ENGINEERING DIRECTIVES AND STANDARDS

Volume	Chapter	Section	Directive Number	Effective Date
II	2	1	12	6/14/1983

SUBJECT: PAVEMENT STRUCTURE DESIGN

1. **PURPOSE**: The purpose of this directive is to establish Louisiana DOTD policy for design of pavement structures.

2. **SCOPE:** This directive affects all pavement structures including flexible and rigid pavements, overlays, reconstruction and rehabilitation projects.

3. **POLICY:** The Soil Design Engineer shall be responsible for determining the design thickness of pavements including base and surface courses for all highways, airports and other public facilities being designed by the Department of Transportation. This work will be activated upon request of the Road Design Engineer. The Planning Division shall furnish the needed traffic information when requested by the Soil Design Engineer and the district and central laboratories will furnish information on the necessary soils investigations. This information will be used in conjunction with the following guidelines and procedures to determine the recommended design which is furnished to the Road Design Engineer for his use or for distribution to consultants and/or other Department personnel.

   Airport projects will be designed in accordance with FAA standards in effect at the time of the design.

   Pavement design methods to be used for flexible and rigid pavements shall be as set forth in the latest revision of "AASHTO Interim Guide for Design of Pavement Structures, 1972", as revised in 1981, with proper adaptions in pavement coefficients, soil support values, regional factors and modulus of subgrade reaction, etc. These adaptions will be based on Louisiana experience and local conditions. Further modifications to the AASHTO pavement design methods have been made to cover Bridge Replacement Projects, Overlay Projects and Reconstruction and Rehabilitation Projects.

   Projects off the state maintained system may be designed in accordance with local standards with the concurrence of Louisiana DOTD and such other state and federal agencies as may be involved.

   The following guidelines will be used:

   A. Rural project pavements will be designed using, as a minimum, the highest design ADT on the continuous section between population centers of 5,000; for freeways, population centers of 20,000 or more will apply. The intent is to obtain continuity of structural design for reasonable lengths of highways. Reasonable lengths are considered to be no less than 20 to 25 miles.

   B. The ADT Analysis Period used will be 20 years. However, this period may be modified where stage construction or other factors are considered. The same ADT will be used for both flexible and rigid pavement design.

   C. Directional distribution will be made by assigning 50% of the traffic to each direction unless special conditions warrant some other distribution. For purposes of structural design, 100% of the traffic in one direction will be assigned to the design lane for two lane roads, 100% of the traffic in one direction for four lane and five lane roads, and 80% of the traffic in one direction for six lane roads.

   D. A Terminal Serviceability Index (Pt) of 2.5 will be used as a guide for design of major highways and 2.0 for highways with lesser traffic volumes. (Nomographs on Pages 6 - 9.)

   E. Pavement coefficients for design were originally established at the ASSHTO Road Test and were modified by local history and experience in Louisiana. (See Attachment No. 1)

   F. A Regional Factor of 1.5 will be used for locations north of the 31st parallel and 1.0 for those south. If a project crosses the parallel, the factor for the region in which the major part of the project falls will be used.

G. For concrete properties, a minimum flexural strength of 600 psi is assumed. Normally, a Factor of Safety of 1.33 is used resulting in an allowable working stress of 450 psi. For freeways and other high volume facilities in metropolitan areas with populations exceeding 50,000, a Factor of Safety of up to 2.0 may be used. In the event that a Factor of Safety of greater than 1.33 is used in rigid pavement design and an alternate flexible section is considered, design thickness of the flexible section shall be adjusted accordingly. A value of 4,200,000 psi will be used for the modulus of elasticity of the concrete.

H. Ramp thickness on roadways with portland cement concrete pavement shall be the same as the thickness of the roadway but not to exceed 10 inches unless predicted ramp traffic requires a thicker pavement, in which case the ramp traffic will determine thickness.

I. The modulus of subgrade reaction (k) will be estimated on the basis of previous experience of the Department and is obtained from a chart prepared for this purpose. (See Attachment No. 2)

J. When used as bases for flexible pavement, immediately on top of the subgrade, cement stabilized, cement treated or aggregate base courses shall be a minimum of eight inches thick and asphaltic concrete base course shall be a minimum of four inches thick.

K. Minimum pavement slab thickness for Portland Cement Concrete Pavement is eight inches.

Portland Cement Concrete designs of less than eight inches may be approved on parish roads when the AASHTO design indicates thinner concrete is acceptable and where load posting of the road is a design consideration.

L. Any fractional design thickness determined by the flexible or rigid design nomographs will be rounded off upward to the next 1/2 inch.

M. Cement, lime or emulsion treated material or an aggregate material will be used as a working table wherever the Department considers it necessary. The same working table will be used for each design when alternates are considered. No allowance for the working table will be included in the design.

N. Any pavement design over three years old will be reviewed prior to letting the project to determine if changing conditions such as proposed changes in land use might have an effect on the original design.

4. OVERLAY DESIGN PROCEDURES. The procedure used by the Department for design of overlays on existing flexible pavements carrying heavy traffic on major routes is based on the AASHTO Interim Guide for Flexible Pavements. The Guide is used to determine thickness of asphaltic concrete overlays by subtracting the existing pavement structure from the total thickness required by a new design analysis. In using this procedure, a soil support value is assigned to the subgrade after a soil survey, and each of the layers is assigned a layer coefficient on the basis of experience.

A similar procedure is also used for asphalt overlays of originally rigid pavements. However, in this case, the final thickness determined by design analysis is tempered by experience regarding width of cracks and joints.

Design of overlays on pavements carrying lighter traffic on minor routes is basically by experience. When improvement in the load carrying capacity of the pavement is not an object, one or more lifts of asphaltic concrete is specified to improve the riding quality.

5. RECONSTRUCTION & REHABILITATION PROJECTS. Design of pavements or determination of several options which may be employed, such as cold planing, recycling, slab jacking, slab breaking or total reconstruction will be arrived at by a group of qualified engineers after they have made their necessary investigations.

6. PAVEMENT THICKNESS FOR BRIDGE REPLACEMENT PROJECTS. A special procedure has been developed by the Department to determine pavement thickness for bridge replacement projects. The application of this procedure is limited to bridge replacement projects where the total length of approach roadways is less than 2000 feet and the maximum ADT is 2500. In this procedure, which may be used on the state system with the exception of primary routes or major truck routes, pavement thickness is determined by locating the project on a state map for "soil support category" and then referring to a nomograph which specifies the thickness based on the ADT. (Nomographs on Pages 10 - 12.)

7. **OTHER ISSUANCES AFFECTED**. All directives, memoranda, or instructions issued prior to this directive which are in conflict are rescinded.

8. **EFFECTIVE DATE**. This directive will be effective upon receipt.

NOTE: Pavement type selection will be in accordance with EDSM No. II.2.1.11.

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PAVEMENT COEFFICIENTS FOR FLEXIBLE SECTION DESIGN

			STRENGTH	COEFFICIENT
I.	SURFACE COURSE			
	Asphaltic Concrete			
	Types 1, 2 and 4 WC and BC		1200	0.33
	Type 3 WC		1700	0.40
	Type 3 BC		1400	0.36
II.	BASE COURSE			
	UNTREATED			
	Sand Clay Gravel		3.5-	0.07
	Shell and Sand - Shell		2.2-	0.10
	CEMENT TREATED			
	Soil Cement		300 psi+	0.15
	Sand Clay Gravel		500 psi+	0.18
	Shell and Sand - Shell	4.0%	500 psi+	0.18
	Shell and Sand - Shell	5.5%	650 psi+	0.23
	LIME TREATED			
	Sand Clay Gravel		2.0-	0.12
	ASPHALT TREATED			
	Hot Mix Base Course (Type 5A)		1200+	0.33
	Hot Mix Base Course (Type 5B)		800+	0.28
III.	SUBBASE COURSE			
	Lime Treated Sand Clay Gravel		2.0-	0.14
	Shell and Sand - Shell		2.0-	0.14
	Sand Clay Gravel		3.5-	0.11
	Lime Treated Soil		3.5-	0.11
	Old Gravel or Shell Roadbed (8" thickness)		—	0.11
	Sand (R-Value)		55+	0.11
	Suitable Material -A-6 (PI=15-)		—	0.04
IV.	COEFFICIENTS FOR BITUMINOUS CONCRETE OVERLAY			
	BASE COURSE			
	Bituminous Concrete Pavement			
	New			0.33
	Old			0.24
	Portland Cement Concrete Pavement			
	New			0.50
	Old, fair condition			0.40
	Old, failed			0.20
	Old, pumping			0.10
	Old, pumping (to be undersealed)			0.35