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GUIDELINE FOR ASPHALT PAVEMENT DESIGN IN COLORADO

COMMENTARY

These Guidelines were developed by the Colorado Association of Geotechnical Engineers (CAGE) to assist Geotechnical Engineers in planning and conducting geotechnical investigations and design studies for asphalt pavement designs in Colorado. It is emphasized that these Guidelines are not mandatory nor does each outlined procedure or recommendation apply to every project. Rather, the Guidelines are offered for consideration by the Geotechnical Engineer as suitable for particular sites and projects.

The purpose of this document is to provide a general guide to the procedural processes used in Colorado when designing flexible pavement thickness. Although local regions may differ in procedure from these guidelines, the intent or function should not. The function of the designer is to provide design recommendations for a pavement structure that should, with proper construction and timely maintenance, reach or exceed its design life. The information contained within is a compilation from various design entities. The designer and reviewer of pavement thickness designs should be willing to recognize new and emerging technologies that continue to promote the best practices that produce a pavement structure appropriate to its intended service.

Several municipalities currently have pavement design standards that are outdated, several based on the 1972 AASHTO Interim Guide for Design of Pavement Structures. The Metropolitan Government Pavement Engineers Council (MGPEC) was established to standardize the pavement design procedures and requirements between the various municipalities. However, several member agencies are using "bits and pieces" of the MGPEC pavement design approach along with AASHTO or CDOT methodologies..

At the time of development of this document, we are aware of several municipalities that are considering revising their current pavement design standards. A document of this nature will assist the municipality in developing a standard that is consistent with the philosophy and standard of practice recommended by geotechnical engineers practicing in this area. Several municipalities currently have standards that do not allow for pavement design alternatives and construction procedures that are recognized by other municipalities in this area. Pavement design and asphalt pavement technology is continually evolving and a document of this nature will bring this technology to the forefront.

These Guidelines are intended to apply to geotechnical investigations in support of design of asphalt pavements. They are not intended as guidance for land use review or geologic hazard assessment. For more information regarding those activities, refer to Senate Bill 72-35, C.R.S. 30-28-101, et seq., House Bill 73-1574, C.R.S. 34-1-201 and to Policy

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Statement 50.2 of the State Board of Licensure for Professional Engineers and Professional Land Use Surveyors.

The Guidelines follow standard engineering problem-solving procedures: (A) Define the problem; (B) Explore conditions which pertain to problem solution(s); (C) Establish specific and reasonably implemented recommendations for problem solution(s); (D) Provide geotechnically-related construction recommendations pertaining to the solution(s); and (E) Identify potentially related issues pertaining to the solution(s), and express limitations of the study.

The experience and judgment of the Geotechnical Engineer should be applied when establishing the scope of study appropriate for a particular site and project. The scope should be developed by the Geotechnical Engineer based upon client input and in consideration of the Geotechnical Engineer's personal or company experience, the standard of practice in the area at the time of the study, the geologic and topographic site conditions, the proposed construction, and the local construction practices and limitations. If the client places limitations on the scope of the geotechnical studies, the Geotechnical Engineer is advised to document those limitations and to state the general risks created by such limitations.

The general methods outlined in these Guidelines do not address environmental conditions, natural hazards, or geologically complex sites. Therefore, it is emphasized that some issues or sites may not be adequately assessed by the methods outlined herein. When the Geotechnical Engineer recognizes that a project may benefit by multi-disciplinary assessments and solutions to mitigate particular problems, the client should be advised about the potential advantages.

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These Guidelines are not intended to be a code nor are they intended to create specifications. Further, these Guidelines are not intended for adoption by local Building Agencies. They were developed for consideration by Professional Engineers practicing geotechnical engineering in Colorado. Some of the Guideline suggestions may not be merited by particular projects.

A. Subgrade Investigation

1. Time of Investigation

   Time of investigation is normally performed at the completion of site grading. Subgrade should be near final elevation. For CIP projects, this may not be feasible. It is important to evaluate subgrade characteristics at final elevation in cut areas.

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2. Spacing of Borings

   Streets; 250 feet to 500 feet with a minimum of one per street
   Parking lots; Judgment of the geotechnical engineer

3. Depth of Exploration

   Five to 10 feet with a minimum five to 10 feet below final subgrade elevation in cut area. Minimum of 20% to 25% is suggested to be 10 feet.

4. Sampling Procedures

   Generally by auger procedures but excavation of test pits appropriate under various circumstances. Split spoon sampling generally recommended for granular soils and California sampler for cohesive soils. Large disturbed samples for subgrade support and Proctor testing. Drive samples in the upper 1 to 2 feet below final grade and as necessary to determine the underlying subsurface profile.

5. Subgrade Conditions

   Considerations should be given to evaluate existing ground water levels and underlying bedrock.

B. Laboratory Testing

1. Natural Moisture Content and Dry Density
2. Classification
3. Swell-Consolidation
4. Subgrade Support; R-value, CBR, Remolded Unconfined Compressive Strength. Commentary on appropriateness of using soil classification.
5. Water Soluble Sulfates
6. Proctors
7. Remolded Swell

C. Determination of Subgrade Design Strength

1. Correlation of R-value, CBR, Unconfined Compressive Strength to Resilient Modulus

   CDOT has a correlation for R-value, AASHTO has several for CBR and MGPEC has equations for unconfined compressive strength. Designer should closely consider the results when selecting final design resilient modulus

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D. Subgrade Preparation

1. Compacted Subgrade - Moisture-Density Treatment of upper 8 to 12 inches

   Pavement performance is dependent upon uniform subgrade support. AASHTO T-180 and T-99 are appropriate based on soil classification

2. Swelling Subgrade

   If clay subgrade soils exhibit an average swell potential greater than 2% under a surcharge pressure of 150 psf to 200 psf, swell mitigation should be addressed. Localized areas of higher swell potential should be addressed individually. CDOT Pavement Design Manual and MGPEC provides additional reference material. Care should be given to site specific situations and local geologic conditions. The following are generally accepted mitigation techniques.

   a. Overexcavation and moisture-density treatment.

      Typical depths of overexcavation generally range from 2 to 5 feet. Addition of moisture to a value over optimum is normally required.

   b. Removal and Replacement

      Depth of removal is generally on the order of 1 to 3 feet. The use of an edge drain should be considered.

   c. Chemical Treatment

      Generally performed in the upper 8 to 12 inches in conjunction with moisture-density treatment alternative. A laboratory mix design should be performed to determine the optimum concentration of chemical stabilization agent to be used. Typical concentrations include 4% to 6% lime, 3% to 5% cement, and 8% to 12% fly ash.

3. Soft and Saturated Subgrade

   Soft and saturated subgrade conditions may exist in the presence of shallow groundwater, beneath existing pavements, areas where collapsible soils are present, and areas influenced by surface water. The conditions need to be mitigated in order to provide for a stable paving platform. Care should be given to site specific situations and local geologic conditions. The following alternatives are generally accepted mitigation techniques.

   a. Chemical Treatment

      Generally performed in the upper 8 to 12 inches. Typical drying agents include lime, fly ash and cement. Concentrations are based on field performance associated with providing a stable paving platform.

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b. Mechanical Treatment

Subgrade can be stabilized using non-reinforced and reinforced techniques. Non-reinforced techniques generally consist of placing large diameter aggregates or recycled materials to depths required to provide a non-yielding platform. Typical depths range from 2 to 4 feet. The reinforced techniques generally include a system of a geosynthetic and an aggregate layer. A typical thickness for the layer system is 1 to 2 feet.

4. Other, fill containing debris, organics, etc.

Unusual areas should be evaluated on a site specific basis.

E. Design Traffic

Traffic loads are the basis for determining the structural requirements of the pavement section. They are also the most variable design criteria. Historically, the pavement design methodologies developed by AASHO related pavement damage to the passage of an axle of any mass or load. Axle loads were normalized to the damage caused by an 18-kip single axle load. AASHTO developed a procedure whereby mixed traffic volumes of different axle loads and configurations were equated to an equivalent number of 18-kip single axle loads (ESAL).

1. Site Specific Traffic

There are three main variables in determining design traffic loading; roadway design life, traffic volume, and traffic type. Most new roadways are designed for a design life of 20 years. The design life for pavement rehabilitation projects is typically much shorter, from 5 to 10 years. In the absence of municipal requirements, the judgment of the geotechnical engineering should determine the roadway design life.

When possible, the traffic volume used in the determination of the roadway design ESAL should be based on current or recent traffic counts or transportation plan with average daily traffic (ADT) data. Population growth projections should be factored into the estimate of the traffic volume over the design life of the pavement. For many municipalities, minimum design ESALS or 18-kip Equivalent Daily Load Applications are provided based on the roadway classifications.

The type of vehicular traffic will play a significant road in the estimation of the design ESALs for the pavement design. Heavily loaded trucks typically impart the majority of loads and subsequent damage during the design life of a pavement and should therefore be carefully estimated. These include trash trucks, school buses, mass transit vehicles, delivery trucks, and construction traffic. The estimated design traffic volume is converted to 18-kip ESALs

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through the use of Load Equivalency Factors developed by AASHTO. Load Equivalency Factors can be found in AASHTO, CDOT and MGPEC Pavement Design Manuals. The actual Load Equivalency Factors should be based upon the traffic information that is available.

2. Ranges in ESALs, based on Street Classification

   If site specific traffic studies are not available, the following table should be considered based on street classification.

STREET CLASSIFICATION	RANGE 18-KIP ESAL
Arterial	1,460,000 to 1,825,000
Major Collector	730,000 to 1,095,000
Minor Collector	219,000 to 365,000
Local	58,400 to 73,000
Cul-de-sac	36,500 to 58,400

   Street classifications at and above major commercial collector status, the traffic impact study should be reviewed and traffic levels considered in design.

3. Parking Lots

   The following table provides 18-kip ESALs that should be considered in design of parking lots based usage:

STREET CLASSIFICATION	RANGE 18-KIP ESAL
Automobile Parking Stalls	21,900 to 36,500
Secondary Drives	36,500 to 58,400
Primary Drives	58,400 to 73,000
Loading Docks	73,000 to 182,500

F. Pavement Design Equation

1. 1993 AASHTO Pavement Design Procedures

   The 1993 AASHTO pavement design procedures are generally the most accepted and used procedures by pavement engineers in Colorado. The AASHTO pavement design equation should be solved through the use of DARWin™, Nomograph, other Industry Programs/Resources

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Several pavement design input parameters are required for use in solving the AASHTO pavement design equation. The required input parameters and the recommended values for consideration are summarized as follows:

STREET CLASSIFICATION	INITIAL SERVICEABILITY	TERMINAL SERVICEABILITY	RELABILITY (%)	STANDARD DEVIATION
Arterial	4.5	2.5	90 – 95	0.44
Major Collector	4.5	2.5	90 – 95	0.44
Minor Collector	4.5	2.5	85 – 90	0.44
Local	4.5	2.0	80 – 85	0.44
Cul-de-sac	4.5	2.0	75 – 80	0.44
Parking Lot	4.5	2.0	75 – 80	0.44

G. Design Thickness

The AASHTO pavement design equation is solved to determine a design structural number based on the subgrade support, the design traffic and the input parameters (serviceability, reliability, standard deviation). The following equation provides the basis for converting the design structural number (SN) into the actual thickness of asphalt, base and subbase:

$$SN = a_1D_1 + a_2D_2m_2 + a_3D_3m_3$$

where

a_1, a_2, a_3 = layer coefficients representative of surface, base, and subbase courses, respectively

D_1, D_2, D_3 = actual thickness (in inches) of surface, base, and subbase courses, respectively

m_2, m_3 = drainage coefficients for base, and subbase courses, respectively

1. Layer Coefficients

Coefficients for hot mix asphalt pavement, aggregate base course and subbase course materials are based on AASHO Road Test recommendations, adjusted for Colorado conditions. Other coefficients are based on laboratory test results and actual performance. Chemically stabilized subgrade materials can perform as a structural in the pavement section if a sufficient strength gain has been achieved as a result of the stabilization process.

Generally accepted layer coefficients for hot mix asphalt generally range from 0.40 to 0.44. The changes in the hot mix asphalt mix designs as a result of SHRP Program has resulted in a general acceptance for use of a layer coefficient of 0.44 for hot mix asphalt.

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Aggregate base course can consist of unbound materials such as gravels or may consist of bound materials such as chemically treated subgrades. Bases may be constructed of gravels, mixtures of soil and aggregate, mixtures of asphalt and aggregate, and recycled asphalt and concrete pavements. Recommended base layer coefficients for unbound materials to be used in pavement thickness design are provided in Table 3.3 of the Colorado Department of Transportation 2010 Pavement Design Manual. It is strongly suggested that Colorado Department of Transportation Report No. CDOT-2009-5, "Analysis of Using Reclaimed Asphalt Pavement (RAP) as a Base Course Material", be reviewed prior to selection of the layer coefficient. In addition, Table 3.2 of the CDOT pavement design manual provides for recommended structural layer coefficients for chemically treated subgrade materials based on unconfined compressive strength testing.

Subbase layers are usually distinguished from the base course layers by less stringent specification requirements for strength, plasticity, and gradation. Subbase layers are generally not used in pavements constructed along the Front Range of Colorado but are used in some instances on the Western Slope.

The following are layer coefficients that should be considered in the design of the flexible pavement layered system.

MATERIAL	LAYER/STRUCTURAL COEFFICIENT
Asphalt Concrete	0.40 – 0.44
Granular Base Coarse	0.12 – 0.14
Chemically Treated Subgrades	
Lime, Cement, Fly Ash Stabilized	0.11 - 0.14
Cement Treated Base Course	0.20 – 0.22
Bituminous Treated Base Course	0.20 – 0.22

2. Drainage Coefficients

The drainage coefficient represents the effects of subsurface drainage of unbound base or subbase layers. The effect of drainage on asphalt pavement performance is a function of the quality of subsurface drainage and the amount of time during the year that the asphalt pavement structure is exposed to high moisture levels.

QUALITY OF DRAINAGE	DRAINAGE COEFFICIENT
Excellent	1.1 – 1.15
Good	1.0 -1.10
Fair	0.9 – 1.0
Poor	0.8 – 0.8
Very Poor	0.7 – 0.8

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It is generally accepted by pavement engineers in Colorado to use a drainage coefficient of 1.0 for unbound base and subbase layers.

3. Pavement Section Alternatives

   a. Full-Depth

      Full-depth asphalt pavement sections consist of asphalt concrete constructed directly on prepared subgrade. Full-depth pavement sections perform well on granular subgrades (A-1 to A-4 soils). Cohesive subgrade materials (A-6 and A-7-6 soils) are subject to reduction of support strength and permanent deformation when significantly wetted. Full-depth asphalt pavement sections may be problematic on cohesive subgrade materials without additional design considerations. Thickness of full depth asphalt will generally ranged from 5 to 12 inches. If additional structural capacity is needed above 12 inches, considerations should be taken for the structural requirement to be achieved by the addition of a base layer.

   b. Flexible Composite

      Flexible composite sections consist of asphalt pavement constructed over a layer of unreinforced granular base course placed over prepared subgrade. The granular base course may consist of crushed aggregates or recycled paving materials. The granular material should be angular in shape, not rounded. If a composite section is constructed over cohesive soils (A-6 and A-7-6 soils), placement of a woven geogrid fabric between the subgrade and the granular material to maintain separation should be considered. Section 2.10 of the 2010 CDOT Pavement Design Manual provides guidance on this issue. Based on adjacent landscape irrigation practices, an edge drain should be considered where cohesive subgrades are present. When edge drains are selected, they are generally used on collector and arterial streets. Routine maintenance is critical in the success of the edge drain system.

      Thickness of a composite base material may range from 6 to 12 inches

   c. Chemically Treated

      Chemically treated sections consist of asphalt pavement constructed over chemically treated subgrades. The subgrades may require chemical stabilization because of weak support properties, wet conditions, or potential for differential movement. Chemical stabilizers may include lime, fly ash, cement or bituminous material. Chemical stabilization will improve the support capacity and constructability of the subgrade, and can be given structural credit as part of the overall structural capacity of the pavement if sufficient strength gain is achieved.

      A site specific mix design must be performed if chemical stabilization is selected. The mix design should address potential reactions with soluble

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sulfates in the subgrade soils and the appropriate amount of stabilizer required to achieve adequate improved strength (typically 160 psi) if structural credit will be given.

Thickness of chemically treated subgrade may range from 8 to 12 inches.

d. Mechanically Treated

Mechanically treated sections consist of asphalt pavement constructed over reinforced granular base materials. Reinforcement consists of a multi-axial geogrid placed directly on a stable, prepared subgrade. Reinforced granular base course layers are starting to be recognized as a benefit to the structural capacity of the pavement section but have yet to be officially accepted by local agencies.

H. Asphalt Mix Selection

1. Superpave Mix Design & Mix Selection

Superpave mix designs have generally replaced Marshall and Hveem mix designs for nearly all applications in Colorado. The Superpave mix design methodology consists of three primary components. These components are:

- PG Asphalt Binder Selection
- Gyratory Compaction Level
- Aggregate Gradation and Physical Properties

A Superpave mix design can be established for all paving applications (highways to driveways). A Superpave mix design may or may not include a modified asphalt binder.

2. PG Asphalt Binder Selection

There are generally five different grades of Performance Graded (PG) asphalt binders used in Colorado. PG 58-28, PG 64-22, PG 58-34, PG 64-28, and PG 76-28. PG 64-28, PG 58-34, PG 70-28, and PG 76-28 are modified asphalt binders and are restricted to top mat of paving and where warranted based on traffic and climate conditions. PG 76-28 is generally restricted in use to very high traffic, heavy truck volume arterials or highways. PG 58-34 is generally restricted in use to very low temperature conditions to address the potential of low temperature transverse thermal cracking. Pavement distress associated with surface oxidation is mitigated primarily through mix design (gradation, asphalt binder content) and not through asphalt binder selection. Smaller sized mixes (Sx) generally have higher asphalt binder content mixes and are used to mitigate surface oxidation, raveling, and weathering related distress.

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PG ASPHALT BINDER	STREET CLASSIFICATION USEAGE	COMMENTS
PG 58-34*	Minor Collectors, Locals, Cul-de-sacs, Parking Lots	Polymer modified asphalt Mountainous Areas Very low temperature areas
PG 58-28	Minor Collectors, Locals, Cul-de-sacs, Parking Lots	Unmodified asphalt
PG 64-22	Major Collectors, Arterials	Unmodified asphalt, most commonly used PG grade
PG 64-28*	Major Collectors, Arterials	Polymer modified asphalt colder temperature areas
PG 70-28*, PG 76-28*	Major Collectors, Arterials	Polymer modified asphalts

* - asterisk denotes generally restricted to top lift/wearing surface

3. Gyratory Compaction Level

Superpave mixes are designed in the laboratory using a Gyratory compactor. The gyration levels are 50, 75, and 100. 100 gyration mixes are generally restricted to high volume interstates or heavy truck arterial intersections. The predominate gyration level for most mixes is 75 gyration.

SUPERPAVE GYRATION LEVEL	SUGGESTED USE*
50	Occasional light vehicular and pedestrian traffic, bike paths, playgrounds, tennis courts
75	Predominate gyration level, Parking lots, cul-de-sacs, locals, collectors, minor arterials
100	Very high volume, heavy truck intersections, heavy truck major arterials, high volume interstate highways

*CDOT 2010 Pavement Design Manual provides guidance on design gyration based on ESALs and temperature

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4. Aggregate Gradation & Lift Thickness

There are three generally accepted mix types used in Colorado – SG (1"), S (3/4"), and Sx (1/2"). SG is reserved for bottom or lower lift paving in multi lift applications. Both S and Sx mixes can be used for top mat paving and both can be used in high traffic conditions. The generally accepted standard for lift thickness is three times (3X) the nominal maximum aggregate size. Thus the minimal thickness for an SG gradation should be 3", 2-1/4" for S, and 1-1/2" for Sx. Adjustments in mix design gradation should be considered when the lift thickness is less than the minimums shown. For thin lift overlays (less than 1-1/2"), the maximum aggregate size should be 100% passing the 3/8" sieve.

SUPERPAVE AGGREGATE GRADATION	RECOMMENDED RANGE IN LIFT THICKNESS	SUGGESTED USE
Sx (Modified)*	1"	Preventive Maintenance thin lift overlays, surface mixes
Sx (1/2")	1½" to 2½"	Surface mixes, some intermediate mixes
S (3/4")	2" to 3"	Bottom, intermediate and some surface mixes
SG (1")	3" to 4"	Bottom mats for multi lift paving

*denotes ???

Stone Matrix Asphalt (SMA) mixes is a type of hot mix asphalt (HMA) that is used in Colorado but is normally used for surface layers on streets that are expected to experience extreme traffic loading. Stone Matrix Asphalt (SMA) is a gap-graded HMA that maximizes rutting resistance and durability with a stable stone-on-stone skeleton held together by a rich mixture of asphalt binder, filler, and stabilizing agents.

I. Recent/New Technologies

Hot mix asphalt pavement technology is continually evolving with new and emerging technologies that strive to produce a pavement structure appropriate to its intended service. Although there are several concepts and technological approaches for improvement of HMA mixes and the approach to flexible pavement design, two important concepts have been selected for discussion.

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1. Perpetual Pavements

A perpetual pavement is defined as an asphalt pavement designed and built to last longer than 50 years without requiring major structural rehabilitation or reconstruction, and needing only periodic surface renewal in response to distresses confined to the top of the pavement. Full depth and deep-strength asphalt pavement structures have been constructed since the 1960s. Full-depth pavements are constructed directly on subgrade soils and deep-strength sections are placed on relatively thin (4 to 6 in.) granular base courses. One of the chief advantages of these pavements is that the overall section of the pavement is thinner than those employing thick granular base courses. Such pavements have the added advantage of significantly reducing the potential for fatigue cracking by minimizing the tensile strains at the bottom of the asphalt layer. An asphalt perpetual pavement structure is designed with a durable, rut resistant, and wear resistant top layer with a rut resistant intermediate layer and a fatigue resistant base layer.

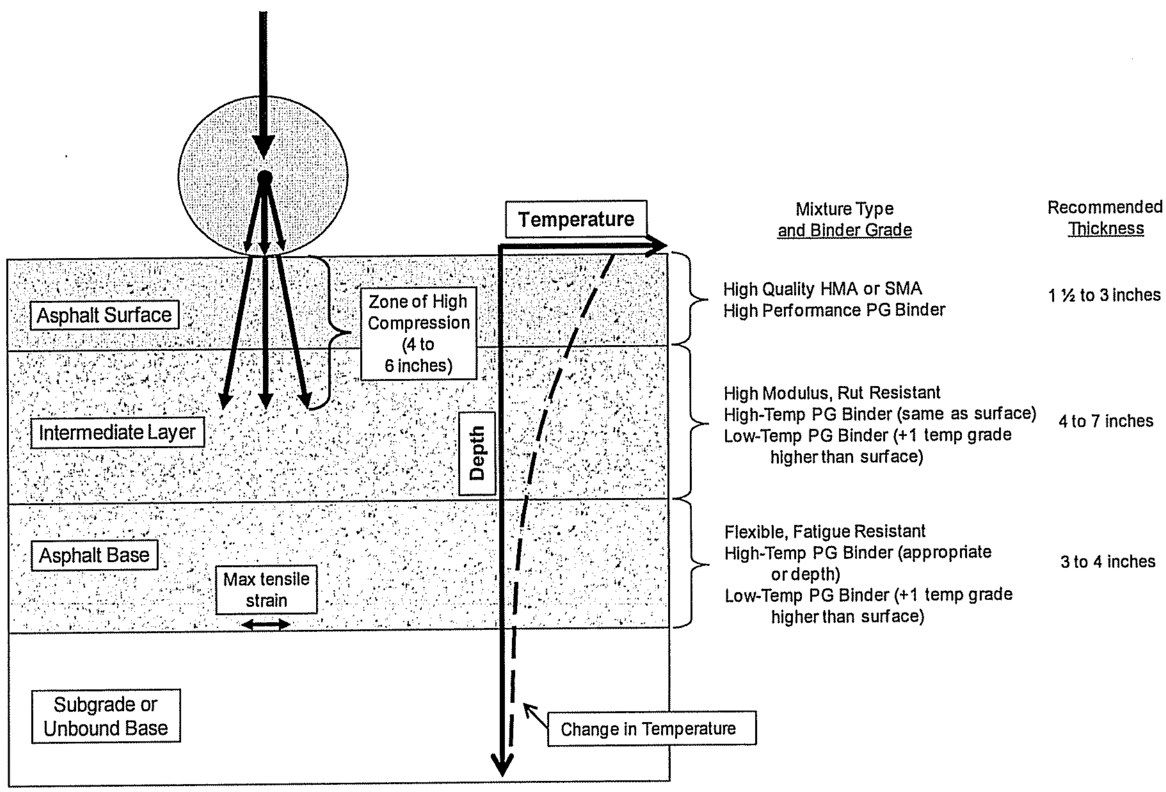

Figure 1 Perpetual Pavement Design Concept

This concept may be used in conventional, deep strength, or full depth asphalt structural layering. In mechanistic design, the principles of physics are used

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to determine a pavement's reaction to loading. Knowing the critical points in the pavement structure, one can design against certain types of failure or distress by choosing the right materials and layer thicknesses. Therefore, the uppermost structural layer resists rutting, weathering, thermal cracking, and wear. SMAs or dense-graded Superpave mixtures provide these qualities. The intermediate layer provides rutting resistance through stone-on-stone contact and the durability is imparted by the proper selection of materials. Resistance to bottom-up fatigue cracking is provided by the lowest asphalt layer having a higher binder content or by the total thickness of pavement reducing the tensile strains in this layer to an insignificant level.

Pavement systems (like the perpetual pavement design) resist full depth fatigue cracking in the wheel path and can therefore achieve a very long performance life. Pavement distresses tend to be surface durability in nature and can be mitigated primarily through periodic surface maintenance and rehabilitation.

2. AASHTO M-E Design Approach

The Mechanistic-Empirical Pavement Design Guide (MEPDG) represents a major change in the way pavement design is performed. Mechanistic refers to the application of the principles of engineering mechanics and empirical is based upon experience or observation alone. The MEPDG uses a rational design approach that has three basic elements:

a. theory used to predict a critical distress response parameter (stresses, strains, deflections, etc.) (mechanistic part),
b. an evaluation of the materials properties applicable to the selected theory, and
c. the determination of the relationship between the magnitude of the critical distress parameter in question to the performance level desired (empirical part).

The output from the MEPDG is a prediction of distresses and International Roughness Index (IRI) (smoothness) at each selected reliability level. Thus, it is not a direct thickness design procedure.

The MEPDG uses an iterative trial design process (combination of layer types, layer thickness, and design features) for a given set of site conditions and failure criteria at a specified level of reliability. Traffic, materials, and climatic inputs are combined with structural elements to develop a trial design. MEPDG considers the mechanistic relationship between stress and strain (linear or nonlinear), the time dependency of strain under a constant stress level (viscous or non-viscous), and the degree to which the material can

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rebound or recover strain after stress removal (plastic or elastic). Pavement responses to the combined effects of load and climate are computed using sophisticated finite element (rigid pavements) and elastic layer (flexible pavements) computer models. The design and analysis of a trial design is based upon the concept of total accumulated damage. An incremental damage approach is used to calculate the accumulated damage in the pavement over the design life. The design life is divided into time periods of 2 weeks for flexible pavements and 1 month for rigid pavements. In each time increment, the daily, seasonal, and long-term changes in material properties, traffic, and climate are considered. The total damage over the design life is the sum of the damage accrued in each time increment. The procedure empirically relates damage over time to pavement distresses. The distress types considered in the MEPDG are rutting, fatigue cracking, and thermal cracking in asphalt-surfaced pavements, joint faulting and transverse cracking in jointed plain concrete pavements, and punchouts in continuously reinforced concrete pavements. In addition, pavement smoothness (IRI) is analyzed for all the pavement types. The design procedure verifies whether the pavement structure will sustain the prevailing traffic loads and climatic conditions without exceeding the design limits. If the trial design meets the performance criteria, a feasible design has been reached. If not, the designer can modify the trial design as needed until the criteria are met.

References

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