Pavement Type Selection

At The Georgia D.O.T.

Presented By

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Pavement Type Selection Process

- Pavement Type Selection (PTS) is a process that:
  » Combines engineering and economic analyses.
  » Assists engineers in choosing a cost-effective pavement type.
  » Is not an exact science.
  » The 1993 AASHTO Guide allows for other factors to be considered along with engineering and economic factors.
Pavement Type Selection Process

- This is a new process for the GDOT.
- The pavement being selected, regardless of type shall:
  » Carry the anticipated lifetime loading.
  » Perform under site specific geotechnical (soil support) and
  » Environmental (precipitation and drainage) conditions.
Pavement Design

- **Pavement Design** selects a combination of materials of known strengths and thickness to withstand and support the anticipated lifetime loading repetitions.

- The design is expected to perform under the site specific conditions.

- The lifetime loading repetitions and materials are site specific dictated by the anticipated traffic.

- The lifetime Design Period and Serviceability Loss are essential components of the Pavement Design Procedure.
Pavement Design

- **Design Period** is the period of time that elapses from the time the pavement deteriorates from its initial serviceability level to its terminal serviceability level.

- **Serviceability Loss** is the gradual loss in pavement quality over its design life.
Life Cycle Cost Analysis

- **Life Cycle Cost Analysis (LCCA)** compares alternate Pavement Types, designed for a given project over an **Analysis Period**.

- **LCCA also compares associated future maintenance, rehabilitation, and User Costs over the Analysis Period.**

- **Analysis Period** is the length of time for which an LCCA is conducted for economic analysis and comparison of the various alternates.
Life Cycle Cost Analysis

- A LCCA analysis considers at least two viable pavement alternatives for consideration.

- Following the completion of the LCCA analysis, alternatives are ranked using a multi-criteria analysis matrix.
Multi Criteria Analysis Matrix

» This matrix has weights assigned as a percentage to criteria / factors in the LCCA analysis, e.g. 
  Construction Costs, Maintenance Costs, User Delay Costs, etc...

» Major Factors
  – LCCA criteria that have readily quantifiable costs (unit costs, more certainty in their values,).

» Minor Factors
  – LCCA criteria that have costs that are less readily quantifiable (less certainty in their values).
Multi Criteria Analysis Matrix

Criteria with readily quantifiable unit costs

- Material Costs: from historical bid prices
- Traffic Control Costs: from historical bid prices
- Construction Costs
Multi Criteria Analysis Matrix

Criteria with less readily quantifiable unit costs

- *User Delay Costs*
- *Familiarity with construction of proposed pavement type*
- *Performance of proposed pavement type on other projects*
- *Conservation / Recycling of Materials*
- *Stimulation of Competition between construction industries*
GDOT Defaults for Design and LCCA

- **GDOT** uses a *design period of 20 years* for both rigid and flexible pavements.
- **GDOT** uses an *initial serviceability level of 4.5* and a *terminal serviceability level of 2.5 (AASHTO 1972)*.
- **GDOT** typically uses an *analysis period of 40 years* for LCCA.
Existing Pavement Evaluations

- Are needed when the existing pavement or portions thereof will be utilized in the proposed construction. They consist of the following:
  
  » Visual Distress Survey: according to PACES distress guidelines and definitions.

  » Falling weight deflection (FWD) testing of the existing pavement may also be requested.
Existing Pavement Evaluations

- Coring to determine all existing pavement layer thicknesses.
- Cores also reveal the material condition of the existing layers, and
- If the Pavement Evaluation Engineer deems necessary, additional laboratory testing of cores will be performed.
Existing Pavement Evaluations

- The GDOT procedures and guidelines for performing Existing Pavement Evaluations are being developed.

- The guidelines will describe rigid and flexible pavement distresses with visual aids and how those distresses factor into rehabilitation strategy recommendations.

- The guidelines will be a unit in the upcoming Pavement Design Manual (PDM) which is due in December 2005.
Major Steps in Pavement Type Selection

Step I: Field Engineering and Design

- Complete a Pavement Evaluation if any existing pavement is being retained.
- Develop several pavement design alternates for comparison.
- Plan appropriate maintenance treatments at regular intervals for the various design alternates.
Major Steps in Pavement Type Selection

» **Step II: Economic Analysis**

- Perform a LCCA comparing the different pavement designs proposed, including their maintenance.
- Incorporate user delay costs for all construction periods.
- Weigh-in the results of the LCCA comparing different pavement designs using a multi-criteria analysis matrix.
Major Steps in Pavement Type Selection

» **Step III: Engineering Judgement**

- Incorporates the designers’ experience and common sense.
- **Recommend** the most suitable design alternate.
A Good Pavement Type Selection Process

- Establishes a method for selecting the preferred pavement alternate for the given project or corridor.

- It is part of a comprehensive Pavement Management approach.
A Good Pavement Type Selection Process

- This method takes into account the total construction and user delay costs over the life of the pavement (LCCA).

- Incorporates the designers’ experience and recommends the most suitable design alternate.
Pavement Type Selection Process

- Pavement Type Selection is also
  - A Project Specific Process.
  - Applicable to Major Projects.
  - Its recommendation(s) must be justifiable to GDOT management making the entire process a transparent one.
Project Types

- **Projects for which no PTS is needed are:**
  - **Routine Maintenance Projects**
    - *Mill and Inlay: Top down cracking*
    - *Mill and Overlay: Top down cracking + structural addition*
    - *Overlay: seal minor cracks + provide additional layer*
  - **Safety Improvement Projects**
    - *Intersection Improvements*
  - **Bridge Replacement Projects**
Project Types

Projects for which a P T S is needed are:

» Interstate Widenings and Rehabilitation
» Major Arterial Projects in Urban Areas
» Major Maintenance Reconstruction Projects
» New Corridor Widening / New Construction
Pavement Type Selection

Examples

- **Example 1:**
  
  *New Construction - Extension of Toccoa Bypass*

  - **Base Type:** Graded Aggregate
  - **Initial one-way AADT:** 7,390
  - **Final one-way AADT:** 12,240
  - **Average one-way AADT:** 9,815
  - **24 Hr Truck %:** 10
Pavement Type Selection
Examples

- **Alternate 1** *
  - Asphalt Concrete
  - Lifetime ESAL’s: 6,900,00
  - Required SN: 6.18
  - AC Thickness: 9.5 inches
    - (11.5 inches for 3.0% underdesign)
  - Base: 12 inches
  - Total Thickness:
    - 21.5 inches
    - 23.5 inches
      (for 3.0% underdesign)

- **Alternate 2**
  - PCC With Dowels
  - Lifetime ESAL’s: 11,900,000
  - Slab Thickness: 10.0 inches
  - AC Interlayer: 3.0 inches
  - Base: 12 inches
  - Total Thickness:
    - 25.5 inches
      (for 2.2% underdesign)
Pavement Type Selection

Examples

- Example 2:

  New Construction - Relocation of SR17 / Avalon Bypass

  - Base Type: Graded Aggregate
  - Initial one-way AADT: 11,750
  - Final one-way AADT: 19,250
  - Average one-way AADT: 15,500
  - 24 Hr Truck %: 12
# Pavement Type Selection

## Examples

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<thead>
<tr>
<th>Alternate 1</th>
<th>Alternate 2 *</th>
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<tbody>
<tr>
<td><strong>Asphalt Concrete</strong></td>
<td><strong>PCC With Dowels</strong></td>
</tr>
<tr>
<td>Lifetime ESAL’s: 13,000,00</td>
<td>Lifetime ESAL’s: 11,900,000</td>
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<tr>
<td>Required SN: 6.71</td>
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<tr>
<td><strong>AC Thickness: 11.5 inches</strong></td>
<td><strong>Slab Thickness: 10.0 inches</strong></td>
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<tr>
<td>(for 10.6% underdesign)</td>
<td>(for 15.0% underdesign)</td>
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<td><strong>Base: 12 inches</strong></td>
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