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February 8, 2006

ENGINEERING AND POLICY MEMORANDUM NO. CEB-1-06

TO: ENGINEERS, DEVELOPERS, AND OTHER INTERESTED PARTIES

FROM: HENRY ENG, FAICP, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

SUBJECT: STRUCTURAL DESIGN REQUIREMENTS FOR
NEW ASPHALT CONCRETE PAVEMENTS

Attached is our *Structural Design Requirements for New Asphalt Concrete Pavements.* This new standard, which becomes effective on March 1, 2006, will supersede the *Design Standards for Flexible Pavements* under Engineering and Policy Memorandum No. CEB-1-02, dated February 6, 2002.

Should there be any questions, please call Mr. Weston Wataru of our Civil Engineering Branch at 527-6303.

HE:dl
Attachment

Structural Design Requirements for New Asphalt Concrete Pavements

Applicability

The following standard applies to the design of new flexible pavements only. This standard is not applicable to the design of asphalt concrete resurfacing or the rehabilitation of existing pavement structures.

Design Life

New flexible pavements shall be designed for a minimum life of 40 years based on anticipated traffic. It is anticipated that over this life one or more surface layer rehabilitation efforts will be necessary to maintain the pavement in acceptable condition.

Pavement Materials

When specialized design with the participation of a geotechnical engineer is not required, pavement structure shall consist of the following three layers:

Table 1: Pavement Materials

Pavement Layer	Approved Materials[a]
Surface course	Mix #3, Mix #4, or other asphalt concrete materials approved by the City
Asphalt treated base course (second course)	Plant mix asphalt treated base, or other asphalt concrete materials approved by the City
Aggregate base course (first course)	Aggregate base course with a minimum CBR of 85, or other materials approved by the City

a. For material definitions, see *Standard Specifications for Public Works Construction*, September, 1986.

Subgrade Support

Required pavement structure is determined by the amount of support offered by the subgrade. Measurements of subgrade resilient modulus (M_R), resistance value (R-Value) or California Bearing Ratio (CBR) are acceptable. In order to use Table 3, M_R and R-Value measurements may be converted to CBR values using the following equations with the following limitations:

Table 2: Subgrade Support Conversion Equations

Conversion Equation	Limitation
$M_R(psi) = 1500 \times CBR$	Fine grained soils with a soaked CBR of 10 or less
$M_R(psi) = 1155 + 555 \times (R\text{-}value)$	Fine grained soils with an R-value of 20 or less
$R - value = \frac{1500(CBR) - 1155}{555}$	Fine grained, non-expansive soils with a soaked CBR of 8 or less

Other correlations between M_R, R-value and CBR may be used if they are substantiated by local data to the satisfaction of the City.

Pavement Structure

Pavement structural design is divided into two classes depending upon expected pavement loading. Coordination with the City is required in order to determine existing or future plans for traffic, bus routes and development (including phased developments), all of which can affect expected loading.

Low-Volume Pavements

Low-volume pavements are those pavements likely to support relatively few loads over their design life. Their design is often controlled by constructability and the ability to accommodate future rehabilitation efforts. Low-volume pavements are defined as those pavements that meet all of the following criteria:

1. Fewer than 1 million equivalent single axle loads (ESALs) anticipated over the design life of the pavement. For a design life of 40 years, this gives 25,000 ESALs/yr if traffic growth is neglected.

2. No regular bus routes. This includes routes of City, school and private buses.

Table 3: Required Pavement Layer Depths for Low-Volume Pavements[a, b]

Subgrade CBR (%)	Expansion Value (%)	Surface Course	Asphalt Treated Base Course	Aggregate Base Course
> 10	0 to 3.0	2 inches	3 inches	6 inches
> 5 to 10	> 3.0 to 4.5	2 inches	4 inches	6 inches
> 3 to 5	> 4.5 to 6.0	2 inches	4 inches	12 inches
≤3	> 6.0	2 inches	Specialized design with participation of a geotechnical engineer	

a. Approved materials are listed in Table 1.
b. When measured values of subgrade CBR and expansion value give different designs, use the more conservative, or thicker, design.

Low-volume pavements may also be designed using methods discussed in the "High-Volume Pavements" section. If this is done, Table 3 shall represent minimum layer thicknesses.

High-Volume Pavements

Pavements that do not meet low-volume criteria are considered "high-volume" pavements because they must support an appreciable amount of loading and their design is likely controlled by this loading.

High volume pavement must be designed using an approved structural design method. Table 3 serves as minimum pavement layer thicknesses, when using approved design methods. The City has approved the following methods:

- American Association of State Highway and Transportation Officials (AASHTO) *Guide for Design of Pavement Structures*, 1993 edition.
- *Pavement Design Manual, Revision March 2002,* prepared by Department of Transportation, State of Hawaii
- Asphalt Institute method as described in MS-1 *Thickness Design – Highways & Streets*, 9th edition. The software version of this method, SW-1, may also be used.
- Perpetual Pavement design as done by *PerRoad* software (version 2.4 or later) available for free from the Asphalt Pavement Alliance.

Other pavement design methods must be approved by the City.

This supersedes the Design Standards for Flexible Pavements dated February 6, 2002.