Memo

New Mexico Department of Transportation

SUBJECT: Infrastructure Design Directive IDD-2006-06 (Pavement Design Directive)

DATE: 2-22-2006

TO: Office of Infrastructure Divisions
Transportation Design Community

FROM: Steven P. Harris, Chief Engineer
Office of Infrastructure Divisions

FILE REFERENCE: PSESHARE:Design Directives

In an effort to fulfill the agency's commitments to the delivery of STIP and GRIP programs we have prepared the following new directive and guidance for Pavement Design and Selection which is to be used effective immediately on all Department of Transportation projects.

Attached to this memo are the Pavement Design Directive along with the corresponding Pavement Type Selection and Design Guideline.

As a reminder, the Design Directives reside in the PSESHARE drive. General Office staff is to utilize the \\asgopinon\pseshare drive to access the Directive. District and Regional Office staff can access the Directive utilizing the appropriate District drive as indicated below:

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NEW MEXICO DEPARTMENT OF TRANSPORTATION
02/22/06
PAVEMENT DESIGN DIRECTIVE (IDD-2006-06)

Steven P. Harris, PE. Chief Engineer
Office of Infrastructure Divisions

AUTHORITY: Titles 23 Highways, Chapter One-Federal-Aid Highways, Section 154 Federal-State Relationship and 23 CFR Part 626 Pavement Policy, Section 626.3 Policy.

PURPOSE: Pavement shall be designed to accommodate current and predicted traffic needs in a safe, durable and cost effective manner.

DEFINITIONS: Pavement Structure Design means a project level activity where detailed engineering and economic considerations are given to alternative combinations of subbase, base, and surface materials which will provide adequate vehicular load carrying capacity. Factors which are considered include: materials, soil support characteristics, traffic, ESALs (one 18 Kip single axle load is one ESAL) climate, and maintenance, drainage, and life-cycle costs.

"Pavement Preservation" is a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations. A Pavement Preservation program consists primarily of three components: **"Preventive Maintenance"**, **"Minor Rehabilitation"** (non structural), and **"Routine Maintenance"** activities

An effective pavement preservation program will address pavements while they are still in good condition and before the onset of serious damage. By applying a cost-effective treatment at the right time, the pavement is restored almost to its original condition. The cumulative effect of systematic, successive preservation treatments is to postpone costly rehabilitation and reconstruction. During the life of a pavement, the cumulative discount value of the series of pavement preservation treatments is substantially less than the discounted value of the more extensive, higher cost of reconstruction and generally more economical than the cost of major rehabilitation. Additionally, performing a series of successive pavement preservation treatments during the life of a pavement is less disruptive to uniform traffic flow than the long closures normally associated with reconstruction projects.

"Preventive Maintenance" is defined as work accomplished to preserve and/or extend the service life of a pavement that does not add capacity or significant increased pavement section structural thickness. District forces shall administer appropriate "Preventive Maintenance" measures by implementing appropriate strategies to preserve, maintain, and/or extend the service life of a roadway with minimal incurred costs. Preventive Maintenance is a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity).

Preventive maintenance is typically applied to pavements in good condition having significant remaining service life. As a major component of pavement preservation, preventive maintenance is a strategy of extending the service life by applying cost-effective treatments to the surface or near-surface of structurally sound pavements. Examples of preventive treatments include asphalt crack sealing, chip sealing, slurry or micro-surfacing, thin and ultra-thin hot-mix asphalt overlay, concrete joint sealing, diamond grinding, dowel-bar retrofit, and isolated, partial and/or full-depth concrete repairs to restore functionality of the slab; e.g., edge spalls, or corner breaks.

“Routine Maintenance” consists of work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service. Routine maintenance consists of day-to-day activities that are scheduled by maintenance personnel to maintain and preserve the condition of the highway system at a satisfactory level of service. Examples of pavement-related routine maintenance activities include cleaning of roadside ditches and structures, maintenance of pavement markings and crack filling, pothole patching and isolated overlays. Crack filling is another routine maintenance activity which consists of placing a generally, bituminous material into “non-working” cracks to substantially reduce water infiltration and reinforce adjacent top-down cracks. Depending on the timing of application, the nature of the distress, and the type of activity, certain routine maintenance activities may be classified as preservation. Routine Maintenance activities are often “in-house” or agency-performed activities.

“**Rehabilitation”** consists of structural enhancements that extend the service life of an existing pavement and/or improve its load carrying capacity. Rehabilitation techniques include restoration treatments and structural overlays. Rehabilitation projects extend the life of existing pavement structures either by restoring existing structural capacity through the elimination of age-related, environmental cracking of embrittled pavement surface or by increasing pavement thickness to strengthen existing pavement sections to accommodate existing or projected traffic loading conditions. Two sub-categories result from these distinctions, which are directly related to the restoration or increase of structural capacity.

“Minor Rehabilitiation” consists of non-structural enhancements made to the existing pavement sections to eliminate age-related, top-down surface cracking that develop in flexible pavements due to environmental exposure. Because of the non-structural nature of minor rehabilitation techniques, these types of rehabilitation techniques are placed in the category of pavement preservation. Minor rehabilitation is defined as work accomplished to enhance and/or extend the service life of a pavement with an existing serviceability index (Ride Quality Index) that is typically 3.2 or higher. This does not include added shoulder width or capacity. These guidance criteria are meant as an aid to NMDOT staff who determine criterion for preservation projects. The guidance described herein is not meant to be prescriptive and can include the District need for a minor rehabilitation project.

“Major rehabilitation" is defined as work accomplished to increase serviceability and the extend life of an existing pavement whose serviceability index (Ride Quality Index) is approximately between 2.5 to 3.7 for interstates and national highway routes and between 2.0 to 3.7 for all other routes. Rehabilitation of the existing driving lanes and shoulders may include recycling of the existing pavement, removal and replacement of deteriorated material, placement of additional surface materials, resolution of surface and sub-surface drainage issues, and/or other work necessary to restore the existing driving lanes and shoulders to a safe and smooth pavement. The rehabilitated typical pavement section shall be based on the current State Materials Bureau structural pavement design guidelines to meet the intended pavement functional and structural performance expectations. These guidance criteria are meant as an aid to NMDOT staff who determine criterion for preservation projects. Major Rehabilitation consists of structural enhancements that both extend the service life of an existing pavement and/or improve its load-carrying capability. The guidance described herein is not meant to be prescriptive and can include the District need for rehabilitation projects.

"Corrective Maintenance" is defined as work accomplished to correct roadway deficiencies to ensure a safe riding pavement surface that does not add traffic volume (ADT, or AADT) capacity or significant increased pavement section structural thickness. District forces shall administer appropriate "Corrective Maintenance" measures by implementing appropriate strategies to maintain and/or restore a pavement to a safe and smooth riding condition with minimal incurred costs. Corrective Maintenance activities are performed in response to the development of a deficiency or deficiencies that negatively impact the safe, efficient operations of the facility and future integrity of the pavement section. Corrective maintenance activities are generally reactive, not proactive, and performed to restore a pavement to an acceptable level of service due to unforeseen conditions. Activities such as pothole repair, patching of localized pavement deterioration, e.g. edge failures and/or grade separations along the shoulders, are considered examples of corrective maintenance of flexible pavements. Examples for rigid pavements might consist of joint replacement or full width and depth slab replacement at isolated locations.

"Catastrophic Maintenance" describes work activities generally necessary to return a roadway facility back to a minimum level of service while a permanent restoration is being designed and scheduled. Examples of situations requiring catastrophic pavement maintenance activities include concrete pavement blow-ups, road washouts, avalanches, or rockslides.

"**Reconstruction"** is defined as work accomplished which significantly replaces the existing pavement with a serviceability index level (Ride Quality Index) of approximately 2.5 or less for interstates and national highway routes and approximately 2.0 or less for all other roads. The new typical pavement section shall be based on current State Materials Bureau structural pavement design guidelines to meet the intended pavement functional and structural performance expectations. Reconstruction is the replacement of the entire existing pavement structure by the placement of the equivalent or increased pavement structure. Reconstruction usually requires the complete removal and replacement of the existing pavement structure. Reconstruction may utilize either new or recycled materials incorporated into the materials used for the reconstruction of the complete pavement section. Reconstruction is required when a pavement has either failed or has become functionally obsolete.

"**New Construction"** is defined as work accomplished which provides a new pavement structure for a new typical section shall be based on Department's current structural pavement design procedures to meet the intended pavement functional and structural performance expectations.

GUIDANCE

Project evaluations for “Minor Rehabilitation” shall be performed to obtain the information that is necessary to establish the remaining life and condition of the pavement being evaluated. At a minimum, the thickness of pavement layers and material types based on “as-built plans”, up-to-date traffic loadings, distress surveys (environmental and load related distress conditions), determination of in-place material properties, and photo documentation shall be used to evaluate the performance of the in-place pavement and to forecast the service life of the any proposed “Minor Rehabilitation” action.

Pavement drainage for rehabilitation, reconstruction, and new construction typical sections shall be designed to positively drain surface and sub-surface drainage moisture away from any pavement structure.

Skid resistance surface should be provided on all pavements.

On all flexible pavement surfaces, whose design lane traffic levels are greater then 2000 ADT, an open-graded friction course (OGFC) shall be used. On low-volume roads, whose design lane traffic levels are 2000 or less ADT, the use of chip seals, micro-surfacing, or similarly Department approved alternatives may be considered. The Director of Infrastructure may suggest other uses of chip seals or micro-surfacing as a substitute for OGFC.

On all rigid pavement surfaces, whose design lane traffic levels are greater than 2,000 ADT, diamond grinding or other similar approved alternatives shall be considered.

Shoulders for rehabilitation, reconstruction, and new construction shall be designed to allow underlying moisture to drain away from the pavement structure.

On all high-volume pavements, whose traffic levels are greater than 2000 ADT and whose heavy-commercial volume is 15% or greater of the traffic volume, the structural pavement section for the shoulders can be of the same thickness of each material type as the mainline roadway. This shall also apply to pavement structural sections associated with the construction of additional lanes and acceleration and deceleration lanes. Shoulder sections can also be evaluated and designed to optimize and balance capitol costs of the HMA section. The optimized shoulder section can be designed at a structural number equivalent to one half of the traveled roadway structural number. For all other pavements, the structural section for the shoulders is not required to match or meet these guidelines. However, shoulder structural sections are required to meet the minimum pavement layer thickness criteria contained in the Department’s structural pavement design guidelines.

Extending the roadway pavement section beyond the edge (shoulder) line lanes reduce edge stresses and the potential for edge drop-offs, increase safety, and reduce maintenance costs. When considering a reduced pavement section on the roadway shoulders an additional 1.5 feet beyond the shoulder stripe for continuation of the driving lane section is recommended on all pavements before reducing the pavement thickness on the shoulder.

All pavement investigations for the purposes of determining recommended structural pavement typical section alternatives on rehabilitation, reconstruction, and new construction will be performed by or under the guidance of this Directive. The pavement investigation will include, but is not limited to, distress surveys of existing pavement, documenting the existing layer thicknesses of in-place pavement structure, and the determination of in-place pavement material properties (soil and aggregate gradations, in-situ moistures conditions, Atterberg limits, AASHTO soils classifications, R-Value strength) of the top 2 feet of subgrade and existing pavement layers. Additionally, up-to-date traffic loadings, climatic data, and photo documentation shall be used to evaluate and to forecast the expected performance of all proposed rehabilitation, reconstruction, or new construction alternative recommendations.

All pavement design related recommendations, drawings, specifications or reports that are produced by or for the practice of pavement designs for use on any Department project by Private Consultants shall bear the New Mexico seal and signature of the New Mexico Professional Engineer in responsible charge of and directly responsible for the work issued. Additionally, that individual must be the on the approved Department pavement designer list.

All pavement design related recommendations, drawings, specifications or reports that are produced by or for the practice of pavement designs for use on any Department project by Department personnel shall be reviewed by the Professional Engineer in responsible charge of and directly responsible for the work issued. Additionally, that individual must be the on the approved Department pavement designer list.

PROCEDURES as described in CROSS REFERENCE:
Pavement Design Guidelines are attached to this Directive.

REFERENCES:
http://www.fhwa.dot.gov/pavement/preservation/091205.cfm

PAVEMENT CLASSIFICATION GUIDELINES					
	Type of Activity	**Increase Capacity**	**Increase Strength**	**Reduce Aging**	**Restore Serviceability**
	New Construction	X	X	X	X
	Reconstruction	X	X	X	X
	Major (Heavy) Rehabilitation		X	X	X
	Structural Overlay		X	X	X
Pavement Preservation	**Minor (Light) Rehabilitation**			X	X
	Preventive Maintenance			X	X
	Routine Maintenance				X
	Corrective (Reactive) Maintenance				X
	Catastrophic Maintenance				X

Table 1 – Pavement Classification Guidelines

New Mexico Department of Transportation's
Pavement Type Selection and Design Guideline

INTRODUCTION

The Department's intention is to select and design pavements that best accommodate current and predicted traffic needs in a safe, durable and cost effective manner. To achieve this intent, the pavement designer must evaluate various pavement alternatives where design means a project level activity where detailed engineering and economic considerations are given to alternative combinations of subbase, base, and surface materials which will provide adequate vehicular load carrying capacity. Factors which are considered include: materials, soil support characteristics, traffic, ESALs (one 18 Kip single axle load is one ESAL) climate, and maintenance, drainage, and life-cycle costs. In instances where a dispute on pavement thickness design arises, the Director of Infrastructure may resolve the dispute, refer the dispute to the Dispute Resolution Board, or delegate the dispute resolution to an appropriate technically qualified engineer within the NMDOT structure.

This procedure allows for the consideration of the use of flexible, rigid, and composite pavement structures. It also allows for the consideration of standard and other innovative pavement rehabilitation and maintenance strategies such as but not limited to:

- The use of recycled materials;
- Fabric reinforcements; and
- Other materials and processes that will economically enhance and extend the life of the State's roadway system.

Structural pavement type selection and design is dynamic in that concepts are continually changing as analysis and design techniques, materials, and construction processes evolve and new ways are adopted by the Department. Therefore, it is imperative that this policy be periodically reviewed and updated to accurately reflect the Department's current practices and procedures. By doing this, the Department believes that better consistency in pavement selection and design will exist within the Department, both General Office and Districts, and with the private consultant community.

It is important to note that while every effort has been made in preparing this policy to address as many considerations as possible, that not <u>all</u> possible considerations and/or alternatives have been or will be addressed that a given pavement designer may want to consider. This is due to an individual designer's actual experience in pavement type selection and design procedures as well as that designer's experience at a given geographical location within the State of New Mexico. Therefore, it is highly encouraged that before a final pavement design recommendation is made, that the pavement designer review adjacent and/or similar projects. This will ensure that all design assumptions and recommendations are consistent and, if not, that any design inconsistencies are justified and warranted for that particular project.

TECHNICAL DESIGN REFERENCE STANDARDS

The American Association of State Highway and Transportation Officials (AASHTO) interim guide for "Design of Pavement Structures", 1972 (revised in 1981), shall be used for the design of all **flexible pavement structures** using the Department's probabilistic design procedure. The AASHTO guide and it's supplement for "Design of Pavement Structures", 1993, shall be used for the design of all **rigid and composite pavement** structures also using the Department's probabilistic design procedure. These publications will continue to be used until the proposed AASHTO guide for "Design of Pavement Structures", 2002, has been issued and adopted for use by the Department. In addition, the pavement designer must use the latest revision of the Department's Microsoft Excel 2003 pavement design worksheets and must also have purchased the latest versions of the following computer program from Palisade Corporation (www.Palisade.com), 31 Decker Road, Newfield, New York, 14867, telephone number (607) 277-8000:

Required Program: @Risk 4.5 Professional Version

These Excel worksheets and these two specific computer programs are required for the Department's probabilistic pavement design procedure.

PAVEMENT DESIGNER APPROVAL PROCEDURE

All Department project related pavement designers must be on the Department's approved list. If an individual is not on the Department's approved list the Department will reject their submitted pavement design recommendations.

Each individual designer that prepares pavement designs for use on any Department project must demonstrate, to the satisfaction of the Department, their proficiency in using the Department's current design procedures. Once this proficiency has been demonstrated, to the satisfaction of the Department, that individual designer's name will be placed on an approved Department Pavement Designer list. Once their name is placed on this Department's approved list, any pavement design from that approved individual will be accepted by the Department for final review by the Department's Pavement Design Engineer.

All pavement design related recommendations, drawings, specifications or reports that are produced by or for the practice of pavement designs for use on any Department project shall bear the seal and signature of the Professional Engineer in responsible charge of and directly responsible for the work issued. Additionally, that individual must be the on the approved Department pavement designer list. In the case of practice through partnership, at least one of the partners shall be a Professional Engineer and all plans, designs, drawings, specifications or reports that are produced by or for the practice of pavement designs for use on any Department project that are involved in such practice, issued by or for the partnership, shall bear the seal and signature of the New Mexico Professional Engineer in responsible charge of and directly responsible for such work when issued. Additionally, that individual must be the on the approved Department pavement designer list.

To pre-qualify for the advanced training that the Department's Pavement Design Unit will provide, each prospective pavement designer must have evidence of successful completion of either:

- The National Highway Institute Course #131063A, "Hot-Mix Asphalt Pavement Evaluation and Rehabilitation"; and

- The National Highway Institute Course #131029A, "AASHTO Pavement Overlay Design".

  or

- A grade of C or better in either a college level undergraduate or graduate level pavement design course.

Once either or both of these requirements have been completed, then the Department will then provide the needed advanced training of any prospective pavement designer in the use of the Department's pavement design procedures so that they may take the Department's qualification examination. To schedule this training and/or to demonstrate to the Department the required initial proficiency so that an individual can be approved to perform Department related pavement designs, the Department's Pavement Design and Field Exploration Section Head must be contacted at (505) 827-5648 or the Department's Pavement Design Unit Head at (505) 827-3245 to set up an individual appointment. The intent of the prequalification requirement is for the pavement designer to demonstrate a basic understanding of pavement design theory, principles and practical design application.

To ensure long-term design pavement proficiency, an annual proficiency test will be given to each Department approved pavement designer. Field thickness data, laboratory data, and projected equivalent single axle loads (ESALs) will be provided with the particular design requirements. Upon receipt of this information, the Department approved pavement designer will have five (5) working days to perform the required design before it must be submitted to the Department's Pavement Design and Field Exploration Section Head for proficiency evaluation. If this design is acceptable to the Department's Pavement Design and Field Exploration Section Head, the pavement designer's name will remain on the Department's approved list. If the design is not acceptable to the Department's Pavement Design and Field Exploration Section Head, then the pavement designer will be notified and the deficiencies will be discussed. Then, the pavement designer will be required to perform an additional proficiency test that will again be reviewed by the Department's Pavement Design and Field Exploration Section Head. If this design is acceptable, then the pavement designer's name will remain on the Department's approved list. This list will be maintained by the NMDOT State Materials Bureau. If not, then the pavement designer's name will be removed from the Department's approved list until such a time that they can demonstrate their proficiency in using the Department's current design procedures.

SECTION 1

FLEXIBLE PAVEMENT DESIGN PROCEDURE POLICY

Flexible pavement alternatives shall be considered on all pavement design studies and should be compared to rigid pavement design alternatives when warranted per Section 2 of this policy. For all flexible pavement construction, the following design requirements, materials, and procedures will be used:

1. The minimum pavement design life shall be as per Table 1 unless the project's design team leader decides that a different design life is desirable due to individual project cost constraints.

Type of Project	Number of Years	Remarks
New Construction Project	20	
Reconstruction Project	20	
Rehabilitation Project	10	Note 1
Structural Preventative Maintenance Projects	5	Note 2
Special Condition Projects	-	Note 3

Note 1: For pavements that exhibit overall medium or higher severity distresses.
Note 2: For pavements in good condition that exhibit overall low severity distresses.
Note 3: The District Engineer shall request and obtain concurrence from the Deputy Secretary of Operations (or Designee), for design life not consistent with Table 1. Requests must include estimated pavement design life determined in accordance with these guidelines.

Table 1: Minimum Structural Pavement Design Life Criteria

2. The minimum probabilistic design reliability shall be as per Table 2. If a District desires a higher design reliability than the minimum shown so that the designed pavement structure will have less future maintenance needs, the District, in writing, can so notify the pavement designer. These higher design reliability options will be discussed with the project's design team prior to the issuance of the final pavement design recommendations.

Type of Facility	Percent Trucks or Location	Minimum Design Reliability
Interstate Highways	Urban	85%
	Rural	80%
National Highway System	< 15%	75%
	≥ 15%	85%
All New Mexico Routes	< 15%	65%
	≥ 15%	75%
Frontage Roads	---	65%
Turnouts and Detours	---	50%
Interchange Ramps	---	(Note 1)

Note1: Design to same reliability as mainline section.

Table 2: Minimum Probabilistic Design Reliabilities

3. The initial serviceability index (Pi) shall be 4.2 on all projects. This value is based on the measured smoothness of recently completed projects.

4. The terminal serviceability index (P_t) shall be 2.5 on all Interstate and 4-lane National Highway projects and 2.0 for all other projects. Requests for a given project ESALs shall include which P_t value will be used on a particular design so that the correct ESAL projections can be calculated.

5. The flexible design factors for regional factor and PG base grade shall be as per Appendix “A”.

6. The NMDOT structural layer coefficients for new materials shall be as per Table 3.

Material	**Minimum Value**	**Figure**
New HMA	0.44	-
New Stone Matrix Asphalt (SMA)	0.44	-
New Hot Recycled HMA	0.44	-
New Hot-In-Situ Recycled HMA	0.30	-
PCCP Crack and Seat	0.30	-
New Cold In-Situ Hot-Lime Recycled HMA	0.25	-
Asphalt Treated Aggregate Base Course	0.25	-
Cold-Mixed Asphalt Pavement	0.15	-
New Treated Open Graded Aggregate Base Course	0.15	-
New Untreated Aggregate Base Course	0.11	-
New Lime or Cement Stabilized Subgrade	-	1

Table 3: Recommended NMDOT Layer Structural Coefficients

7. The minimum HMA and/or untreated aggregate base course (UTBC) material thickness shall be per Table 4 for all new and reconstruction projects only. The Engineer may adjust the pavement thickness section (HMA, UTBC, TSG) based on Structural Number to accommodate Untreated Aggregate Base Course depth increase of up to two inches in order to provide a construct able pavement section without roundup for Structural Number and without Round-up for HMA lift depths caused by the nominal size of aggregate per HMA mix type (HMA mixes).

   The final pavement section described in the Construction Plan Documents shall be back-calculated for Structural Number (SN) to assure agreement with the State Materials Bureau original structural number calculation.

Traffic, (ESALs)	New HMA	UTBC
Less than 50,000	Surface Treatment	4.0-inches
50,001 to 150,000	2.0-inches	4.0-inches
150,001 to 500,000	2.5-inches	4.0-inches
500,001 to 2,000,000	3.0-inches	6.0-inches
2,000,001 to 7,000,000	3.5-inches	6.0-inches
Greater than 7,000,000	4.0-inches	6.0-inches

Table 4: Minimum Flexible Pavement Total Layer Thickness for New and Rehabilitation Projects Only

8. The point to point subgrade R-value that will be used to determine the probabilistic BestFit distribution shall be calculated using a weighted average based on the material in the top two (2) feet of the final subgrade elevation. The following formula will be used to calculate this representative composite layer R-Value:

$$\text{Composite Layer R-Value} = 0.5 \times \sum (t_i \times RV_I)$$

Where: t_i – layer thickness (feet)
RV_i - layer R-Value

9. On Construction projects whose design speed is 40 mph or higher either an open graded friction course (OGFC) or other alternative material. For Construction projects whose design speed is less than 40 mph, alternative materials may be used or not used at the discretion of the project design team.

10. Table 5 shall be used to determine the type of HMA material that will be used on a project. Additionally, Table 5 shows the recommended minimum and maximum lift thickness that should be considered for design purposes for the selected HMA material. The minimum lift thickness shall not be less than the recommended minimum lift thickness in Table 5 for that particular HMA material type.

HMA Type	Lift Thickness (Inches)	
	Minimum	Maximum
SP-II	3.0	3.5
SP-III	2.5	3.5
SP-IV	1.5	3.0
Stone Matrix Asphalt (SMA)	1.5	2.0
Cold In-Situ Recycled (CIR)	3.0	6.0
Hot In-Situ Recycled (HIR)	1.5	2.0

Table 5: HMA Type Selection Recommendations

11. Thickness increments of 0.25 inches shall be considered to determine the final recommended individual layer constructed thickness. Adjustments may be made as described in paragraph 7 above.

12. The proper selection of the asphalt binder that will be used on a given project is dependent on the climate, projected ESALs, and vehicle travel speed. For all HMA types, a performance graded (PG) asphalt shall be used based on the criteria presented in Appendix "A". Additionally, prior to the preparation of the final pavement design recommendations,

the pavement designer shall contact the Department's Pavement Design Engineer, State Materials Bureau, Santa Fe, New Mexico, to obtain concurrence for the selected project asphalt binder.

13. The final recommended PG asphalt binder grade and HMA thickness shall be conform to the guidelines shown in Table 6 or Table 7.

Table 6: HMA over Base Course Materials Selection Guidelines

HMA Layer	Material	20-Year Traffic ESALs			
		< 10.0 Million		≥ 10.0 Million	
		< 5.5" New HMA	≥ 5.5" New HMA	< 8.0" New HMA	≥ 8.0" New HMA
Surface Layer	HMA	Specify either an SP-III or SP-IV	Specify SP-IV (3.0" Thick)	Specify either an SP-II or SP-III	Specify SP-III (5.0" minimum thickness)
	PG Binder	Specify required PG asphalt binder **(BUMPED FOR ESAL AND TRAFFIC SPEED)**			
Bottom Layer	HMA	Specify same SP material as the surface layer	Specify SP-III for remainder of thickness	Specify same SP material as the surface layer	Specify SP-II for remainder of thickness
	PG Binder	Specify same PG asphalt binder as the surface layer	Specify base PG asphalt Binder **(NO BUMP)**	Specify same PG asphalt binder as the surface layer	Specify base PG asphalt Binder **(NO BUMP)**

Table 7: HMA over Existing HMA Materials Selection Guidelines

HMA Layer	Material	20-Year Traffic ESALs			
		< 10.0 Million		≥ 10.0 Million	
		< 5.5" New HMA	≥ 5.5" New HMA	< 8.0" New HMA	≥ 8.0" New HMA
Surface Layer	HMA	Specify either an SP-III or SP-IV	Specify SP-IV (3.0" Thick)	Specify either an SP-II or SP-III	Specify SP-III (5.0" minimum thickness)
	PG Binder	Specify required PG asphalt binder **(BUMPED FOR ESAL AND TRAFFIC SPEED)**			
Bottom Layer	HMA	Specify same SP material as the surface layer	Specify SP-III for remainder of thickness	Specify same SP material as the surface layer	Specify SP-II for remainder of thickness
	PG Binder	Specify same PG asphalt binder as the surface layer			

14. Where roadway pavement materials (subbase, flexible or rigid pavements) that exceed 10 million dollars for a construction project, life cycle cost analysis will be used to determine cost effectiveness of the each design alternative. The analysis period will be for capitol cost and 35 years.

Shoulder and Shoulder Widening Design

The mainline roadway pavement section shall extend to 1.5 feet beyond the traveled roadway painted edge line (shy-line). Shoulder pavement structural sections on all new and reconstructed pavements shall be constructed of the same materials has the mainline roadway. This shall also apply to pavement structural sections associated with the construction of additional lanes and acceleration and deceleration lanes. In no case, however, will these sections be less than those indicated in Table 4.

On all high-volume pavements, whose traffic levels are greater than 2000 ADT and whose heavy-commercial volume is 15% or greater of the traffic volume, the structural pavement section for the shoulders may be of the same thickness of each material type as the mainline roadway. This shall also apply to pavement structural sections associated with the construction of additional lanes and acceleration and deceleration lanes. Shoulder sections can also be evaluated and designed to optimize and balance capitol costs of the HMA section. The optimized shoulder section can be designed at a structural number equivalent to one half of the traveled roadway structural number. For all other pavements, the structural section for the shoulders is not required to comply these criteria. The shoulder design and main pavement section design, regardless of design approach, shall ensure that the water gradient moves away from and out from under the pavement structure

Pavement Design R-Value and Subgrade Considerations

All existing surfacing, base, subbase, and subgrade materials for pavement construction shall be sampled per the requirements presented in Appendix "C". Additionally, a minimum of a five (5) working day advance notice must be given to the respective District Traffic Engineer of any proposed lane closures.

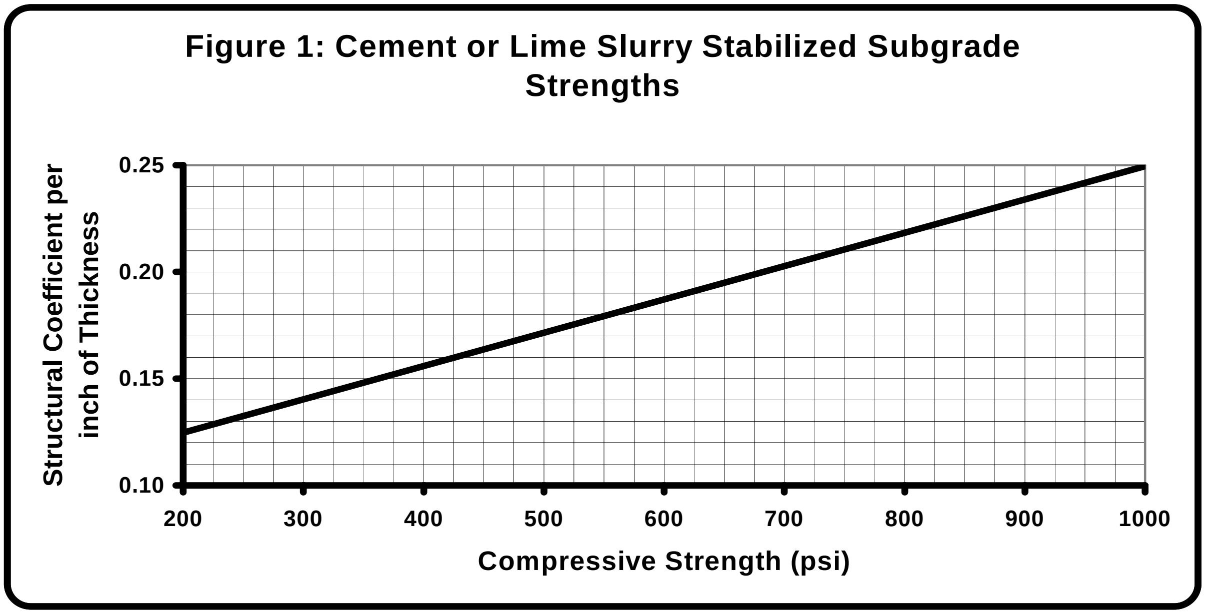
Subgrade material strengths shall be based on AASHTO T 190, "Resistance R-Value and Expansion Pressure of Compacted Soils" using a 300 psi exudation pressure. Other testing procedures, that have been specifically approved for a given project by the Department's Pavement Design Engineer, State Materials Bureau, may also be considered provided that a correlation exists that will convert those testing results to an equivalent laboratory R-value test result. The actual project design R-value shall be determined using the Department's probabilistic design procedure.

Design R-value material will be used in the upper 2-feet portion of all fill areas that are constructed. Construction areas that are at grade or being cut to grade shall not be set up for subgrade excavation and replacement unless the anticipated R-value is less than the design R-value.

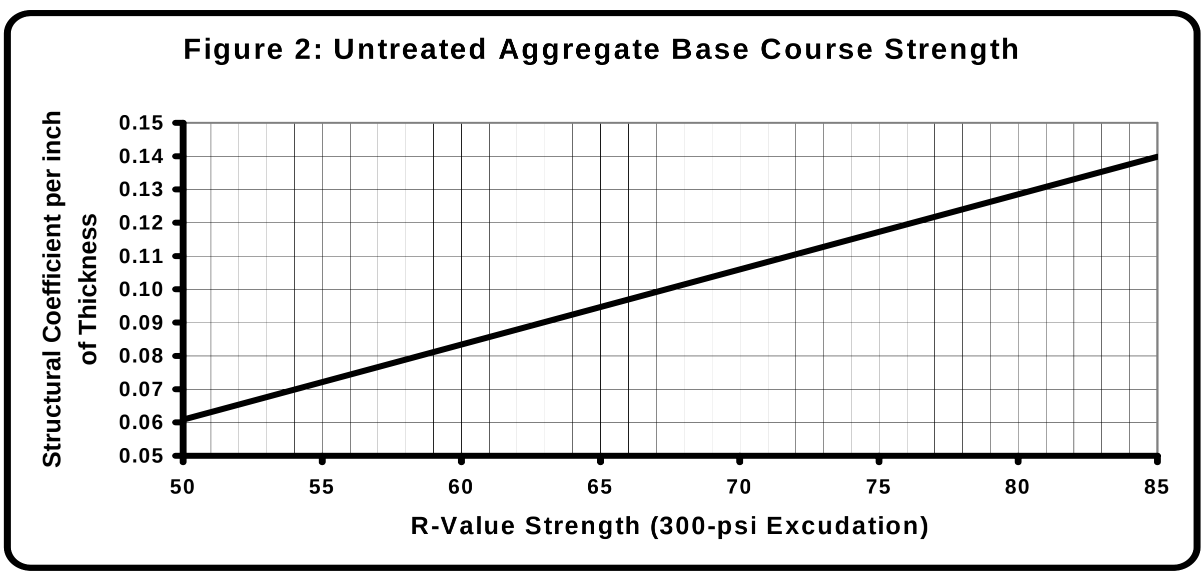
The performance of pavement structures is directly related to the physical and chemical properties of the subgrade soils. Pavement performance problems can develop from subgrade soils that are expansive, collapsible, excessively resilient, frost susceptible and/or highly organic. Another subgrade soil problem may also develop when non-uniform subgrade support exists beneath the pavement structure due to a wide variation in subgrade soil types and/or moisture conditions.

The designer shall consider the use of subgrade soil stabilization on all subgrade soils whose AASHTO soil classification are either an A-2-6, A-2-7, A-3, A-6, or A-7 material. When these soils are encountered, the guidelines contained in FHWA Manual FHWA-IP-80-2, "Soil Stabilization in Pavement Structures – A User's Manual", Volumes 1 and 2, shall be used as a guide for determining the appropriate subgrade stabilization method and procedures. The pavement designer shall then use the results as an alternative consideration for the pavement section. For pavement design purposes, the structural coefficient for this stabilized material shall be determined based on Figure 1. When subgrade stabilization is considered as an alternative, it shall be compared to removing and replacing the top 2-feet of the existing subgrade material for cost effectiveness.

On new construction or reconstruction projects, and on reconstruction areas within rehabilitation projects only, the pavement designer shall confer with the respective District in regards to the subgrade design R-Value on a given project. This design subgrade R-Value shall be based on the existing subgrade R-Value test results and the given project's minimum reliability shown in Table 2. If the District believes that a borrow source of higher subgrade R-Value material is readily available for use on a given project, then pavement designer will change the design R-Value for the project to that particular design R-Value once the District submits, in writing, their recommendation to the pavement designer.



Note: Figure 1 is based on unconfined compressive strength of either lime treated or cement treated specimens prepared by AASHTO T 134 and tested at 7 days for cement treated materials or at 21 days for lime treated materials. If the specimen unconfined compressive strength is less than 200 psi, then the specimen's layer structural coefficient should be determined using test results by performing AASHTO T 190 and Figure 2.



The designer shall also consider the use of reinforcing geotextile and/or geogrid materials at the subgrade/untreated aggregate base interface whenever the subgrade design R-value is less than 20 or when the subgrade material is saturated or unstable. The pavement designer shall use only engineering design procedures that have received prior approval for use by the Department's State Materials Engineer. A listing of these approved procedures is presented in Appendix "B". When using these procedures, the final recommendation shall not be less than the indicated layer thickness shown in Table 4.

If the pavement designer should encounter subgrade soils that are loose and collapsible, these subgrade soils should be considered for dynamic compaction techniques. The guidelines contained in FHWA Report FHWA/RD-86/133, "Dynamic Compaction for Highway Construction", Volume 1, shall be used as a guide for selecting the appropriate design and construction procedures. Other techniques such as chemical injection, stone columns may also be considered to stabilize these types of soils.

Rehabilitation Project Considerations

Cold in-situ flexible pavement recycling, using the hot-lime process, may be used. However, there are situations where this strategy should not be used. These situations are:

- In areas where this material may come in contact with water from an underlying water saturated layer or a high moisture subgrade material; and
- In areas where the material to be recycled does not meet minimum aggregate quality standards for HMA as outlined in Division 400 of the Department's specifications.

A HMA overlay shall be constructed on top of the cold in-situ recycled material and shall meet the minimum design life requirements presented in Table 1. The maximum amount of untreated aggregate base material that can be recycled into the existing HMA material shall be limited to 25% of the planned cold in-situ recycled total design thickness.

Hot in-situ flexible pavement recycling is another option that a pavement designer may consider. However, there are situations where this strategy should not be used. These situations are:

- In areas where the OGFC appears to be rich in asphalt cement. If this exists, it is recommended that this layer be milled off before hot in-situ recycling operations begin; and
- In areas where the existing flexible pavement is highly oxidized and/or severely cracked.

The maximum depth for hot in-situ recycling shall be 2.0-inches.

Prior to the beginning of this operation, representative samples of the material to be recycled must be analyzed by the Department or by a Department approved testing laboratory that is approved to perform these tests. The purpose of this testing is to determine what the type and amount of a new asphalt material, if any, needs to be added to the existing flexible pavement material. A HMA overlay shall be constructed on top of the hot in-situ recycled material if it is structurally needed to meet the requirements of Table 1.

Cold mill and inlay/overlay pavement design considerations shall be based on the design recommendations presented in Table 1.

HMA overlay pavement design considerations shall be based on the minimum design life presented in Table 1. In addition, if the existing pavement is rutted, then the pavement shall either be milled or it shall be micro-surfaced so that the entire rut is removed prior to actual overlay.

Temporary Detour Design

Temporary detour pavements shall be designed consistent with current NMDOT practice described in section 405 of the Standard Specifications.

Bridge Replacement Approach and Departure Design

When a bridge is being replaced on a roadway where the projected 20-year ESAL is equal to or greater than 500,000, the designed bridge approach pavement life shall be for 20-years. For a roadway whose projected 20-year ESAL is less than 500,000, the pavement designer should consider other standard and innovative alternatives along with the standard use of flexible pavement structures. Examples of other standard and innovative alternatives are the use of untreated aggregate base course with a chip sealed surface, emulsified cold-mix pavement materials, flexible pavement millings with a chip sealed surface, etc. The typical length of both the approach and departure pavement is generally from 300 to 450 feet.

SECTION 2

RIGID PAVEMENT DESIGN PROCEDURE POLICY

Rigid pavements shall be considered, as an alternative, anytime when the projected 20-year rigid mainline design ESALs equal or exceed 15,000,000 or for a major intersection or truck ramp.

For the construction of all rigid pavement structures, the following materials and procedures will be used:

1. Plain jointed Portland cement concrete pavements shall be designed on all projects.

2. Class F (3000 psi @ 14 days) Portland cement concrete shall be used on all slip-formed pavements. Class AA (4000 psi @ 28 days) Portland cement concrete shall be used on all cast-in-place pavements.

3. The initial serviceability index (P_i) shall be modeled as a normal distribution whose mean is 4.20 and standard deviation is 0.20. For probabilistic analysis, the BestFit function will be **RiskNormal (4.20,0.20)** with the final P_i being selected based on reliability presented in Table 3 on page 4 of this policy.

4. The terminal serviceability index (P_t) shall be 2.5 on all Interstate and 4-lane National Highway projects and 2.0 for all other projects. Requests for a given project ESALs shall include which P_t value will be used on a particular design so that the correct ESAL projections can be calculated.

5. Table 8 shall be used to determine the "Loss of Support (LS)" for base materials.

Type of Material	Elastic or Resilient Modulus		Loss of Support	
	Minimum	**Maximum**	**Minimum**	**Maximum**
Cement Treated Aggregate Base	1,000,000	2,000,000	0.0	1.0
Cement Aggregate Mixtures	500,000	1,000,000	0.0	1.0
Asphalt Treated Base	350,000	1,000,000	0.0	1.0
Asphalt Stabilized Mixtures	40,000	300,000	0.0	1.0
Lime Stablized	20,000	70,000	1.0	3.0
Unbound Granular Materials	15,000	45,000	1.0	3.0
Fine Grained or Natural Subgrade Materials	3,000	40,000	2.0	3.0

Table 8: Typical Ranges of Loss pf Support Factors

6. Table 9 shall be used to determine the "Load Transfer Coefficient (J)".

Shoulder Type	Load Transfer Devics	
	Yes	**No**
Asphalt	3.2	4.2
Tied P.C.C.	2.9	4.0

Table 9: Load Transfer Coefficients

7. Table 10 shall be used to determine the "overall Drainage Coefficient (C_d).

	Percent of Time Pavement Structure is Exposed to Moisture Levels Approaching Saturation			
Quality of Drainage	**Less Than 1%**	**1 to 5%**	**5 to 25%**	**Greater Than 25%**
Excellent	1.25 to 1.20	1.20 to 1.15	1.15 to 1.10	1.10
Good	1.20 to 1.15	1.15 to 1.10	1.10 to 1.00	1.00
Fair	1.15 to 1.10	1.10 to 1.00	1.00 to 0.90	0.90
Poor	1.10 to 1.00	1.00 to 0.90	0.90 to 0.80	0.80
Very Poor	1.00 to 0.90	0.90 to 0.80	0.80 to 0.70	0.70

Table 10: Recommended Values of Drainage Coefficients

8. The most recent Department specifications, serial drawings, and special provisions shall be used.

9. Portland cement concrete pavement slab thickness shall not be less than 8.0-inches in designed thickness.

10. Incremental thickness increases of 0.25 inches shall be considered on a given rigid pavement design.

11. Both rural and urban sections shall be designed using a Type I untreated aggregate base course layer. This base course material will be a minimum of 6.0-inches in thickness.

12. On all urban projects, a Portland cement concrete pavement shoulder shall be used and be tied to the mainline roadway in conformance with the Department's latest joint detail standard drawings. A 30-inch tie bar spacing shall be used.

13. On all rural projects, a widened Portland cement concrete pavement lane shall be used. This lane shall extend a minimum of 2-feet beyond the edge of the travel lane and may be used in combination with the construction of flexible pavement shoulders.

14. The designer shall consider the use of subgrade soil stabilization on all subgrade soils whose AASHTO soil classification are either an A-2-6, A-2-7, A-3, A-6, or A-7 material. When these soils are encountered, the guidelines contained in FHWA Manual FHWA-IP-80-2, "Soil Stabilization in Pavement Structures – A User's Manual", Volumes 1 and 2, shall be used as a guide for determining the appropriate subgrade stabilization method and procedures. The pavement designer shall then use the results as an alternative consideration for the pavement section. When subgrade stabilization is considered as an alternative, it shall be compared to removing and replacing the top 2-feet of the existing subgrade material for cost effectiveness.

15. Rigid pavements generally will be designed for a 20-year life. However, for urban projects a 30-year design life may be used at the discretion of the project design team.

16. Life cycle cost analysis will be used to determine cost effectiveness of the design. The analysis period will be for 35 years and will include the following considerations:
    - All normally expected pavement maintenance activities that would occur over the entire analysis period; and

- All normally expected rehabilitation project or projects that would occur after the pavement's 20-year or 30-year design life that will extend its total service life to 35-years. This may include the use of whitetopping and ultra-thin whitetopping.

Shoulder and Shoulder Widening Design

Shoulder pavement structural sections on all new and reconstruction projects shall be constructed of the same materials and thickness as the mainline roadway except as noted in #8 above. This shall also apply to pavement structural sections associated with the construction of additional lanes and acceleration and deceleration lanes. The subgrade for roadway shoulders shall be in the same plane for drainage considerations.

Pavement Design R-Value and Subgrade Considerations

This shall be the same as detailed in the "Flexible Pavement Design Procedure Policy" section.

Rehabilitation Project Considerations

Cracking and seating of Portland cement concrete pavements shall have a minimum HMA overlay of 5-inches constructed over the top of the cracked and seated Portland cement concrete pavement with a reinforcement fabric located between the HMA leveling course and the HMA overlay. The HMA leveling course may include an additional 25% material to account for leveling needs.

Portland cement concrete pavement restoration consists of slab under-sealing, when determined to be cost effective, full and partial slab replacement, slab grinding, and joint sealing.

Bridge Replacement Approach and Departure Pavement Design

This shall be the same as detailed in the "Flexible Pavement Design Procedure Policy" section.

SECTION 3

DISTRICT DEVELOPED PROJECTS

General Design Guideline

On all projects, both construction and maintenance, where a District is responsible to prepare either a book format project or a full set of construction plans, the District will have the responsibility for the final pavement design. However, the District will consult with a Department approved pavement designer, who meets the requirements presented on page 2 “Pavement Designer Approval Procedure”, for both non-federal and federal projects. The purpose of this consultation is to ensure that the final pavement design is the most cost-effective possible for the available funding. All District deviations from this policy should be brought to the attention of the State Materials Bureau Chief so that needed modifications to this policy may be considered. This will ensure that this policy will reflect the most current acceptable practices for future District use.

Non-Federally Funded Project Pavement Designs

A District may request that the Department’s Pavement Design and Field Exploration Section prepare a project’s pavement design recommendations as described in these NMDOT Pavement Type Selection and Design Guidelines. If the Department’s Pavement Design and Field Exploration Section is requested to prepare a project’s pavement design recommendation, then adequate lead time must be given so that all traffic projections for design ESALs, field investigation, material testing, and design work can be scheduled and performed without affecting already scheduled STIP pavement design and testing activities. This time period may range from six (6) to eight (8) months depending on the project’s scope. If a District elects to prepare the pavement design recommendations, the Department Pavement Design and Field Exploration Section will assist the District as requested.

Federally Funded Project Pavement Designs

In addition to the requirements and conditions for “Non-Federally Funded Project Pavement Designs”, a representative from the appropriate oversight authority must be involved in all field reviews and approval of the project’s final pavement design recommendations. It is the District’s responsibility to coordinate these field reviews with the appropriate oversight authority. Once the final pavement design recommendation has been received and concurred with by the Department’s Pavement Design Engineer, the Department’s Pavement Design Engineer will then forward the final pavement recommendation to the appropriate oversight authority for their review and approval. If the appropriate oversight authority does not approve the forwarded pavement design recommendations, the Department’s Pavement Design Engineer will coordinate any resolution process that needs to occur between the appropriate oversight authority and the District.

SECTION 4

LIFE CYCLE COST ANALYSIS

Costing of competing products may be determined by evaluating the capitol investment required to build the pavement structure (rigid or flexible) and the associated recurring annual costs required to keep the pavement structure functional. The recurring annual costs may be calculated as Present Value. The recurring annual Present Value cost can be calculated from the following equation:

$PV=A_r\ ((1+d)^n-1/d(1+d)^n))$
Where A_r = Recurring annual amount
d = Discount rate – use 4%
n = number of years

and where Discount Rate Equal:
$d_r= (1+d_n/(1+I))-1$ or $d_n = (1+d_r)(1+I) -1$
where I is the general rate of Inflation – use 3%

Net present-value analysis, using a capitol cost analysis period and 35 year maintenance period, shall be the method used in calculating flexible, rigid, or composite pavement life cycle costs. In this method, all costs that will be associated with a given project, both current and future, are combined in terms of a current payment in current dollars where capitol costs are considered along with the Present Value of the recurring annual costs. The advantages of this method are:

- The benefits and costs of the various alternatives are related and are expressed as a capitol cost of investment and a Present Value cost of recurring annual costs;
- Alternatives with different construction and maintenance costs can be compared;
- All monetary costs are expressed in current dollar terms; and
- This method is computationally simple and straightforward.

This analysis shall consider, at a minimum, initial construction and future rehabilitation costs. Actual routine maintenance costs may be considered by the pavement designer to further refine their analysis, but this is not a requirement because of the minimal impact these costs have on any given analysis.

Appendix "A"

Flexible Design Factors

The design factors for projects located in each District shall be determined using the appropriate Table and the actual referenced location or, if a project location is located between two referenced locations, the design factors shall be interpolated using the two closest referenced locations. The final PG asphalt binder shall be selected using the criteria presented in Table A-7.

County Name	Station Name	Longitude (Degrees)	Latitude (Degrees)	Regional Factor	PG Base Grade
Dona Ana	Hatch	107.18	32.67	0.6	70-22
	Jornada Experimental Range	106.73	32.62	1.0	
	New Mexico State University	106.75	32.28	0.5	
Grant	Cliff	108.52	32.83	1.1	64-22
	Faywood	107.87	32.63	0.7	
	Fort Bayard	108.15	32.80	0.9	
	Gila Hot Springs	108.22	33.20	1.2	
	Mimbres Ranger Station	108.02	32.93	1.3	
	White Signal	108.37	32.55	0.9	
	Hachita	108.32	31.93	0.8	70-22
	Redrock	108.73	32.70	0.7	
Hidalgo	Animas	108.82	31.95	0.9	70-22
	Lordsberg	108.65	32.30	0.7	
Luna	Columbus	107.63	31.83	0.7	70-22
	Deming	107.73	32.25	0.7	
	Florida	107.48	32.43	0.9	
	Gage	108.02	32.22	0.9	
Sierra	Aleman Ranch	106.93	32.92	1.0	64-22
	Hillsboro	107.57	32.93	1.0	
	Winston	107.65	33.35	1.3	
	Cabello Dam	107.30	32.90	0.7	70-22
	Elephant Butte Dam	107.18	33.15	0.5	
	Truth or Consequences	107.22	33.15	0.5	
Socorro	Augustine	107.62	34.08	1.9	58-28
	Bingham	106.35	33.92	1.3	64-22
	Gran Quivera National Monument	106.08	34.27	1.5	
	Magdalena	107.23	34.12	1.6	
	Bernardo	106.83	34.42	1.4	70-22
	Bosque Del Apache	106.90	33.70	1.4	
	Socorro	106.88	34.08	1.1	

Note: For all INTERSTATE PROJECTS within District 1, the PG base grade will be a PG 70-22.

Table A-1: District #1 Base PG Grades

(See Table A-7 to Determine Final PG Grade)

County Name	Station Name	Longitude (Degrees)	Latitude (Degrees)	Regional Factor	PG Base Grade
Chaves	Elk	105.30	32.95	1.5	70-22
	Bitter Lakes Wildlife Refuge	104.40	33.47	1.7	
	Roswell Municipal Airport	104.53	33.40	1.4	
Curry	Clovis	103.20	34.42	1.4	64-22
	Melrose	103.62	34.43	1.5	
De Baca	Fort Sumner	104.25	34.47	1.5	64-22
	Yeso	104.62	34.40	1.2	
	Sumner Lake	104.38	34.60	1.4	
Eddy	Carlsbad Caverns	104.45	32.18	0.6	64-22
	Artesia	104.38	32.77	1.3	70-22
	Brantley Dam	104.38	32.52	0.8	
	Carlsbad	104.23	32.42	0.7	
	Carlsbad Cavern City	104.27	32.33	0.9	
	Hope	104.73	32.82	1.1	
	Waste Isolation Pilot Plant	103.80	32.38	0.8	
Lea	Crossroads	103.35	33.52	1.4	64-22
	Pearl	103.38	32.65	1.1	
	Tatum	103.32	33.27	1.4	
	Hobbs	103.13	32.70	0.8	70-22
	Jal	103.20	32.10	0.8	
	Maljamar	103.70	32.82	1.1	
Lincoln	Capitan	105.60	33.53	1.5	58-28
	Corona	105.58	34.25	1.8	
	Ruidoso	105.68	33.33	2.2	
	Carrizozo	105.88	33.63	1.3	64-22
	Circle F Ranch	105.00	33.90	1.5	
	Picacho	105.17	33.35	1.2	
	Ramon	105.00	34.15	1.5	
Otero	Mescalero	105.78	33.15	1.5	58-28
	Cloudcroft	105.75	32.97	3.4	
	Mountain Park	105.82	32.95	1.1	
	Alamogordo	105.95	32.88	0.7	70-22
	Orogrande	106.10	32.38	0.7	
	Tularosa	106.05	33.08	0.6	
	White Sands National Monument	106.18	32.78	1.1	
Roosevelt	Elida	103.65	33.95	1.5	64-22
	Portales	103.35	34.18	1.5	

Table A-2: District #2 Base PG Grades

(See Table A-7 to Determine Final PG Grade)

County Name	Station Name	Longitude (Degrees)	Latitude (Degrees)	Regional Factor	PG Base Grade
Bernalillo	Sandia Park	106.37	35.17	1.8	58-28
	Albuquerque International Airport	106.62	35.03	1.1	64-22
Sandoval	Wolf Canyon	106.75	35.95	3.2	58-28
	Bernalillo	106.55	35.55	1.7	64-22
	Cochiti Dam	106.32	35.63	1.4	
	Corrales	106.60	35.23	1.3	
Valencia	San Mateo	107.65	35.33	1.6	58-28
	Belen	106.77	34.67	1.4	64-22
	Laguna	107.37	35.03	1.6	
	Los Lunas	106.75	34.77	1.3	

Note: For all INTERSTATE PROJECTS within District 3, the PG base grade will be a PG 64-22.

Table A-3: District #3 Base PG Grades

(See Table A-7 to Determine Final PG Grade)

County Name	Station Name	Longitude (Degrees)	Latitude (Degrees)	Regional Factor	PG Base Grade
Colfax	Cimarron	104.95	36.47	2.2	58-28
	Eagle Nest	105.27	36.55	3.4	
	Lake Maloya	104.37	36.98	2.6	
	Maxwell	104.57	36.57	2.5	
	Raton Crews Field	104.50	36.75	2.5	
	Springer	104.58	36.37	2.6	64-28
Guadalupe	Dilia	105.05	35.18	1.7	64-22
	Newkirk	104.25	35.07	1.6	
	Santa Rosa	104.68	34.95	1.4	
Harding	Roy	104.20	35.95	1.9	58-28
	Mosquero	103.93	35.80	1.8	64-22
Mora	Gascon	105.43	35.90	2.2	58-28
	Ocate	105.05	36.18	2.5	
	Valmora	104.93	35.82	2.4	
Quay	Cameron	103.43	34.90	1.6	64-22
	McCarty Ranch	103.37	35.60	1.7	
	Ragland	103.75	34.80	1.6	
	Tucumcari	103.68	35.20	1.4	
	San Jon	103.33	35.12	1.7	70-22
San Miguel	Las Vegas	105.27	35.62	2.6	58-28
	Pecos Ranger Station	105.68	35.58	2.1	
	Bell Ranch	104.10	35.53	1.7	64-22
	Conchas Dam	104.18	35.40	1.3	
Union	Des Moines	103.83	36.75	2.3	58-28
	Grenville	103.62	36.60	2.1	
	Amistad	103.17	35.87	1.9	64-22
	Clayton Municipal Airpark	103.15	36.45	1.8	
	Pasamonte	103.73	36.30	2.1	

Note: For all INTERSTATE 25 PROJECTS within District 4, the PG base grade will be a PG 58-28.

Note: For all INTERSTATE 40 PROJECTS within District 4, the PG base grade will be a PG 64-22.

Table A-4: District #4 Base PG Grades

(See Table A-7 to Determine Final PG Grade)

County Name	Station Name	Longitude (Degrees)	Latitude (Degrees)	Regional Factor	PG Base Grade
Los Alamos	Los Alamos	106.32	35.87	1.7	58-28
Rio Arriba	Abiquiu Dam	106.43	36.23	1.5	58-28
Rio Arriba	Chama	106.58	36.92	2.8	58-28
Rio Arriba	Dulce	107.00	36.95	3.2	58-28
Rio Arriba	El Rito	106.18	36.33	1.8	58-28
Rio Arriba	El Vado Dam	106.73	36.60	2.9	58-28
Rio Arriba	Gavilan	106.97	36.43	3.5	58-28
Rio Arriba	Lindreth	107.03	36.28	2.9	58-28
Rio Arriba	Lybrook	107.57	36.23	2.8	58-28
Rio Arriba	Tierra Amarilla	106.55	36.77	2.9	58-28
Rio Arriba	Alcalde	106.07	36.10	1.8	64-22
Rio Arriba	Espanola	106.07	36.00	1.7	64-22
San Juan	Otis	107.87	36.32	1.9	58-28
San Juan	Aztec Ruins National Monument	108.00	36.83	1.8	64-22
San Juan	Bloomfield	107.97	36.67	1.7	64-22
San Juan	Farmington	108.17	36.75	2.1	64-22
San Juan	Fruitland	108.37	36.73	1.5	64-22
San Juan	Navajo Dam	107.62	36.82	1.3	64-22
San Juan	Shiprock	108.68	36.80	1.7	64-22
San Juan	Chaco Canyon National Monument	107.90	36.03	2.7	64-28
Santa Fe	Santa Fe	105.90	35.68	1.6	58-28
Santa Fe	Stanley	105.97	35.17	2.1	58-28
Taos	Cerro	105.60	36.75	2.9	58-28
Taos	Red River	105.40	36.70	3.0	58-28
Taos	Taos	105.60	36.38	2.5	58-28
Torrance	Clines Corners	105.58	34.93	2.0	58-28
Torrance	Mountainair	106.25	34.52	1.8	64-22
Torrance	Pedernal	105.57	34.63	2.0	64-22
Torrance	Estancia	106.07	34.75	2.2	64-28
Torrance	McIntosh	106.08	34.92	2.3	64-28

Note: For all INTERSTATE PROJECTS within District 5, the PG base grade will be a PG 58-28.

Table A-5: District #5 Base PG Grades

(See Table A-7 to Determine Final PG Grade)

<table>
<tr><th>County Name</th><th>Station Name</th><th>Longitude (Degrees)</th><th>Latitude (Degrees)</th><th>Regional Factor</th><th>PG Base Grade</th></tr>
<tr><td rowspan="6">Catron</td><td>Adobe Ranch</td><td>107.90</td><td>33.57</td><td>2.7</td><td rowspan="5">58-28</td></tr>
<tr><td>Beaverhead Ranger Station</td><td>108.12</td><td>33.42</td><td>2.3</td></tr>
<tr><td>Hickman</td><td>107.93</td><td>34.52</td><td>2.8</td></tr>
<tr><td>Luna Ranger Station</td><td>108.93</td><td>33.83</td><td>2.6</td></tr>
<tr><td>Quemado Ranger Station</td><td>108.50</td><td>34.35</td><td>2.5</td></tr>
<tr><td>Reserve Ranger Station</td><td>108.78</td><td>33.72</td><td>1.7</td><td>64-22</td></tr>
<tr><td rowspan="4">Cibola</td><td>El Morro National Monument</td><td>108.35</td><td>35.05</td><td>2.6</td><td rowspan="2">58-28</td></tr>
<tr><td>Fence Lake</td><td>108.67</td><td>34.65</td><td>2.4</td></tr>
<tr><td>Cubero</td><td>107.52</td><td>35.08</td><td>1.6</td><td>64-22</td></tr>
<tr><td>Grants-Milan Municipal Airport</td><td>107.90</td><td>35.17</td><td>2.1</td><td>64-28</td></tr>
<tr><td rowspan="6">McKinley</td><td>McGaffey</td><td>108.45</td><td>35.33</td><td>2.7</td><td rowspan="3">58-28</td></tr>
<tr><td>Star Lake</td><td>107.47</td><td>35.93</td><td>2.7</td></tr>
<tr><td>Thoreau</td><td>108.23</td><td>35.42</td><td>1.7</td></tr>
<tr><td>Tohatchi</td><td>108.73</td><td>35.85</td><td>1.3</td><td rowspan="2">64-22</td></tr>
<tr><td>Zuni</td><td>108.83</td><td>35.07</td><td>2.0</td></tr>
<tr><td>Gallup Senator Clarke Field</td><td>108.78</td><td>35.52</td><td>2.4</td><td>64-28</td></tr>
<tr><td rowspan="4">Sandoval</td><td>Cuba</td><td>106.97</td><td>36.03</td><td>2.6</td><td rowspan="2">58-28</td></tr>
<tr><td>Wolf Canyon</td><td>106.75</td><td>35.95</td><td>2.7</td></tr>
<tr><td>Jemez Springs</td><td>106.68</td><td>35.77</td><td>1.5</td><td>64-22</td></tr>
<tr><td>Torreon Navajo Mission</td><td>107.18</td><td>35.80</td><td>1.9</td><td>64-28</td></tr>
</table>

Note: For all INTERSTATE PROJECTS within District 6, the PG base grade will be a PG 64-28.

Table A-6: District #6 Base PG Grades

(See Table A-7 to Determine Final PG Grade)

PG Base Grade Modification Procedure

The PG Base Grade in the above tables will be modified per the following guidelines to determine the actual minimum PG asphalt binder that may be used on a given project.

20-Year Design ESAL's (Millions)	Adjustments to PG Base Binder Grade [1] Traffic Loading Rate		
	Standing [2]	Slow [3]	Standard [4]
< 0.3	1	--	--
0.3 to < 3	2	1	--
3 to <10	2	1	--
>10	2	1	1

Note 1:	Increase the high-end temperature grade by the number of grade/s indicated (one grade is equivalent to 6° C)
Note 2:	Standing Traffic - the average traffic speed is less than 15 mph.
Note 3:	Slow Traffic - the average traffic speed ranges from 15 mph to less than 45 mph
Note 4:	Standard Traffic - the average traffic speed is 45 mph or greater

Table A-7: PG Base Grade Modifications

Appendix “B”

Approved Listing of Geotextile Pavement Design Procedures

1. The Tensar Corporation, “Design Guideline for Flexible Pavements with Tensar Geogrid Reinforced Bases”, Tensar Technical Note BR2, March, 1987.

2. Approved equal.

Appendix “C”

Pavement Profile Minimum Requirements

Introduction

The purpose of these requirements is to outline the minimum exploration that is needed to adequately characterize the existing layer thickness and subgrade strength of a pavement structure for pavement design. The information developed from these procedures will be used by the pavement designer in determining the minimum pavement structure thickness that is required to support a given number of equivalent single axle loads (ESALs).

Safety and Utility Coordination

When performing this work, all pertinent Federal Occupational Safety and Health Administration (OSHA) procedures and regulations for safe operations of equipment and excavation procedures shall be observed at all times. Traffic control requirements shall meet the minimum as established in the “Manual on Uniform Traffic Control Devices” (MUTCD). Finally, prior to actual sampling, all utility clearances shall be coordinated and cleared with New Mexico One Call System, Inc., Albuquerque, New Mexico, by calling 1-800-321-2537, or, in the case of non-membership in New Mexico One-Call, all utilities will be cleared with the local governing entity.

General Profile Requirements

Prior to actual sampling of the existing pavement materials, an on-site review of the entire project will be conducted by a certified Geologist or a field technician who is under the direct supervision of a certified Geologist. The purpose of this review is to determine what type of sampling equipment and utility clearances that will be required on a particular project based on, but not limited to, project plans and profiles, maps, photos, and interviews with the local Highway Department Maintenance Foremen to identify problem areas. After this on-site review has been completed, the certified Geologist or field technician will randomly locate and then mark each test hole along the proposed roadway such that the minimum sampling frequency shown in Table C-1 for two lane roadways or Table C-2 for four or more lane highways is met.

Project Length (Miles)	**Deflection Testing Conducted?**	
	Yes	**No**
Less than 4	4 per mile	6 per mile
Greater Than or Equal to 4	4 per mile	4 per mile
Existing Shoulders	1 per mile	1 per mile
NOTE 1: All tests will be performed in the lane of increasing mile post direction.		
NOTE 2: All signalization projects are exempt from this table.		

TABLE C-1: Two Lane Highway Minimum Number of Test Holes.

Project Length (Miles)	Deflection Testing Conducted?	
	Yes	No
Less than 4	4 per mile each direction	6 per mile each direction
Greater Than or Equal to 4	4 per mile each direction	4 per mile each direction
Existing Shoulders	1 per mile each direction	1 per mile each direction
NOTE 1: All tests will be performed in the driving lane.		
NOTE 2: All signalization projects are exempt from this table.		

TABLE C-2: Four or More Lane Highway Minimum Number of Test Holes.

The actual location of the randomly selected and marked test holes shall be accurately tied to either a centerline survey station or to an existing milepost using an odometer that is accurate to within one-hundredth of a mile.

The sampling of the existing materials shall extend a minimum of 3.0 feet into the subgrade through the top of the existing surface unless bedrock or boulders are encountered. Within each test hole, each soil type encountered will have a minimum of 40 pound sample removed and placed in a plastic lined sample sack to prevent moisture loss with each sample sack identified using the Department's Form MT-88 (Rev 9/91). Also, an accurate geotechnical hole log recording all material types, depth, and field identification will be maintained and given to the pavement designer.

After the test hole has been sampled and logged, each test hole shall be backfilled and compacted. Any excess and/or other suitable material may be used for backfill except that the final top surface must be comparable material to that which was removed from the top surface. Every effort shall be made to obtain adequate compaction so that the test hole repair does not fail under traffic. Under no circumstances will a test hole be left open to traffic over night.

Existing Roadway Additional Sampling Requirements

These additional requirements pertain to work that is to be done on projects that involves no major or substantial grade or alignment changes and the project is primarily a 3R (resurfacing, rehabilitation, and restoration) or an overlay project. The test holes shall:

- Be located in the center of each lane; and
- Base course and subbase materials will be sampled separately.

On projects where cold in-situ recycling may be used, the existing asphalt material shall be sampled by obtaining a core, whose minimum diameter is 4.0-inch, per the requirements of Tables D-1 or D-2 or as requested by the pavement designer.

New or Reconstruction Project Additional Requirements

These additional requirements pertain to work that is to be done on projects that involve the investigation of new centerline and/or an alignment that will undergo a significant grade change. The test holes shall:

- Be a minimum of 3.0 feet into natural ground or 3.0 feet below the final subgrade elevation in cut section, except if rock is encountered;

- Be located on centerline when there is no appreciable side slope; and
- In offset situations, offset holes shall be used where one or both edges of the roadway section may be cutting into a hillside, although the centerline profile indicates a fill section. The distance right or left of the centerline, together with the elevation of the top of the test hole, shall be logged.

If it is not possible to excavate to the desired depths with a backhoe, foundation drilling shall be used to log the nature of the type of materials. In the event that solid rock is encountered, holes should be drilled and logged, including such data as feet per second drilled and type of equipment used.

Sample Laboratory Testing

All profile samples shall be tested in accordance with AASHTO procedures. All samples shall be preliminary tested for gradation, Atterburg Limits, moisture content and shall be classified using the AASHTO classification criteria for soil type by the Department or an approved private laboratory when requested by the Department. The pavement designer, based on the preliminary test results shall then select those samples that need to be tested for R-Value strength and possibly lime or cement stabilization. No samples shall be discarded until the pavement designer has accepted the final complete test results for a given project.

Appendix “D”

Falling Weight Deflection Testing Requirements

Introduction

The purpose of these requirements are to outline the minimum testing requirements for falling weight deflection testing of existing pavement structures. This type of testing should be used on all Department overlay or rehabilitation projects to supplement the Appendix “C” testing results.

Minimum Equipment Requirements

All equipment used for deflection testing will meet the latest requirements given in the American Society of Testing and Materials (ASTM) procedure D-4694. Additionally, the equipment shall have on file with the Department’s Pavement Investigation and Design Section Head a copy of it’s most recent annual equipment calibration and certification that is issued by a Federal Highway Administration (FHWA) approved calibration and certification center. The last equipment calibration and certification will not be more than one (1) year old at the time the testing is performed on any Department project. A minimum of seven (7) deflection measurement devices shall each be located at 0-inches, 8-inches, 12-inches, 18-inches, 24-inches, 30-inches, and 48-inches from the applied impulse load center of impact. The loading plate shall have a diameter of 12-inches with a center 4-inch diameter hole through which a deflection sensor shall be located.

Testing Procedures

The interval between successive test locations will be 250 feet unless otherwise directed by the particular project’s Pavement Designer. An impulse load of nine thousand (9000) pounds-force will be used unless this load causes any of the deflection measurement devices to exceed their capabilities. If this does occurs, then the impulse load may be reduced a maximum of two thousand (2000) pounds-force but should be kept has high as possible depending on the measurement capabilities of the deflection sensors. A single test will be taken and reported at each test location. However, the operator needs to monitor the recorded deflections at each location to ensure that these measured deflections decrease with increasing radial distance. If this does not occur, then the operator needs to determine why this did not happen (i.e. a small rock might be under one of the sensors, the pavement has a large crack between two or more sensors, equipment malfunction, etc.), correct the problem and either retest at that location or move up 10 feet and test again.

On two lane highways, testing shall be performed only on the lane of increasing milepost direction. While keeping the established testing interval, if a profile testing hole is encountered, an additional test will be conducted and logged at that location throughout the project’s limit.

On four or more lane highways, testing will be performed in both directions of travel in the driving lane. Again, while keeping the established testing interval, if a profile testing hole is encountered, an additional test will be conducted and logged at that location throughout the project’s limit.

Final Report

The final data file for each Department project tested shall include the following information:

1. Project Control Number;
2. Route Name;
3. Date of test;
4. Location and direction of lane tested (i.e. “Driving NBL”, “Driving SBL”, “Passing EBL”, etc);
5. Relative milepost location of each test point;
6. The actual load-deflection data for each test point; and
7. Pavement surface temperature for each test point.