DELIVERING FOR QUEENSLAND

Technical Note 216

Embankment Fill Materials

November 2025

Queensland Government

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1 General

The availability of suitable general earth fill materials, whether site-won or sourced nearby, must be considered during the design phase. This is particularly important when specifying or selecting embankment types (either homogeneous or zoned embankments), adopting subgrade parameters for pavement design and determining appropriate subgrade treatment types.

For new embankments exceeding 3 m in height, if the available earth fill consists mainly of Class A2, Class C or Class D materials, zoned configurations should be considered to optimise the use of these available materials in accordance with MRTS04 *General Earthworks*.

The availability of Class A1 material is becoming increasingly constrained across the state, which can significantly impact project costs and delivery timeframes. While Class A1 material is mandatory for structural zones of bridges located over waterways, its use in general embankment construction should be minimized wherever possible. Importantly, where both Class A1 and Class B materials meet performance requirements, Class B must be specified in preference to Class A1. This ensures that scarce A1 material is reserved for applications where it is essential.

2 Material types

General earth fill materials used for embankment construction in MRTS04 *General Earthworks* are classified into Classes A, B, C, or D, primarily based on their expansive potential as indicated by the Weighted Plasticity Index (WPI). Class A is further subdivided into Classes A1 and A2, depending on the erodibility of the material, which is assessed using the Plasticity Index (PI) and fines content. Additional requirements for subgrade materials include soaked or unsoaked CBR value and CBR swell, which are typically specified by the pavement designers.

If suitable rock material is available, particularly from site cuttings, rock fill may also be used for embankment construction. Other materials that may be considered include:

- ameliorated dispersive soils using agricultural lime or gypsum
- treated or neutralised potential acid sulfate soils, and/or
- recycled materials (e.g. recycled asphalt pavement – RAP).

The suitability of each material type depends on its properties, such as:

- expansive potential
- erosion resistance
- dispersive characteristics

- California Bearing Ratio (CBR) value, especially for subgrade applications, and
- soil gradation

Guidelines for material placement:

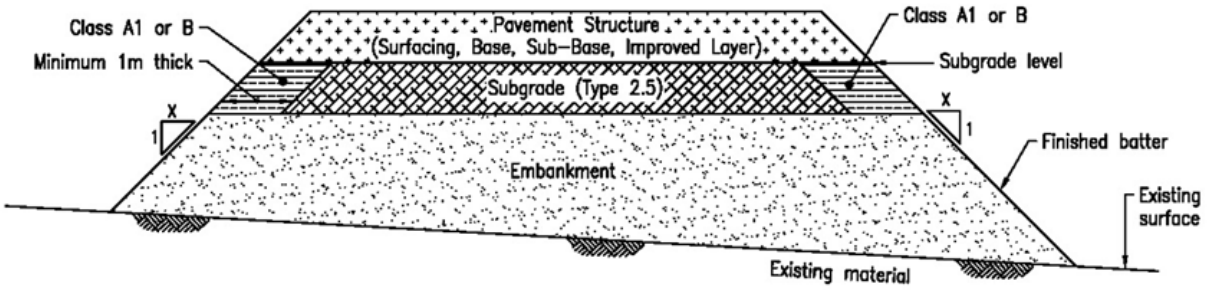
- Most materials may be used within the core zone of zoned embankments.
- Preference should be given to materials with inherent erosion resistance for batter zones, reducing reliance on batter protection. Typically, Class A1 and Class B materials are suitable for these exposed areas.
- For embankments less than 3 m in height, materials classified as A1, A2, B, or C may be used where the batter slope is 1V:4H or flatter.

3 Material substitution for Class A1

Embankment: Class B material should be adopted as the default alternative to Class A1 for embankment construction, except within structural zones of a bridge over waterways, where the use of Class A1 is mandatory. The structure zone is defined in the department's *Geotechnical Design Standard – Minimum Requirements*.

Subgrade preparation: Class A1 material is generally specified by designers for subgrade construction to achieve the required CBR value and swell for pavement design. Where Class A1 is unavailable, Type 2.5 unbound pavement material, in accordance with MRTS05 *Unbound Pavements*, may be considered as an alternative. To control erosion and promote vegetation growth, the outer zone of the Type 2.5 subgrade material should be covered with general earth fill (Class A1 or B), in accordance with MRTS04 *General Earthworks*. Refer Figure 3.

Figure 3 – Required Batter Protection when Type 2.5 material is used as Pavement Subgrade



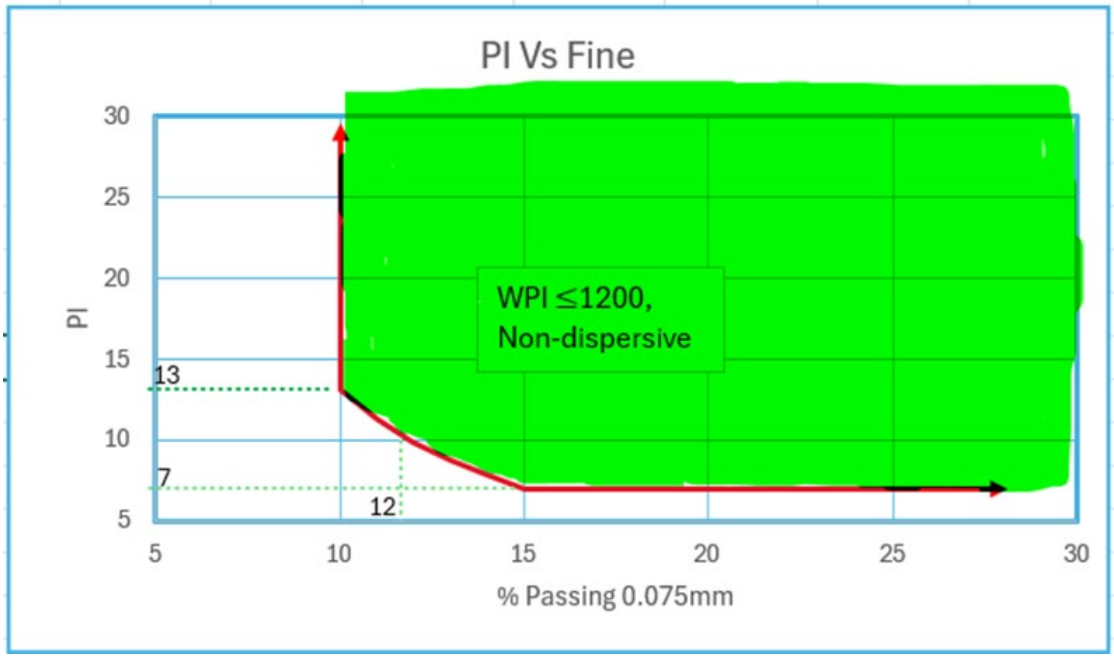
4 Class A1 Material definition

Class A1 material must meet the following criteria:

- Plasticity Index (PI) ≥ 7
- Fines passing 0.075 mm sieve ≥ 15%
- Weighted Plasticity Index (WPI) ≤ 1200, and
- Non-dispersive

These requirements have been updated: any non-dispersive material with WPI ≤ 1200 falling within the shaded area of Figure 4 is classified as Class A1.

Figure 4 – Plasticity Index (PI) and Fine Content Criteria for Class A1 material



5 Geotechnical Investigation

Comprehensive geotechnical investigations must be carried out to characterise and classify site-won materials intended to use as embankment fill and subgrade materials. Testing should include, but is not limited to, the following:

- particle size distribution
- Atterberg Limits
- Modified Emerson Class test (Q168) to assess dispersive potential, and
- soaked or unsoaked CBR and CBR swell for subgrade materials.

It is essential to consider material availability and supply sources during planning and design phases to ensure that the design and schedule accurately reflect suitable material types and associated costs.