*Austroads Safety Barrier Assessment Panel – Technical Advice*

# Technical Conditions of Use Outline

SBTA 22-001, February 2022
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## Preamble

Road safety barrier systems and devices for use on the Australasian road network are assessed by the Austroads Safety Barrier Assessment Panel (ASBAP) in accordance with AS/NZS 3845 Parts 1 and 2. Technical Conditions of Use (TCU) documents are developed for all products which are 'recommended for acceptance'. These documents are a summary of the ASBAP's assessment.

This technical advice provides guidance on interpreting the information contained in the TCU documents.

## Audience

- Road Agencies
- Road Designers.

## Using the Austroads Technical Conditions of Use

The TCU document is a summary of the ASBAP's assessment of the technical performance of the product against AS/NZS 3845 Parts 1 or 2. The TCU is based on the product specific information provided by the proponent, and therefore may be different even if the system appears similar.

Each TCU provides Road Agencies with a range of recommended conditions in which to use the product. Road Agencies may choose to accept the product in accordance with these Austroads conditions or, may impose additional or different conditions of use.

For this reason, the Austroads TCU does not take precedence over any Road Agency specifications and standards. Although in many cases, the Road Agency specifications will align with the Austroads TCU.

The existence of a TCU does not imply that the product is accepted for use by a Road Agency. As such, users should refer to individual Road Agency websites to determine whether this product is accepted for use within that jurisdiction, and if the Road Agency has adopted specific requirements.

## Product outline

The first section of the TCU document identifies the product, date of issue, product owner, ASBAP disclaimer, product status, outline of the accepted product and any variants, impact speed and product manual reviewed at the time of assessment.

### Status:

Each product will have one of the following statuses:

- **Recommended for Acceptance** – assessed by the ASBAP and recommended for acceptance by road agencies.
- **Legacy** – previously assessed by the ASBAP, but no longer recommended for use by road agencies. Existing permanent installations may remain in service until the end of service life, but no new installations should be permitted.

  Products with a legacy status continue to provide the level of performance at which they were originally tested. As such, the relevant road agency will determine when it is considered worthwhile (net beneficial) to replace or upgrade existing installations.

- **Phase Out** – previously assessed by the ASBAP, but no longer recommended for use by road agencies. This status is adopted for temporary products. Road Agencies are recommended to phase out the product, and its use, by a certain date. The date fixed for phase out should allow time for manufacturers, users and hire companies to depreciate their investment and adjust their business model.

Sudden changes in acceptance status will be avoided unless a critical safety issue emerges.

### Product accepted:

- This section provides the name of the default product configuration (often submitted first), as well as a list of variants that have been assessed by the ASBAP and are recommended for acceptance by Road Authorities.
- Variants that are NOT listed have either not been submitted to the ASBAP, or they have been assessed by the ASBAP and were deemed not suitable in accordance with AS/NZS 3845.

### Accepted impact speed:

- The accepted impact speed is typically aligned with the highest test level submitted, e.g. 50 km/h for TL-1, 70 km/h for TL-2 or 100 km/h for TL-3.
- Where the ASBAP identifies an undesirable but compliant behaviour, they may recommend that the product be restricted to roads with a lower operating speed. This may occur when the occupant severity values are above the preferred limit but below the maximum limit.

### Product manual reviewed

- This section lists the product manual that was reviewed by the ASBAP during the assessment.
- It should be noted that the ASBAP does not necessarily accept everything within this listed Manual. Some manuals may include details that should only be considered outside the ‘Normal Design Domain’ for use in unique circumstances.
- The primary purpose of the product manual is to assist installers and traffic management companies to install or deploy the barrier, and for maintainers to inspect or repair the product. This primarily includes the bill of materials, handling, component assembly and installation tolerance requirements of the product.

## Design requirements

AS/NZS 3845 Parts 1 and 2 specify AASHTO Manual for Assessing Safety Barrier Hardware (MASH) as the current basis for crash testing, thereby superseding NCHRP350. The changes are in response to the ongoing industry progress, market trends and changes in the average vehicle size, plus an increased availability of MASH tested products becoming available to the Australasian market.

The design requirements section outlines information derived from physical crash testing undertaken in accordance with MASH. As such, these design values must be provided in order to achieve the associated containment level specified in the first column.

Where a product has multiple configurations or has achieved multiple containment levels, it is imperative that the associated design values (e.g. point of redirection, anchor/post spacing, dynamic deflection and working width) are used.

### Containment level

- **T**he MASH Test Level of the specific barrier configuration. It is important to note that each MASH test level contains a range of impact scenarios (crash tests) that must be undertaken, therefore the design values provided are a consolidation of all the associated tests.

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### Point of Redirection (PoR)

- The point at which the barrier will redirect the test vehicle(s) within the working width listed. For more information refer *ASBAP Technical Advice SBTA 21-001 Downstream Point of Redirection.* By default, the PoR is based on the crash tested impact point, unless additional evidence has been provided. Users may notice that the TL-3 and TL-4 point of redirection are often different. This is a result of the larger/taller vehicle needing additional upstream barrier to achieve the specified working width.
- While vehicles that impact the barrier upstream of the approach PoR may still be contained, they may not be redirected. In these circumstances, the vehicle behaviour and/or barrier performance is likely to differ (e.g. the barrier may deflect more).
- Where the TCU states “Interface between barrier and end treatment”, this infers that the terminal may have redirective capability, therefore the PoR may be measured from the connection point between the terminal and longitudinal barrier, or within the terminal length if detailed on the product specific terminal TCU.

### Tested article length

- The total length of barrier installation during crash testing, measured between the start and end PoR. For more information on minimum barrier lengths refer *ASBAP Technical Advice SBTA 21-002 Minimum length of W-beam barriers.*

### Anchor/post spacing

- The nominal post or anchor spacing used during the crash tests for the associated test level. It is also the anchor/post spacing required to achieve the specified deflection and working width values for the associated test level.

### Dynamic deflection

- The maximum dynamic deflection observed during all the associated crash tests for the relevant containment level. Dynamic deflection is defined as “the largest transverse deflection of any part of a road safety barrier system recorded during a full-scale crash test”. For more information refer *Austroads Guide to Road Design Part 6*.

### Working width

- The maximum working width observed during all the associated crash tests for the relevant containment level. Working width is measured from the outermost extremity on the traffic side, regardless of shape, to the furthest extremity of any part of the system or vehicle during and after the impact. Working width is recorded during full scale crash testing and contains three sub-elements: deflection, system width and roll allowance. For more information refer *Austroads Guide to Road Design Part 6* and *ASBAP Technical Advice SBTA 20-002 Working Width for temporary barriers.*

### Notes

- Any additional conditions that are required to achieve the associated test level. This may include a specific anchor type, or it may recommend restrictions on certain value combinations.

Users should note that some products may achieve different test levels based on the specific combination of post/anchor spacings, length and/or foundation. For example, some temporary products may achieve MASH TL-4 when installed with a larger post spacing, and only MASH TL-3 when installed with a smaller post spacing. This is because configurations with larger deflections will often result in a more stable outcome for taller vehicles.

In addition, some TCUs may contain variants that are considered suitable in constrained locations (e.g. base plated posts or reduced post spacings) but are not listed as a separate configuration within the design requirements section. These variants have not demonstrated compliance with a specific containment level, but have been deemed acceptable by the ASBAP, to accommodate common constraints on the network.

As such, it is imperative that designers use a combination of appropriate values for the desired test level.

## Approved connections

This section provides a list of connections/terminals which have been assessed by the ASBAP as being suitable.

All safety barriers must have an accepted connection or terminal attached at both the leading and trailing end. Only connections or terminals that are listed in the TCU are recommended for use. This ensures that an assessment of the proposed transition has been undertaken and that the suppliers of proprietary products are satisfied with the connection proposed.

For longitudinal barriers, this section will list all accepted terminals and any specific conditions.

Transitions/connections are critical especially when moving from a flexible (low-stiffness) longitudinal barrier to a stiffer terminal.

- Where the TCU recommends use adjacent one-way traffic, this may be due to a lack of testing of the terminal or connection in the reverse (adverse) direction.
- Where the TCU recommends a risk assessment adjacent two-way traffic, this may be because the occupant injury values were marginally below the maximum threshold during reverse (adverse) direction impacts.

For end treatments, this section of the TCU is limited.

## Design guidance

The design guidance section outlines any other key design values to be considered by the designer, including minimum installation length, system width, minimum distance to excavation, side slope limit, system conditions, typical areas of use and foundation pavement conditions.

### Minimum installation length

- By default, the minimum installation length is based on the crash tested length, unless additional evidence has been provided. While barrier lengths shorter than the tested article length shown in the TCU are possible, the designer must consider how this will affect other performance values (e.g. deflection). Designers should consult with the product supplier or mitigate the risk through additional controls, such as reducing the posted speed. For more information refer *ASBAP Technical Advice SBTA 21-002 Minimum Length of W-Beam Barriers.*

### System width

- The width of all above ground assembled barrier components. This will include the toe of barrier or the top rail, but it may not include the sub-surface foundation.

### Minimum distance to excavations

- Safety barriers should be installed with sufficient distance to the hinge point to accommodate the barrier's accepted dynamic deflection (measured from the front of barrier) and to provide adequate lateral support for the system (measured from the back of barrier), whichever is the greater. This ensures that there is no damage to the batter following an impact and that the lateral support for the system is adequate to achieve the tested conditions. For more information refer *ASBAP Technical Advice SBTA 17-002 Proximity to Batter Hinge.*

### Side slope limit

- The maximum slope of the ground surface, prior to the product behaviour being affected. Standard side slope limit is 10:1 unless additional testing or justification is provided.

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### System conditions

- This section may note product limitations (e.g. minimum curve radii) or limitations regarding where the product can be placed (e.g. cannot be placed adjacent to a kerb).

### Location guidance

The following guidance indicates where the product is likely to be suitable.

- **Gore area use** – indicates that the product (often symmetrical) can be impacted from either side in the approach direction and therefore can be placed in locations such as the gore area.
- **Pedestrian and Cycleway use** – indicates that the product does not generate excessive levels of debris during an impact.
- **Frequent impact likely** – indicates that the product is likely to withstand nuisance impacts or can be repaired/replaced relatively easily.
- **Remote location** – indicates that the product is likely to withstand nuisance impacts, does not require regular inspection/maintenance or can be repaired/replaced relatively easily.
- **Median use** – indicates that the product (often symmetrical) can be impacted from either side (both directions) and therefore can be placed in a median.

### Foundation pavement conditions

Indicates the range of post/pin types that have been deemed suitable and the foundations in which they can be installed. It is important to note that the post/pin may have a significant influence on how the system performs during an impact (e.g. how much the post/pin rotates or when the post/pin shears).

The maximum accepted impact speed is listed in this section, given there may be specific post/pin types that can only be used for a certain containment level.

Steel rail barriers on concrete pavements, typically have two options: a base plate post which attaches directly to the concrete, or a driven post with coring holes which requires the installer to cut holes within the concrete foundation. Where neither option is listed, then the product has not demonstrated suitable performance with a base plated post variant or within a cored hole. As such, the product is not recommended for use with these pavement conditions.

Safety barriers are often tested in strong foundations. To achieve the tested containment, equivalent foundation soil strength must be verified on site. If a weaker soil is realized it is likely that as a minimum the safety barrier will have a greater deflection, if not fail, during impact. If the foundation soil type cannot be verified through geotechnical testing, it is recommended that a post pull-over test be conducted to validate the capacity of the soil and foundation.

## Notated Technical Conditions of Use

The information above has been summarised and notated onto the attached TCU template.

## Panel Crashworthiness Assessments

Crashworthiness assessments are issued for products which have been assessed by the Panel against MASH test protocol in accordance with AS/NZS 3845. There are other approvals required for these products prior to their consideration for use.

Therefore, a product which has been issued a ‘Crashworthiness Assessment’ has been deemed to be crashworthy however, this is not the only consideration. Users should select products which are fit for purpose to their total requirements, noting that crashworthiness is just one aspect to consider.

# References

## Standards

AS/NZS 3845.1:2015, *Road safety barrier systems and devices: part 1: road safety barrier systems.*

Austroads 2022, *Guide to road design part 6: roadside design, safety and barriers,* AGRD06-22, Austroads, Sydney, NSW.

AASHTO 2016, *Manual for assessing safety hardware,* 2nd edn, American Association of State Highway and Transportation Officials, Washington, DC, USA

## Other

ASBAP 2020, *ASBAP Technical Advice SBTA 20-002 Working Width for temporary barriers,* Austroads, Sydney. NSW.

ASBAP 2017, *ASBAP Technical Advice SBTA 17-002 Proximity to Batter Hinge,* Austroads, Sydney. NSW.

ASBAP 2021, *ASBAP Technical Advice SBTA 21-001 Downstream Point of Redirection,* Austroads, Sydney. NSW.

ASBAP 2021, *ASBAP Technical Advice SBTA 21-002 Minimum length of W-beam barriers,* Austroads, Sydney. NSW.

# Safety Barrier Technical Conditions for Use (annotated)

## Safety Barrier

| | | |
|---|---|---|
| Photo of the product | **Issue Date:** Publish date of the TCU | **Proponent:** System Owner |
| | This document is a summary of the Austroads Safety Barrier Assessment Panel's assessment of the technical performance of the product against AS/NZS 3845 Parts 1 or 2 only. It does not consider procurement practices by individual Road Agencies. The Austroads Safety Barrier Assessment Panel may at any time, withdraw or modify this document without notice.<br><br>These Technical Conditions for Use do not imply that this product may be used on roads under the care and control of individual Road Agencies. Users should refer to individual Road Agency websites to determine whether this product is accepted for use within that jurisdiction, and if the Road Agency has adopted any additional or specific requirements.<br><br>**These conditions do not take precedence over Road Agency specifications and standards.**<br><br>**These conditions do take precedence over instructions in the Product Manual.** | |

| | |
|---|---|
| Status | 'Recommended for acceptance', 'Legacy' or 'Phase out' |
| Product accepted | The name of the default product configuration (often submitted first).<br><br><u>Variants</u><br>A list of variants that have been assessed by ASBAP and are recommended for acceptance by Road Authorities<br>Variants that are NOT listed above are NOT recommended for acceptance. |
| Accepted impact speed | The accepted impact speed is typically aligned with the highest test level submitted; e.g. 50km/h for TL-1, 70km/h for TL-2 or 100km/h for TL-3 and higher.<br>Where ASBAP identifies an undesirable but compliant behaviour, they may recommend that the barrier be restricted to roads with a lower operating speed, (This may occur when the occupant severity values above the preferred but below the maximum limit). |
| Product manual reviewed | This section lists the product manual that was reviewed by ASBAP during the assessment.<br>It should be noted that the Panel does not necessarily accept everything within this listed Manual. Some manuals may include details that should only be considered outside the 'Normal Design Domain' for use in unique circumstances. |

### Design Requirements

| Containment Level | Point of Redirection | | Tested Article Length (m) | Anchor/Post Spacing (m) | Dynamic Deflection (m) | Working Width (m) | Notes |
|---|---|---|---|---|---|---|---|
| | Leading (m) | Trailing (m) | | | | | |
| MASH TL-3 | | | | | | | |

The point at which the barrier will redirect the test vehicle(s) within the working width listed

The total length of barrier installed during crash testing, measured between PoNs.

The maximum dynamic deflection and working width observed during all the associated crash tests for the associated containment level.

Any additional conditions that are required to achieve the associated containment level

### Approved Connections

| *An accepted end treatment must be provided at both ends of all barrier installations* | |
|---|---|
| **Public Domain Products** | |
| W-Beam Guardrail | For longitudinal barriers, this section will list all accepted terminals and connections and any specific conditions. Transitions/connections are critical especially when moving from a flexible (non-rigid) longitudinal barrier to a less flexible (more rigid) terminal.<br><br>For end treatments, this section of the TCU is limited. |
| Thrie-Beam Guardrail | |
| Concrete | |
| **Proprietary Products** | |
| | See above |

## Design Guidance

| | |
|---|---|
| Minimum installation length | metres between anchorages (often equal to the tested article length) |
| System width (m) | The width of all above ground assembled barrier components. This will include the toe of barrier or the top rail, but may not include the sub-surface foundation. |
| Minimum distance to excavation (m) | This distance is based on the barrier's accepted dynamic deflection, or the distance needed to provide adequate lateral support for the system, whichever is the greater. |
| Side slope limit | The maximum slope of the ground surface, before the product behaviour is affected. Standard side slope limit is 10:1 unless additional testing or justification is provided. |
| System conditions | This section may note product limitations (e.g. curves) or limitations regarding where the product can be placed (e.g. adjacent to a kerb). |
| Gore area use | indicates that the product (often symmetrical) can be impacted from either side in the approach direction and therefore can be placed in locations such as the gore area. |
| Pedestrian area use | indicates that the product does not generate excessive levels of debris during an impact. |
| Cycleway use | indicates that the product does not generate excessive levels of debris during an impact. |
| Frequent impact likely | indicates that the product is likely to withstand nuisance impacts or can be repaired/replaced relatively easily. |
| Remote location | indicates that the product is likely to withstand nuisance impacts, does not require regular inspection/maintenance or can be repaired/replaced relatively easily. |
| Median use | indicates that the product (often symmetrical) can be impact from either side (both directions) and therefore can be placed in a median. |

| **Foundation Pavement Conditions** | | | | | |
|---|---|---|---|---|---|
| **Pavement Type** | **Use** | **Max Accepted Impact Speed (km/h)** | **Post/Pin Spacing (m)** | **Post/Pin Type** | **Pavement Construction** |
| Concrete | Permitted or Not Permitted | | | e.g. driven post, base plated post, driven pin, chemical anchor. | e.g. reinforced concrete slab |
| Deep lift asphaltic concrete | | | | | |
| Asphaltic concrete over granular pavement | | | | | |
| Flush seal over granular pavement | | | | | |
| Unsealed compacted formation | | | | | |

***Note: Installation in pavement conditions not permitted above have not been justified to the Panel's satisfaction***

The maximum accepted impact speed is listed in this section, given there may be specific post/pin types that can only be used for a certain test level.