1. Purpose

The purpose of this road design note is to ensure an effective and consistent approach towards the application of continuous safety barrier.

Continuous safety barrier refers to the design and installation of barrier along the entire road length. Rather than designing a barrier to shield a specific hazard(s), continuous safety barrier is designed as a longitudinal element of the road to maximise driver protection and to contain errant vehicles before they roll, impact a hazard or cause a head-on collision.

This document details the design requirements specific to continuous safety barrier and therefore must be read in conjunction with available Austroads guidelines and VicRoads supplements.

2. Application

While continuous safety barrier can be implemented on any road, it is most effective on high-speed roads with sealed shoulders, minimal access points and few constraints; hence it is optimal for routes that connect capital cities, major provincial centres or link major centres of production.

Continuous safety barrier aims to protect the entire roadside, yet some areas cannot be protected due to constraints that prohibit the installation of barrier (e.g. driveways, intersections). The residual risk of these areas must be assessed and treated where possible (removed or relocated), although in some situations (often urban), the frequency of constraints may be too high, and the effectiveness of continuous safety barrier may not be achieved.

In Victoria, continuous safety barrier should be the first (preferred) option on 80km/h roads and above, and considered on lower speed roads.

3. Design methodology

Unlike the traditional design methodology, continuous safety barrier should be treated like a longitudinal component of the road, intended to shield all roadside elements as effectively as possible. This includes all hazards within the ‘area of interest’ (not only within the clear zone), areas of flat terrain that may cause roll-over, and cut embankments irrespective of grade.

As such, some traditional barrier design steps are often less critical (e.g. hazard identification and barrier length of need) given the focus on protecting the entire road length.

When designing continuous safety barrier, the key focus of design should be providing:

- a maximum protected length/area,
- a suitable and functional safety barrier that performs optimally during impact, and
- a barrier that aids safe and sustainable operation and maintenance of the road.

In addition, all unprotected areas or hazards should be recognised and assessed with an attempt to mitigate with other treatments.
4. Summary - cheat sheet

RDN 06-15 provides an effective and consistent approach towards the application of continuous safety barrier. The following page is a summary of RDN 06-15.

RDN 06-15 details the design requirements specific to continuous safety barrier and therefore must be read in conjunction with available Austroads guidelines and VicRoads supplements.

- Continuous safety barrier should be treated like a longitudinal component of the road, with an intent to shield all roadside elements as effectively as possible; including all hazards within the ‘area of interest’ (not only within the clear zone), areas of flat terrain that may cause roll-over, and cut embankments irrespective of grade.

- Attractive roadsides strengthen a sense of place and give travellers a more rewarding experience. Continuous lengths of similar barrier types and designs are desirable to draw focus on the natural landscape.

- WRSB and flexible GF systems should be used where possible, as these barrier types have the lowest impact severity and greatest potential to reduce occupant injury. Rigid systems should be used in constrained locations and on high volume urban freeways.

- Table 1 provides common brownfield (retrofit) scenarios and the preferred safety barrier type.

- MASH products should be installed where possible to future proof the serviceability of the asset.

- Every effort should be made to achieve the desirable offset of 4.0-6.0 metres as it allows broken down vehicles to pull over clear of traffic lanes and provides space for maintenance vehicles. An offset closest to this range is preferred.

- Greater offsets allowed in certain locations, e.g. stopping bays.

- Median barrier offsets between 2.0m-3.0m should be avoided to discourage vehicles from pulling over into a narrow shoulder.

- Where a divided carriageway has two or fewer lanes in one direction, median barrier offsets may be less than minimum, when a barrier offset 3.0m or greater is provided on the outer verge.

- Projects should consider mitigation measures for lengths of reduced barrier offset: speed reduction, localised pull over opportunities, increased sight lines, advisory signing.

- Safety barrier should be overlapped to maintain a continuous barrier system.

- Maximum safety barrier length is typically 1km for WRSB. Longer lengths may be used where the risk of nuisance impacts is low; desirable offset, straight alignment, ATLM. Maximum length of Flexible GF not defined.

- Provision for stopping includes non-discretionary and elective stopping to allow safe pull over in the event of an emergency or voluntary stopping, e.g. Emergency Stopping Bay.

- Bays are provided at least every 1km-4km. The precise frequency should be determined with consideration of: a route plan, minimising the cost of earthworks required, providing adequate sightlines, and targeting high risk stopping sites.

- Help Phone Bays can be removed unless poor cellular coverage is identified.

- Provide adequate access for emergency services where possible. Contact local service to agree/determine locations of access points.

- Traditional length of need process not critical; rather commence the barrier at the earliest location possible and identify potential unprotected areas.

- Run-out area requirements to be provided at critical and appropriate locations along the proposal.

- Barrier must be offset or flared to 3.0m near a side road or property access to provide sight lines. Otherwise, individual risk assessment is required.

- Barrier clearance to hinge point (6:1 or flatter) should be more than working width. Where this requires considerable earthworks, ‘absolute minimum’ is the support width; 1.0m for WRSB and 0.5m for flexible and semi-rigid GF.

- Replace all MELT, BCTA, BCTB & FLEXEFENCE Standard terminals with a G.R.E.A.T, T.T. or Flex fence TL-3 terminal.

- Upgrade existing guard fence (<686mm) using Abraham Blocks or Replace with a more forgiving system.

- Consider raising the height of existing guard fence (<720mm) using Abraham Blocks or consider replacing with a more forgiving system.

- Consider replacing Sentryline II (releasing) terminals with a Sentryline III (non-releasing) terminal when the barrier offset is <3m and barrier length is 500m and greater.

- Assess the performance requirements of existing 3-rope WRSB systems and upgrade where cost effective;

- System specific designs may be considered when the proprietary product is known

- Provide flexible GF and rub-rail on high risk motorcycle routes; crash history, high volume, tight curves.

- Fauna crossings to be considered in consultation with Urban Design.

- Medians less than 10m, single barrier run can be used. Medians greater than 10m; two barrier runs required unless the median is free of hazards, the barrier is 10:1 and a second barrier run is catered for in the future.

- Entry and exit ramps should be treated. However, the main carriageway must take priority. Sight lines are critical. Must allow for vehicles to pass a broken-down vehicle.

- Speed management treatments (e.g. speed limits and speed calming) may be needed through townships or on roads with high frequency of side roads, access points and median access points.

- Unprotected areas must be assessed and treated where possible. Exposed hazards within the clear zone must be removed to eliminate the risk of injury (preferred), relocated behind the barrier, or relocated beyond the clear zone (least preferred) as per AGRD Part 6, Section 4.

- Sealing in front of barrier not required unless considered a local high-risk location.

- Audio tactile line marking to be installed in-front of barrier to mitigate the likelihood of impact.

- Road Safety Audits and/or a Safe System Assessment to be conducted at various stages of the project.

- Safety barrier maintenance strips only considered were treatment offers whole-of-life benefit.

- Maintenance and service authority access points to be strategically located to support maintenance activities.
5. Safer speeds
While continuous safety barrier supports the use of high operating speeds, the actual safety risk will depend on the frequency of constraints that prohibit the installation of barrier (e.g. driveways and intersections). These locations will have a different risk profile.

As such, speed management treatments (e.g. reduced speed limits and speed calming treatments) may be needed in combination with continuous safety barrier where:

- the subject road length passes through townships and continuous safety barrier cannot be achieved due to the frequency of side roads, access points and median openings, as well as pedestrian activity and the amenity requirements of councils;
- the subject road length has a high frequency of at-grade intersections or pedestrian crossings and the risk of vehicle-vehicle and vehicle-pedestrian fatal and serious injuries can be mitigated through speed management (e.g. reduced speed limits);
- the existing road geometry is less than suitable for the current operating speed and can be supported by crash history. These locations must undertake an assessment of horizontal curvature, cross fall, existing sight lines, and other factors to demonstrate the benefits of speed management.

6. Hazard removal and relocation
To achieve zero fatal and serious injuries, the entire roadside environment must be considered to have an element of risk and designs must aim to eliminate risk.

While continuous safety barrier aims to protect the entire roadside, some areas or hazard cannot be protected due to site constraints or terminals. As such, the residual risk must be assessed and treated where possible. Exposed hazards within the clear zone must be removed to eliminate the risk of injury (preferred), relocated behind the barrier, or relocated beyond the clear zone (least preferred) as per AGRD Part 6, Section 4.

"it is impractical to maintain a clear area at a high standard at all times to eliminate the risk of vehicle roll-over risk"

If the removal or relocation of exposed hazards within the clear zone is considered cost prohibitive, then the likelihood of a ‘vehicle to hazard’ impact should be assessed to justify the value to treat. Where removal or relocation is not feasible, supportive treatments should be considered to reduce the likelihood or severity of an impact (e.g. line marking, audio tactile, signing, speed, etc).

7. Aesthetics / Landscape architecture
Attractive roadsides strengthen a sense of place and give travellers a more rewarding experience. These are important factors for both the tourism industry and for the quality of life of Victorians. Projects must recognise that the presence of continuous safety barrier will have a large influence on the road identity and community perception, hence providing a pleasant and enjoyable roadside is a critical consideration.

At high speeds, the large scale landscape is what typically attracts the motorist’s attention and a landscape that is characterised as untouched or unspoiled usually evokes a positive reaction, while if a landscape is changed, some believe the value has been lost.

Drivers are stimulated by variation but dulled by monotony, therefore, it can be important to avoid the use of unnatural infrastructure variation, such as changing barrier types and offsets regularly, which may detract from the landscape.

Continuous lengths of similar barrier types and designs are desirable to allow focus on the natural landscape. Hence, the type of barrier selected and design should carefully consider the following, with the intent to provide a consistent roadside barrier design:

- existing barrier types present and lengths;
- the potential to replace those existing barrier types; and
- the number of transitions required for each barrier type.

Recognising that barrier types will eventually need to change to suit specific site constraints and barrier performance requirements, projects should generally aim to vary the barrier type no more than once every 5km (i.e. 3 minutes of travel), but is not mandatory.

8. Context Sensitive Design (CSD)
CSD provides flexibility, to encourage designers to investigate and adopt criteria considered appropriate or tailored for a particular situation. CSD can be used to address multiple priorities and project objectives.

Consideration of design criteria, outside of the normally accepted range, that can support the goal of Safe System and Towards Zero, is encouraged and should comprise technical advice from VicRoads during development. Early input and development will assist projects during the preparation of CSD documentation and assure objective clarity and approval by the Regional Director or PRC. For further guidance on CSD and the approval process, refer Context Sensitive Design – The application of Design Domain and Design Exception (WORKING DRAFT).

Where design elements less than minimum are adopted, appropriate measures or some form of mitigation of adverse effects must be incorporated to offset the lower design values used or be balanced with appropriate risk management when adopting CSD principles. The requirement for mitigation
measures and the resultant specific actions must be assessed for each case and addressed from the outset. The proposed use of mitigation strategies and their expected impact on the substantive safety of the roadway must be documented within the CSD summary report.

9. Safety barrier requirements

9.1. Safety barrier classification
- Flexible safety barriers comprise both wire rope safety barrier (WRSB) systems and flexible (weak post) w-beam systems;
- Semi-rigid safety barriers comprise strong post w-beam systems (such as Type-B Guard Fence) and thrie-beam systems;
- Rigid safety barriers comprise concrete F type barriers.

The above products were accepted at the time of publication. Refer to Road Design Note 06-04 – Accepted Safety Barrier Products for a list of current products and classification.

9.2. Preferred safety barrier systems

Only safety barrier products listed under VicRoads Road Design Note 06-04 can be used. Discontinued safety barrier products shall not be considered. Accepted barrier variants are listed within the product detail sheet.

Flexible systems are preferred where possible, as these barrier types have the lowest impact severity and greatest potential to reduce occupant injury.

WRSB systems are preferred given their effectiveness for errant vehicle occupants, Test Level 4 containment and low installation cost, however, flexible w-beam systems can have advantages over WRSB systems, including potentially lower maintenance costs, a lower offset from barrier hinge points and lower deflection requirements for long lengths and on the inside of curves.

Semi-rigid and rigid barriers should be limited to constrained situations where a) the use of a flexible system is cost prohibitive, b) at connections to rigid barriers and structures, c) the barrier is not easily accessible for repair or d) is likely to result in a greater whole of life cost. Rigid barriers are preferred by VicRoads on high volume urban freeways.

Barrier selection should take whole-of-life costs (installation, maintenance, repair) into consideration and the most suitable system for the road length should be selected.

VicRoads has completed a whole-of-life cost assessment for both flexible barrier types. Findings from the whole-of-life (30 year) model showed that WRSB and flexible w-beam have similar cost-effectiveness in an unmodified, unconstrained application. Given the relatively small difference (approx. 10%) and sensitivities possible within the assessment, it was evident that the most effective system for a particular site will depend on the ability to utilise the benefits and minimise disbenefits of each system.

General guidance has been provided in Table 1 for common rural brownfield (retrofit) scenarios and the preferred safety barrier system.

<table>
<thead>
<tr>
<th>Common road characteristics</th>
<th>Preferred Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadsides permitting a barrier offset of 3.6m from the traffic lane with hazards offset 1.5-2.3m from the barrier</td>
<td>WRSB</td>
</tr>
<tr>
<td>Roadsides permitting a barrier offset of 1.5m or less from the traffic lane</td>
<td>Flexible W-Beam</td>
</tr>
<tr>
<td>Roads with a geometry less than 200m radius</td>
<td>Flexible W-Beam</td>
</tr>
<tr>
<td>Where barrier length (between terminals) is less than 100m</td>
<td>Flexible W-Beam²</td>
</tr>
<tr>
<td>Higher risk motorcycle routes</td>
<td>Flexible W-Beam with rub rail or equivalent</td>
</tr>
<tr>
<td>Narrow/wide medians (&gt;6.2m) without fixed hazards, excluding the scenarios above</td>
<td>WRSB</td>
</tr>
<tr>
<td>Narrow medians (&lt;6.2m) without fixed hazards, excluding the scenarios above⁵</td>
<td>WRSB or Flexible W-Beam</td>
</tr>
<tr>
<td>Roads designated as Road Maintenance Category (RMC) 5 and 6, in accordance with Standard Section 750 and VicRoads register of public roads⁴</td>
<td>Flexible W-Beam</td>
</tr>
</tbody>
</table>

Notes:
1. Providing a desirable to minimum barrier offset and adequate deflection area.
2. Projects must also consider aesthetics and the preference for a uniform barrier type.
3. WRSB is currently preferred given the higher containment and ability to repair the barrier without foundation works.
4. Recognises the less frequent inspection regime, longer repair times and risk of WRSB remaining damaged.
5. Refer VRS to AGRD Part 3 and RDN 03-08.

While semi-rigid and rigid barriers are stiffer than flexible barrier systems during impact, they continue to provide acceptable performance for occupants and often provide greater containment and less deflection, making them useful in constrained locations.

Transition to MASH

VicRoads, in harmony with Austroads, is transitioning to safety barrier products rated in accordance with the Manual for Assessing Safety Hardware (MASH). While both MASH and NCHRP-350 products are accepted for use, we recommend that MASH products are installed where possible to future proof the serviceability of the asset. Projects should avoid comparison between MASH and NCHRP350 given that the lower impact energy and deflection will often make NCHRP350 products cheaper and more attractive to contractors and installers.
9.3. Safety barrier offsets

As stated in VicRoads Supplement to AGRD Part 6, every effort should be made to achieve the desired offset of 4.0 metres as it allows broken down vehicles to pull over clear of traffic lanes and provides space for maintenance vehicles. Refer to VRS to AGRD Part 6 for barrier offset requirements.

Recognising that continuous barrier will transform how people use and maintain our roads, providing an operational barrier is especially important on Freeways/Highways, and projects should consider greater barrier offsets (i.e. 4m-6m) where existing conditions permit. A typical order of priority from the edge line to the safety barrier is provided below.

In addition, providing a consistent barrier offset is especially important for lengths of continuous barrier. Consistent barrier design can help stabilise road users when located within their field of view, while frequent changes in barrier offset can mislead drivers and negatively impact their driving, especially in adverse visibility conditions.

As such, the offset of continuous barrier should take into account the characteristics of the route and aim for a consistent barrier offset where possible. This approach may require the designer to balance other design elements such as kerb offset or deflection in certain locations, to achieve a functional barrier design and maximise the protected area.

Left side offsets (order of priority):

- desirable 6.0m – 4.0m with minimal to no earthworks
- desirable 4.0m with minimal earthworks or moderate earthworks on Freeways/Highways
- minimum 4.0m - 3.0m with moderate earthworks; mitigation measures to be considered
- minimum 3.0m with moderate earthworks if required; mitigation measures to be considered
- minimum 3.0m with considerable earthworks and a reduced offset to hinge point if required
- where only offsets of less than 3.0m can be achieved, projects should consider the operational effects and mitigate where possible. Refer to the guidance provided in VicRoads Supplement to AGRD Part 6 and other sections of this document.

Median / right side offsets (order of priority):

- desirable 4.0m-3.0m with minimal to no earthworks,
- minimum 2.0m-1.5m with minimal to no earthworks where barrier offset is ≥ 4m on left side,
- minimum 1.5m with moderate earthworks where barrier offset is ≥ 3m on left side,
- less than 1.5m where a documented design assessment has been completed, considering guidance provided in VicRoads Supplement to AGRD Part 6 and other sections of this document.

Given the economic impact of earthworks, subjective terms (e.g. considerable) have been used. In general, these terms should be defined as follows:

- **Minimal Earthworks**: No widening of the existing formation, additional pavement widening or shoulder sealing is contained within the existing formation
- **Moderate Earthworks**: Minimal widening of the existing formation as required and minor changes to existing cut and fill batters, table drains and drainage structures
- **Considerable Earthworks**: Extensive widening of the existing formation and significant impacts on existing cut and fill batters, table drains and drainage structures. Some sections may include road reconstruction or realignment.

Median barrier offsets between 2.0m-3.0m should be avoided to discourage vehicles from pulling over into a narrow shoulder. Where a divided carriageway has two or less lanes in one direction, median barrier offsets may be less than minimum when a 3.0m barrier offset or greater is provided on the verge. This limits the number of lanes a vehicle may have to cross in the event of breakdowns to stop clear of the traffic lanes.

**Mitigation measures for reduced barrier offset**

Projects should consider the following mitigation measures for considerable lengths of reduced barrier offset:

- Speed reduction
- Localised pull over opportunity
- Above desirable sight lines
- Signs or other advisory information
- Freeway management systems (e.g. variable speed/ lane use)
- Stakeholder education/awareness (maintenance/CFA)
- User education & public awareness

9.4. Safety barrier overlaps

There is often a need to overlap two separate barrier lengths in a way that maintains continuous safety barrier and prevents errant vehicles from encroaching into the roadside.

![Figure 2: Typical Barrier Overlap for WRSB](#)
Accordingly, all overlaps shall be such that the terminating system is located in front (closer to the traffic lane) of the commencing system, with Points of Need (PON) intersecting at right angles to the travel lane. Where practical, full dynamic deflection of the terminating system should be provided between an overlapping flexible or semi-rigid barrier system. WRSB intermediate anchors may also be provided where practical.

Full dynamic deflection for the terminating system must be provided in any case where the commencing barrier system is rigid, such that an errant vehicle will not deflect into the blunt end of the rigid system.

Typical barrier overlap layouts have been developed on a previous project for common situations. While these drawings are not a standard or minimum requirement, they may be adopted when the layout is suitable for site. Refer Section 15 for further information and Appendix A.

9.5. Maximum safety barrier length

There is no fixed maximum length for an installation of WRSB. However, if the barrier is hit, particularly at the end anchor, the ability of the barrier to resist subsequent impacts before the barrier is repaired is uncertain. To reduce the risk of long lengths of barrier being disabled by single vehicle impacts, a maximum length of 1 km should generally be adopted. A new length should commence thereafter via an overlap of PON between the separate lengths.

“The decision to use WRSB lengths longer than 1km is not prohibited, but should consider the overall barrier performance”

The decision to use WRSB lengths longer than 1km is not prohibited, but should consider the overall barrier performance, including the added risk of secondary impacts and additional deflection versus the ability to mitigate these risks or eliminate intermediate anchors. For example, where majority of risks have been managed a WRSB length of up to 2km could be achieved.

Other barrier systems may have a greater maximum length, given that the impact damage is more localised, but must consider barrier offset to the edge line, sight distance, provision for stopping and emergency services.

9.6. Provision for stopping

Roadside stopping is expected and therefore, must be considered where long lengths of continuous safety barriers are installed so that drivers can safely pull off the road in the event of an emergency, such as a broken-down vehicle. Where the road has 2 lanes or less in each direction, provision for stopping can be managed entirely within the LHS roadside.

Where the road has three or more lanes in each direction, it is preferable to have provision for stopping on both sides of the carriageway to limit the number of lanes a vehicle may have to cross in the event of breakdowns.

In the case of non-discretionary stopping (e.g. urgent / emergency stopping), continuous safety barriers should be offset 3m or greater (desirable 4.0m-6.0m) from the edge line so that occupants are able to open the doors of a passenger vehicle clear of the traffic lane. See Section 9.3. If continuous safety barrier is installed less than 3m from edge line, stopping should be discouraged by limiting the length of reduced offset and by providing advice to drivers on where to stop.

In the case of elective/ discretionary stopping (e.g. the driver has an element of choice and will stop at a location which they perceive as safe), it is desirable that stopping opportunities are available off the main carriageway where the speed environment is low.

Where existing off-road opportunities are not available, it is recommended that Emergency Stopping Bays are provided at least every 1km-4km to give drivers additional space to stop further from the traffic lane.

The precise frequency and locations of emergency stopping bays (ESB’s) or other should be determined with consideration of; a route plan, minimising the cost of earthworks required, providing adequate sightlines, and targeting high risk stopping sections such as steep grades and reduced barrier offsets. Regular spacings are more likely to meet driver expectation and increase use.

The preferred layout of an ESB should be in accordance with Figure 4, which includes a desirable offset of 5m-6m from edge line and length of 55m. No additional sealing is required and ESB’s should have advanced signing where appropriate to advise drivers. A typical Emergency Stopping Bay combined
with a maintenance access has been developed and attached in Appendix A.

Provision for heavy vehicle stopping should also be considered where the CV percentage is high. Opportunities for Heavy Vehicle stopping may be provided less frequently and the layout of ESB’s should be modified to consider the length and width of expected vehicles.

9.6.1. Help Phone Bays

The retention, installation or upgrading of help phones should be avoided due to the availability of mobile phones and other methods of incident detection. However, the VicRoads Help Phones Policy (2016) recognises that in high risk locations (e.g. lack of cellular coverage), the retention, installation or upgrading of help phones may be considered.

Where continuous barrier is proposed adjacent to a help phone bay, that is to be retained, the barrier must be flared and aligned behind the bay/phone to allow for normal access.

TC-2024 and TC-2025 detail the standard help phone bays installed on the Victorian network, both of which should be treated with a similar barrier alignment shown in Figure 4; smaller curve radii could be used for flexible w-beam systems.

Where existing kerb is present, it is desirable that a kerb-barrier offset shown in SD 3502 is provided, however, this may not always be achievable, and an alternative offset may be required for the short bay length. Where possible, a mountable kerb could be installed to limit the effects on barrier performance.

9.7. Emergency services

The roadside can be critical to the operational activity and response of emergency services. As such, installations of continuous safety barrier must consider the needs of local emergency services and provide adequate access where possible. Frequency of access points and locations must be determined in the context of a specific road section (e.g. access to water supply and high-risk locations).

It is important to consult with emergency services during the design development as it is not always practical to achieve an access break every 1km. Access locations are useful to prevent; delays from barrier dismantling, restricted escape routes and delays from travelling around barriers.

Recognising that most emergency access locations will require a 4m separation between barriers, these locations should be selected based on the following:

- locating the break on sags or straights where sight distance is greatest,
- locating the break separate from diverge or merge points where the risk of Run-off-Road is highest, and
- flaring the approach terminal to maximise protection as far as practicable.

Emergency access may be combined with stopping bays; Refer Appendix A – Typical barrier drawings

9.8. Length of need requirements

The commencement of barrier lengths should not be determined in accordance with the traditional Length of Need (LON) approach. Safety barrier lengths should commence at the earliest possible location and extend as far as practical. At each barrier terminal, the run-out length method can be used to determine the area of exposed hazards beyond the barrier that may be impacted by errant vehicles. As such, the following solutions should be considered:

- Removal of hazards that are not adequately shielded by the barrier,
- Relocate hazards to ensure they are adequately shielded by barrier,
- Relocate hazards beyond the clear zone,
- For single hazards that may not be practical to remove or relocate, such as power poles, consider additional safety treatments such as Raptor Cushions,
- Provision of the run-out area for vehicles that may impact the gating terminal
- Ensure that the preceding safety barrier has a straight alignment and the succeeding safety barrier is flared as much as feasible. This will reduce the likelihood of an errant vehicle entering the roadside environment.

9.9. Run-out area requirements

Run-out areas are to be provided in accordance with SD 3571 and 3573 for barrier lengths that commence after entry and exit ramps, side roads, truck rest areas / stack sites or property access points. All other locations shall be treated as appropriate with either:

- a connection to or extension of an existing barrier length;
- an overlap with an existing or new barrier length, including overlaps with a gap for roadside access.

9.10. Barrier impact on sight lines

Adjacent to side roads and private property access points, safety barrier must be installed and/or flared to a minimum offset of 3.0m from traffic lane to reduce the impact on sight lines for exiting vehicles. Otherwise, individual assessments are required. Roads with horizontal and vertical curves may require additional barrier offset (3m+) to achieve sight lines.

In cases where sight distance is already substandard and the installation of a roadside barrier is likely to reduce sight lines below what is currently available, consideration to relocate the access road must be the first priority, before accepting that a lower level of protection is the most cost-effective solution.

The potential for safety barriers to impact sight lines on horizontal curves must be considered in accordance with the relevant Austroads and VicRoads guidelines. When sight lines on the inside of horizontal curves are below substandard, a barrier system that reduces deflection and maximises offset to the traffic lane should be considered.
9.11. Barrier offset to the hinge point
Continuous safety barriers should be located such that the
dynamic deflection is contained within the verge width (6:1 or
flatter). Where this requires considerable earthworks, the
following minimum offsets must be provided unless a design
exception is adopted:
- WRSB must be located 1000 mm from the hinge point;
- Flexible W-Beam must be located 500 mm from the hinge
point to back of post.

These values are based on the ‘Support Width’ in accordance
with VicRoads Supplement to AGRD Part 6.

9.12. Replacement of existing barrier
Where existing safety barriers do not meet current performance
standards, their upgrade or replacement should be considered
as follows:
- Replace the following end terminals with currently
  accepted products:
  o MELT – Replace with a G.R.E.A.T;
  o BCTA – Replace with a G.R.E.A.T;
  o BCTB – Replace with a G.R.E.A.T; or Trailing
    Terminal where applicable;
  o Flexfence Standard Wire Rope Terminal – Replace
    with a Flexfence TL3 End Terminal;
- Upgrade the height of existing guard fence using Abraham
  Blocks or Replace with a more forgiving system, where the
  existing height is <686mm to top of w-beam;
- Consider raising the height of existing guard fence using
  Abraham Blocks or consider replacing with a more
  forgiving system, where the existing height is <720mm to
  top of w-beam. Proposed locations must demonstrate an
  overall cost benefit and should review total length, vehicle
  types and terminals;
- Consider replacing Sentryline II (releasing) terminals with a
  Sentryline III (non-releasing) terminal when the barrier
  offset is <3 m and barrier length is 500 m and greater.
- Assess the performance requirements of existing 3-rod
  WRSB systems and upgrade where cost effective;
- Assess the performance requirements of existing WRSB
  installations that are outside current guidance and consider
  upgrading where insufficient.

Notes:
1. 686mm is the lowest height within tolerance using the superseded
    mounting height of 706mm.
2. Requirements for legacy products may differ to current guidelines
    (e.g. deflection, verge support, terminals). As such, an assessment
    should be completed to determine if the existing products will
    perform within the current site conditions and upgrade where this
    performance is not acceptable. Where legacy products will perform
    as intended, an upgrade is not required.

9.13. System specific design
In accordance with RDN 06-02 and RDN 06-08, system
specific designs may be considered when the proprietary
product is known, and the barrier can be designed with
consideration of product specific crash testing provided by the
System Supplier. System Specific designs should be specified
on the design plans and should be used in isolation of other
systems (e.g. not connected).

Please contact the VicRoads Safe System Engineering team to
discuss any system specific designs that may have been
identified for consideration on recent projects. System specific
designs that have been successfully assessed may ultimately
be included within the product acceptance for broader use.

The information below specifies the approach for treating
routes or sections of road that are considered to have a high
risk for motorcycle crashes. This may include popular
motorcycle routes or road sections with a significant motorcycle
crash history.
- Where the risk of motorcyclists leaving the road, and
  impacting a roadside hazard is considered high risk (e.g.
  tight curve or crash history), a combination of safety
  barrier and continuous motorcyclist protection should be
  adopted. Refer to VicRoads RDN 06-04 for accepted
  products;
- Where the volume of motorcyclists is high, and the barrier
  is located close to the traffic lane (e.g. <1.5m), flexible w-
  beam systems are preferred given the posts do not
  protrude above the rail.

Where WRSB is being installed and there is a specific
motorcyclist RoR crash history, post protection products may
be considered in the high-risk location and only when the
expected impact speed is low (<60km/h).

10. Treatment of the median
10.1. Number of barrier runs
To minimise the risk of fatal and serious injuries, safety barriers
should be located such that they satisfy the offset requirements
for both traffic directions (e.g. 6m-4m offset) which will result in
the use of two barrier runs where the median is greater than
10m.

While two runs are desirable, it may not be practical for all road
sections (e.g. current maintenance), therefore, one run of
flexible wire rope safety barrier may be considered in the centre
median where the conditions in Table 2 are all satisfied.

Where any one of the conditions is not met, two runs of safety
barrier are preferred in the median. Both runs of barrier should
be designed to meet the principles contained within this
document.
Table 2: Conditions for a single median barrier

<table>
<thead>
<tr>
<th>Median Width &lt; 10m</th>
<th>Median Width &gt; 10m</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are no fixed hazards within the median OR all fixed hazards can be removed.</td>
<td>There are no fixed hazards within the median OR all fixed hazards can be removed.</td>
</tr>
<tr>
<td>The grade throughout the median is no steeper than 10:1 OR can be re-graded as such.</td>
<td>The grade throughout the median is no steeper than 10:1 OR can be re-graded as such.</td>
</tr>
<tr>
<td>The barrier can be located such that it satisfies the offset requirements in this document for both directions.</td>
<td>The barrier can be located such that it satisfies the offset requirements for one direction and will allow for the retrospective installation of a second run of safety barrier should there be a future need.</td>
</tr>
</tbody>
</table>

10.2. Median openings
Where median openings are required to be provided or maintained, consideration should be given to staggering the gap between safety barrier systems. This is applicable where two rows of barrier are required in the median.

Typical barrier layout drawings for median openings, are in Appendix A.

11. Treatment of entry and exit ramps
Entry and exit ramps should be considered for treatment with due consideration of the following:

- Treatment of the through carriageway of the road must take priority over the ramps - sight lines are critical,
- For single lane ramps, the provision of any safety barrier on the ramps must not prevent the ability to overtake any broken-down vehicles;
- Adequate roadside access must be provided as required.

12. Treatment of rural townships
Where the subject road length passes through a township(s), the installation of safety barrier should be considered as the primary treatment. It is acknowledged that continuous safety barrier may not be feasible due to the frequency of intersections, access to roadside parking, median openings, access points, pedestrian crossing points, etc. Furthermore, liaison with the relevant Local Government Authorities (LGAs) will be required regarding amenity requirements, roadside access and maintenance, etc.

Where continuous safety barrier cannot be installed through townships refer also Section 3. Safer speeds.

13. Treatment of urban locations
Where continuous barrier is being applied in an urban environment, the designer must consider the impact of barrier on other road user functions, such as

- Pedestrian and cyclist access and connectivity
- DDA requirements
- Bus access and routes
- Local events
- Local services (e.g. waste management)

14. Supporting treatments
Supporting treatments improve the effectiveness of continuous safety barrier and help create sustainable operation and maintenance of the road.

14.1. Sealing in front of barrier
Providing a sealed pavement in front of a safety barrier will reduce the frequency of collisions. Thereby reducing the rate of repair works and the likelihood that an un-repaired barrier will be impacted. Paving can also support the ongoing maintenance of the road, including eliminating the need to mow grass between the traffic lane and barrier, or between barrier and road furniture.

In general, providing pavement for the full width between barrier and traffic lane is desirable and should be provided when the barrier is offset 3m or less from the traffic lane.

Where less than full width pavement is being considered, including when the barrier is offset more than 3m, designers should determine a pavement width in accordance with AGRD Part 3 and VicRoads supplements, while also considering the potential safety and maintenance risks of adopting a narrower width. If there is a localised issue that has been identified as high-risk (e.g. sub-standard sight distance), additional pavement width should be provided at that location. For retro-fit barrier installation, the benefit-cost of increasing the existing pavement should be evaluated.

![Figure 5: Typical black ATLM rib](attachment:Figure5.png)

14.2. Audio tactile Line marking
Audio tactile line marking (ATLM) reduces the frequency of nuisance impacts (therefore the likelihood that the barrier is damaged). ATLM should be installed along the entire barrier length to reduce the likelihood of impact with continuous safety barriers.

Application of ATLM to be in accordance with RDN 03-10 Audio Tactile Line Marking.
15. Road Safety Audit (RSA) and Safe System Assessment (SSA)

In accordance with the current VicRoads Road Safety Audit (RSA) Policy 2011, an RSA should be undertaken at each stage of the project. Where an exemption to this policy is being considered, based on project cost and specific risk factors, at minimum a RSA must be conducted at both the detailed design, traffic management and post opening stages.

In addition to above, a Safe System Assessment (SSA) must be considered in accordance with VicRoads Safe System Assessment Guidelines.

16. Roadside access and maintenance philosophy

16.1. Safety barrier maintenance strips

The provision of safety barrier maintenance strips, concrete or otherwise, will generally not be supported for the rollout continuous safety barrier. Exceptions may be made if it can be shown that maintenance strips offer greater benefits, on a whole-of-life comparison, over alternative practices. Applications for an exception must demonstrate the consideration of current technology including mowing equipment and/or alternative maintenance strip materials such as controlled grasses.

16.2. Maintenance and service authority access

For the purpose of providing access to services, assets or for roadside maintenance activities, strategically located gaps in the safety barrier should be selected in consultation with and consideration of affected asset owners. This can be done for the entire route or a section of road.

Ideally, gaps should be designed as overlaps between safety barrier lengths that allow for vehicle access, but still prevent errant vehicles from entering the roadside environment.

Depending on the site constraints, the overlaps should be designed as follows (in order of preference):

- 90-degree PON overlap
- 25-degree PON overlap
- 10-degree PON overlap
- No overlap. Start and stop two separate barrier lengths.

While 90-degree PON overlaps are preferred and should be provided for a typical ‘no access’ barrier overlap, the lateral width can be quite large where access is required. As such, 25-degree PON overlaps are more typical default for maintenance and service authority access locations.

Typical access layouts have been provided in Appendix A. While these drawings are not a standard or minimum requirement, they may be adopted when the layout is suitable for site.

Roadside access gaps are designed for frequent use by mowers, tractors, etc. For infrequent use, such as cranes and excavators, the asset will be temporarily pulled down.

The locations and orientation of access gaps should consider the desirable entry and exit of frequent maintenance vehicles. This includes providing entry and exit locations between obstacles, such as creeks, culverts, trees, etc. Typical tractors are 2.5-3.5m wide and 3.5m high.

Projects should consider undertaking minor works during installation to support the potential cost savings of ongoing maintenance.

Where maintenance is required in the area between the face of barrier and edge of traffic lane (for example grassed areas), permanent roadside signs should be relocated behind the barrier.

16.3. Fauna crossing

On our roads, many animal species die per annum including some species of environmental significance. Fauna crossings may range from providing culverts, bridges, gaps within the barrier or rub rail, or fencing to restrict or corral fauna to an appropriate crossing point. A generic treatment on one project may not suit other locations or fauna, therefore, a specific treatment particularly suited to the local fauna and environment will need to be determined.

In general, wildlife should be discouraged from accessing roadways (other than low-speed and low-traffic volume roads) to minimise road kill and therefore gaps in WRSB and flexible W-Beam are not recommended. This advice is to be reviewed periodically by fauna experts, as more information becomes available on wildlife behaviour in roadsides with continuous barrier.

Safety barriers with rub-rail for motorbikes may obstruct the movement of wombats, echidnas, possums and other animals that are too large to squeeze under the rub rails. Where these species habitat nearby areas, gaps in the rub rail should be considered to allow animals to escape from the road, but not provide access to the road.

When roads divide habitats and/or small populations of wildlife, expert fauna advice should be provided to assess the risk from reduced animal movement. For more guidance on the subject it is recommended to contact Urban Design – Integration Services.
Bibliography

1) Towards Zero – Safe System Roadside Design Principles for High Speed Divided Roads
2) AS/NZS 3845.1:2015 - Road Safety Barrier Systems.
3) Austroads Guide to Road Design Part 6: Roadside Design, Safety and Barriers
4) VicRoads Supplement to the Austroads Guide to Road Design Part 6: Roadside Design, Safety and Barriers
5) Road Design Note 06-02 D September 2016 - The use of Wire Rope Safety Barriers (WRSB)
6) Road Design Note 06-04 L June 2018 - Accepted Safety Barrier Products
7) Road Design Note 06-08 B December 2017 - The use of Flexible and Semi-Rigid Guard Fence
8) SD 3502 - Guard Fence and Wire Rope Safety Barrier Offset Guidelines;
9) SD 3544 - Trailing Terminal General Arrangement
10) SD 3545 - Gating Re-directive Absorbing Terminal Runout Area Details
11) SD 3573 - Wire Rope Safety Barrier Terminal Runout Area Details
12) SD 3901 - Concrete Barriers SD 3901 Type F Shape Barrier
13) Proprietary safety barrier product manuals
14) Typical drawings for Roadside access gaps (refer to Appendix A)

Appendices:

APPENDIX A: Typical barrier drawings

For information and suggestions please contact:
VicRoads Safe System Engineering team,
60 Denmark St, Kew Vic 3101
Email: safesystemengineeringdesign@roads.vic.gov.au

Road Design Note 06-15– Revision Summary

<table>
<thead>
<tr>
<th>Issue</th>
<th>Approved</th>
<th>Date</th>
<th>Amendment</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-15</td>
<td>M-SSE</td>
<td>March 2019</td>
<td>First edition</td>
</tr>
</tbody>
</table>

Road Design Notes are subject to periodic review and may be superseded.
Appendix A – Typical barrier drawings

Typical barrier drawings have been provided for common scenarios. While these drawings are not a standard or minimum requirement, they may be adopted by projects when the layout is suitable for site. The drawings have been marked ‘working release’ while the Safe System Engineering team make minor drafting changes.

Please contact safesystemengineering@roads.vic.gov.au if you have additional drawings that may be included.

Table of Contents

<table>
<thead>
<tr>
<th>Number</th>
<th>Page</th>
<th>Description</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>763654</td>
<td>13</td>
<td>Continuous safety barrier - M &amp; A Divided roads</td>
<td>Provides a summary of this RDN for divided roads. Should be read in conjunction with the relevant sections.</td>
</tr>
<tr>
<td>763655</td>
<td>14</td>
<td>Continuous safety barrier - B &amp; C Undivided roads</td>
<td>Provides a summary of this RDN for divided roads. Should be read in conjunction with the relevant sections.</td>
</tr>
<tr>
<td>782001</td>
<td>15</td>
<td>Formation widening – Guard fence and WRSB</td>
<td>Distance between barrier and hinge point shown is a minimum and does not cater for dynamic deflection (desirable).</td>
</tr>
<tr>
<td>782002</td>
<td>16</td>
<td>Cut embankment – No Kerb</td>
<td>Distance between barrier and cut batter is 2.5m minimum to allow for typical maintenance practices.</td>
</tr>
<tr>
<td>782003</td>
<td>17</td>
<td>Cut embankment – With Kerb</td>
<td>Must consider drainage requirements. Verge area (behind kerb) should be sloped towards the kerb.</td>
</tr>
<tr>
<td>782004</td>
<td>18</td>
<td>Table drain relocation (FILL)</td>
<td>Need to consider the available space for maintenance.</td>
</tr>
<tr>
<td>782005</td>
<td>19</td>
<td>Table drain relocation (CUT)</td>
<td>Need to consider the available space for maintenance.</td>
</tr>
<tr>
<td>782006</td>
<td>20</td>
<td>Emergency services – Median Barrier Access - 90 Degrees PoN overlap</td>
<td>To be used after consideration of 90 and 25-degree PoN overlap. Refer section 9.4 and 15.2.</td>
</tr>
<tr>
<td>782007</td>
<td>21</td>
<td>Maintenance access – 10 Degrees PoN overlap</td>
<td>To be used after consideration of 90 and 25-degree PoN overlap. Refer section 9.4 and 15.2.</td>
</tr>
<tr>
<td>782008</td>
<td>22</td>
<td>Maintenance access – 25 Degrees PoN overlap</td>
<td>To be used after consideration of 90-degree PoN overlap. Refer section 9.4 and 15.2.</td>
</tr>
<tr>
<td>782009</td>
<td>23</td>
<td>Maintenance access – 90 Degrees PoN overlap</td>
<td>Refer section 9.4 and 15.2.</td>
</tr>
<tr>
<td>782010</td>
<td>24</td>
<td>Side road access – Barrier layout</td>
<td></td>
</tr>
<tr>
<td>782011</td>
<td>25</td>
<td>Stopping refuge bay - Wire rope safety barrier</td>
<td></td>
</tr>
<tr>
<td>782012</td>
<td>26</td>
<td>Access on bridge departure – 90 Degrees PoN overlap</td>
<td></td>
</tr>
<tr>
<td>782013</td>
<td>27</td>
<td>Emergency services – Vehicle Median Turn Area</td>
<td>Sight lines are critical. Likely earthworks to achieve barrier offsets and maximum barrier length.</td>
</tr>
<tr>
<td>782014</td>
<td>28</td>
<td>Combined - Refuge Bay &amp; Median Access</td>
<td>Refer Section 9.6.</td>
</tr>
<tr>
<td>782015</td>
<td>29</td>
<td>WRSB – Departure overlap detail (no access)</td>
<td></td>
</tr>
<tr>
<td>782016</td>
<td>30</td>
<td>GF – Departure overlap detail (no access)</td>
<td></td>
</tr>
<tr>
<td>782017</td>
<td>31</td>
<td>WRSB – Approach overlap detail (no access)</td>
<td></td>
</tr>
<tr>
<td>782018</td>
<td>32</td>
<td>GF – Approach overlap detail (no access)</td>
<td></td>
</tr>
</tbody>
</table>
**REFERENCES AND NOTES:**

a). AGRD PART 6: ROADSIDE DESIGN, SAFETY AND BARRIERS AND VICROADS SUPPLEMENT TO AGRD PART 6 TAKE PRECEDENCE.

**SUBJECT TO FURTHER AMENDMENT FOR DISCUSSION PURPOSES ONLY**

**UNFINISHED DRAWING**

**EXISTING GUIDELINE DRAWING**

**VicRoads Drawing No. 763654**

**PHONE (03) 9854 2666**

**60 DENMARK STREET**

**KEW **

**VICTORIA 3101**

**TYPICAL SAFE SYSTEM ROADSIDE DESIGN FOR HIGH SPEED DIVIDED ROADS - M AND A CLASS**

**N.T.S.**

---

**PREFERRED SAFETY BARRIER SYSTEM**

**Common Scenarios**
- Preferred Barrier
- Minimum Offset
- Desirable Offset

**Examples:**
- Where barrier length (between terminals) is 100m
- Barrier to be located on a drivable slope
- Median widths 6.2m in width without fixed hazards, excluding the scenarios above
- Roadsides with a barrier offset of 3-6m from traffic lane
- Higher risk motorcycle routes

**Preferred Barrier System**
- Flexible W-Beam
- WRSB or Flexible W-Beam with rub rail or equivalent

**Preferred Barriers**
- Flexible W-Beam
- WRSB
- Flexibale W-Beam
- Flexible W-Beam
- Flexible W-Beam
- WRSB

**Preferred Barrier**
- Existing Shoulder
- Existing Invert
- Linemarking
- Audio Tactile

---

**NOTE:**
- Dynamic deflection and/or working width to be in accordance with relevant AGRD's and product detail sheets. Typically, dynamic deflection of 3.0m for WRSB and 4.5m for flexible guard fence may be assumed, working width includes dynamic deflection and roll allowances.
- Barrier offset to hinge point should be equal to dynamic deflection. Refer RDN 06-02 and RDN 06-08 for design preferences. Absolute minimum offset to be 0.5m for WRSB and 1.0m for flexible and rigid guard fences.
- The maximum preferred WRSB length should not exceed the longer length by exception.

---

**UNFINISHED DRAWING**

**SUBJECT TO FURTHER AMENDMENT FOR DISCUSSION PURPOSES ONLY**

**INFORMATION SHOWN IS CURRENT AS AT DATE:**

**CONTACT:** Tony Fusca

---

**END OF DRAWING**

---

**INVESTMENT AND DESIGN SERVICES**

---

**GUIDELINE DRAWING**

---

**GUIDELINE DRAWING**

---

**GUIDELINE DRAWING**
**Typical Safe System Roadside Design for B and C Class Roads**

**Preferred Safety Barrier System**

<table>
<thead>
<tr>
<th>Common Scenarios</th>
<th>Preferred Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadsides with a barrier offset of 3.0m from traffic lane + hazard offset 3.0m from barrier</td>
<td>WRSB</td>
</tr>
<tr>
<td>Roadsides with a barrier offset of 6.0m from traffic lane</td>
<td>Flexible W-Beam</td>
</tr>
<tr>
<td>Roads with geometry &lt; 200m radius</td>
<td>Flexible W-Beam</td>
</tr>
<tr>
<td>Where barrier length between terminals is &lt; 100m</td>
<td>Flexible W-Beam with rubber rail equivalent</td>
</tr>
<tr>
<td>Higher risk motorcycle routes</td>
<td>Flexible W-Beam</td>
</tr>
<tr>
<td>Roadsides with a barrier offset of 2.0m from traffic lane + hazard offset 1.5-2.3m from barrier</td>
<td>WRSB</td>
</tr>
<tr>
<td>Roadsides with a barrier offset of 3.0m from traffic lane + hazard offset 1.5-2.3m from barrier</td>
<td>WRSB or Flexible W-Beam</td>
</tr>
<tr>
<td>Roads designated as road maintenance category 5 or 6 or in accordance with Standard Section 150 and VicRoads Register of Public Roads</td>
<td>Flexible W-Beam</td>
</tr>
</tbody>
</table>

**Barrier Offsets**

1. Barrier offsets should be maximized where possible. Offsets > 6m should be limited to emergency stopping bays or where it is cost effective to do so existing conditions.
2. Barrier offsets between 2.0m - 3.0m should be avoided to discourage vehicles from stopping in a narrow shoulder.
3. Offset options (in order of priority):
   - **Barrier**:
     - 5.0m - 6.0m may include considerable earthworks.
     - 4.0m - 5.0m may include moderate earthworks.
     - 3.0m - 4.0m may include minor earthworks.
   - **Flexible**:
     - 3.0m may include considerable earthworks and reduced offset to edge point if required.
     - 2.0m - 3.0m should be limited to areas where possible.

**Barrier Deflection**

1. Barrier deflection and/or working widths to be in accordance with RDN’s and product detail sheets. Typically, a maximum of 2.0m for WRSB and 1.7m for flexible guard fence may be assumed.
2. Barrier to be located on a drivable slope.
3. Barrier to be located on a drivable slope.
4. Barrier to be located on a drivable slope.
5. Barrier to be located on a drivable slope.
6. Barrier to be located on a drivable slope.
7. Barrier to be located on a drivable slope.
8. Barrier to be located on a drivable slope.
9. Barrier to be located on a drivable slope.
10. Barrier to be located on a drivable slope.
11. Barrier to be located on a drivable slope.
12. Barrier to be located on a drivable slope.
13. Barrier to be located on a drivable slope.

**Dynamic Deflection**

Typically, dynamic deflection of 2.5m for WRSB and 1.7m for flexible guard fence may be assumed.
CUT EMBANKMENT
GUARD FENCE / FLEXIBLE W-BEAM

2.5m

SHOULDER

AREA TO BE CLEAR OF HAZARDS

1.6m FOR FLEXIBLE W-BEAM

DEFLECTION ZONE

BARRIER TO BE INSTALLED
2.5m AWAY FROM CUT EMBANKMENT TOP

AREA TO BE CLEAR OF HAZARDS
1.65m FOR FLEXIBLE W-BEAM

(REFER TO APPENDIX A RDN 06-02)

1.5m TO 1.8m

AREA TO BE CLEAR OF HAZARDS

1.00m FOR GUARD FENCE

CUT EMBANKMENT
WITH WRSB

OFFSET THE BARRIER 2.5m FROM THE
EMBANKMENT WHERE POSSIBLE TO ALLOW FOR
MAINTENANCE VEHICLE ACCESS BEHIND THE
BARRIER. OTHERWISE ENSURE THE
EMBANKMENT IS OUTSIDE THE DEFLECTION ZONE.

CUT EMBANKMENT

REFERENCE:
TRAFFICWORKS
MAY'17
VICROADS

FILE: 166030-FLP-02
PROJ: 166030-FLP-02
CAT: 1

DRAWING NO.: 166030-FLP-02
SHEET NO.: 1

CONTRACT NO.: 166030-FLP-02

DESIGNED: 13-JUL-17
DRAWN: 3:50PM
APPROVED: 166030-FLP-02
SAFE SYSTEM BARRIER
CUT EMBANKMENT WITH WRSB

CUT EMBANKMENT
GUARD FENCE / FLEXIBLE
W-BEAM

AREA TO BE CLEAR OF HAZARDS
1.6m FOR FLEXIBLE W-BEAM

BARREL TO BE INSTALLED 2.5m AWAY
FROM CUT EMBANKMENT

AREA TO BE CLEAR OF HAZARDS
1.5m TO 1.8m

1.65m FOR FLEXIBLE W-BEAM
1.00m FOR GUARD FENCE

AREA TO BE CLEAR OF HAZARDS

W-BEAM
GUARD FENCE / FLEXIBLE
CUT EMBANKMENT

1:6 (MAX.)
1:10 (DESIRABLE)

1:6 (MAX.)
1:10 (DESIRABLE)
OFFSET TRAFFIC LANE

DEFLECTION ZONE

EXISTING SURFACE PROFILE (VARIES)

RELOCATE TABLE DRAIN TO OUTSIDE OF THE DEFLECTION ZONE

SAFETY BARRIER

REFER TO

RDN 06-07 FOR WRSB
RDN 06-02 FOR W-BEAM

BACKFILL TABLE DRAIN WITH TYPE-B FILL

TYPICAL SECTION - TABLE DRAIN RELLOCATION (FILL)
TYPICAL SECTION - TABLE DRAIN RELOCATION (CUT)
NOTES
1. WHERE SITE CONDITIONS DIFFER FROM THE TYPICAL LAYOUT, A MINIMUM GAP OF 4.0m IS DESIRED BETWEEN THE TWO BARRIER SYSTEMS. WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.
2. WHERE THE SHOULDER IN THE FAST LANE IS LESS THAN 3m, TRAFFIC MANAGEMENT SHOULD BE IMPLEMENTED TO ALLOW MAINTENANCE VEHICLE ACCESS INTO THE MEDIAN.

WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.

OFFSET OF 4.0m IS DESIRED FOR NEW INSTALLATIONS (3.0m MIN).

WHERE SITE CONDITIONS DIFFER FROM THIS TYPICAL LAYOUT, AS A MINIMUM, ENSURE THAT A GAP OF 4.0m IS PROVIDED BETWEEN THE TWO BARRIER SYSTEMS. WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.

WHERE THE SHOULDER IN THE FAST LANE IS LESS THAN 3m, TRAFFIC MANAGEMENT SHOULD BE IMPLEMENTED TO ALLOW MAINTENANCE VEHICLE ACCESS INTO THE MEDIAN.

WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.

WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.

WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.

WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.

WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.

WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.

WHERE MAINTENANCE ACCESS IS TO BE PROVIDED ON AN EXISTING SYSTEM, THE EXISTING OFFSET SHOULD BE MAINTAINED.
NOTES

1. BASED ON A 12m WRSB TERMINAL.
25 DEGREE POINT OF NEED OVERLAP

NOTE 1) REFER TO 6.2m BASED ON A 12m WRSB TERMINAL.

WIRE ROPE SAFETY BARRIER (WRSB)

WRSB TERMINAL

POINT OF NEED OVERLAP AT 25°

MARD STAND
200mm CRUSHED ROCK HARD STAND AREA 1% OR FLATTER
FOR APPROVED ALTERNATIVE ASPHALT / CONCRETE

EMERGENCY SERVICES OPERATION & MAINTENANCE ACCESS

SHELF CRUSHED ROCK HARD

10:1 OR FLATTER

200mm CRUSHED ROCK HARD STAND

NOTE 1) BASED ON A 12m WRSB TERMINAL.

TRAFFIC LANE

DIRECTION OF TRAFFIC

SHOULDER

CURVED LENGTH OF 200m

45.5m

57.5m REFER TO NOTE 1

TRAFFIC LANE

WRSB TERMINAL

NOTE 1) REFER TO 6.2m BASED ON A 12m WRSB TERMINAL.

WIRE ROPE SAFETY BARRIER (WRSB)

WRSB TERMINAL

POINT OF NEED OVERLAP AT 25°

MARD STAND
200mm CRUSHED ROCK HARD STAND AREA 1% OR FLATTER
FOR APPROVED ALTERNATIVE ASPHALT / CONCRETE

EMERGENCY SERVICES OPERATION & MAINTENANCE ACCESS

SHELF CRUSHED ROCK HARD

10:1 OR FLATTER

200mm CRUSHED ROCK HARD STAND

NOTE 1) BASED ON A 12m WRSB TERMINAL.
90 DEGREE POINT OF NEED OVERLAP

SHOULDER

TRAFFIC LANE

TRAFFIC LANE

SHOULDER

CURVED LENGTH OF 200m

28.2m

55.0m

NOTE 1) BASED ON A 12m WRSB TERMINAL.

NOTE 2) REFER TO 7.6m (REFER TO NOTE 1)

WIRE ROPE SAFETY BARRIER (WRSB)

NOTE AS SPECIFIED

DIRECTION OF TRAFFIC

DIRECTION OF TRAFFIC

WRSB TERMINAL

NOTE AS SPECIFIED

HARD STAND

220mm CRUSHED ROCK

MAX STAND AREA

1% OR FLATTER

FOR APPROVED

ALTERNATIVE ASPHALT / CONCRETE

EMERGENCY SERVICES OPERATION & MAINTENANCE ACCESS (WRSB)

SAFETY BARRIER

WIRE ROPE

67m (REFER TO NOTE 1)

NOTE 1)

OVERLAP AT 90°
<table>
<thead>
<tr>
<th>TERMINAL OFFSET</th>
<th>LONGITUDINAL LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>W (m)</td>
<td>V (m)</td>
</tr>
<tr>
<td>1.0</td>
<td>20.0</td>
</tr>
<tr>
<td>1.3</td>
<td>24.4</td>
</tr>
<tr>
<td>2.0 (MAX)</td>
<td>28.2</td>
</tr>
</tbody>
</table>

Refer to VicRoads SD 3573

**NOTES**
1. Safety barrier should extend as close to the side road / access as practicable.
SAFE SYSTEM BARRIER
ACCESS ON BRIDGE DEPARTURE
PON OVERLAP

BARRELS TO BE EXTENDED TO ENSURE THAT THE MAINTENANCE ACCESS LOCATION IS WITHIN A DRIVEABLE SURFACE.

SEE ABOVE FOR BRIDGE BARRIER EXTENSION DETAILS.

TRAILING TERMINAL

5 SPACES AT 500 x 500
7 SPACES AT 1000 SPACINGS x 7000

5600
5600

10010

5000
10000

2000
2500

TRAVEL

SAFETY BARRIER

1:6 MAXIMUM

TERMINAL

OFFSET AS POINT OF NEED OVERLAP

500
10000

TRAILING TERMINAL

EXTRU AS REQUIRED

EXTEND EXISTING BRIDGE DEPARTURE SIDE OF BARRIER TO A LOCATION WHERE THE SURFACE IS DRIVEABLE (IE 6:1).

SEE ABOVE FOR BRIDGE BARRIER EXTENSION DETAILS.

DETAILS.

BRIDGE CONNECTION
REFER SD 4048 FOR BRIDGE BARRIER.

GUARD FENCE AND CONNECTION BETWEEN ENSURE SATISFACTORY DIRECTION OF TRAVEL.

DIRECTION OF TRAVEL
DIRECTION OF TRAVEL

SAFETY BARRIER OR FLATTER

10.0m

TERMINAL

TERMINAL

SPECIFIED

200mm CRUSHED ROCK

HARD STAND AREA

1:6 MAXIMUM

ENDS OF DECK AND OTHER AREA TOP OF PLANTER

ENDS OF DECK

5 SPACES AT 2500
2500
2000

2500
2500

2000
2000

TRAILING TERMINAL

10.0m

4.0

1:6 OR FLATTER

HARD STAND AREA

200mm CRUSHED ROCK

SAFETY BARRIER

5 SPACES AT
2500

10.0m

5 SPACES AT
2500
PREFERRED LAYOUT FOR STOPPING REFUGE BAY

NOTES:

1. 100m RADIUS CURVES ARE ACCEPTABLE IN THIS INSTANCE ONLY TO LIMIT THE SIZE OF THE REFUGE BAY.

2. REDUCED POST SPACINGS WILL BE REQUIRED IN THESE AREAS.

3. UNYIELDING HAZARDS SHOULD NOT BE LOCATED WITHIN 5% OF 100m RADIUS CURVE SECTIONS WHERE IMPACTS ON THE CONVEX SIDE OF THE CURVE ARE POSSIBLE.

<table>
<thead>
<tr>
<th>TRAFFIC LANE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARC LENGTH</td>
</tr>
<tr>
<td>(m)</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

TRAFFIC LANE:

- 100m RADIUS CURVES ARE ACCEPTABLE IN THIS INSTANCE ONLY TO LIMIT THE SIZE OF THE REFUGE BAY.
- REDUCED POST SPACINGS WILL BE REQUIRED IN THESE AREAS.
- UNYIELDING HAZARDS SHOULD NOT BE LOCATED WITHIN 5% OF 100m RADIUS CURVE SECTIONS WHERE IMPACTS ON THE CONVEX SIDE OF THE CURVE ARE POSSIBLE.
NOTES

1. SAFETY BARRIER SHOULD EXTEND AS CLOSE TO THE SIDE ROAD / ACCESS AS PRACTICABLE.

<table>
<thead>
<tr>
<th>TERMINAL OFFSET</th>
<th>LONGITUDINAL LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;W&quot; (m)</td>
<td>&quot;Y&quot; (m)</td>
</tr>
<tr>
<td>1.0</td>
<td>20.0</td>
</tr>
<tr>
<td>1.5</td>
<td>24.4</td>
</tr>
<tr>
<td>2.0 (MAX)</td>
<td>26.2</td>
</tr>
</tbody>
</table>
NOTES:
1. 100m radius curves are acceptable (with reduced post spacings) in this instance only to limit the size of the refuge bay.
2. Reduced post spacings will be required in these areas.
3. Unyielding hazards should not be located within 5m of 100m radius curve sections where impacts on the convex side of the curve are possible.

Preferred Layout for Stopping Refuge Bay

ALTERNATIVE LAYOUT FOR STOPPING REFUGE BAY
### Traffic Conditions for Use

1. **Typical Setup for Divided Carriageway:**
   - Existing barrier on the approach side.

2. **Existing Barrier or the Approach Side:**
   - Maintain clearance along the length of the approach end terminal.

### Notes

1. **Design Speed:**
   - 30:1
   - 26:1
   - 24:1
   - 21:1
   - 15:1
   - 14:1
   - 12:1
   - 11:1

#### Design Philosophy

1. **Improved:**
   - No transition closer to the traffic lane.
   - Install overlap behind barrier.

2. **Maximised:**
   - Install overlap behind barrier.
   - Remove existing terminal and realign barrier.

**Design Speed:**

- 120 km/h
- 100 km/h
- 90 km/h
- 80 km/h

### Table 1

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>Wire Rope End Terminal (m)</th>
<th>Wire Rope End Terminal (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>3.1</td>
<td>26.1</td>
</tr>
<tr>
<td>100</td>
<td>3.1</td>
<td>24.1</td>
</tr>
<tr>
<td>90</td>
<td>3.1</td>
<td>22.1</td>
</tr>
<tr>
<td>80</td>
<td>3.1</td>
<td>20.1</td>
</tr>
</tbody>
</table>

### Notes

1. **Approach Offset:**
   - Refer to note 3 & 4

2. **Departure Offset:**
   - Refer to note 5

### Typical Lay-outs

1. Install overlap behind barrier.
2. Transition barrier to same offset.
3. Safe system barrier.

### General Notes

- **Notes to AGGR Part 6 for Required Flare Rates of Safety Barriers:**
  - Refer to AGRD part 6 for required flare rates of safety barriers.

- **Notes:**
  - Refer to AGRD part 6 for required flare rates of safety barriers.

- **Flare Rate:**
  - 1.5m - 2.1m clearance.

### Workshop Notes

- **Design Philosophy:**
  - Improved.
  - Maximised.

- **Approach Offset:**
  - Refer to note 3 & 4

- **Departure Offset:**
  - Refer to note 5

### Additional Details

- **Wire Rope End Terminal:**
  - Wiring angle.
  - Flare rate.

- **Design Speed:**
  - 120 km/h
  - 100 km/h
  - 90 km/h
  - 80 km/h

- **Approach Offset:**
  - Refer to note 3 & 4

- **Departure Offset:**
  - Refer to note 5

### Additional Information

- **Notes:**
  - Refer to AGRD part 6 for required flare rates of safety barriers.

- **Flare Rate:**
  - 1.5m - 2.1m clearance.

- **Design Philosophy:**
  - Improved.
  - Maximised.
**WORKING RELEASE**

**CONDITIONS FOR USE**
1. **Typical Setup for Divided Carriageway**
2. Existing Barrier or the Approach Side

**Point of Need Overlap Between the Two Terminals**
- Refer to Note 6
- Maintain clearance of the approach end terminal
- Curve Length

**Guard Fence / Flexible W-Beam**
- VicRoads approved end terminal
- Refer to RDN 06-04

**Approach Offset**
- Refer to Note 3 & 4

**Departure Offset**
- Refer to Note 1

**Notes**
- Design Speed
- Flare Rate

**Notes to AGRD Part 6 for Required Flare Rates of Safety Barriers**

**Typical Layouts**

**Design Speed (km/hr)**
- Flare Rates
  - 80: 2.2
  - 100: 2.4
  - 115: 2.6

**Maximum Flare Rate of 8:1 where Transition is to be Minimised and Not Exposed to the Traffic**
- Refer to SD 4071

**Notes**
1. Guard Fence / Flexible W-Beam to be installed on a 40m radius or to manufacturer requirements
2. Where the Offset is less than the existing barrier, the transition is designed to view the existing barrier
3. The desirable offset of the barrier from the traffic lane is 1.5m (3.0m maximum)
4. Where the proposed offset is less than 3.0m approval should be sought from the Superintendent
5. It is advisable to have the transition between the point of exit of the two barrier systems to ensure discontinuous protection along the alignment
6. The design of the transition barrier will determine the feasibility that the performance of the barrier in front is not impacted by the barrier behind it.

**Design Philosophy**
1. Install overlap behind existing barrier
2. Transition to proposed offset (3.0m desired - maintain existing offset)

**General Notes**
- Refer to AGRD Part 6 for Required Flare Rates of Safety Barriers
**TYPICAL LAYOUTS**

**WIRE ROPE SAFETY BARRIER**

**DEPARTURE OVERLAP TREATMENT**

- Point of Need (refer to Note 5)
- Maintain clearance along the length of the approach end terminal

**Approach Offset** (refer to Note 3 & 4)

**Barrier Plane Gate**

- Refer to Table 1
- BARRIER FLARE RATE
- APPROACH END TERMINAL
- POINT OF NEED
- APPROACH OVERLAP TREATMENT

**Traffic**

**Traffic**

**NOTES**

1. Design Speed and Flare Rate are to be used where transition length is to be observed. A design speed 3.0m clearance is required. Reference to APPENDIX A.

2. Where the Offset is to be observed, the offsets to the traffic line should be maintained to the required barrier line. Refer to Note 3 & 4.

3. The maximum offset of 3.0m per Note 6.

4. Where the Offset is less than 3.0m, approval should be sought from the Superintendent.

5. It is desirable to have to point of need overlap between the approach and transition barriers.

6. The overlap of the approach barrier will determine the clearance of the overlap between the two systems. This will be determined by the addition to the traffic lane by the approach barrier.

**DESIGN PHILOSOPHY**

- Existing BARRIER on the Approach Side.
- Existing Offset (Refer to Note 6)
- Transition to proposed Offset (3.0m Desired - Maintain Existing Offset)

**CONDITIONS FOR USE**

1. Should be only used in divided carriage way.
2. Existing Barrier or the Approach Side.

**NOTES TO AGRD PART 6 FOR REQUIRED FLARE RATES OF SAFETY BARRIER**

<table>
<thead>
<tr>
<th>Design Speed</th>
<th>SKY LINE OFFSET</th>
<th>FLARE RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>2.1</td>
<td>24:1</td>
</tr>
<tr>
<td>90</td>
<td>2.2</td>
<td>24:1</td>
</tr>
<tr>
<td>100</td>
<td>2.4</td>
<td>20:1</td>
</tr>
<tr>
<td>110</td>
<td>2.6</td>
<td>18:1</td>
</tr>
</tbody>
</table>

**MAXIMUM FLARE RATE OF 8:1 WHERE TRANSITION IS TO BE OBSERVED AND NOT EXPOSED TO THE TRAFFIC (REFER TO SD NOTE 6).**

**CONDITIONS FOR USE**

1. Should be only used in divided carriage way.
2. Existing Barrier or the Approach Side.

**NOTES TO AGRD PART 6 FOR REQUIRED FLARE RATES OF SAFETY BARRIER**

- Design Speed and Flare Rate are to be used where transition length is to be observed. A design speed 3.0m clearance is required. Reference to APPENDIX A.

- Where the Offset is to be observed, the offsets to the traffic line should be maintained to the required barrier line. Refer to Note 3 & 4.

- The maximum offset of 3.0m per Note 6.

- Where the Offset is less than 3.0m, approval should be sought from the Superintendent.

- It is desirable to have to point of need overlap between the approach and transition barriers.

- The overlap of the approach barrier will determine the clearance of the overlap between the two systems. This will be determined by the addition to the traffic lane by the approach barrier.

**DESIGN PHILOSOPHY**

- Existing BARRIER on the Approach Side.
- Existing Offset (Refer to Note 6)
- Transition to proposed Offset (3.0m Desired - Maintain Existing Offset)

**NOTES TO AGRD PART 6 FOR REQUIRED FLARE RATES OF SAFETY BARRIER**

<table>
<thead>
<tr>
<th>Design Speed</th>
<th>SKY LINE OFFSET</th>
<th>FLARE RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>2.1</td>
<td>24:1</td>
</tr>
<tr>
<td>90</td>
<td>2.2</td>
<td>24:1</td>
</tr>
<tr>
<td>100</td>
<td>2.4</td>
<td>20:1</td>
</tr>
<tr>
<td>110</td>
<td>2.6</td>
<td>18:1</td>
</tr>
</tbody>
</table>

**MAXIMUM FLARE RATE OF 8:1 WHERE TRANSITION IS TO BE OBSERVED AND NOT EXPOSED TO THE TRAFFIC (REFER TO SD NOTE 6).**