Complete yield checks and monitor thickness determinations to construct the work as shown on the plans. Use the tolerances for lift thickness in accordance with 2360.3.E, “Surface Requirements” and surface smoothness requirements in accordance with 2399 for occasional variations and not for continuous over-running or under-running, unless otherwise required by the Engineer.

The contract unit price for asphalt mixture production includes the cost of the material and loading onto Department-provided trucks at the mixing plant.

The Department will pay for plant mixed asphalt pavement on the basis of the following schedule:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2360.501</td>
<td>Type SP* Wearing Course Mixture ‡‡</td>
<td>ton [metric ton]</td>
</tr>
<tr>
<td>2360.502</td>
<td>Type SP* Non-Wearing Course Mixture ‡‡</td>
<td>ton [metric ton]</td>
</tr>
<tr>
<td>2360.503</td>
<td>Type SP* Course Mixture ‡‡ in [mm] thick,</td>
<td>square yard [square meter]</td>
</tr>
<tr>
<td>2360.504</td>
<td>Type SP* Course Mixture ‡‡</td>
<td>square yard [square meter]</td>
</tr>
<tr>
<td>2360.505</td>
<td>Type SP * Bituminous Mixture for Specified Purpose</td>
<td>ton [metric ton]</td>
</tr>
<tr>
<td>2360.506</td>
<td>Type SP * Bituminous Mixture Production</td>
<td>ton [metric ton]</td>
</tr>
</tbody>
</table>

* Aggregate size Designation, 9.5, 12.5 or 19 as appropriate, see 2360.1.A.3.
† "Wearing" or “Non Wearing” as appropriate.
‡ Traffic level in accordance with Table 2360-1, “Traffic Levels.”
§ AC binder grade designation (Table 2360-2).
# Lift thickness shown on the plans.

2363 PERMEABLE ASPHALT STABILIZED STRESS RELIEF COURSE (PASSRC) AND PERMEABLE ASPHALT STABILIZED BASE (PASB)

2363.1 DESCRIPTION
PASSRC is typically constructed on the in place concrete or bituminous surface to act as a separation layer and move water rapidly from beneath the unbounded concrete overlay for greater service life.

PASB is typically constructed on a prepared base under a new concrete or bituminous surface to quickly drain surface infiltrated water accumulating under the pavement.

2363.2 MATERIALS
A Aggregate.
Use MnDOT 3139.3.

B Asphalt Binder
Use MnDOT 3151.A (PG 64-22)

C Mixture Design

C.1 Sample Submittal
At least 15 days prior to the beginning of mixture production, submit representative samples of aggregate and the asphalt binder to perform the PASSRC or PASB mix design in District Materials Lab where the project is located. Submit aggregates that require magnesium sulfate soundness at least 30 days prior to the start of asphalt production.

C.2 Aggregate
1. Submittal. Submit to the District Materials Engineer an 80 lb [35 kg] sample of aggregate retained on the #4 [4.75 mm] sieve and 35 lb [15 kg] of aggregate passing the #4 [4.75 mm] sieve. The Contractor will obtain and store an equal size sample until the Mixture Design Report (MDR) is issued.
2. Intent to Sample. Provide the agency with 24 hour advance notification.
3. Testing. Test for the quality of each source, class, type and size of virgin and non-asphaltic salvage aggregate source will be done for the mix design.

C.3 Asphalt Binder

1. Submittal. Submit 4-1 quart [1.0 L] samples of the same PG grade as required and also from the same supplier as production will come from.

C.4 Mixture

Provide the proposed Job Mix Blend for each combination of aggregates to be used in the mixture. Include the following information:

1. Composite gradation. Based on the proportions of each material, determine the composite gradation in percent of total aggregates.
2. Individual gradation. Determine the gradation for each individual component.

C.5 Mixture Design Report (MDR)
The Engineer will issue an MDR when the mixture design is successfully completed. The MDR will include the Job Mix Formula (JMF) requirements for gradation and asphalt cement content. Paving without an MDR is not allowed.

D. Mixture Quality Management.

D.1 Sampling and Testing

Production sampling and testing rates for start-up and production are shown in the Schedule of Materials Control (MCS). Take aggregate quality samples as directed by the Engineer. Sample the following items in accordance with the MCS:

1. Gradation.
2. Coarse Aggregate Angularity
3. Asphalt Content

D.2 Documentation

Include the following production test rests, and mixture on the Department approved Test Summary sheet.

1. Gradation. Sieves listed in 3139.3.B
2. Coarse aggregate angularity
3. Percent asphalt binder content (spot check).
4. Aggregate proportions in use at the time of sampling
5. Tons where sampled
6. Cumulative tons.
7. Tons represented by test
8. Signature Line for Agency and Contractor Representative.
9. MnDOT verification sample test result.

D.3 JMF Limits

The mixture production targets and JMF limits, as shown in Table 2213-1, are listed on the MDR. Field results may deviate from the JMF target; however, JMF limits as show below are used as the specification limits for acceptance.

<table>
<thead>
<tr>
<th>Table 2213-1 JMF Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>Gradation</td>
</tr>
<tr>
<td>Asphalt Binder Content</td>
</tr>
</tbody>
</table>

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2363.3 CONSTRUCTION REQUIREMENTS

A. Handling and Placement.

1. Mixing and Compaction Temperature. Use binder supplier recommended temperatures. Unless authorized by the Engineer, do not produce the mixture no more than 30°F above the recommended maximum mixing temperature. The Department will not pay for or allow placement of any mixture produced at more than 30°F above the recommended maximum mixing temperature.

2. Rutting of Existing Surface. Equipment used to deliver or place the mixture cannot rut the in-place aggregate base (filter) layer or subgrade, or tear or displace the geotextile if used. Any ruts formed must be repaired and leveled to satisfaction of the engineer, at no cost to the agency, prior to placing the mixture so that water draining through the mixture will not pond and create soft spots in the base/subgrade.

3. PASSRC:
   a. Construction Sequence.
      i. Construct interceptor drains (if required by design)
      ii. Build PASSRC layer
      iii. Construct pavement.
      iv. Trench in permeable base drain adjacent to slab.
      v. Install variable depth 3138 Class 5 shoulder aggregate (do not remove the in-place bituminous shoulders)
      vi. Place new bituminous shoulder structure.

B. Surface Preparation.
Remove loose or deteriorated surfacing and clean the surface by power sweeping and air blasting. Removal of deteriorated areas from joints, cracks, bituminous patched areas, etc. may require air blasting, the use of a small milling machine, or handwork as directed by the Engineer. Air blasting must performed with at least 100 psi [690 kPa] equipment.

C. Maintenance.
The contractor is responsible to maintain the integrity of the PASSRC or PASB until the concrete or bituminous pavement is placed on it. Any deficiencies in thickness, smoothness, or density need to be corrected.

1. Contamination. Keep the PASSRC and PASB and associated drains free of soils or other contaminants. Contaminated material shall be removed and replaced by the Contractor to the satisfaction of the Engineer at no cost to the Department.

2. Drainage. Maintain drainage so water is not allowed to pond in the PASSRC or PASB.

3. Construction Equipment. Concrete hauling units, either loaded or empty are permitted on the PASSRC. Only the paver, rollers, and bituminous haul trucks are only allowed to drive on the PASB. The bituminous haul trucks can only drive on the PASB immediately in front of the paver to unload, and then leave the PASB as soon as the bituminous is unloaded.

4. Density. PASSRC and PASB need to be dense and stable after construction so it will not rut when the overlying pavement is placed.

5. Damage. The contractor will repair the PASB or PASSRC promptly by the Contractor, as directed by the engineer, at no expense to the Agency.

D. Concrete Pavement Construction.

1. Whitewash Coating. Within 2 hours prior to constructing a concrete overlay, coat the permeable asphalt layer with a whitewash of hydrated lime and water. A uniform color of whitewash, not darker than the uncoated concrete after curing will be applied to the permeable asphalt layer. The purpose of the whitewash is to reduce the heat generated from the black surface of the permeable asphalt layer, and thus giving an even curing temperature within the pavement. If the whitewash should wear off due to construction operations, replace it or cool the surface with water immediately prior to paving.
2. Dowel Baskets. Use an anchorage system of sufficient length and a minimum shank diameter of 0.177 inch [0.45 cm] to penetrate the in-place concrete a minimum of 1 inch [25 mm]. A minimum of seven anchorage points are required, four on the side of the basket facing the front of the paver. Fasten the baskets to the surface so that they may not be moved vertically or horizontally more than 1/8 inch [3 mm] from the permeable asphalt layer. The anchorage procedure must be demonstrated prior to the start of paving.

E. Drain Installation.
1. Concrete Pavement. Install drain after pavement is constructed
2. Bituminous Pavement. Install drain after the non-wear course(s) are constructed, but before the wearing course is placed.
3. Shoulder/Base Aggregate. Install drains before shoulder/base aggregate is placed.

F. PASB Widening.
1. Subsurface drain. Construct the subsurface drain prior to cutting the pavement widening trench. Place the fine filter aggregate 4 inches [100 mm] above the proposed bottom of the pavement widening. Placement of the subsurface drain after the widening trench has been cut and widening placed will be allowed only with a special widening design and when approved by the Engineer.
2. Trench. Prior to placement of the PASB, shape and compact the bottom of the widening trench. No equipment will be allowed in the trench except that used for compaction. After shaping and compaction of the widening bottom, the exposed edge of the in place pavement must be clean and free of soil so that water is free to drain into the adjacent PASB. Do not crush the in place drain pipe. After compaction, place clean filter aggregate. If the filter aggregate or PASB becomes contaminated, these materials will be replaced or cleaned.
3. Geotextile. If required by the design, upon completion of compaction, place the geotextile in the bottom of the widening trench. Extend the geotextile from the edge of the in place pavement to the inside edge of the drain trench. Do not lap up onto the in place pavement nor extend across any part of the drain trench.

G. Pavement Density.
1. Method. Use MnDOT 2360.3.D.2, Ordinary Compaction Method
2. Temperature. The contractor is advised that it may be necessary to permit the permeable asphalt layer to cool sufficiently before compaction rolling to prevent rutting and shoving. In no case will compaction be allowed at less than 110°F [43°C].
3. Water. Water may not be used to accelerate the cooling process.
4. Rollers. Self-propelled steel wheeled compacting equipment must weigh at least 8 ton [7.3 tonne]. Rollers must be steel wheeled both front and back and capable of reversing without backlash and equipped with spray attachments for moistening both rollers. Vibratory compaction will NOT be allowed. When the mixture placed exceeds 100 tons per hour, at least two rollers must be used. Adequacy of compaction to provide stability will be judged by the Engineer. Over rolling, to the extent that aggregate particles degrade, is not permitted. ..........

H. Verification Testing.
Verification testing will be performed on the Quality Assurance samples for gradation and coarse aggregate angularity. The department will monitor 1 asphalt binder content spotcheck per day. Allowable differences (tolerances) between contractor and MnDOT test results are specified below in Table 2213-3. Substitute the Agency results for acceptance when the tolerance is exceeded.
1. **Failing Materials**
   (Gradation, Coarse Aggregate Angularity, and Extracted Asphalt Binder Content)

   The determination of price adjustments for failing materials will be based on the specification limits outlined in Table 2213-2 as shown below for that specific test. Reduced payment as shown in the table below will be applied to all tonnage represented by the individual test results that do not meet the limits. The Contractor cannot continue to produce failing mixture. A continual basis is defined as all lots in a day’s production failing to meet specification requirements for gradation, crushing, or binder content, or more than 50% of the lots on two or more consecutive days which fail to meet specification requirements for gradation, crushing, or binder content.

<table>
<thead>
<tr>
<th>Item</th>
<th>Allowable Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Aggregate Angularity, % fractured faces (%P)</td>
<td>15</td>
</tr>
<tr>
<td>Asphalt binder content:</td>
<td></td>
</tr>
<tr>
<td>Ignition Oven %</td>
<td>0.3</td>
</tr>
<tr>
<td>Gradation sieve, % passing:</td>
<td></td>
</tr>
<tr>
<td>No. 4 [4.75 mm] and larger</td>
<td>5</td>
</tr>
<tr>
<td>No. 10 [2.00 mm]</td>
<td>3</td>
</tr>
<tr>
<td>No. 40 [0.425 mm]</td>
<td>3</td>
</tr>
<tr>
<td>No. 200 [0.075 mm]</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Table 2213-2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Pay Factor, % *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradation</td>
<td>95</td>
</tr>
<tr>
<td>Coarse aggregate crushing</td>
<td>90</td>
</tr>
<tr>
<td>Extracted Asphalt binder content</td>
<td>90</td>
</tr>
</tbody>
</table>

* Apply the lowest pay factor when using multiple reductions on a single test.
** No price reduction for asphalt content in excess of allowable tolerance provided there is no visual observation of asphalt drain down.

J. **Thickness and Smoothness Requirements.**

1. Elevation. The finished surface of permeable asphalt layer at any point of measurement must not vary be more than ±5/8 inch [16 mm] from the prescribed elevation for that point as determined from the grades staked by the Engineer and the cross section in the Plan.
2. Thickness. Within ±1/4 inch [6 mm] of the compacted depth shown on the typical section in the plan.
3. Deficient. The contractor will correct any areas which are deficient by more than 1/4 inch [13 mm] by scarifying, adding mixture, compacting, shaping, and finishing in accordance with these specifications, or directed by the Engineer.

For PASSRC, two alternatives have been developed for control of payment for unbounded concrete overlays. The first option offers Agency surveying; the second option offers Contractor surveying. The designer should insert the selected option in the Special Provisions. The 2 options are listed below as Option #1 and Option #2. If the designer does not say which option to use leave both in.

**Option #1 - Agency Survey Method for Pavement Profile Control**

1. Place the PASSRC layer to the width and compacted depth shown on the typical section in the plans.
2. After placement of all the PASSRC, the Contractor will notify the Agency that the Agency has 5* days to survey the pavement surface at 100 foot [30 m] intervals (25 feet [7 m] in transition areas)
on centerline and 12 feet [3.6 m] left and right of centerline and place hubs at 50 foot intervals on both sides of roadway. Based on this survey, the Agency will establish a concrete paving profile that closely follows the old profile to control concrete quantity but has not abrupt changes.

3. Use a stringline for grade control on both sides of the roadway during paving.

4. The Contractor will be paid for all of the Structural Concrete produced and placed up to 102 percent of the amount computed by the agency survey crew in their determination of the profile and resulting estimated structural concrete quantity, unless otherwise approved by the Engineer. Determine the quantity by computerized printouts from the Contractor’s plant as verified by cement cutoffs with the consideration of any waste as determined by the Engineer.

5. The Contractor cannot make a claim for any additional ride incentive or reduction in the ride disincentive due to the agency selecting the finished profile or the concrete overlay.

6. Take concrete cores 2 feet [0.6 m] from the outside pavement edge.

* Suggested time period. This may be modified by the Agency.

**Option #2 - Contractor Survey Method for Pavement Profile Control**

1. Place the PASSRC layer to the width and compacted depth shown on the typical section in the plans.

2. After placement of all the PASSRC, the Contractor will survey the pavement surface at 100 foot [30 m] intervals (25 feet [7 m] in transition areas) on centerline and 12 feet [3.6 m] left and right of centerline and place hubs at 50 foot intervals on both sides of roadway. Based on this survey, the Contractor will use these results to establish a recommended paving profile for review by the Engineer. The Engineer will approve or disapprove the Contractor’s recommended paving profile within 3 working days. Approval is based on establishing a concrete paving profile that closely follows the old profile to control concrete quantity but has no abrupt changes.

3. Use a stringline for grade control on both sides of the roadway during paving.

4. The Contractor will be paid for all of the Structural Concrete produced and placed up to 102 percent of the amount computed by the Contractor’s survey crew in their determination of the profile and resulting estimated structural concrete quantity, unless otherwise approved by the Engineer. Determine the quantity by computerized printouts from the Contractor’s plant as verified by cement cutoffs with the consideration of any waste as determined by the Engineer.

5. The Contractor cannot make a claim for any additional ride incentive or reduction in the ride disincentive due to the agency selecting the finished profile or the concrete overlay.

6. Take concrete cores 2 feet [0.6 m] from the outside pavement edge.

**2363.4 METHOD OF MEASUREMENT**

Measurement for PASB and PASSRC will be in accordance with the following. Bituminous mixture and bituminous material for mixture will be paid for separately.

Measurement will be made by the weight of bituminous mixture for the permeable asphalt layer. Payment will be made at the Contract bid price per ton [metric ton]. Payment for the accepted bituminous mixture will be payment in full for all costs of constructing the permeable asphalt layer, including the costs of mixture production, aggregate incorporation, placement, and compaction. Cost for Bituminous material is specifically excluded. Measurement will be made by the weight of bituminous material incorporated into the permeable asphalt layer. Payment will be made at the Contract bid price per ton [metric ton]. Payment for Bituminous material, based on the acceptance of the permeable asphalt layer, will be payment in full for bituminous material, any additives, and the incorporation of the bituminous material into the mixture.

**2363.5 BASIS OF PAYMENT**

Payment for the accepted quantity of permeable asphalt layer at the Contract unit price of measure will be compensation in full for all costs of furnishing and applying all materials required in this specification. The unit price includes all labor materials, and equipment necessary to complete the work.

Payment for geotextile, when required for widening designs, will be considered incidental.
2365 STONE MATRIX ASPHALT -- SMA

2365.1 DESCRIPTION
This work consists of constructing a Stone Matrix Asphalt Wearing Course Mixture (SMA) placed on a prepared surface in accordance with these specifications.

Construct the SMA to the lines, grades, thicknesses, and typical cross-sections shown on the plans or established by the Engineer.

Stone Matrix Asphalt Mixture Designation Code: SMWEE640E

2365.2 MATERIALS
A Aggregates
Use only virgin aggregates.

A.1 Aggregate Requirements
Provide mineral aggregate meeting the requirements of Table 2365-1, “Stone Matrix Asphalt Aggregate Gradation Broad Bands” and Table 2365-2, “Stone Matrix Asphalt Mixture Aggregate Requirements”:

<table>
<thead>
<tr>
<th>Table 2365-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stone Matrix Asphalt Aggregate Gradation Broad Bands</td>
</tr>
<tr>
<td>(% passing of total washed gradation)</td>
</tr>
<tr>
<td>Sieve Size, inch (mm)</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>3/4&quot; (19.0)</td>
</tr>
<tr>
<td>3/8&quot; (12.5)</td>
</tr>
<tr>
<td>3/8&quot; (9.5)</td>
</tr>
<tr>
<td>#4 (4.75)</td>
</tr>
<tr>
<td>#8 (2.36)</td>
</tr>
<tr>
<td>#200 (0.075)</td>
</tr>
</tbody>
</table>