331.1 GENERAL

The work of Full-Depth Reclamation with Expanded Asphalt Stabilization consists of in-place full-depth reclamation of the existing hot mix asphalt (HMA) and underlying granular base. The reclaimed material is shaped, compacted and then stabilized in-place by the addition of expanded asphalt. The stabilized material is then graded to the required profile and compacted. Following a minimum three-day curing period, the stabilized base is overlaid with HMA.

Full-Depth Reclamation with Expanded Asphalt Stabilization should be considered for roads that are severely cracked and structurally inadequate.

331.2 REFERENCES - None

331.3 TENDER ITEM

Full-Depth Reclamation with Expanded Asphalt Stabilization

331.4 SPECIFICATIONS

Details of the work are contained in OPSS 331.

331.5 SPECIAL PROVISIONS

The designer should refer to Chapter "E" of the CDED Manual to review the applicable special provisions.

331.6 STANDARD DRAWINGS

There are no Ontario Provincial Standard Drawings directly applicable to this type of work.
331.7 DESIGN

331.7.1 Geotechnical Design Considerations

The processing depth should target approximately 50% by mass of asphalt coated particles. The extent that the existing granular material contains asphalt coated particles should be considered when determining the processing depth. Where project conditions will result in a blended material significantly greater than 50% by mass of asphalt coated particles, the designer should reduce adjust the minimum amount of expanded asphalt to be added.

The amount of expanded asphalt to be added (design rate) is calculated using the following formula:

Design rate of expanded asphalt = 0.04 x uncoated aggregate particles (% by mass) + 0.015 x asphalt coated particles (% by mass)

For example, the design rate for a mix with 50% uncoated particles and 50% asphalt coated particles is 0.04 x 50% + 0.015 x 50% = 2.75%.

Typical reclamation equipment has a total maximum processing depth of 300 mm. A maximum of 50% of the total maximum processing depth may be existing asphalt. This means that, in locations where the bituminous pavement depth is greater than 150 mm, milling of the existing asphalt pavement to a thickness of 150 mm or less is required prior to in-place full-depth reclamation. Alternatively, larger pavement thicknesses may be more suited to cold in-place recycling (CIR) or cold in-place recycling with expanded asphalt (CIREAM).

Refer to CDED B510-5 for documentation requirements for milling (asphalt pavement removal, partial-depth).

For projects with variation in existing asphalt pavement thicknesses, different pulverizing depths should be considered by clustering the pavement into segments of similar asphalt pavement thickness, and the design rate of expanded asphalt calculated for each segment accordingly.

Full-Depth Reclamation with Expanded Asphalt Stabilization is meant to be a two-step process so that road profile and cross-fall can be corrected in the first pass, i.e. pulverizing and reshaping the road profile. In the second pass, expanded asphalt is added to stabilize the granular base and reclaimed material. A one step process using recycling train similar to CIR or CIREAM process is available and is commonly used, however it allows only minor cross-fall correction (<0.5%).

The widths required for in-place processing are often wider than the widths required for stabilization with expanded asphalt. The Geotechnical section may recommend and designers should consider processing without stabilization existing tapers or
paved shoulders, or where tapers or paved shoulders are being introduced. In some cases, granular shoulders are also processed without stabilization. Full width processing will ensure similar performance and drainage of the granular material. Following the in-place processing, expanded asphalt stabilization is typically only performed for full-lane pavement widths. Any required grading should be carried out as part of the in-place processing operation and not during the expanded asphalt stabilization process.

Cold mix widening, full-depth curve widening, and asphalt curb and gutter may be processed with the underlying granular.

The stabilized layer will gain strength over time and will perform similar to an asphalt binder layer, and one layer of hot mix overlying as wearing course may be sufficient, depending on traffic loading and design parameters. To date, surface treatment and micro-surfacing have not been used as the wearing surface.

Heavy traffic is not recommended on the processed surface before it has cured and been sealed with a wearing course. The wearing surface must be placed during the same construction season.

The designer should be aware that the length of the recycling operation may affect traffic management. A typical recycling train may extend up to 80m long.

331.7.2 Pre-Engineering Investigation

This section describes procedures and tests to be carried out during pre-engineering investigations on potential Full-Depth Reclamation with Expanded Asphalt Stabilization projects.

Adequate pre-engineering must be carried out to establish existing pavement thicknesses and composition. Ground Penetrating Radar (GPR) is a useful method of providing more frequent measurement for the thicknesses of the asphalt and the underlying granular layers.

This information is required for the designer to determine the processing depth, and the blend proportion of uncoated and asphalt coated particles, and to determine whether pre-milling is required.

Field investigation is required to determine the pavement condition and distress manifestations. The borehole layout and drilling protocol should follow the applicable regional geotechnical investigation guideline.
331.7.3 Other Design Considerations

The work requires the use of a pilot vehicle as part of the process. The regional traffic section should be consulted regarding the deletion of the pilot vehicle requirement if the work is on a freeway.

A pre-engineering mix design is recommended during the pre-engineering investigation stage to confirm the in-situ materials are suitable for stabilization, and to determine whether corrective aggregate or additive would be required for the mix to meet the minimum tensile strength requirement.

331.7.4 Information to be Provided to Bidders

The existing pavement depth must be included in the documents in the form of soils borings, pavement cores, or ground penetrating radar graphs. In the absence of soils borings, pavement cores, or ground penetrating radar graphs, a table shall be included in the drawings denoting the existing pavement depths throughout the work area.

331.8 COMPUTATION

331.8.1 Source of Information

Requirements are as recommended in the Pavement Design Report or by the Regional Geotechnical Section.

331.8.2 Method of Calculation

Full-Depth Reclamation with Expanded Asphalt Stabilization

This is a plan quantity payment item. Areas in square metres may be measured or scaled from plans.

331.9 DOCUMENTATION

331.9.1 Contract Drawings

In complicated layout locations, the areas may be symbolized on the contract drawings. Drawing details may be required, for example where the limits of reclamation (in-place processing) and stabilization do not coincide.

Typical sections are required indicating the road widths and depths to be in-place processed and the widths and depths of expanded asphalt stabilization. Staged typical sections may be required to fully detail the work, for example when the addition of granular is required to correct crossfall and/or superelevation.
331.9.2 **Q-Sheets**

The station to station limits and offsets for this work is to be shown on the ‘Quantities – Hot mix and Granular’ sheets together with the corresponding areas in square metres. A separate line entry should be initiated in any location where the stabilization depth changes.

331.9.3 **Documentation Accuracy**

Station locations are required to the nearest metre accuracy, and offsets to the nearest 0.1 metre. Areas are calculated to the nearest whole square metre.