

VIRGINIA DEPARTMENT OF TRANSPORTATION

LOCATION AND DESIGN DIVISION

INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: PAVEMENT DESIGNS	NUMBER: IIM-LD-158.12
SPECIFIC SUBJECT: SURFACE TREATMENTS; STABILIZATION; SUBSURFACE MATERIAL; PAVED SHOULDERS; CROSSOVERS	DATE: MAY 22, 2014
	SUPERSEDES: IIM-LD-158.11
APPROVAL:	B. A. Thrasher, P.E. State Location and Design Engineer Approved May 22, 2014

Changes are shaded.

CURRENT REVISION

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- This memorandum was revised to remove General Notes P-2 and G-7. These notes remain applicable and are included in IIM-LD-110.24.
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EFFECTIVE DATE

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- This memorandum is effective upon receipt for all projects that have not been turned in for Pre-Advertisement Conference.
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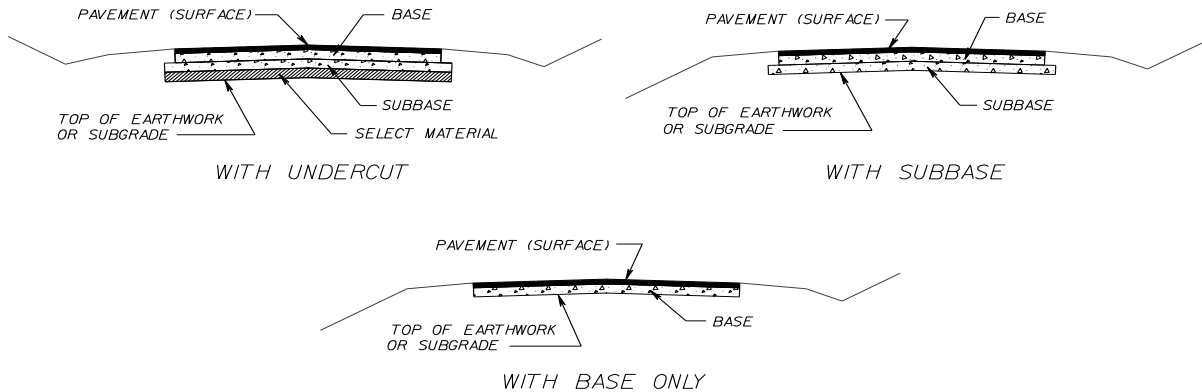
PROCEDURES

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- Pavement recommendations are requested by submitting Form LD-252 to the District Materials Engineer.

EXPLANATIONS OF PAVEMENT COMPONENTS

- The following terms are to be used on plans, typical sections and summaries:

PAVEMENT DETAILS



MIX TYPE COMPARISON AND APPLICATION RATE

Asphalt Concrete Mixes (Note 4)	Nominal Maximum Aggregate Size	Normal Application Rate (Note 1)
Surface Mix		
SM-9.0	3/8 inch (9.5 mm)	1 inch – 110 lb/ yd ² (25.0 mm – 60 kg/m ²)
SM-9.5	3/8 inch (9.5 mm)	1.5 inch - 165 lb/ yd ² (40.0 mm – 90 kg/m ²)
SM-12.5	1/2 inch (12.5 mm)	1.5 inch - 165 lb/ yd ² (40.0 mm – 90 kg/m ²)
SM-19.0	3/4 inch (19.0 mm)	2 inch – 220 lb/ yd ² (50.0 mm – 125 kg/m ²)
SMA-9.5	3/8 inch (9.5 mm)	1.5 inch - 165 lb/ yd ² (40.0 mm – 90 kg/m ²)
SMA-12.5	1/2 inch (12.5 mm)	1.5 inch - 165 lb/ yd ² (40.0 mm – 90 kg/m ²)
Intermediate Mix		
SMA 19.0 (intermediate)	1/2 to 3/4 inch (12.5 to 19.0mm) (Note 2)	2 inch – 220 lb/ yd ² (50.0 mm – 125 kg/m ²)
IM-19.0	3/4 inch (19.0 mm)	2 inch – 220 lb/ yd ² (50.0 mm – 125 kg/m ²)
Base Mix		
BM-25.0	1 inch (25.0 mm)	3.0 inch (Note 3) (75.0 mm)
Open Graded Drainage Layer		
OGDL	--	2.0 inch (50 mm)

Note 1 Application rate is based upon 110 pounds per square yard per inch (2.35 kilograms per square meter per millimeter) of thickness.

Note 2 SMA Intermediate design criterion allows the mixture to meet the definition of either nominal maximum aggregate size.

Note 3 Application rate for BM Type mixes should be determined from the actual specific gravity of the mixture as called for by the Materials Division or by region as indicated in the Asphalt Base Mixes Table on Sheet 4.

Note 4 The application rate for a given mix does not change due to the "A", "D", or "E" designation in the mix type.

- This table is used for design purposes. This table should not supersede Section 315 of the Road and Bridge Specifications for field application rates.
- For initial construction, it is not recommended to place multiple lifts of surface or intermediate asphalt concrete mixes. A second lift of surface or intermediate may be approved and placed when initial construction has been completed.

GENERAL NOTES

- General Notes P-2 and G-7 are to be shown on the General Notes Sheet (See IIM-LD-110).

WEIGHTS OF ASPHALT CONCRETE MATERIALS

- In computing weights of asphalt concrete base mixes, the following weights in kilograms per square meter per millimeter (pounds per square yard per inch) of depth shall be used unless otherwise directed by the Materials Division.

ASPHALT CONCRETE BASE MIXES

The following table is to be used only when rates are not provided in the Materials Division's Pavement Design:

DISTRICT	AREAS	BASE MIX WEIGHTS	
		kg/m ² /mm	Lbs/S.Y./In.
Bristol	Abingdon-Marion-Wytheville-Galax	2.46	115
	Bluefield-Big Stone Gap-Woodway-Bristol	2.39	112
Salem	Buchanan-Roanoke-Salem-Radford-Martinsville	2.43	114
Lynchburg	Lynchburg	2.41	113
	Danville	2.35	110
	South Boston	2.37	111
Richmond		2.35	110
Suffolk		2.35	110
Fredericksburg		2.35	110
Northern Virginia	Arlington-Fairfax	2.61	122
Culpeper	Charlottesville	2.52	118
	Culpeper-Flint Hill	2.41	113
Staunton		2.39	112

The weight of the asphalt mixtures listed is based on 95% of theoretical maximum density.

PRIMING/CURING OF SUBSURFACE MATERIAL

SUBSURFACE MATERIAL	NEXT COURSE	SUBSURFACE MATL. NOT SUBJECTED TO PUBLIC TRAFFIC	* SUBSURFACE MATL. SUBJECTED TO PUBLIC TRAFFIC
AGGREGATE BASE MATERIAL AND OTHER MATERIAL NOT LISTED HEREIN	ASPHALT CONCRETE – SURFACE MIX, INTERMEDIATE MIX or BASE MIX	<u>H</u>	<u>F</u> PRIME & COVER
	ASPHALT CONCRETE – OPEN GRADED DRAINAGE LAYER	<u>A</u> PRIME	<u>F</u> PRIME & COVER
	OTHER MATERIAL	<u>D</u>	<u>F</u> PRIME & COVER <u>G</u>
CEMENT STABILIZED SUBBASE OR SUBGRADE	HYDRAULIC CEMENT CONCRETE	<u>B</u> CURING AGENT	<u>F</u> PRIME & COVER
OTHER MATERIAL		<u>D</u>	<u>F</u> PRIME & COVER
CEMENT STABILIZED SUBGRADE & SUBBASE	ASPHALT CONCRETE – SURFACE MIX, INTERMEDIATE MIX or BASE MIX	<u>B</u> CURING AGENT	<u>F</u> PRIME & COVER
	ASPHALT CONCRETE – OPEN GRADED DRAINAGE LAYER	<u>A</u> PRIME	<u>F</u> PRIME & COVER
	OTHER MATERIAL	<u>B</u> CURING AGENT <u>C</u>	<u>F</u> PRIME & COVER
LIME STABILIZED SUBGRADE	MATERIAL OTHER THAN ASPHALT CONCRETE	<u>E</u> WATER	<u>F</u> PRIME & COVER

* If subjected to public traffic for 3 months or longer, additional application may be necessary if so, include quantities in summary.

A Include quantity in summaries. Use Note I on typical section sheet.

The rate of application is to be obtained from the Materials Division if a recommendation has not been received. (Normally 1.8 L/m² (0.4 gal./S.Y.) of Liquid Asphalt Material Type RC-70, MC-70, or RC-250, or 1.8 L/ m² (0.4 gal/S.Y.) of CRS-2 or CRS-2L.)

B Do not include quantity in summaries. Use Note J on typical section sheet.

C When the next coarse is Blotted Seal or Surface Treatment use Note **L** on typical section sheet.

D When a hydraulic concrete base is placed on a subbase or subgrade, prime is not required.

If recommended, include in summaries and use Note **I** on typical section sheet.

E A lime stabilized subgrade is not overlaid with asphalt concrete. A recommendation should be obtained from the Materials Division if the situation occurs.

If recommended, include in summaries and use Note **I** on typical section sheet.

F Include quantities in summaries. Use Note **I** on typical section sheet.

G When the next coarse is Blotted Seal or Surface Treatment use Note **K** on typical section sheet.

H Do not specify prime or cure. Do not include any quantities in summaries. Do not use either Note **I** or **J**.

PLAN NOTES

When the pavement design requires that hydraulic cement stabilized subgrade, subbase or base be primed, or when such primed area is subjected to public traffic, liquid asphalt material and cover material (type) are to be set up as bid items, in accordance with Section 311 of VDOT's Road and Bridge Specifications. Note **I** is to be placed on the typical section sheet.

I

Prime shall be a Liquid Asphalt Material RC-70, MC-70, or RC-250, applied at the rate of * 1.8 L/m² (0.4 gal./S.Y.) or CRS-2 or CRS-2L applied at the rate of 1.8 L/m² (0.4 gal./S.Y.). When subjected to public traffic, the primed area shall be covered with Fine Aggregate Grading B or No. 10 Aggregate at the rate of 8 kg/m² (15 lbs. / S.Y.).

* .9 L/m² (0.2 gal./S.Y.) when used with cement stabilized subbase or subgrade and lime stabilized subgrade.

When the pavement design does not require a prime on a hydraulic cement or lime stabilized subgrade, subbase or base, liquid asphalt material and cover material for curing are not to be set up in the summaries, however, the application rates are to be shown, and at least two cover materials are to be specified. Note **J** is to be placed on the typical section sheet.

J

When liquid asphalt material is used as a curing material for a hydraulic cement or lime stabilized course, it shall be Liquid Asphalt Material (insert type) and applied at the rate of (specify rate). Where necessary for maintenance of construction traffic, cover materials (specify type and all optional materials) shall be applied at the rate of (specify rate). All costs for such curing materials and any cover materials shall be included in price bid for the hydraulic cement or lime stabilized course.

K

Prime and Cover are to be placed on areas subject to public traffic as soon as possible. When Blotted Seal Coat or Surface Treatment is specified, the Prime and Cover shall be the initial seal or prime coat with same rate as shown on plans.

L

When liquid asphalt material is used as a curing material it shall be the initial seal of Blotted Seal Coat (Surface Treatment). Cover material as specified is to be applied immediately.

OPTIONAL SURFACE TREATMENTS FOR LOW VOLUME ROADS

- For projects with traffic volumes ≤ 250 ADT, the District Administrator or Resident Administrator may choose the "Blotted Seal Coat (Type ____)" as recommended by the Materials Division, or the "Prime and Seal" or "Prime and Double Seal" design option as specified under "APPLICATIONS".

- Documenting File:

When the type of pavement structure is proposed, if the District Administrator/Residency Administrator chooses the optional design surface treatment instead of the preferred "Blotted Seal Coat (Type ____)", a letter from the District Administrator/Residency Administrator must be incorporated in the project file requesting the option.

CUTBACK ASPHALTS

- Limitations on the Use of Cutback Asphalts have been established under Policy Memorandum DPM 3-9 to reduce air pollution and they will govern the use of cutback asphalts in maintenance and construction activities performed by the Department and its contractors.

- The total amount of cutback asphalts statewide shall not exceed 10% of the total asphalt used in construction and maintenance activities. The total amount of cutback asphalts in the Richmond, Hampton Roads, and Fredericksburg Highway Districts used in construction and maintenance activities shall not exceed 4400 Metric Tons (4,850 tons) per year.

It is conceivable that these limits could be reached before the end of the construction season, at which time the use of cutback asphalts would be prohibited. Emulsion asphalts (CMS-2, CRS-2, etc.) will be an allowable substitution.

- Summarization:

The types of aggregate and acceptable types of asphalt to be used for the required applications of surface treatments are to be shown in block form in the area of the summary.

Show symbol"⊗" and Plan Quantity note for Blotted Seal Coat (Type___).

For blotted seal coats, the estimate is to show pay items for m² (S.Y.) of "Blotted Seal Coat (Type C)", "Blotted Seal Coat (Type D)" or "Blotted Seal Coat (Type C-1)".

For "Prime and Seal" or "Prime and Double Seal", the estimate is to show pay items for metric tons (tons) of "Cover Material (Type)" and liters (gallons) of "Liquid Asphalt Material." It is not necessary to show the types of asphalt.

SURFACE TREATMENT APPLICATIONS

- Note types of Surface Treatment and rates of application for each type of Base Course.
- The Asphalt Concrete should be shown on the original plans as a separate contract to be let when needed and shall be set up on a tonnage basis.
- Typical Section Sheet:
- Designers will designate on the Typical Section heading the type of surfacing required (i.e. Type C Blotted Seal Coat, Type D Blotted Seal Coat, Type C-1 Blotted Seal Coat, Prime and Seal or Prime and Double Seal.)

FOR PROJECTS UNDER CONSTRUCTION (SUBJECT TO TRAFFIC)						
TYPE C BLOTTED SEAL COAT						
INITIAL SEAL		FINAL SEAL		BLOT SEAL		TYPE C BLOTTED SEAL COAT
LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	BLOT FINE AGGREGATE	
RC-70, RC-250, MC-70 or MC-250 @ 1.8 L/m ² (0.40 gals./Sq.Yd.)	No. 68 /Stone, Slag or Crushed Gravel @ 16 kg/m ² (30 lbs/Sq.Yd.)	CRS-2, CMS-2 or CMS-2h @ 0.8 L/m ² (0.17 gals./Sq.Yd.)	No. 8P Stone, Slag or Crushed Gravel @ 8 kg/m ² (15 lbs./Sq.Yd.)	CRS-2, CMS-20 or CMS-2h @ 0.7 L/m ² (0.15 gals./Sq.Yd.)	Fine Aggr. #Grading B , Natural or Mfg. @ 5 kg/m ² (10 lbs./Sq. Yd.)	
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	m ² (S.Y.)
*	*	*	*	*	*	⊗

* QUANTITY IS SHOWN FOR ESTIMATING PURPOSES ONLY AND COST SHALL BE INCLUDED IN PRICE FOR TYPE C BLOTTED SEAL COAT.

⊗ DENOTES ITEM(S) TO BE PAID FOR ON BASIS OF PLAN QUANTITIES IN ACCORDANCE WITH THE CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS.

OPTION

RECOMMENDED DESIGN FOR OPTIONAL PRIME & SEAL TREATMENT FOR UNSTABILIZED AGGREGATE BASE MATERIAL			
PRIME		SEAL	
LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE
RC-70, RC-250 or MC-250 @ 1.8 L/m ² (0.40 gals./Sq.Yd.)	No. 68 Stone, Slag or Crushed Gravel @ 16 kg/m ² (30 lbs./Sq.Yd.)	CRS-2, CMS-2 or CMS-2h @ 1.4 L/m ² (0.30 gals./Sq.Yd.)	No. 8P Stone, Slag or Crushed Gravel @ 10 kg/m ² (18 lbs./Sq. Yd.)
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)

SURFACE TREATMENT FOR UNSTABILIZED AGGREGATE BASE MATERIAL

RECOMMENDED DESIGN FOR TYPE D BLOTTED SEAL COAT TREATMENT FOR UNSTABILIZED AGGREGATE BASE MATERIAL								
INITIAL SEAL		INTERMEDIATE SEAL		FINAL SEAL		BLOT SEAL		TYPE D BLOTTE D SEAL COAT
LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	BLOT FINE AGGREGATE	
RC-70,RC-250 MC-70 or MC-250 @ 1.8 L/m ² (0.40 gals./Sq.Yd.)	No. 68 Stone,Slag or Crushed Gravel @ 16 kg/m ² (30 lbs./Sq.Yd.)	CRS-2, CMS-2 or CMS-2h @ 0.8 L/m ² (0.17 gals./Sq.Yd.)	No. 8P Stone, Slag or Crushed Gravel @ 8 kg/m ² (15 lbs/Sq.Yd.)	CRS-2, CMS-2 or CMS-2h @ 0.8 L/m ² (0.17 gals./Sq.Yd.)	No. 8P Stone, Slag or Crushed Gravel @ 8 kg/m ² (15 lbs./Sq.Yd.)	CRS-2, CMS-2 or CMS-2h @ 0.7 L/m ² (0.15 gals./Sq.Yd.)	Fine Aggr. Grading B, Natural or Mfg @ 5 kg/m ² (10 lbs./Sq.Yd.)	
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	m ² (S.Y.)
*	*	*	*	*	*	*	*	⊗

* QUANTITY IS SHOWN FOR ESTIMATING PURPOSES ONLY AND COST SHALL BE INCLUDED IN PRICE FOR BLOTTED SEAL COAT TYPE D.

⊗ DENOTES ITEM(S) TO BE PAID FOR ON BASIS OF PLAN QUANTITIES IN ACCORDANCE WITH CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS.

OPTION

RECOMMENDED DESIGN FOR OPTIONAL PRIME & DOUBLE SEAL TREATMENT FOR UNSTABILIZED AGGREGATE MATERIAL					
PRIME		INITIAL SEAL		FINAL SEAL	
LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE
RC-70, RC-250 or MC-250 @1.8 L/m ² (0.40 gals./Sq.Yd.)	No. 68 Stone, Slag or Crushed Gravel @ 16 kg/m ² (30 lbs./Sq.Yd.)	CRS-2, CMS-2 or CMS-2h @ 1.2 L/m ² (0.26 gals./Sq.Yd.)	No. 8P Stone, Slag or Crushed Gravel @ 10 kg/m ² (18 lbs./Sq.Yd.)	CRS-2 or CMS-2, CMS-2h @ 1.2 L/m ² (0.26 gals./Sq.Yd.)	No. 8P Stone, Slag or Crushed Gravel @ 10 kg/m ² (18 lbs./Sq.Yd.)
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)

**SURFACE TREATMENT FOR HYDRAULIC CEMENT STABILIZATION,
CEMENT STABILIZED SUBGRADE, AND LIME STABILIZED SUBGRADE**

ASPHALT SURFACE TREATMENT - TYPE C-1 BLOTTED SEAL COAT FOR HYDRAULIC CEMENT STABILIZED AGGREGATE BASE MATERIAL						
INITIAL SEAL		FINAL SEAL		BLOT SEAL		TYPE C-1 BLOTTED SEAL COAT
LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	BLOT FINE AGGREGATE	
CRS-2, CMS-2 or CMS-2h @ 2.35 L/m ² (0.50 gal./Sq.Yd.)	No. 68 /Stone,Slag or Crushed Gravel @ 16 kg/m ² (30 lbs/Sq.Yd.)	CRS-2, CMS-2 or CMS-2h @ 2.12 L/m ² (0.45 gals./Sq.Yd.)	No. 8P Stone,Slag or Crushed Gravel @ 13.3 kg/m ² (25 lbs./Sq.Yd.)	CRS-2, CMS-20 or CMS-2h @ 0.7 L/m ² (0.15 gals./Sq.Yd.)	Fine Aggr. Grading B, Natural or Mfg @ 5 kg/m ² (10 lbs./Sq. Yd.)	
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	m ² (S.Y.)
*	*	*	*	*	*	⊗

* QUANTITY IS SHOWN FOR ESTIMATING PURPOSES ONLY AND COST SHALL BE INCLUDED IN PRICE FOR TYPE C BLOTTED SEAL COAT.

⊗ DENOTES ITEM(S) TO BE PAID FOR ON BASIS OF PLAN QUANTITIES IN ACCORDANCE WITH CURRENT VDOT ROAD AND BRIDGE SPECIFICATIONS.

OPTION

RECOMMENDED DESIGN FOR OPTIONAL PRIME & SEAL TREATMENT FOR UNSTABILIZED AGGREGATE BASE MATERIAL					
PRIME		INITIAL SEAL		FINAL SEAL	
LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE	LIQUID ASPHALT MATERIAL	COVER MATERIAL AGGREGATE
RC-70, RC-250 @ 1.1 L/m ² (0.25 gals./S. Y.)	Fine Aggr. Min. grading B @ 7 kg/m ² (12 lbs./S. Y.)	CRS-2, CMS-2 or CMS-2h @ 1.2 L/m ² (0.26 gals./S. Y.)	No. 8P Stone, Slag or Crushed Gravel @ 10 kg/m ² (18 lbs./S. Y.)	CRS-2 or CMS-2, CMS-2h @ 1.2 L/m ² (0.26 gals./S.Y.)	No. 8P Stone, Slag or Crushed Gravel @ 10 kg/m ² (18 lbs./S.Y.)
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)
LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)	LITERS (GALLONS)	METRIC TONS (TONS)

SECONDARY ROADS - TYPICAL PAVEMENT STRUCTURE DESIGN

- SURFACE COURSES:

Surface courses may be omitted from the initial contract where the traffic is less than 200 vpd. In these cases, the completion of the improvement should occur the following construction season, normally utilizing a P-40_____ project number for improvements on the secondary system.

- PORTLAND CEMENT CONCRETE PAVEMENT:

- Concrete shall be Class A-3 Paving Concrete. The concrete pavement shall be Continuously Reinforced or Plain Jointed Portland Cement Concrete with a minimum transverse joint of 5 m (15 feet) and a maximum joint spacing of 6 m (20 feet).

- BASE COURSES:

Aggregate Base Materials shall meet requirements of VDOT's current Road and Bridge Specifications.

Type I- Aggregate Base Material (crushed material only)
Aggregate Number 21A or 21B (for < 1000 projected ADT).
Aggregate Number 21B (for \geq 1000 projected ADT).

Type II- Aggregate base material (crushed or uncrushed material)
Aggregate Number 21A, 21B or 22 (use for ADT of 1000 or less).

Type I materials are normally crushed, quarry materials. Type II materials are normally processed, locally available materials.

When it is intended to stabilize a local material with cement, approximately 10 percent by volume should be used. When lime is the stabilizing agent, approximately 5 percent by weight should be used. In all cases, however, representative samples of material must be submitted to the laboratory for testing, to determine the correct percentage of stabilizing agent.

When it is possible to do so, alternate types of bases to provide reasonable competition should be set up. This will attract more bids and will result in more economical construction costs.

When the surface course is not included in the original contract, the base material should be treated with a surface application of calcium chloride at the rate of 1 kg/m² (1.75 lbs./ S.Y.).

- MINIMUM DESIGNS (LESS THAN 50 ADT):

The base should consist of a minimum depth of 150 mm (6") of aggregate base material, Types I or II, Size No. 21A, 21B, or 22. For traffic in excess of 50 ADT, surface treatment may be required. Higher anticipated traffic volume will necessitate additional depths of subbase, select material or plant mix material, depending upon traffic volumes and weights.

- CEMENT OR LIME STABILIZED SUBGRADE:

When cement stabilized subgrade is recommended, approximately 10 percent by volume should be used. When lime is the stabilizing agent, approximately 5 percent by weight should be used. In all cases, however, representative samples of the soil must be submitted to the laboratory for testing.

- FOR ADDITIONAL INFORMATION ON PAVEMENT DESIGNS FOR SECONDARY ROADS REFER TO PAVEMENT DESIGN GUIDE FOR SUBDIVISION AND SECONDARY ROADS IN VIRGINIA.

PAVED SHOULDERS

The Materials Division will recommend the pavement design and depth of shoulder courses on a project by project basis. All asphalt paved shoulders shall be smooth asphalt surface course.

- The purposes of paved shoulders are to:
 - Reduce accidents and related costs.
 - Save maintenance costs.
 - Provide "lateral support" for mainline pavement allowing longer service life.
 - Provide additional area for bicyclists, pedestrians and over-width vehicles.
- Paved shoulders are effective with normal pavement edgeline markings installed to maintain paved shoulder area and are economically justifiable.

- RURAL AND URBAN PRINCIPAL MINOR ARTERIALS

Paved Shoulders are to be provided in accordance with the current Design Guidelines in Appendix A of the VDOT's Road Design Manual.

On Ramps with a radius of less than 150 m (500'), consider (depending on radius of curve, percent of trucks, etc.) the extension of the full-pavement structure through the inside paved shoulder area to eliminate rutting of the pavement edge.

- RURAL AND URBAN COLLECTOR AND LOCAL ROADS AND STREETS

Two - Lane projects:

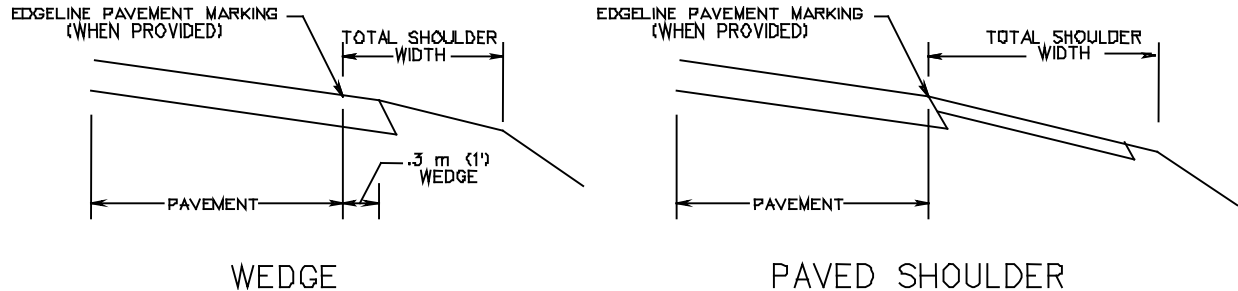
Provide a minimum 1.2 m (4') wide paved shoulder when the graded shoulder is 1.5 m (5') wide or greater and:

- a) Design year ADT > 2000 VPD, with $\geq 5\%$ total truck and bus usage or
- b) The route is an AASHTO Approved Interstate Bicycle Route or designated as a bicycle route on a Locality's Thoroughfare Plan and the minimum graded shoulder width is 1.8 m (6') or greater. See the Bicycle Facilities Guidelines in VDOT's Road Design Manual for additional guidelines and situations where a wider paved shoulder is necessary.

Provide a 0.9 m (3') wide paved shoulder when the graded shoulder is 4' wide and Design year ADT > 2000 VPD, with $\geq 5\%$ total truck and bus usage.

For the above situations, the remainder of the shoulder will be topsoil and seeded.

Projects without paved shoulders will be provided a .3 m (1') wide wedge (same slope and same pavement structure as pavement) to eliminate raveling of the edges. Wedge to be included in total width of shoulder. (See below)



Four-lane projects:

Provide 1.8 m (6') wide paved shoulder to right of traffic and .9 m (3') wide paved shoulder to the left of traffic.

Provide centerline and normal pavement edgeline pavement markings.

Six lanes or more:

Provide minimum 3.0 m (10') wide paved shoulder to the right and left of traffic.

Provide centerline and normal pavement edgeline pavement markings.

CROSSOVERS AND LEFT TURN LANES - PAVEMENT DESIGNS

- Crossover Designation:

Crossover types have been redefined, as indicated below; designated as Type I, Type II and Type III and will be so indicated on the plans. (Not applicable to Urban projects).

Type I

Commercial Entrance, Arterial, Primary or Secondary carrying more than 1,000 vehicles per day thru the crossover. (Design year traffic)

Type II

Primary or Secondary carrying 400 to 1,000 vehicles per day thru the crossover. (Design year traffic)

Type III

Secondary under 400 vehicles per day, private entrance or turn around. (Design year traffic)

- Construction With Mainline:

When turn lanes and crossovers are constructed with the mainline (other than portland cement concrete pavement), the pavement for crossovers will be based on the mainline pavement design at a substitution ratio of 1:2 of asphalt concrete to aggregate base, subbase, select material or subgrade stabilization.

For Type I, both subbase and stabilized subgrade will be replaced by asphalt concrete. For Type II, the stabilized subgrade will not enter into the computations. For Type III, both stabilized subgrade and subbase will be deleted from the computations. Where binder courses are recommended for the mainline, they should be replaced by the base course on a 1:1 ratio for crossovers.

In the following example, one mainline pavement design is assumed and the method of arriving at all three types of crossover pavement is illustrated.

The mainline pavement consists of:

90 kg/m²(165 lbs/S.Y.) of Asphalt Conc., Type SM-9.5 A or SM-9.5D,
150 mm (6") Asphalt Conc., Type BM-25.0 = 150 mm (6") BM-25.0
150 mm (6") Aggregate Subbase Material = 75 mm (3") BM-25.0A
150 mm (6") Cement Stabilized Subgrade = 75 mm (3") BM-25.0A

The preceding substitution ratios would yield crossover pavement designs as follows:

Type I Crossovers

Surface - 90 kg/m² (165 lbs/S.Y.) Asphalt Concrete,
Type SM-9.5 A or SM-9.5 D
Base - 300 mm (12") Asphalt Concrete, Type BM-25.0A

Type II Crossover

Surface - 90 kg/m² (165 lbs/S.Y.) Asphalt Concrete,
Type SM- 9.5 A or SM-9.5 D
Base - 225 mm (9") Asphalt Concrete, Type BM-25.0A

Type III Crossovers

Surface - 90 kg/m² (165 lbs/S.Y.) Asphalt Concrete,
Type SM-9.5 A or SM-9.5 D
Base - 150 mm (6") Asphalt Concrete, Type BM-25.0A

Plan Note - The following plan note should be used when turn lanes and crossovers are built concurrently with the mainline pavement:

The contractor shall have the option to furnish aggregate base or subbase material Size 21A or 21B, in accordance with specification requirements, in lieu of asphalt concrete for the bottom 75 mm (3 inches) of each type crossover design. The thickness of the Size 21A or 21B replacement material shall be 150 mm (6 inches). Payment will be made at the unit prices for the material actually used to construct the crossover.

Turn Lanes/Crossovers Constructed Separately From Existing Mainline

- When turn lanes and crossovers are constructed separately from existing mainline pavement, use the following design criteria, applicable to all pavement types:

Type I (over 1000 VPD)

90 kg/m² (165 lbs./sq. yd.) of asphalt concrete, Type SM-9.5 A or SM-9.5 D
150 mm (6") base, asphalt concrete, Type BM-25.0A
150 mm (6") subbase material, Size 21B

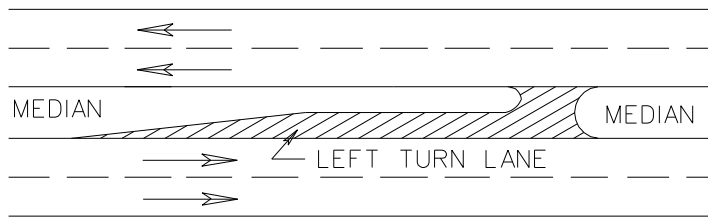
Type II (400 to 1000 VPD)

90 kg/m² (165 lbs./sq. yd.) of asphalt concrete, Type SM-9.5 A or SM-9.5 D
75 mm (3") base asphalt Type BM-25.0A
50 mm (6") subbase material, Size 21 or 21A

Type III (under 400 VPD)

90 kg/m² (165 lbs./sq. yd.) of asphalt concrete, Type SM-9.5 A or SM-9.5 D
150 mm (6") subbase material, Size 21A

Plan Detail - The hatched area in the sketch below denotes the pavement area to be constructed of the crossover material.



I - TYPE I
CROSSOVER REQ'D.

Crossover/Left Turn Lane Summaries - Each crossover and left turn lane is to be a separate entry in the paving summary with the estimated quantity in the appropriate column and the type noted in the remarks column. The depth of base should also be shown.

IN PLACE MATERIALS

- When the in place material below the "subgrade" elevation is to be stabilized, it is to be set up as "Hydraulic Cement Stabilized Subgrade" or "Lime Stabilized Subgrade". The typical sections should show the depth and % by volume of hydraulic cement or kg/m² (lbs./S.Y.) of lime. The summaries should be set up as follows:

Hydraulic Cement Stabilized Subgrade	
Manipulation _____ depth mm (in.)	Hydraulic Cement _____ % by volume
m ² (S.Y.)	Metric Tons (Tons)

Lime Stabilized Subgrade	
Manipulation _____ depth mm (in.)	Lime _____ kg / m ² (lbs. / S.Y.)
m ² (S.Y.)	Metric Tons (Tons)

- When the subgrade consists of hydraulic cement stabilized select material it is to be set up on the typical sections as "Hydraulic Cement Stabilized Subgrade". The summaries are to be set up as follows:

HYDRAULIC CEMENT STABILIZED SUBGRADE		
Select Material Type _____ Min. CBR _____	Manipulation _____ Depth mm (in)	Hydraulic Cement _____ % by Volume
m ³ or Metric Tons (Cu. Yds. or Tons)	m ² (Sq. Yds.)	Metric Tons (Tons)

Note: When central mixing of the stabilized subgrade is required, manipulation is not to be summarized and the specified percent of hydraulic cement is to be shown by weight.

- When stabilized aggregates are specified, either as a base or subbase, they will be processed at a central mix plant, unless otherwise indicated. The hydraulic cement content shall be specified "____% by Weight" on the summary sheet. The summaries (including footnote) are to be set up as follows:

HYDRAULIC CEMENT STABILIZED AGGREGATE	
Cement Stabilized Aggregate Mat'l. No. ____/or ____ Cement Stabilized Aggregate Base Mat'l. Type ____ No. ____	Hydraulic Cement ____% by Weight
m ³ or Metric Tons (Cu. Yds. or Tons)	*Metric Tons * (Tons)

- * Quantity is for estimating purposes only and cost shall be included in price for (specify item). The Hydraulic cement tonnage has been included in the quantity for the hydraulic cement stabilized (specify item).

SPECIAL PROVISIONS

- A Specification is available for applicable projects as follows:

- <http://www.virginiadot.org/business/manuals-default.asp>