

SAMPLE DESIGN OF AN ASPHALTIC OVERLAY WITH PAVING FABRICS

Prepared by:

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EXISTING PAVEMENT CONDITIONS

Sub grade CBR value:3 One way daily 18 kips single axle loads: 80
Existing Surface Layer: 2.0 inches Traffic growth rate: 3%
Asphalt Binder Course: 3.8 inches Present Serviceability Index: 2.0
Aggregate Base Course: 10.0 inches

Based on pavement evaluation, i.e. rutting, cracking and fatigue the pavement has reached 2.0 PSI. A PSI of 2.0 means that 85% people who travel the road complain that the ride is unacceptable. PPI ranges from 0 to 5 and 5 means an excellent ride.

EVALUATION OF EXISTING PAVEMENT STRUCTURE

The existing pavement design records show that the pavement was designed by AASHTO procedure based on the following information:

Structural Number for the design: 4.0 SSV based on CBR 3: 1.8

AASHTO design equation: $SN = a_1d_1 + a_2d_2 + a_3d_3$

Where a_1 , a_2 and a_3 are structural coefficients of strength and d_1 , d_2 and d_3 are thickness' of various layers.

$$4.0 = 2.0 \times 0.44 + 3.75 \times 0.44 + 10.0 \times 0.14$$

$$4.0 = 3.9 \quad \text{Design was OK}$$

Structural strength coefficient for new asphaltic concrete: 0.44

Structural strength coefficient for new aggregate base: 0.14

DESIGN FOR AN OVERLAY

Pavement needs to be upgraded to the previous strength

Average traffic one way 18 kip single axle loads 120

Traffic growth 3.0%

Subgrade CBR same 3.0

Structural Number 4.0

According to AASHTO design the structural strength coefficients for the old pavement since it reached a PSI of 2.0 are considered 70% of the original values.

Structural strength coefficients for old pavement:

Asphalt cement concrete $0.44 \times 0.70 = 0.31$ Aggregate Base $0.14 \times 0.70 = 0.098$

By using the latest AASHTO design equation: $SN = a_1d_1 + a_2d_2m_2 + a_3d_3m_3$

Where a and d are same as previously explained and m_2 and m_3 are recommended drainage factors by AASHTO for fair draining base and sub-base which is 0.8 per AASHTO table 2.4. Drainage for this type of base is considered fair. Water is removed within a week from the base. Also part of this aggregate base had been intermixed with sub grade during the service life of the pavement

EVALUATION OF THE EXISTING PAVEMENT FOR STRUCTURAL STRENGTH

$$4.0 = 2.0 \times 0.31 + 3.75 \times 0.31 + 10.0 \times 0.098 \times 0.8$$

$$4.0 = 2.6$$

The pavement needs to be strengthened by at least 1.4 structural numbers: $4.0 = 2.6 + 1.4(3.0 \times 0.44)$

Overlay required = 3.0 inches

By incorporating Mirafi[®] MPV into the overlay design, drainage factor can be eliminated. The fabric will also provide additional service life.

Mirafi[®] MPV performs three functions in an overlay:

- Drastically reduce the surface water penetration into base and sub grade
- Increase pavement fatigue life
- Retard reflective cracking

Research done by California Department of Transportation clearly show that performance of paving fabric in the pavement system is equal to 1.2 inches of a Hot Mix Asphalt overlay. Additionally if you evaluate the performance based on cost/benefit ratio on life cycle basis it is very cost effective.

Incorporation of Mirafi[®] MPV fabric

With Mirafi[®] MPV use the old AASHTO equation for design

$SN = a_1d_1 + a_2d_2 + a_3d_3 + \text{Mirafi}^{\text{®}} \text{ MPV paving fabric}$

$4.0 = 2.5 \times 0.44 + 2.0 \times 0.31 + 3.75 \times 0.31 + 10.0 \times 0.098$

$4.0 = 3.9$ Overlay design is OK

Place 2.5 inches of Hot Mix Asphalt overlay with Mirafi[®] MPV fabric

Mirafi[®] MPV reduced the design thickness by 0.5 inches and the pavement will perform as equal or better than standard design. At the next overlay cycle fabric will still be providing the same benefits during the design of that overlay.

PAVEMENT FABRIC CONSTRUCTION SPECIFICATION

MATERIALS:

The pavement paving fabric shall be furnished by an ISO approved manufacturer of polypropylene or polyester geosynthetics and is utilized to extend the service life of pavement overlays. The paving fabric shall be needle punched, nonwoven and heat treated on one side and shall conform to the following physical and mechanical properties:

Property	Units (MARV)	Test Method	Minimum Avg. Roll Value
Mass Per Unit Area	oz/yd ² /(gm/m ²)	ASTM D3776	4.1 (140)
Grab Tensile Strength	lb (N)	ASTM D4632	102 (450)
Grab Elongation at Break	%	ASTM D1682	50
Mullen Burst Strength	lb (kPa)	ASTM D3786	200 (1378)
Asphalt Retention	gal/yd ² (l/m ²)	ASTM D6140	0.21 (1.04)

A Certificate of Compliance for the paving fabric used on the project shall be furnished by the manufacturer to the engineer. The paving fabric shall be supplied in protective a cover or wrap that is capable protecting the fabric from ultraviolet rays, abrasion, and water. Mirafi® MPV500 or approved equal paving fabric should be used. Mirafi® MPV 500 is available from TenCate Geosynthetics, (888) 795 0808 or (706) 693 2226.

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Asphalt Sealant: The Engineer shall approve asphalt cement. A grade asphalt of the same type used in the manufacture of the hot mix asphalt for the overlay should be acceptable.

EQUIPMENT:

Asphalt Distributor: The distributor must be suitably metered and capable of spraying the asphalt cement uniformly and at the prescribed application rate. No drilling or skipping shall be permitted.

Fabric Handling Equipment: A tractor or similar mechanical device with mounted laydown equipment that is capable of handling full rolls of fabric shall be used. The equipment shall be capable of laying the paving fabric smoothly without excessive wrinkles and/or folds.

Miscellaneous Equipment: Stiff bristle brooms used to smooth, and scissors (or blades) used to cut the paving fabric shall be provided by the Installer. A pneumatic-tired roller may be needed in some cases to smooth paving fabric into the asphalt cement.

INSTALLATION PROCEDURE:

Surface Preparation: The surface on which the paving fabric is to be placed shall be free of dirt, water, vegetation and other foreign materials. Open cracks $\frac{1}{4}$ inch or larger shall be filled with sand mixed asphalt as directed by the Engineer. Cracks larger than $\frac{1}{4}$ inch or holes shall be filled with cold or hot mix asphalt. The use of a leveling course may be required prior to placing the paving fabric in severe cases.

Application of Sealant: The asphalt cement and binder must be uniformly spray-applied at the specified rate. The quantity required may vary with the surface condition of the existing pavement (e.g. degree of porosity), but shall be applied at a nominal rate of 0.25 gallons per square yard of residual asphalt.

Application of asphalt cement will be performed by truck-mounted distribution equipment whenever possible, with hand spraying kept to a minimum. The temperature of the asphalt cement must be sufficiently high to permit a uniform spray pattern. The minimum recommended temperature for asphalt cement is 290oF, and should not exceed 325oF at the contact surface.

Paving Fabric Placement: The paving fabric shall be placed onto the asphalt cement with a minimum of wrinkles before the asphalt can cool or lose its tackiness. The paving fabric shall be placed so that the non-heat treated (bearded or fuzzy) side is placed downward, into the sealant, thus providing optimum bond between fabric and pavement during the construction process. As directed by the Engineer, wrinkles severe enough to cause “folds” shall be slit and laid flat in the direction of paving operations. Brooming the paving fabric will assist it in making intimate contact with the pavement surface. Any overlap of the paving fabric should be minimized, although an overlap of 1 to 3 inches is recommended to insure full closure of overlapping layers. Transverse joints should be shingled (overlapped) in the direction of paving operations to prevent edge pick-up by the paver. The contractor installing the paving fabric must prove that they have at least 4 years experience in placing paving fabric.

In the event that asphalt cement should bleed through the paving fabric before the hot mix asphalt is placed, it may be necessary to absorb any visible sealant by spreading sand or hot mix asphalt over those areas. This should minimize the tendency for construction equipment tires to lift the paving fabric when driving over it. Turning of paving equipment and other vehicles on the paving fabric must be kept to a minimum to avoid movement or damage to the fabric.