traffic Signal Faces - 14.2

AMENDMENT RECORD

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1. **Scope**

The aim of this Operational Instruction is to enable personnel concerned with the installation of traffic signal lanterns to ensure that the signal faces are aimed in the correct direction to maximise the response from drivers and reduce confusion. It will enable designers to specify the correct visors and louvres to be attached to traffic signal lanterns associated with traffic signal faces and to provide, where necessary, screening of signal faces from adjacent approach roads.

This guide is intended to avoid the unnecessary provision of 300mm lanterns and screening devices whilst providing for all the functional requirements of the signal faces according to Nationally approved Standards. It also provides guidance for installing traffic signals co-located with level crossings.

This Operational Instruction should be read in conjunction with the Guide to Traffic Engineering Practice Part 7 Traffic Signals (2003) and AS 1742 part 14 Traffic signals and AS1742 Part 7 on Railway Level crossings.

The guidance provided in this Operating Instruction is intended to provide consistency of the application of the traffic signal lanterns on roads under the care, control and management of Department for Transport Energy and Infrastructure.

2. **Definitions**

A dictionary of terms is included in the Road Rules, and a definition of terms is included in AUSTROAD GUIDE TO TRAFFIC ENGINEERING PRACTICE PART 7 2003, AS2144 Traffic Signal Lanterns, AS 1742 Manual of Uniform Traffic Control Devices, Part 14 Traffic signals. These terms and definitions are repeated here where pertinent.

**Approach**
That section of road consisting of one or more lanes used by vehicles approaching a controlled area.

**Aspect**
A single optical system on a signal face capable of being illuminated at any given time.

**Controlled Area**
That portion of a carriageway or intersection, the entry into which is controlled by traffic signals.

**Display**
A signal aspect that is illuminated.

**Dual Primary Signal Face**
The signal face mounted on a post either on the median at or near the right of the stop line, or if there is no median or the median is too narrow, to the right and near the projection of the stop line.

**Extended Range lantern**
A vehicular lantern with a light output and distribution that is suitable for traffic signal applications that require recognition by vehicle drivers from distances of up to 240m.
General Purpose Lanterns
A vehicular lantern with a light output and distribution that is suitable for traffic signal applications that require recognition by vehicle drivers from distances of up to 100m.

Level crossing
An area where a road and railway meet at substantially the same level.

Louvres
An assembly of mechanical baffles mounted within the visor to reduce sun phantom (horizontal louvres) or to restrict angular coverage of a signal (vertical louvres).

Primary Signal Face
The signal face mounted on a post at or near the left of the stop line of the approach.

Secondary Signal Face
A traffic signal mounted on a post located on the far right side of the controlled area.

Traffic Signal Aspect
A single optical system (circular, arrow or symbolic) on a single face capable of being illuminated at a given time. Red, yellow, green and white aspects are used for vehicle movements.

Tertiary Signal Face
A traffic signal mounted on a post located on the far left side of the controlled area.

Traffic Signal Display
A signal aspect that is illuminated.

Traffic Signal Face
A set of signal aspects in a common assembly generally in one or two columns placed together with a target board to improve signal visibility, facing traffic from one direction.

Traffic Signal Lantern
A signal assembly of optical components (one or more aspects), together with the means of connecting them to a power supply and facility for mounting the complete assembly.

Traffic Signal Site
A traffic signal site may be an intersection or a pedestrian activated crossing controlled by traffic signals or a special situation e.g. a one-way bridge operation.

Twin Red lights
Means a device showing, in a horizontal or diagonal arrangement, 2 illuminated red circular aspects that flash alternately. (These lights are normally incorporated in the level crossing sign assembly RX-5 that includes the RX-6 ‘cross bucks’ sign.)

Screening devices
Visors with louvres used to obscure the view of signal faces from drivers.

Visor
An attachment to the face of a signal aspect to minimise the sun-phantom effect and/or to reduce the possibility of a signal being seen by traffic for which it is not intended.
3. **Vehicle Displays - Face Functions**

_Table 3.1_ defines the main functions of the primary signal faces as providing Warning and Stopping information to drivers; and the main function of the secondary and tertiary faces provides Starting and Manoeuvring information to drivers.

<table>
<thead>
<tr>
<th>Location of Signal Faces</th>
<th>Warning</th>
<th>Stopping</th>
<th>Starting</th>
<th>Manoeuvring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Secondary</td>
<td>‡</td>
<td>‡</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Tertiary</td>
<td>‡</td>
<td>‡</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Dual Primary</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Overhead Primary</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Overhead Secondary</td>
<td>‡</td>
<td>‡</td>
<td>Yes</td>
<td>‡</td>
</tr>
<tr>
<td>Overhead Tertiary</td>
<td>‡</td>
<td>‡</td>
<td>Yes</td>
<td>‡</td>
</tr>
</tbody>
</table>

NOTE: Abstracted from Table 7.1 GTEP Part 7, page 52.

‡ These functions may also be provided depending on site geometry, topography and other conditions.

Table 3.1 Signal Face Functions

4. **Vehicle Displays - Aiming Distance Requirements**

<table>
<thead>
<tr>
<th>Approach speed km/h</th>
<th>STOPPING (metres to stop line)</th>
<th>WARNING (metres to stop line)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤50</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>60</td>
<td>80</td>
<td>130</td>
</tr>
<tr>
<td>70</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>80</td>
<td>120</td>
<td>170</td>
</tr>
</tbody>
</table>

NOTE: Abstracted from Table 7.3 GTEP Part 7, page 58.

Table 4.1 Recommended Aiming Distances

Warning sight distance is to be achieved by the alignment of all primary signal faces.

Stopping sight distance is to be used as the initial alignment of all secondary and tertiary signals.

Starting Sight Distance is to be achieved by turning the secondary or tertiary signal face towards the centre of the approach so that the display is clearly discernable by to a driver stopped 3 metres from the stop line on the approach to which the signal face applies, however it is not necessary for the driver at the stop line to be able to view the full face of the display.

Starting Sight Distance, where a secondary or tertiary signal face applies to only a single traffic movement, is to be achieved by turning the lantern towards the centre of the approach lanes used for that traffic movement so that it is clearly visible to a driver stopped 3 metres from the stop line on the lanes to which it applies.

It is desirable to achieve warning sight distance with tertiary and secondary lanterns where this is achievable without compromising the stopping or starting functions.
5. Vehicle Displays - Sizes and Numbers of Signal Faces

Typical standard signal face sizes are shown in Table 5.1 below.

<table>
<thead>
<tr>
<th>Speed Zone (km/h)</th>
<th>Aspect Type</th>
<th>Signal Face</th>
<th>Primary</th>
<th>Duplicate Primary</th>
<th>Secondary/ Tertiary</th>
<th>Obscured Primary/ Secondary Alternative Overhead</th>
<th>Extended Range Overhead</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 70</td>
<td>Circular</td>
<td>Primary</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Arrow Symbols</td>
<td>Primary</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>80 – 110</td>
<td>Circular</td>
<td>Primary</td>
<td>300</td>
<td>300</td>
<td>200/300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Arrow Symbols</td>
<td>Primary</td>
<td>300*</td>
<td>300*</td>
<td>300*</td>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

1. May be 200mm where turning speed <75km/h
2. Where there is no duplicate primary signal at an extended range approach the secondary or tertiary signal will need to be 300mm

Table 5.1: Typical Standard Signal Face Sizes

Where an intersection is in a speed zone less than 80km/h all signal faces will be 200mm. The design sight distance for 200mm aspects is 100m, and for 300mm aspects is 240m.

The Guide to Traffic Engineering Practice PART 5, Intersections at Grade, Table 5.1, page 24, shows stopping sight distance below a speed of 80km/h is less than 100m and above a speed of 80km/h is over 100m. The extended range lantern is therefore designed to provide adequate warning for the driver to stop on the approach to traffic signals in speed zones equal or greater than 80km/h.

Rules for the allocation of lanterns to an approach:

- A minimum of 3 signal faces is to be provided for any through movement.
- A minimum of 2 signal faces is to be provided for any turning movement.
- Extended range lanterns (300mm) are required at speeds of 80km/h and over.
- Where a 300mm overhead primary signal aspect has been provided for the extended range functionality the size of the lower mounted primary lantern signal faces may be reduced to 200mm (subject to the minimum number of 300mm lanterns being provided).
- All signal aspects, including combinations of circle and/or symbolic arrows, on the same signal face shall be the same size.
- Where a 300mm aspect is required this shall take precedence over the provision of the 200mm aspect size.
- The primary signal face shall be provided on all approaches except where it is obscured by an obstruction, e.g. by trees or verandas at close range (say less than 2m). Where a primary signal face would be obscured by an obstruction as described above and cannot therefore be provided an overhead primary signal face shall be provided to replace it. Where overhead signal faces are
provided, not for extended range but merely as an alternative location to otherwise obscured signal faces the overhead will be 200mm.

- For circular aspects, where 300mm signal faces are provided for the extended range function, at least two 300mm signal faces are to be provided. These will normally be provided at the Primary (or overhead Primary if added) and Dual Primary locations. Where there is no dual primary the second 300mm signal face shall normally be provided at the secondary location. However where a 300mm left turn arrow is required with the tertiary circular signal face, and if no right turn arrow is provided, the secondary circular aspects may be 200mm.

- For arrow aspects where a speed zone is 80km/h, or over, two extended range 300mm signal faces shall be provided to facilitate the “warning” and “stopping” function of the primary signal face on the turn approach. However where the turning speed of the vehicles is below 75km/h the size of the lanterns should be reduced to 200mm, providing the circular display, as part of the combined signal face, is also permitted to be provided at the 200mm size.


6.1 Type of Visors

There are 3 types of visors and their use and cut off angles are tabulated in Table 6.1.

Type A OPEN – recommended for use in most locations, can be visible up to 180°.

Type B CLOSED – recommended for use where the lantern is to be hidden from the view of drivers on other approaches. In terms of the normal shielding of secondary and tertiary lanterns from the view of drivers on adjacent approaches the Type B should be all that is necessary for effective and safe control.

Type C CUTAWAY – These are cut away on one side only and are visible on the cutaway side as if they are Type A (see example in Figure 6.1).

Note: Type C is only used with the long visor and is not normally used by DTEI. Its use may however be considered if both the Stopping and Starting aiming distances are not achievable in the same lantern by use of the Type B visor. Where a Type C is used it should be specified as left and right and the cutaway should be on the side nearest the driver on the approach to which the lantern applies.
### Table 6.1 Cut Off Angles For Visors

<table>
<thead>
<tr>
<th>Lantern size (mm)</th>
<th>Visor Type as AS 2144</th>
<th>Length (mm)</th>
<th>Angle for total cut off of Signal indication.</th>
<th>Angle from normal to the signal face</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Open Type A</td>
<td>200</td>
<td>No restriction</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>Closed Type B</td>
<td>200</td>
<td>90°</td>
<td>45°</td>
</tr>
<tr>
<td>200</td>
<td>Closed Type B</td>
<td>300</td>
<td>67°</td>
<td>34°</td>
</tr>
<tr>
<td>200</td>
<td>Cutaway Type C</td>
<td>300</td>
<td>Open side no restriction, 34° on closed side</td>
<td>34°</td>
</tr>
<tr>
<td>200</td>
<td>Closed Type B</td>
<td>200</td>
<td>53°</td>
<td>27°</td>
</tr>
<tr>
<td>200</td>
<td>Closed Type B</td>
<td>200</td>
<td>31°</td>
<td>16°</td>
</tr>
<tr>
<td>300</td>
<td>Open Type A</td>
<td>300</td>
<td>No restriction</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>Closed Type B</td>
<td>300</td>
<td>90°</td>
<td>45°</td>
</tr>
<tr>
<td>300</td>
<td>Closed Type B</td>
<td>400</td>
<td>74°</td>
<td>37°</td>
</tr>
<tr>
<td>300</td>
<td>Cutaway Type C</td>
<td>400</td>
<td>Open side no restriction, 37° on closed side</td>
<td>34°</td>
</tr>
<tr>
<td>300</td>
<td>Closed Type B</td>
<td>300</td>
<td>53°</td>
<td>27°</td>
</tr>
<tr>
<td>300</td>
<td>Closed Type B</td>
<td>300</td>
<td>31°</td>
<td>16°</td>
</tr>
</tbody>
</table>

* Notes:
1. Cutaway visors are not normally used by DTEI
2. Louvres for restricting vision to 53 degrees are mounted vertically and comprise one louvre assembly fitted to the side of the lantern nearest the other approach road with 90mm vanes mounted 25mm apart.
3. Louvres for restricting vision to 31 degrees are mounted vertically and comprise two louvre assemblies with 90mm vanes mounted 25mm apart (Figure 6.1 shows the dimensions of the vanes for a single louvre assembly).
4. Drafting templates showing the visibility angles are available to assess the risk of sighting signal faces on adjacent approach roads and provides guidance on the devices to be provided to minimise the risk.
5. Table abstracted from Table 7.4 GTEP Part 7 page 59.

Table 6.1 Cut Off Angles For Visors

### 6.2 Application of Standard Visors and Louvres

Primary lanterns shall be fitted with open visors. Secondary and tertiary lanterns shall be fitted with closed visors.

All non-LED circular aspects in east and west facing signal faces shall be fitted with horizontal external louvres in the top half of the visors for the effects of sun phantom, see Figure 6.1 (copied from figure 7.10 pages 36 and 42 of AS/NZS 2144:2002.)
Figure 6.1 External Louvres for Traffic Signal Lanterns (taken from Figure 7.10 AS/NZS 2144)

No louvres shall be fitted to symbolic displays such as “arrows” and “B” lights. Symbols with louvres will appear distorted to drivers and may be confused with circular displays.

Long visors and vertical louvres, where necessary, shall be fitted to signal faces that may be sighted by a driver on an adjacent approach road where the display could be misconstrued to apply to the driver. This requirement does not apply to signal faces displaying overlapping traffic movements on the same approach road, e.g. turning arrows in the same signal face with circular displays.

6.3 Types of special visors use at closely associated stoplines

There are two types of visor and louvre configurations for use at closely associated Stop lines, the “tilt visor” using a special visor with horizontal louvres and the other a conventional closed visor using vertical louvres.

**TILT VISOR**

The tilted visor for the use with 200mm lanterns comprises a visor, 300mm long with five 120mm louvres at 25mm spacing, fixed at $10^\circ$ to the normal of the signal face.

Visors with horizontal louvres at $14^\circ$ angle of tilt are also available for use where $10^\circ$ provides insufficient obscuration. These $14^\circ$ angled visors are identified with a “V” shaped cut on the side of the visor as shown in Figure 6.2.
This type of visor is only to be used with a green circular aspect.

![Diagram of visor and louvre](image)

**VERTICAL LOUVRED VISOR**

The visor with vertical louvres may be used with 200mm or 300mm aspects, and may be used in all aspects of a standard 3-aspect circular signal face.

Vertical louvres can be angled more acutely than tilted visors and may therefore be more effective where extreme obscuration is required.

The type of visor (200mm is shown in the example) to be used with vertical louvres is shown in Figure 6.3.
6.4 Application of Special Visors with Louvres.

Special visors are normally used where adjacent traffic signals are less than 200m apart and should not be used where the distance, measured between adjacent controlled stop lines is greater than 200m.

Visors with louvres are positioned at an angle to the view of drivers and are intended to remove any confusion for the driver where closely associated stop lines have different displays. This situation is typically found where a driver may misread the green display from a downstream adjacent signal site to indicate that it is safe to proceed across the stop line at the near site, which may be showing a contrary display (red or yellow).

Where there is a problem with stopped vehicles proceeding during the red display the use of vertical louvres might be a more effective treatment than the tilted lantern. Drivers will often start to move based on the extinguishing of the red signal and where it is considered necessary to address this issue the vertical louvre arrangement can be applied to the yellow and red displays as well as the green.

An example of where to locate visors and louvres at staggered “T” intersections is shown in Figure 6.4.

The principle objective of using sharply angled visors with louvres is to avoid drivers approaching the first approach (1), which is displaying yellow or red being confused by the second approach (2), which is displaying green.

Peripheral vision decreases as speed increases and drivers focus their attention farther ahead. The driver can therefore be unaware of any changes to interposing signals. There is also the possibility that a driver, waiting at a stop line, who is only
able to see the secondary lanterns, may inadvertently proceed on seeing a green signal at the adjacent signal site.

Where closely associated intersections are controlled as for example at a staggered T-configuration the use of visors and louvres needs careful design. The use of vertical louvres in preference to tilt lanterns can be very effective in screening closely associated lanterns from through movements but continue to provide side road drivers with clear indication of the green signal at the second approach (2) on the major road. This is particularly the case for the tertiary side (and left primary) lanterns for a right-left stagger and the secondary side (and right primary) lanterns for a left-right stagger. (As shown in Figure 6.4 where the signal faces suitable for vertical louvres are shown with a ‘V’ symbol)

When the tilt visor is used this will normally be applied to the green circular aspects on all signal faces on an approach (2). However where vertical louvres are used but this is not considered a suitable treatment for some signal faces, the remaining signal faces on the same approach may have the tilt visor applied to the circular Green aspects

A mixture of both vertical louvres and tilt lanterns should provide adequate obscuration without restricting a driver’s view of the significant lanterns.

Figure 6.4: Staggered T Intersection showing the Locations of Louvres
7. **Vehicle Displays - Target Boards.**

All traffic signal faces except pedestrian displays shall be provided with target boards. Lanterns will be configured with the front of the aspects in the same plane.

Where signal faces control the same approach road, the signal aspects shall be configured as a single lantern within the single target board. Examples of typical signal faces are shown below in Figure 7.1.

8. **Pedestrian Displays – Application of Visors and Louvres**

Pedestrian lanterns are usually to be orientated in the direction of the middle of the crosswalk on the far side of the crossing.

All pedestrian lanterns are required to be fitted with standard visors as provided for in the Guide To Traffic Engineering Practice Part 7. Where split approach pedestrian phasing is used on an approach vertical louvres are required to be fitted to both the pedestrian aspects at the kerb side.

---

Figure 7.1 Permissible Signal Face Layouts. (as abstracted from Figure 5.15 GTEP page 26)
Split approach pedestrian phasing is normally used where there is a median and the road is exceptionally wide. At these locations the long crossing time necessary for a single pedestrian approach would create excessive and unnecessary delays to all users of the intersection.

The median where split approach phasing is used should be 2.4m or wider in order to accommodate waiting pedestrians.

Where split approach pedestrian movements are provided, it is essential that a pedestrian standing on the side of the road, waiting to cross, is unable to see the pedestrian lantern on the farthest side of the road as this may be providing a conflicting signal. This correct view of the pedestrian display is achieved by providing an unobscured pedestrian face mounted on the pole in the median and an obscured face on the pole on the far kerb.

To obscure the potentially conflicting signal face, the marked crosswalks on each approach are aligned at a different angle to the kerb, and visors with vertical louvres are fitted to the pedestrian displays on the opposite kerbside to mask the pedestrians’ view of the signal face.

The visors and louvres to be fitted Pedestrian signal faces for split approaches are as shown in Figure 8.1.

![Figure 8.1 Pedestrian Visor with Vertical louvres for use with Split approaches](image)

### 9. Vehicle Displays - Traffic Signals at Rail Level Crossings

Some rail level crossings that display ‘twin red lights’ alternately flashing during the time trains use the crossing are also equipped with road traffic signals.

To minimise the signage clutter and ensure effective displays it is necessary to combine the road vehicle traffic signal faces on the same pole as the railway level crossing twin red lights and associated signs. The arrangement shown in Figure 9.1
depicts the appropriate and consistent arrangement of the road traffic signal faces with the rail equipment.

The equipment mounted on the pole should contain the following facilities in order from top to bottom (see Figure 9.1):

- Level crossing sign, “R6-24 – Cross Buck (Rail) is always located at the top of the arrangement.
- The warning sign W7-2 – X Tracks, used if more than 1 track is present at the crossing, is located directly below the Level crossing sign.
- The Traffic Signal Face is located beneath the track number warning sign if used or the Level crossing sign.
- Twin Red lights (alternately flashing) associated with the railway barrier are located beneath the road traffic signal face.
- The STOP ON RED SIGNAL (R6-9) is used at the bottom of the arrangement.

Where road traffic signals are co-located, these must be attached at all flashing twin red lights positions on a single approach.

Figure 9.1: Sign and Traffic Signal Layout at Level Crossings
10. References

- AUSTROADS GUIDE TO TRAFFIC ENGINEERING PRACTICE PART 7
- Australian Standard AS 1742 manual of traffic control devices part 14 traffic signals
- Australian Standard SA 1742 manual of traffic control devices part 7 level crossings.
- South Australian Traffic Act, Regulations and Road Rules

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