DELIVERING FOR QUEENSLAND

Bruce Highway Targeted Safety Program (BHTSP)

Design Program Note

April 2026

Queensland Government

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Contents

Definitions / Glossary of terms

Summary of abbreviations and unfamiliar words used in a publication.

Term	Definition
BHFMS	Bruce Highway Fatigue Management Strategy
BHTSP	Bruce Highway Targeted Safety Program
BHVAP	Bruce Highway Vision and Action Plan
E&T	Engineering and Technology Branch within Transport and Main Roads
ED	Executive Director
EDD	Extended Design Domain
KPI	Key Performance Indicator
May	Indicates the existence of an option. Where the word 'may' is used, it indicates that use of the device is conditional, or optional. Usually, no specific requirement for design or application is intended.
Must	Indicates that a statement is mandatory. Where certain requirements in the design or application of the device are described with the 'must' stipulation, it is mandatory that, when an installation is made, these requirements be met.
PDO	Program Delivery and Operations Branch within Transport and Main Roads
PMO	Program Management Office
PN	Program Note
PPR	Project Proposal Report
QRSTUV	Queensland Road Safety Technical User Volumes
RPDM	Road Planning and Design Manual
Shall	Indicates that a statement is mandatory. Where certain requirements in the design or application of the device are described with the ‘shall’ stipulation, it is mandatory that, when an installation is made, these requirements be met.
Should	Indicates a recommendation. Where the word 'should' is used, it is considered to be recommended use, but not mandatory. Any recommendation that is not applied must be based on sound traffic engineering judgement and documented.
TN	Technical Note
TTM	Temporary Traffic Management

1 Preamble

1.1 Document purpose

The purpose of this Program Note (PN) is to provide a clear intent, scope guidance and limitations Program Delivery and Operations (PDO) shall use in planning, designing and delivering upgrades under the Bruce Highway Targeted Safety Program (BHTSP).

This PN will detail the desired outcomes for the design of works delivered under BHTSP. This PN shall be read in conjunction with the other documents that have been issued to create a suite of PNs for the BHTSP. This PN will be reviewed periodically and updated to incorporate program learnings, innovation and emerging technology. Additional PNs may be developed and added to the suite of PNs as needed during the delivery of the program.

1.2 Rationale

This PN shall be read in conjunction with the applicable technical specifications, standards and guidelines as they will not be repeated or referenced in this document.

This PN outlines the design approach for the BHTSP and will, at times, exceed the minimum requirements of these documents. The higher standards reflect the objectives of the approved Project Proposal Report (PPR) and heightened safety focus of the BHTSP to ensure the delivery of the projected benefits of this program of works, balancing delivery efficiency with safety for road workers and road users.

1.3 Application

This PN shall be used to design and construct all upgrades under the BHTSP. This PN should be read in conjunction with the other documents in the suite of BHTSP PNs as appropriate.

It is recognised that other works by the Department of Transport and Main Roads and third parties will be undertaken on the Bruce Highway concurrently which will not align with the BHTSP PNs.

The *Bruce Highway Scope Management and Design Guideline* does not apply to BHTSP.

1.4 Questions or feedback

Where scope or criteria are not detailed in this PN, clarification shall be sought from the PDO Program Director in the first instance. For any questions or feedback relating to this PN, please contact the BHTSP Program Management Office (PMO) via email at BHTSP@tmr.qld.gov.au.

2 Vision and standards

2.1 Strategic context

2.1.1 Strategic planning purposes

The BHTSP will complement existing upgrades and bring forward new safety projects on priority sections with the poorest safety record on the Bruce Highway north of Gympie to Cairns to reduce the severity and frequency of crashes.

2.1.2 Priority road network

The Bruce Highway is a Priority 1 (PRN1) under the department's *Priority Road Network Investment Guidelines*: identified as roads that provide the main inter and intra-state thoroughfares as well as connections to major population and economic zones.

2.1.3 Design vehicle

The design vehicle for capital upgrading through lanes is generally a **PBS 2A 26 m B-Double**. The check vehicle for these sections is a 26 m B-Double.

Sections of the highway are currently operating PBS 3A 36.5 m Type 1 road train under permitted freight movements. The check vehicle for the sections already allowing access for PBS 3A vehicles **only** is Type 1 road train and any upgrades considering utilising this vehicle for design shall seek prior approval from the Executive Director (ED) BHTSP before design commencement.

For intersections, the largest approved (permitted or as-of-right) vehicle class for the side road will be utilised for the design vehicle with an appropriate check vehicle for turning movements.

2.2 Planning and design development

There are 5 work types identified to be addressed as part of the BHTSP which are:

- Wide-Centre Line Treatment (WCLT) (including Audio Tactile Line Marking (ATLM))
- Pavement Strengthening (PS)
- Overtaking Lanes (OTL)
- Intersection Improvements (INT), and
- Narrow Bridges (NB).

The development of a Fatigue Management Strategy that also considers rest area requirements is another key element of the BHTSP.

The BHTSP has identified targeted safety-related proposed priorities to be addressed through the Program, as follows:

- **Deficiencies**: Review and consideration of safety-focused proposed investments as outlined in the *Bruce Highway Vision and Action Plan* (BHVAP), as well as consideration of competing safety issues on the Bruce Highway.
- **Work type prioritisation**: Deficiencies prioritisation for each work type to ensure an evidence-based approach toward future investment priorities.
- **Notional allocations**: Notional funding allocation levels for the work types, based on proposed investments identified in BHVAP, needs assessment and stakeholder feedback (including the Bruce Highway Advisory Council).
- **Ranking of proposed priorities**: Work type proposed priorities categorised from High Priority 1 to High Priority 4, iteratively informed by the notional allocations.

A process for ranking the deficiencies, based on the proposed work type treatment, was used to provide a starting point for the identification of priority projects for packaging, acknowledging that the current committed funding would not be sufficient to address all deficiencies. The identified deficiencies by work type are each categorised as either High Priority 1 (HP1), High Priority 2 (HP2), High Priority 3 (HP3) or High Priority 4 (HP4).

Addressing HP1 and HP2 deficiencies are the basis for program funding and are part of the moderation process for identifying initial projects.

2.2.1 Planning effort

The prioritised deficiencies and nominated work types essentially inform the Planning phase for projects within the Program and generally **no further analysis** (e.g., AusRAP, safety rating) is required.

The (internal) Business Case requirement for BHTSP requires a *BHTSP Project Scope Identification*, that includes the Australian Government's Simple Benefit Cost Ratio Tool (BCR), to be completed by PDO and submitted to the PMO.

The exception to this will be the Narrow Bridges work type, in which a succinct Options Analysis will need to be undertaken and submitted for review to the ED (BHTSP) prior to progressing further. Refer to Section 2.4 for more detail.

The Temporary Traffic Management (TTM) and Fatigue Management Infrastructure (FMI) requirements will also need to be considered during the Planning stage of projects. Details about these requirements are included in the relevant PNs.

The treatment options detailed in the *BHTSP Foundation Program Note* and this PN will inform the design outputs for projects.

2.3 Capacity considerations

2.3.1 Level of service

Assessment is out of scope for this Program.

2.3.2 Duplication

Duplication as a capacity treatment is out of scope for this Program. There may be sections of duplicate carriageway provided for overtaking opportunities where appropriate.

2.3.3 2+1 configuration

This component is out of scope for this Program.

2.3.4 Overtaking lanes

Overtaking Lanes are an eligible work type for this Program, are derived from the BHVAP identified priorities and have been assessed and prioritised as part of the Program development. Work locations are identified by indicative chainage and will be confirmed as part of the packaging process.

2.3.4.1 General guidance

- Minimum length of an overtaking lane is to be 950 m excluding tapers.
- No overtaking to be permitted in the reverse direction of the overtaking lane.
- All overtaking lanes to have a 1.0 m wide painted chevron median with a double barrier line and ATLM.
- Shoulder widths on overtaking lanes to be a minimum of 2.0 m or match down / upstream widths if wider.
- No right turns are permitted:
  - within 15 seconds of travel time from the overtaking merge unless a dedicated turn lane is provided, and/or
  - into accesses or at intersections within the overtaking lane unless the turn is protected.

Where temporary works, such as widening, are required to manage traffic, a value engineering assessment should be undertaken to determine whether these temporary works should be made permanent for the use of other benefits, such as overtaking lanes, stopping bays or wider shoulders.

2.4 Bridges

Specific bridges from the BHVAP identified priorities list are included in the BHTSP; these are narrow (under 8.0 m kerb to kerb) and a safety risk. Value for money in addressing the deficiency of narrow widths will be the primary objective.

Generally, the first option to be considered is replacement of the existing structure at-grade. The second option is duplication; construction of a new bridge at a width suitable for one-way traffic and continued use of the existing structure, retrofitted for one-way traffic flow. Widening the existing structure may be considered but is not likely to offer value for money or be technically feasible. The width of the bridge (kerb to kerb) is to match the chosen BHTSP WCLT cross-section width as per Section 2.5.1.

Bridge solutions (including packaging of multiple locations together) in the form of a succinct Options Analysis will need to be undertaken and submitted for review to the ED BHTSP prior to progressing further.

2.4.1 Immunity upgrades

Incidental immunity improvement can be supported if bridge replacement with new approaches is the approved solution and results in a change in grade line.

2.4.2 Major deviations and major floodplain immunity treatments

This component is out of scope for this Program.

2.5 Cross-section

2.5.1 Widths

The Program final vision standard for two-lane undivided sections of the Bruce Highway (based on through lanes and shoulders only) is 12.0 m, comprising 3.5 m traffic lanes plus 2.0 m shoulders and a 1.0 m WCLT with recoverable batter slopes and removal or protection of non-frangible hazards.

11.0 m (as above but with 1.5 m shoulders) is the minimum vision standard and acceptable where 12.0 m does not present a value for money solution.

Exceptions to the provision of the 1.0 m WCLT are:

- divided multi lane roadway, and
- urban areas where the posted speed is at or below 60 km/h.

Figures showing typical cross-section options are included in Section 2.9.2.1 of this PN.

2.5.2 Formation widening and side tracks

Where ordinarily temporary works, such as side tracks and over-widening, are required to manage traffic, a value engineering assessment should be undertaken to determine whether these temporary works should be made permanent. This should be considered during the project Planning and Design stages.

2.5.3 Design class

Engineering and Technology (E&T) Branch advise that projects with significant formation widening (e.g., <10.5 m formation width reconstructed to 12 m formation width) are considered as Design Class B projects for which a full geometric assessment is required. EDD / Design Exceptions to be justified as appropriate for Class B projects.

Work on sections that are not being widened should be treated as a Design Class C project.

Geometric assessments for most design parameters are not considered for Design Class C projects unless there is a crash history associated with a specific parameter.

Road Design Classes B & C are outlined further within the *Road Planning and Design Manual* (RPDM) Volume 3, Part 1.

Further advice and confirmation should be sought from E&T regarding other work types.

2.5.4 Table drains

It is recommended, in general, that a flat-bottomed table drain be adopted subject to site constraints and considering cost efficiencies. V-drains remain a functional solution and have not been eliminated as a choice. All cuttings shall employ a table-drainless design pending excavation considerations.

2.5.5 Urban bypass

This component is out of scope for this Program.

2.5.6 Intersections

2.5.6.1 Rural intersections

Application of a consistent standard for rural intersections will provide a consistent driver experience reducing unexpected surprises for drivers and a reduced safety risk.

The **minimum** standard is:

- Intersections with other state-controlled roads or local authority roads to include:
  - painted Channelised Right (CHR(s)) turn lanes, and
  - offset Channelised Left turn lanes (CHL).

- Property accesses to include:
  - Basic Right turns (BAR), and
  - left turn taper.

Provisions above these minimum treatments shall be applied based on traffic volumes, including assessments for flag lighting, raised channelisation (and appropriate lighting) and service road provision to allow for rationalisation of accesses.

A departure below these minimum treatments may be possible through a detailed risk assessment.

The department's Standard Drawing 1807 *Property Access - Rural Property Access* provides further guidance for rural property accesses.

2.5.6.2 Urban intersections

There are no urban intersections anticipated in this Program. Any exceptions are to be approved by the ED (BHTSP).

2.5.7 Bridges

The deficiency analysis has generated a list of nominated bridge sites to be considered for delivery.

Design Criteria for Bridges and Other Structures gives the required guidance on this component.

2.5.8 Culverts

Culverts are to be extended where existing headwalls are either within the shoulder or located outside the shoulder but within 0.5 m of the shoulder point of the widened or new formation.

A condition assessment should be undertaken as part of the Design process to determine condition and if replacement or remediation is required.

Full replacement of culverts will need approval from the ED BHTSP.

2.5.9 Pavements

2.5.9.1 Scope

The condition of the existing pavement shall be considered for all safety projects with the intent to provide a consistent high-quality outcome across the longitudinal and cross-sectional extents of the project.

Pavement strengthening is in scope for WCLT, OTL, Narrow Bridge (approaches) and Intersection work types, as well as the stand-alone Pavement Strengthening work type. More detail about the relationships between the various work types will be included in the *BHTSP Foundation Program Note* (currently being developed).

The relevant departmental guidelines for pavement rehabilitation options and pavement design standards will apply, including but not limited to the latest versions of:

- *Pavement Design Supplement* (PDS)
- *Pavement Rehabilitation Manual* (PRM)
- Guideline *Pavement Investigation and Analysis*
- Guideline *Structural Design Procedure for Triple Blend Stabilised Subbase*
- *Materials Testing Manual* (MTM)
- *Guide to the Visual Assessment of Pavements*, and
- Relevant *MRS / MRTS Suite.*

This section draws on these documents to outline:

- pavement treatment goals
- pavement condition intervention levels
- design life and relevant standards, and
- typical design options.

2.5.9.2 Pavement treatment goals

A minimum 20-year design life is nominated for any pavement rehabilitation works, as per existing departmental standards.

2.5.9.3 Typical scope of pavement works in addition to proposed safety works

The scope of pavement works will depend on the specific project scope, condition of the existing pavement, projected traffic loads, and exposure to water. Pavement rehabilitation / pavement strengthening works may be required on existing pavements in addition to any new pavement works, to provide a consistent high-quality outcome across the longitudinal and cross-sectional extents of the project. While each site will have specific requirements, it is generally expected that the condition of the existing pavement is an indicator of the scope of works required to achieve a 20-year design life, with treatment scope to be refined during Project Scoping Identification stage.

As such, the following condition categories are intended to guide initial expectations about pavement rehabilitation / pavement strengthening works required:

- **Very Poor Condition:** If significant defects are present that indicate inadequate structural capacity, full reconstruction or rehabilitation of existing pavement may be required, prior to any resurfacing or additional strengthening works such as overlays. This may require treatment of significant depths of existing pavement and multiple layers to address deficiencies within the existing pavement structure that are influencing failure modes causing the severe condition defects.
- **Poor Condition:** At a minimum, treatment of the existing pavement base and potentially subbase layers, and strengthening, but may require full rehabilitation of deeper layers of the existing pavement depending on condition, failure modes and projected traffic loads.
- **Fair Condition or Better:** If pavement condition and strength is adequate for projected traffic volumes and loads, treatment may include shape correction and overlay, resurfacing, or overlays (subject to pavement and drainage design checks).

Guidance on pavement condition assessment is included in Appendix A.

Regardless of pavement condition, the surface drainage of the road should be checked for aquaplaning potential and superelevation and crossfall checked to assess if it complies with current requirements. If these are deficient then the geometry of the road may need to be corrected, which may require additional or different pavement works.

2.5.9.4 Pavement investigation, selection and design

Pavement investigation and design should be based on PDS and PRM, including but not limited to aspects detailed in the following sections.

2.5.9.4.1 Detailed assessment of the existing pavement and support conditions, including field and laboratory investigation

The pavement investigation scope is site / project dependent and should be determined by a pavement designer / engineer, with guidance provided in the department's Guideline *Pavement Investigation and Analysis*, *Pavement Design Supplement* (PDS) and *Pavement Rehabilitation Manual* (PRM).

Typically for the Bruce Highway, investigations will include but not limited to the following to determine suitable pavement rehabilitation or design options:

- desktop review of existing information
- visual inspection, and
- field investigation and associated laboratory testing to determine:
  - pavement configuration and lateral and longitudinal variability

  - support conditions
  - failure modes, and
  - material properties and potential for reuse of existing materials, e.g., as part of temporary or permanent widenings, stabilised subbase or base layers, or fill.

Further guidance on investigation is included in Appendix A.

2.5.9.4.2 Pavement selection

It is expected that a significant proportion of works undertaken in this Program will be on rural sections of the Bruce Highway. Pavement selection applies to both the strengthening of existing pavement and the widened platform required for WCLT and OTL. This section outlines:

- pavement types suitable for anticipated loading and environments for the BHTSP
- pavement material considerations
- treatment of existing pavements, and
- surfacing treatment considerations.

Table 2.5.9.4.2 provides guidance about different pavement types and materials to consider for the BHTSP.

Table 2.5.9.4.2 – Guide to the selection of pavement types based on traffic for the BHTSP

Pavement Type			**Rural**	
			Average Daily Equivalent Standard Axles (ESA) in Design Lane in Year of Opening	
Abbreviation	**Description**	**PDS Reference**	**1000 to <3000**	**≥3000**
SLBB	Lightly bound granular base with sprayed seal surfacing*	Table 2.2.10(a)	✓	✗✗
SFB	Foamed bitumen stabilised pavement with sprayed seal surfacing*	Table 2.2.9(c)	✓	✗✗
ALBB	Lightly bound granular base with asphalt surfacing*	Table 2.2.10(b)	✓	✗✗
AFB(B)	Asphalt over foamed bitumen stabilised base pavement*	Table 2.2.9(b)	✓✓	✓
DSA	Deep strength asphalt pavement*	Table 2.2.6(b)	✓✓	✓✓

Pavement Type			Rural	
			Average Daily Equivalent Standard Axles (ESA) in Design Lane in Year of Opening	
Abbreviation	**Description**	**PDS Reference**	**1000 to <3000**	**≥3000**
AFB(A)	Asphalt over foamed bitumen stabilised subbase pavement*	Table 2.2.9(a)	✓	✓
FDA	Full depth asphalt pavement*	Table 2.2.6(c)	✓✓	✓✓
Notes				
✓✓	Typically, suitable.			
✓	May be suitable following project-specific assessment (e.g., to consider relatively high initial cost and/or performance risk).			
✗✗	Typically, unsuitable due to anticipated poor or uncertain performance.			
*	If existing pavement has significant defects or signs of distress; these will need to be treated as part of any rehabilitation works. In some cases, insitu stabilisation of the existing pavement may be an economical way of reusing existing materials; homogenising existing pavement layers and producing a subbase with improved strength, stiffness and moisture resistance.			

Note: Extract of Table 2.2.1 – Guide to the selection of pavement types based on traffic from the PDS. Table has been amended to omit lower average daily Equivalent Standard Axles and urban environments.

Pavement materials

Rural sections of the Bruce Highway typically experience significant traffic loading and repetitions, and high rainfall environments, often with low strength subgrades. This impacts suitable pavement options, where resilient treatments and material options will be required. Moderate to high exposure to water; or any areas of frequent submergence / inundation such as floodways are likely to require moisture resistant material options such as:

- lightly bound pavement materials
- foamed bitumen stabilised materials
- triple blend stabilised subbase materials
- asphalt materials
- heavily bound pavement materials, and
- concrete (e.g., floodways).

Treatment of existing pavements

There will be several options where treatment of existing pavements is required as part of pavement rehabilitation / strengthening works. One option may be stabilisation of the existing materials into a new subbase using triple blend stabilisation or lightly bound pavement materials. This can be considered as part of a potential treatment option to address possible deficiencies in existing pavements such as over-stabilised base layers with severe fatigue cracking; lateral and depth variations in existing materials; buried seals, low strength subgrades, and poor drainage.

Use of 300 mm to 350 mm triple blend stabilised subbase in pavement widenings in lieu of other improved layer types is typically adopted where the adjacent existing pavement is concurrently rehabilitated to incorporate an insitu triple blend stabilised subbase prior to full width construction of overlying pavement layers. Depending on traffic management constraints, sections of existing pavement can be pulverised and spread into the widening, followed by insitu stabilisation full width to create a consistent subbase. The triple blend stabilised subbase layer typically is not sealed and not exposed to public trafficking. Note that existing cement stabilised bases may not be suitable for re-stabilisation unless blended with imported or existing unbound granular materials, and/or fill and subgrade materials from lower in the existing pavement.

Guidance on the design of pavements with triple blend stabilised subbases is provided in Guideline *Structural Design Procedure for Triple Blend Stabilised Subbase*. Guidance on mix design testing requirements for insitu stabilised layers is provided in the *Materials Testing Manual*. If stabilisation of any insitu materials is a potential option; investigation locations should be planned to capture the likely material variability across the site and include sufficient bulk sampling for potential mix design testing. Mix design testing can take one to two months, so sufficient time should also be allowed for testing to identify suitable additives, optimal stabilising agent contents and working times.

Surfacing treatments

Sprayed seal surfacing may be appropriate in many locations, noting attention needs to be paid to construction practices (e.g., surface preparation to achieve a ‘good’ surface for sealing). For the BHTSP it is recommended that asphalt surfacing be considered if the two-way AADT is greater than 10,000.

Where there are high horizontal stresses (e.g., at intersections or climbing lanes) or high traffic loads then an asphalt surfacing may be required (rather than a sprayed seal). Asphalt surfacing may also be selected for other reasons (e.g., to help with ‘constructability’ to manage construction / trafficking risks when the two-way AADT is above 4,000). Irrespective of the reason, appropriate design (e.g., fatigue) checks are required when thin (or thick) asphalt is included in the pavement.

If a dense graded asphalt surfacing is being considered in a high speed location (a section with speed limit above 80 km/h)—such as when the traffic loading is too high for a seal, the existing surfacing is dense graded asphalt or where stone mastic and open graded asphalt are not locally / practically available—it is recommended that the crash history, road geometry and surface drainage be checked to confirm it is a suitable choice (e.g., curve geometry at or above 'desirable' minimums), and that a stone mastic asphalt, open graded asphalt or high friction surface treatment be considered in locations where there is a safety concern / crash history related to skidding / surface friction, and asphalt surfacing is required / proposed.

Constructability considerations

Pavement selection and treatment options for existing pavements will also require consideration of constructability. This will require consideration of traffic management options and constraints, including offline, temporary or permanent additional widenings to facilitate traffic movements during construction under program traffic management requirements. Weather conditions during the construction phase should also be considered when selecting subgrade treatments and pavement treatment options, including during wet seasons.

Innovative materials and approaches

Innovative materials and approaches for pavements could be adopted but delivery timeframes and performance risks must be considered. Where innovative options can address specific project issues, then designers are encouraged to raise these with the PDO project team early in the process.

Any innovative approach needs be holistic and consider:

- engineering, WH&S and environmental aspects amongst others
- future rehabilitation (e.g., location / depth of geosynthetics), and
- design period (e.g., 20 years) and performance over this period (e.g., durability, ageing).

The adoption of innovative materials or approaches must be supported by independent research substantiating the factors outlined above, and selection and design method(s).

2.5.9.4.3 Detailed design considerations

The pavement design will require consideration of factors including but not limited to:

- drainage considerations including hydraulic and afflux impacts limiting potential gradeline rise, drainage constraints, and condition and number of culverts
- overlay or inlay options for pavement strengthening, including adequacy of support conditions and potential constraints around gradeline rise

- material availability, sustainability and resilience to severe weather events or poor drainage
- mix design for any potential stabilised layers for existing and/or imported materials
- subgrade treatment and problematic soils
- contractor and plant availability and capability
- future rehabilitation options, including working within gradeline and hydraulic constraints to allow room for future asphalt overlay or other overlays / strengthening treatments, and
- surfacing design

2.6 Speed limits and hazards

The default rural speed limit should be used as the benchmark for the design speed limit in all rural sections except where geometric deficiencies prevent this or a contemporary *Queensland Road Safety Technical User Volumes* (QRSTUV): *Guide to Speed Management* speed limit review has allowed for an alternative posted limit, including 110 km/h.

All non-frangible objects within 5 m of the edge line and non-recoverable batters shall require consideration of treatment options and all design decisions shall be documented in accordance with the roadside risk evaluation in Austroads' *Guide to Road Design* Part 6.

2.7 Road safety barriers

Road safety barriers should only be installed where the roadside hazard cannot be removed, relocated, modified to be frangible or traversable, or adequately separated from the carriageway (e.g., by providing a recoverable batter or sufficient offset), and where shielding the hazard with a barrier represents the most appropriate and cost-effective safety treatment, in accordance with the RPDM Supplement – Part 6. Road safety barrier systems are to be installed in accordance with relevant technical specifications for each product. The standard National Roadside Risk Intervention Threshold (NRRIT) value of 0.6 adopted by the department shall be used for the BHTSP.

Replacing, upgrading or extending existing safety barriers (including approach barriers at structures) or end terminals should be undertaken if the existing barrier is unable to reasonably protect the adjacent hazard. Compliance with current standards is desirable, however many existing safety barriers and/or end terminals which may not comply with current standards may still provide reasonable performance.

Engineering assessment should be used to ensure only those safety barriers or end terminals that are unlikely to perform safely are to be replaced. If a decision is made to replace or extend existing public domain steel beam barriers with the same type, it constitutes an Extended Design Domain (EDD).

All pre-existing road safety barrier systems within the footprint of the project are to be assessed for serviceability and suitability. There is no documented assessment approach for existing road safety barriers. Suppliers may have guidance about proprietary road safety barrier products. Upgrades to current standards are to be implemented only where warranted.

Construction within 25 m of a Queensland Rail corridor, that is not at a level crossing, does not automatically trigger safety barriers, however, may require a risk assessment to be undertaken. Advice from the BHTSP PMO should be sought in this situation.

For guidance about temporary road safety barriers, please refer to Section 2.3.5.3 of the *BHTSP Temporary Traffic Management Program Note*.

2.7.1 Continuous barriers

Given there may be longer and more continuous lengths of barrier installed along the highway, the designer shall follow the guidelines indicated in Sections 5.12, 6.9.4 and 6.16 of Austroads' *Guide to Road Design* Part 6.

Road safety barriers should be located (e.g., offset, lateral position) as far as possible from the edge of the traffic lane as site conditions permit with a minimum offset of 3 m to accommodate a stopped truck. This enables errant drivers to recover and regain control of the vehicle, minimising the frequency of barrier impacts. Wider offsets can reduce nuisance impacts on the barrier and enable disabled or stopped vehicles to be free of the traffic lanes, reducing the risk of crashes.

2.8 Signage and delineation

2.8.1 Line marking

All new permanent line marking should be cold applied plastic.

2.8.2 Audio Tactile Line Marking (ATLM)

ATLM is considered a mandatory element of WCLT. ATLM shall be installed as part of both edge line and centre lines subject to the limitations in *Queensland Guide to Road Safety* (QGRS) Part 2.

Existing sections of WCLT without ATLM should be identified and treated as part of adjacent projects or enroute to other projects.

2.8.3 Retroreflective Raised Pavement Markers (RRPMs) and Road Edge Guide Posts (REGPs)

RRPMs and REGPs are to be installed on the Bruce Highway to current specifications.

2.8.4 Signage

Traffic signage is to be installed in accordance with current departmental specifications and standards.

The Australian Government has specific signage requirements for projects they fund. Signage templates for the segments will be developed and published in *Guideline: Project Recognition Signs*. Due to the number of individual projects associated with the BHTSP, project-signage is to be installed for road segments rather than individual projects. The road segments will be determined once the works program has been identified.

2.9 Constructability considerations

2.9.1 Constructability

The constructability of the works is to be considered during the Design stage to ensure the safe project delivery while reducing road user impacts during construction as much as possible. Any Constructability Reports relating to the design are to be provided as part of the Tender if the works are to be delivered as a Transport Infrastructure Contract – Construct Only (TIC-CO) project.

2.9.2 Temporary Traffic Management (TTM)

Due to the number and extent of Program worksites along the Bruce Highway, TTM shall be considered during the Planning and Design stage. Designers shall demonstrate how the design achieves the required TTM objectives in the project design documentation. This shall be included in the Constructability Report certified by a Registered Professional Engineer Queensland (RPEQ) and could include a Traffic Management Plan (TMP) prepared by a Traffic Management Designer (TMD).

Two-lane, two-way flow of traffic is be maintained at all times, with opportunities to reduce the traffic flow to a single lane limited to specific times and circumstances.

Approval must be sought from the ED (BHTSP) when two-way flow cannot be maintained and there is a need to implement shuttle flow arrangements. Two-lane, two-way traffic flow can be achieved through localised pavement widening, the construction of side tracks, or other site-specific means.

Where temporary works, such as widening or side tracks, are required to manage traffic, a value engineering assessment should be undertaken to determine whether these temporary works should be made permanent for the use of other corridor benefits, such as overtaking lanes, stopping bays or wide shoulders.

Speed limits during construction are to be maintained as close to the normal posted speed wherever possible. Where speeds are to be reduced to manage worker safety during work hours, suitable speeds should be set outside of work hours to maintain road user safety while minimising delays to road users.

Any TTM concepts, plans or guidance schemes that are developed during the Design Stage should be provided as part of the Tender if the works are to be delivered as a TIC-CO project and specifically flagged with the Contract Administrator and Project Manager.

Construction projects delivered under Program Transport Infrastructure Contract – Target Cost (TIC-TC) and TIC-CO contracts will have Key Result Areas (KRAs) and Key Performance Indicators (KPIs) relating to TTM and Road User Experience built in.

More details about TTM considerations, including the departure approval process, are included in the *BHTSP Temporary Traffic Management Program Note*.

2.9.2.1 Cross-section options

Figures 2.9.2.1(a) to (e) illustrate cross-section options that can be adopted to align with the BHTSP Vision Standard. Figures 2.9.2.1(c), (d) and (e) illustrate arrangements that can be adopted to utilise additional width that results from maintaining continuous traffic flow during construction.

The position of the crown line in the centre of the figures below is indicative. The actual crown line position within the WCLT should be determined during project design.

Figure 2.9.2.1(a) – Typical 11 m formation cross-section

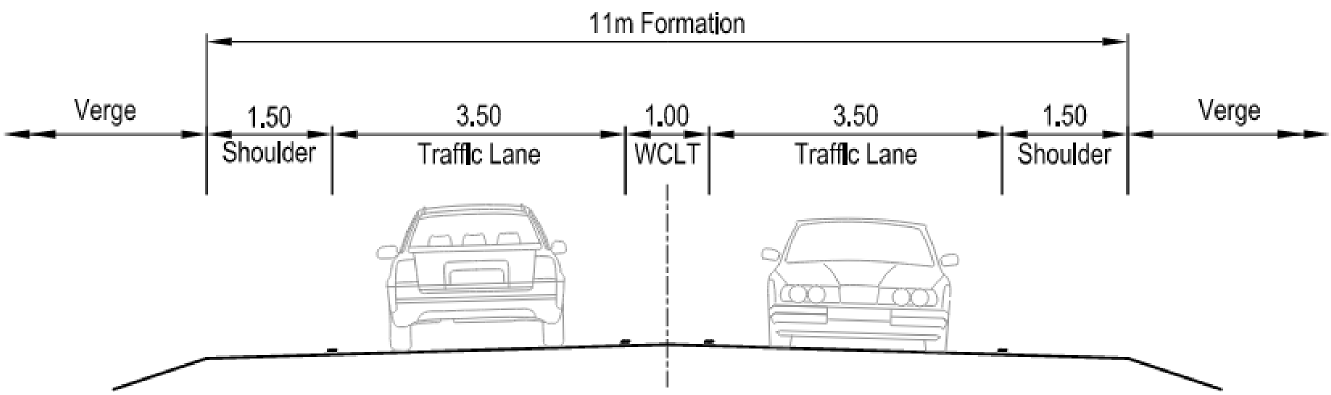


Figure 2.9.2.1(b) – Typical 12 m cross-section

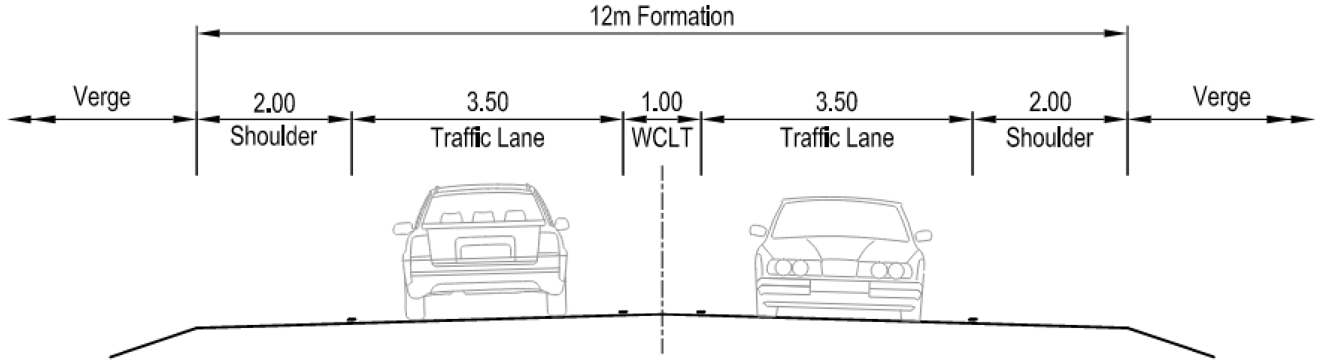


Figure 2.9.2.1(c) – Typical 14 m cross-section

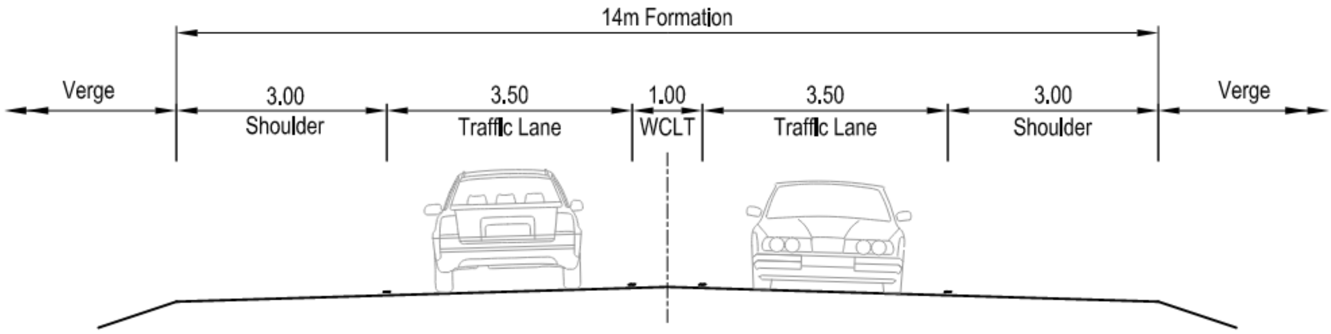


Figure 2.9.2.1(d) – 16 m cross-section – single lane arrangement

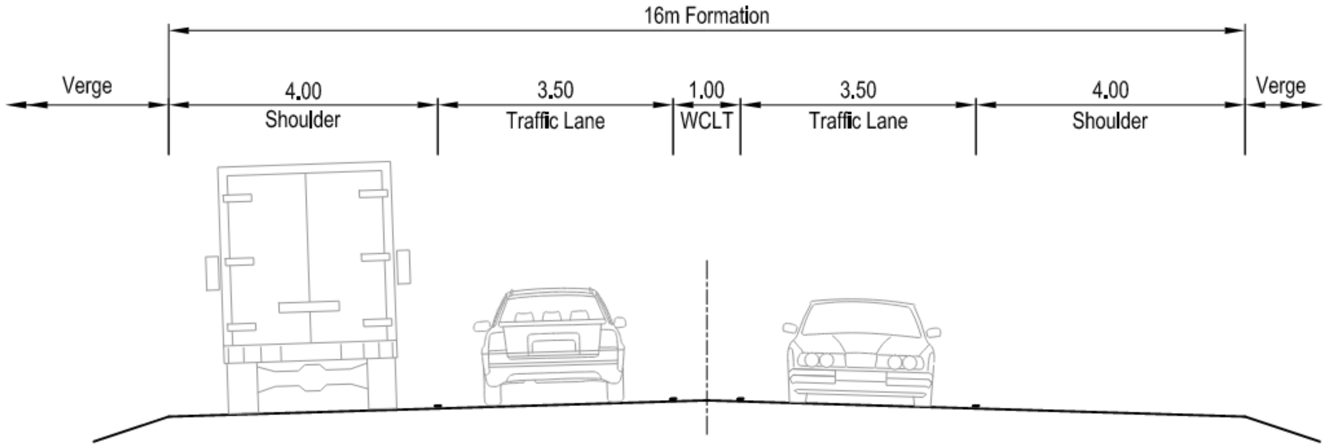
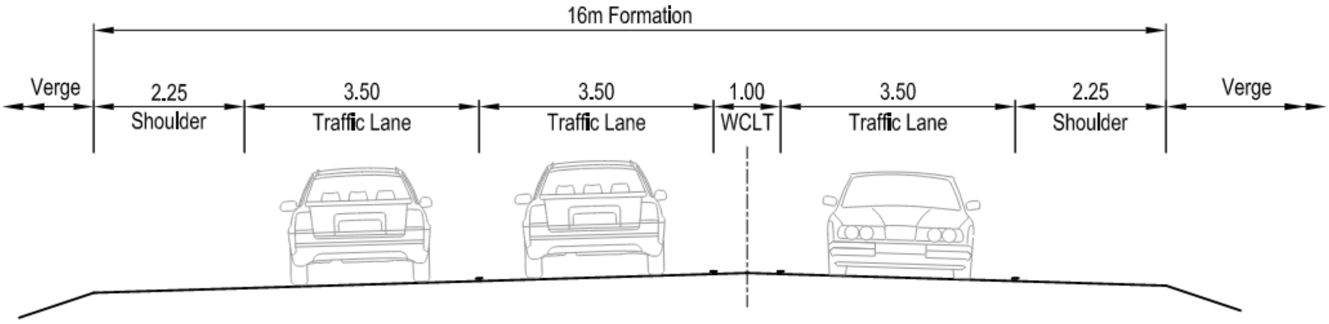


Figure 2.9.2.1(e) – 16 m cross-section – overtaking lane arrangement



2.10 Social infrastructure

2.10.1 Rest areas

The Bruce Highway *Fatigue Management Strategy* (FMS) and *BHTSP Fatigue Management Infrastructure (FMI) Program Note* will cover this aspect separately.

2.10.2 Stopping bays

Regular, informal stopping areas are required for emergencies (flat tyres, checking loads, vehicle breakdown, etc). The Bruce Highway *FMS* vision is to provide stopping bays every 5 mins, or at approximately 6 km spacing. PDO Districts should provide a suitable number of stopping bays along the Bruce Highway to complement formal rest areas. The placement of these will be considered as part of the project design in accordance with the BHTSP FMI PN.

Stopping opportunities may utilise 1 on 6 batters (or flatter) for standard passenger vehicles, or stopping bays utilising local shoulder widening including at cut / fill interfaces.

Localised widening required to accommodate continuous traffic flow during construction can provide future opportunities for informal and formal stopping areas. Informal stopping can occur within a 3 m shoulder, while formal stopping bays require a minimum of 3.5 m shoulder for passenger vehicles and a 4.5 m wide shoulder for heavy vehicles.

If formal stopping bays are to be removed during the construction of BHTSP projects, then all signage relating to the stopping bay (including advance signage beyond the project extents) are to be covered or removed during construction. Unless otherwise informed, these stopping bays are to be reinstated as part of the project.

2.10.3 Active transport infrastructure

Where sites overlap with the *Principal Cycle Network*, provision for cyclists must be included in accordance with the department's *Cycling Infrastructure Policy* and current design guidance. Provision for pedestrians must also be provided where pedestrian demand exists.

All existing active transport infrastructure is to be reinstated as part of the works unless otherwise advised by the BHTSP PMO.

2.10.4 Emergency vehicle access

Emergency vehicle access requirements are to be considered on a site-specific basis during design.

2.10.5 Weigh sites and weigh bridges

New sites are out of scope for this Program. All existing infrastructure is to be reinstated as part of the works unless otherwise advised by the BHTSP PMO.

2.10.6 Noise

No specific noise treatments are considered for application under this Program. Typical departmental standards will apply to triggers for installing noise treatments.

2.10.7 Public transport

The provision of new public transport infrastructure is out of scope for this Program. All existing infrastructure is to be reinstated as part of the works and remain operational during the project (including temporary relocation). PDO Districts are to liaise with local Network Services and Operations team to confirm the standard of any reinstated infrastructure for the specific location.

2.10.8 Environmental

Environmental works and offsets shall be implemented to current requirements on all state-controlled roads.

2.10.9 ITS infrastructure

If existing ITS infrastructure (i.e., CCTV, VMS, cabinets, signage, detectors, etc) is to be relocated to accommodate works, identification of how this can be undertaken as ‘early works’ in advance of the construction is required. This will require consultation with the BHTSP PMO and E&T Branch to ensure continuity of service throughout the duration of the Program.

Access to existing ITS infrastructure for maintenance, repair or replacement must be allowed for during project construction and therefore is to be considered during project design.

Any existing infrastructure that is removed during construction, including loop detectors, is to be reinstated as part of the works unless otherwise advised by the BHTSP PMO.

3 Extended Design Domain and Design Exception

Where it is not possible to achieve the requirements contained in this document, the following may be required:

- adoption of Extended Design Domain (EDD) criteria, and/or
- adoption of a lesser standard that does not compromise project outcomes.

All such decisions must be documented and signed by the PDO Program Director (BHTSP).

Relaxations to the department's structural standards are subject to a resolution process via E&T's Structures Unit.

3.1 Departmental approval for EDD

Use of EDD standards and proposed mitigating treatments require no formal approvals from the BHTSP PMO. Individual EDD reports are not required to be generated, however rationale of the use of the EDD is to be documented in the Design Report as per NDD documentation requirements.

For those projects where the application of EDD standards is considered more difficult, complex or non-standard, refer to E&T Branch for guidance.

Using design values below the EDD requires a risk management approach, mitigating treatments and a higher level of supporting documentation than for EDD.

Use of Design Exceptions shall follow existing design processes, as per the RPDM Volume 3, Part 1. It is recommended that E&T's Road Design Unit is approached for advice where Design Exceptions are being considered.

Appendix A: Pavement investigation guidance

The pavement investigation scope is site / project dependent, with guidance provided in Guideline *Pavement Investigation and Analysis*, *Guide to the Visual Assessment of Pavements*, *Pavement Design Supplement* and *Pavement Rehabilitation Manual*, but will require visual inspection and desktop review of existing information; field investigation and laboratory testing to determine failure modes and suitable pavement rehabilitation or design options. The pavement designer / engineer should be involved in scoping pavement investigations.

Each site will have specific requirements around investigation, depending on scope of works, existing pavement condition and variability, and site-specific constraints. Field and laboratory investigation shall be designed to assess the following as part of a suitable pavement rehabilitation or pavement design:

- existing pavement condition and configuration
- existing support conditions
- indicative extents of lateral and longitudinal variability
- failure mode, and
- potential for reuse of existing materials, e.g., as part of temporary or permanent widenings, stabilised subbase or base layers, or fill.

Initial desktop review

Initial desktop review of existing information is required to identify critical areas of potential poor support conditions or failures; assist in pavement condition categorisation; and to allow optimisation of pavement investigation resources and efforts for efficient delivery of a large program of works. Initial desktop review should include at minimum a high-level consideration of existing data such as the following; with more detailed desktop review for potentially large, complex or high risk projects:

- ARMIS data, such as rutting, cracking, roughness, potholes and patching; and pavement structure
- Digital Video Roads (DVR), which may include current and prior years
- historical and As Constructed drawings
- geotechnical information on soils, clay mineralogy, geotechnical reports and flooding and inundation data via iMaps
- checks for desktop resources on problematic subgrade soils such as contaminated soils, expansive soils, dispersive soils, sodic / saline soils and/or acid sulfate soils
- previous investigation information

- TSD (Traffic Speed Deflectometer) information, and
- maintenance records, local knowledge from District, Council and/or Maintenance Contractor, and historical pavement works.

The scope of pavement rehabilitation / pavement strengthening works will depend specific project scope; the condition of the existing pavement, projected traffic loads, and exposure to water. An initial pavement condition assessment can be undertake using desktop review and visual assessment to determine if pavement works should be considered for inclusion in project scope. If there is inconsistency or difficulty classifying pavement condition, the scope of proposed pavement works should be confirmed with Districts on a case by case basis; bearing in mind that the overall intent of any pavement works is to provide a consistent high-quality outcome across the longitudinal and cross-sectional extents of the project.

Some initial guidance is provided based on visual inspection and ARMIS data for pavement structural condition indicators as summarised in the table below.

Table A – Pavement structural condition indicator

Pavement Structural Condition Indicator	Condition Category		
	Very Poor	Poor	Fair
Rutting (mm)	>30 mm	20–30 mm	10–20 mm
Cracking (%)	>10%	4–10%	2–4%
Roughness (NRM Rideability counts/km)	>110	95–110	80–95
Potholes/patching (/km)	Many/Poor* >5% of area	Some/Medium* 0–5% of area	None/Good* 0% of area

*as defined by International Road Assessment Programme (iRAP) Star Rating and *Investment Plan Coding Manual*.

The indicators above are average values for 100 m sections. Where data from both wheel paths is available, both data sets should be considered rather than averaged. Typically, outer wheel path values will be the more severe case due to moisture ingress from the shoulder. However, more recent widening works may have resulted in a newer shoulder / outer wheel path with fewer defects, and an inner wheel path area with more defects. The *Guide to the Visual Assessment of Pavements* provides guidance on defect types and categorisation of severity.

Visual inspection

Pavement structural condition data should be confirmed via a visual assessment. Visual inspection of the pavement should be undertaken by an appropriately experienced pavement designer / engineer to assess condition, evidence of particular failure modes, terrain, drainage, and evidence of problematic subgrade soils; as part of scoping field investigation and assessing site variability.

Visual assessment should be undertaken preferably in person and via Digital Video Road (DVR). This is because some desktop data may not include or accurately reflect pavement condition, depending on when data was collected or conditions at that time. Assessments completed using DVR should include rear and forward cameras. This is because some defects may not show clearly on all camera views.

DVR assessments should also include prior years if recent reseals or asphalt patching is evident; to determine if recent surface treatments may be masking signs of structural distress, such as fatigue cracking, rutting, and potholing or patching. If recent surface treatments are evident, desktop review data and district maintenance records / staff can assist in identifying when reseals and/or significant asphalt patching work may have been undertaken; to assist in identifying which prior DVR records would be relevant for a particular section.

Non-destructive investigation

Some pavements may be in fair condition or better; or recently resealed; and areas of poor condition or insufficient strength may not be immediately evident. Non-destructive pavement investigation techniques can assist in providing information regarding pavement strength, profiles and materials. These could include Falling Weight Deflectometer (FWD) or Ground Penetrating Radar (GPR).

Destructive investigation

Before commencing the destructive pavement investigation, the pavement designer should undertake a holistic review of the project scope, risk, desktop study and available pavement investigation data; to determine the most suitable investigation locations and laboratory materials testing regime within the project scope.

Collecting pavement samples and undertaking laboratory testing is typically the most expensive part of the pavement investigation process. It is recommended that the pavement designer aims to optimise the testing locations by reviewing all available information prior to commencing the destructive pavement investigation. Where possible, the sampling and testing plan should also be optimised to allow one visit to site (that is, one site establishment). This will help reduce costs, strain on resources, program delays and minimise the impact to road users. There may also be opportunities to partner pavement investigation with other field investigations, such as acid sulfate soils, contaminated land, environmental testing or geotechnical investigation; with appropriate input from relevant specialists.

As a minimum trenching and/or test pitting should be undertaken in any areas of proposed pavement works at the following locations:

- areas of severe distress in existing pavements
- areas of likely low strength support conditions due to drainage, terrain or soil types
- in cuttings
- to identify areas of variable pavement profile such as at previous widenings, overlays or additional lanes
- pavement widening areas; including consideration of potential temporary widenings or sidetracks for traffic management
- major culvert extensions, and
- investigation planning can aim to locate test pits or augers in areas of proposed widenings adjacent to pavement trench locations; where suitable for the trench / test pit aims and where field investigation efficiencies are obtained.

Sampling approaches should be planned to obtain sufficient sample volume for required laboratory testing, including consideration of:

- If stabilisation of any insitu materials is a likely option; investigation locations should be planned to provide sufficient bulk sampling for mix design testing. This includes assessing the likely material variability across the site to ensure mix design testing represents various blends of different existing materials or layers that may be incorporated into stabilised materials in any new pavement. Bulk sampling should allow for at least 10 ergotainers or 150 kg of each material type.
- Sampling can also include augers in unbound granular pavements and/or subgrade, noting that augers typically do not provide significant sample volume so are generally more suitable for assessing variability rather than obtaining bulk sample for testing.
- Sampling can also include coring in asphalt or bound pavements.

However, in addition to the points noted above, the following investigation guidelines are provided as a starting point for scoping investigation; to be refined as site specific assessment and detailed design proceeds:

- Very poor or poor condition – 1–2+ test pits and trenches per km in the existing pavement and proposed widening areas; depending on homogeneity of existing pavement and subgrade; that can be supplemented by augers or cores.
- Fair condition – 1 test pits and trenches per km in the existing pavement and proposed widening areas; depending on homogeneity of existing pavement and subgrade; that can be supplemented by augers or cores.

Higher frequencies should be considered to provide greater reliability for design, especially for areas of variable pavement structure, subgrade and problematic soils. This guidance is provided in part due to the anticipated volume of investigation work potentially impacting the department and private investigation and laboratory resources during a period of intense infrastructure investment and construction within the Bruce Highway corridor.

However, investigation density also depends on anticipated pavement and subgrade variability, and test pits and trenches could be supplemented or replaced with augers / coring if appropriate, provided sufficient test pits or trenches are included to obtain required profile information and sample for homogenous sections of pavement and subgrade.

Field and laboratory investigation scoping should include:

- Pavement trenching, typically to at least 1.5–2.0 m below subgrade level, with sampling and Dynamic Cone Penetrometer (DCP) testing; with trenching preferably extending full lane and shoulder width to assess lateral variability.
- Test pitting outside the existing road formation to assess subgrade condition and potential treatments across the extents of site, with sampling and DCP testing.
- Daylighting trenches through batters to assess cutback points for widening details.
- Bulk sampling (granular, bound materials; and subgrade materials) or dry coring (asphalt or bound materials). Bulk sample of granular, bound and subgrade materials should consider sampling in sufficient volume to allow future mix design testing for potential stabilisation of existing materials, e.g., as part of a triple blend stabilised subbase.
- Material testing of existing pavement and subgrade materials, and potential subgrade materials in widenings; as per the department's Guideline *Pavement Investigation and Analysis*.
- Consideration of problematic subgrade soils, such as contaminated soils, expansive soils, dispersive soils, sodic / saline soils and/or acid sulfate soils.