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 P T S 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

- *Alternate 1*
  - » *Asphalt Concrete*
  - » *Lifetime ESAL's: 13,000,00*
  - » *Required SN: 6.71*
  - » *AC Thickness: 11.5 inches*
    (for 10.6% underdesign)
  - » *Base: 12 inches*
  - » *Total Thickness:*
    - – ***23.5 inches***
      (for 10.6 % underdesign)

- *Alternate 2 **
  - » *PCC With Dowels*
  - » *Lifetime ESAL's: 11,900,000*
  - » *Slab Thickness: 10.0 inches*
  - » *AC Interlayer: 3.0 inches*
    (for 15.0% underdesign)
  - » *Base: 12 inches*
  - » *Total Thickness:*
    - – ***25.5 inches***
      (for 15.0% underdesign)