FAA Pavement Design: AC 150/5320-6E – FAARFIELD

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FAA Pavement Design

AC 150/5320-6E, Airport Pavement Design and Evaluation

- Completely revised
- Cancels AC 150/5320-6D
- New design methodologies for Rigid and Flexible pavements
- Software dependent design procedures
- Addresses modern airplane parameters

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Chapter 2
Soil Investigations and Evaluation

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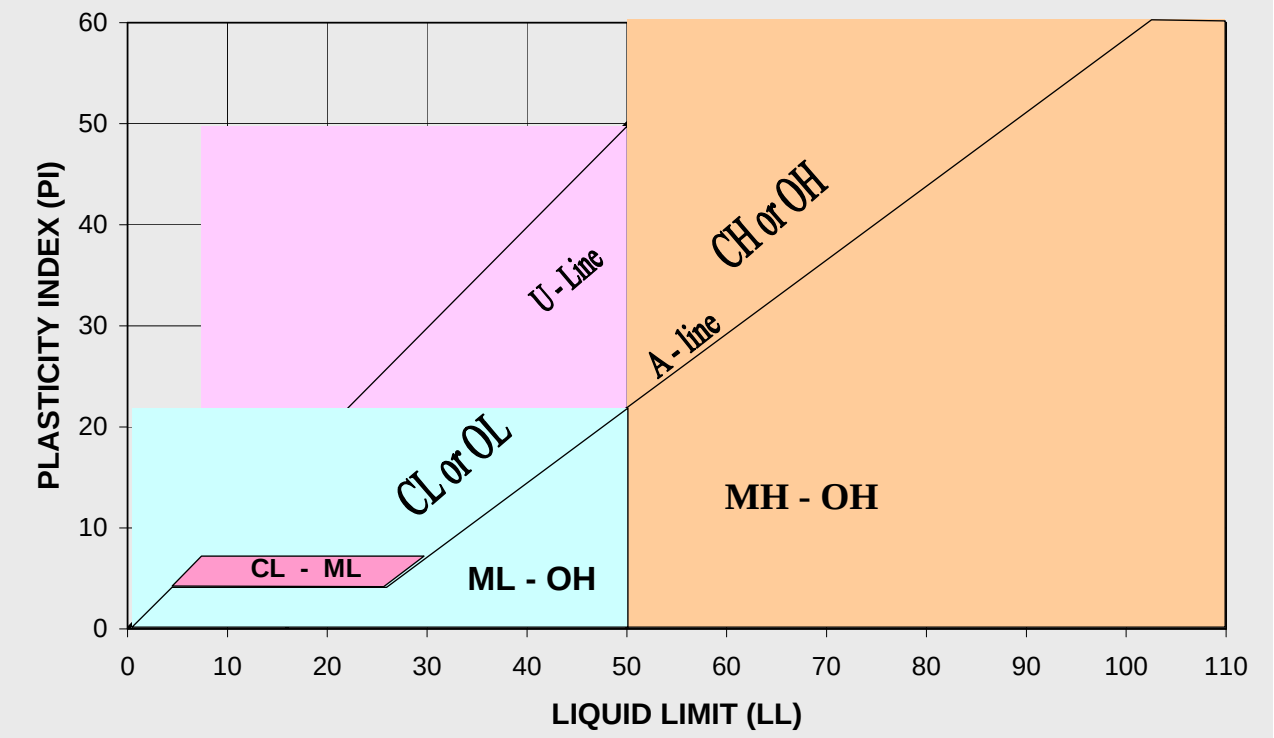
Chapter 2
Soil Investigations and Evaluation

- Very few significant changes
- Still uses Unified Soil Classification (USC) system
  - Reference to ASTM 2487

GW	CL
GP	ML
GM	OL
GC	CH
SW	MH
SP	OH
SM	PT
SC	

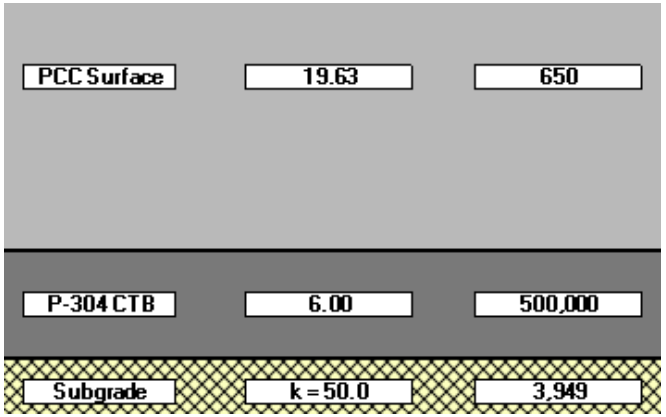


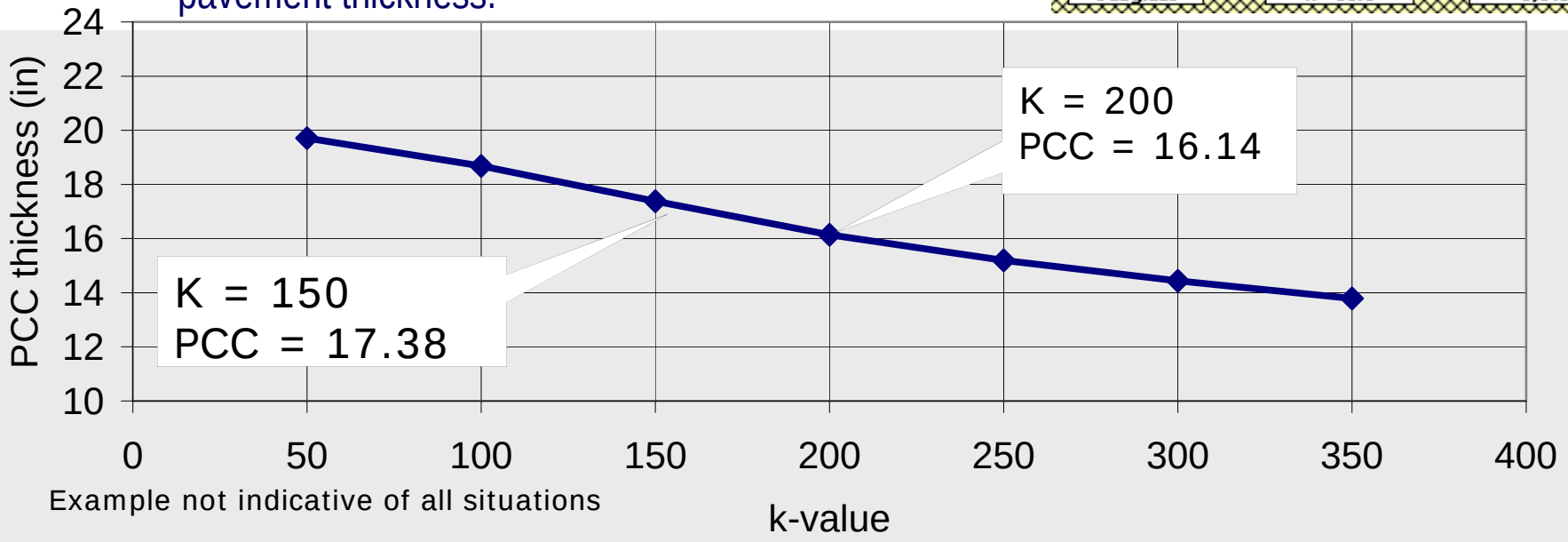
Chapter 2
Soil Investigations and Evaluation

Soil Strength Parameter for RIGID pavement

k-value (pci)

With the 3D finite element design procedure the sensitivity of k-value to rigid design is increased. Errors in selection of k-value can generate noticeable changes in the required pavement thickness.





Example not indicative of all situations

Modulus of Subgrade Reaction – k-value (pci)

- Removed the statement:

  "*Rigid pavement is not too sensitive to k-value and an error in estimating k will not have a large impact on rigid pavement thickness*"

  Design comparisons show that FAAFIELD thickness design is more sensitive to k-value (converted to E) than the previous Westergaard-based procedure.

Chapter 3
Pavement Design

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Chapter 3 - Pavement Design

- Completely New Chapter
- Covers standard pavement design procedures for both flexible and rigid pavement
- Applies to pavement designed for airplanes with gross weights exceeding 30,000 lbs
- Design procedure requires the use of computer program, i.e. FAARFIELD

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Chapter 3 - Pavement Design

- Rigid Pavement Design based on 3-Dimensional Finite Element model
  - Westergaard design procedure no longer used.
- Flexible Pavement Design based on Layered Elastic design procedure
  - US Corp of Engineers CBR Method no longer used

Traffic Models

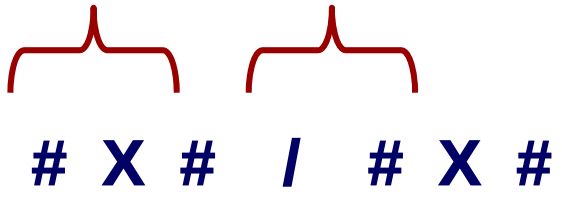
- New procedures require that ALL anticipated traffic be included in the traffic model.
- Concept of “design aircraft” is no longer used
- Cumulative Damage Factor (CDF) replaces need for design aircraft procedure.

Traffic Model – Airplane Characteristics

- FAARFIELD program currently provides 198 different aircraft models
- Each model is unique with respect to gross load, load distribution, wheel spacing, and tire pressure
- Gear types identified in accordance with FAA Order 5300.7
  - Eliminates “widebody” terminology

Traffic Model – Gear Naming Convention

Main Gear Designation Body/Belly Gear Designation



# of gear types in tandem

(A value of 1 is omitted for simplicity.)

Gear type, e.g. S, D, T, or Q

# of main gears in line on one side of the aircraft

(Assumes gear is present on both sides. The value indicates number of gears on one side. A value of 1 is omitted for simplicity.)

Total # of body/belly gears

(Because body/belly gear may not be symmetrical, the gear must identify the total number of gears present and a value of 1 is not omitted if only one gear exists.)

Gear type, e.g. S, D, T, or Q

# of gear types in tandem

(A value of 1 is omitted for simplicity.)

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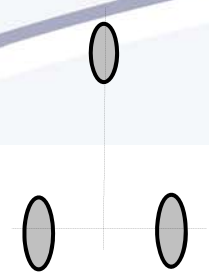
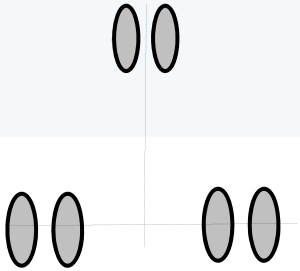
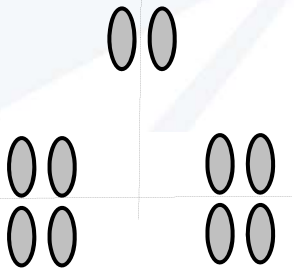
Chapter 3 - Pavement Design -- Examples



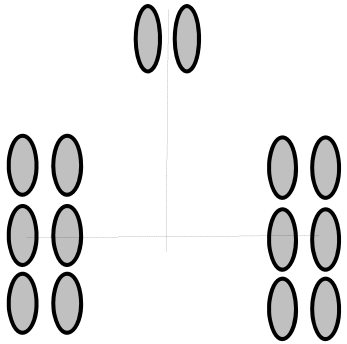
S
Single Wheel



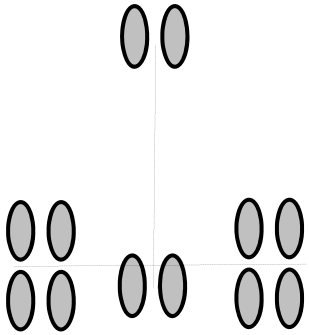
D
Dual Wheel



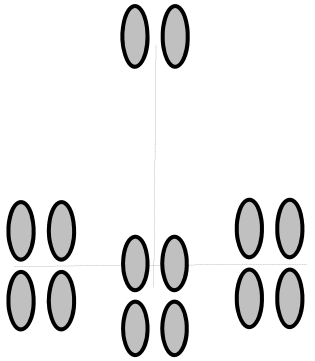
2D
Dual Tandem



3D
B777



2D/D1
DC-10



2D/2D1
A340-600

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Traffic Model – Pass to Coverage (P/C) Ratio

- Lateral movement is known as airplane wander and is model by statistically normal distribution.
  - Standard Deviation = 30.435 inches (773 mm)
- (P/C) -The ratio of the number of trips (or passes) along the pavement for a specific point on the pavement to receive one full-load application.
- -6E utilizes new procedure for determining P/C

Traffic Model – Pass to Coverage (P/C) Ratio

- Rigid Pavement

  One Coverage = One full stress application to the bottom of the PCC layer

- Flexible Pavement

  One Coverage = One repetition of maximum strain at the top of the subgrade layer

Traffic Model – Pass to Coverage (P/C) Ratio

- -6E (FAARFIELD) uses the concept of “Effective Tire Width”
- Rigid Pavement – Effective width is defined at the surface of the pavement (equal to tire contact patch)

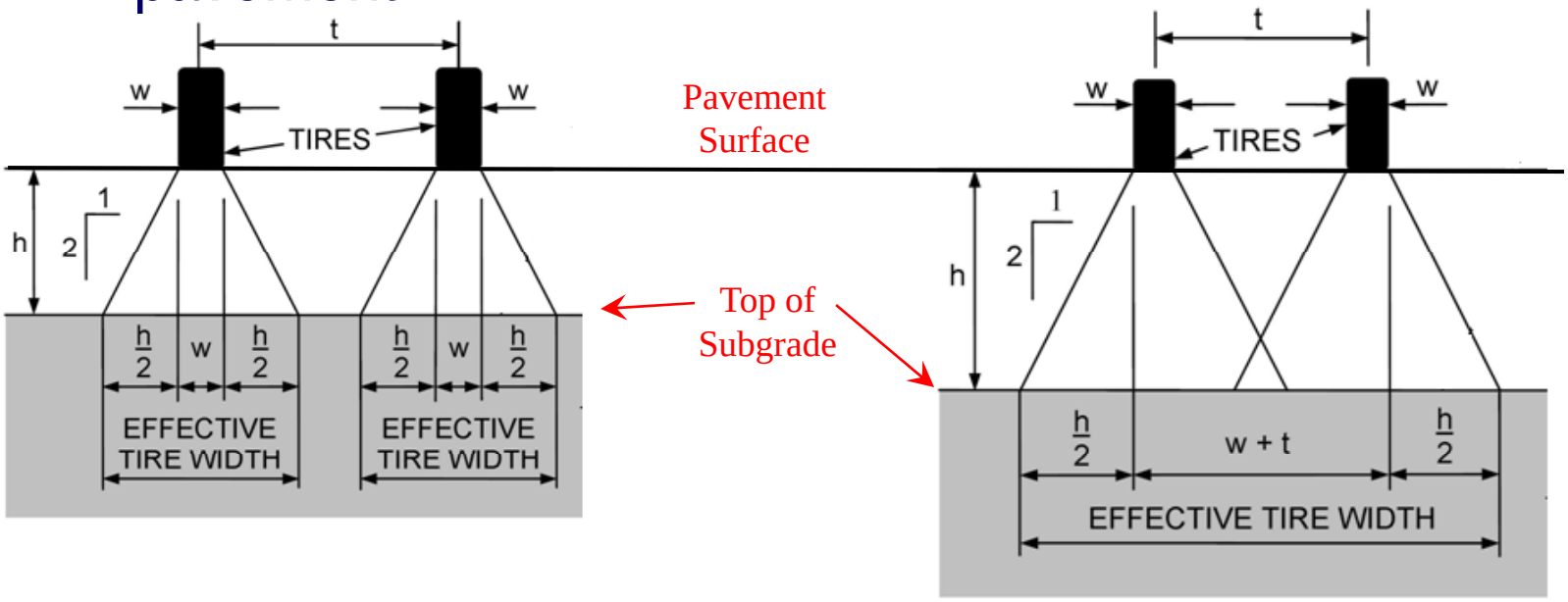
  (same as previous P/C procedures)

- Flexible Pavement – Effective width is defined at the surface of the subgrade layer

Chapter 3 - Pavement Design

Traffic Model – Pass to Coverage (P/C) Ratio

Flexible pavement P/C ratio varies with depth of pavement



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Chapter 3 - Pavement Design – Frost Design

FROST DESIGN - 3 options

- Complete Frost Protection
  - Remove frost susceptible materials to below frost depth
- Limited Frost Protection
  - Remove frost-susceptible material to 65% frost depth
  - Limits frost heave to tolerable level
- Reduced Subgrade Strength
  - Reduce subgrade support value
  - Design adequate load carrying capacity for weakened condition

Chapter 3 Section 3 – Rigid Pavement Design

Traffic Input for Rigid Pavement Design

- Airplane characteristics
  - 198 Airplane models currently available in FAARFIELD
  - Wheel load – determined automatically based on gross weight
  - Wheel locations – Internal to FAARFIELD aircraft library
  - Tire pressure – Internal to FAARFIELD
- Frequency of load application
  - Entered as annual departures
    - Arrival traffic ignored
    - User determines percent of total airport volume

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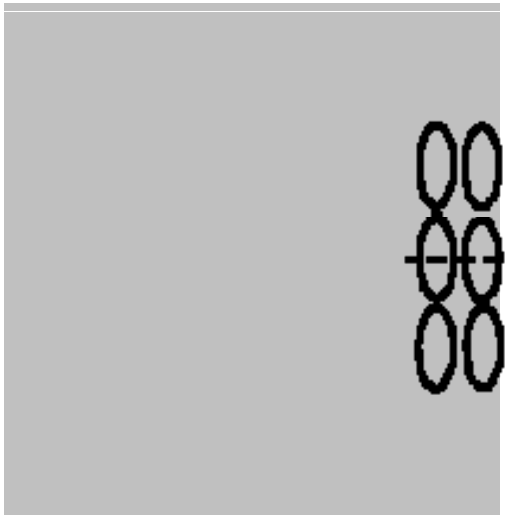
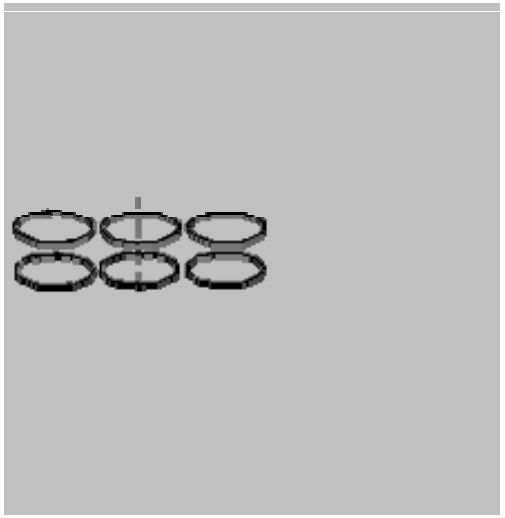
Chapter 3 Section 3 – Rigid Pavement Design

FAArfield – Gear Alignment on slab edge

- FAARFIELD either places the gear perpendicular or parallel to the edge of a slab.
- FAARFIELD makes this determination.





Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

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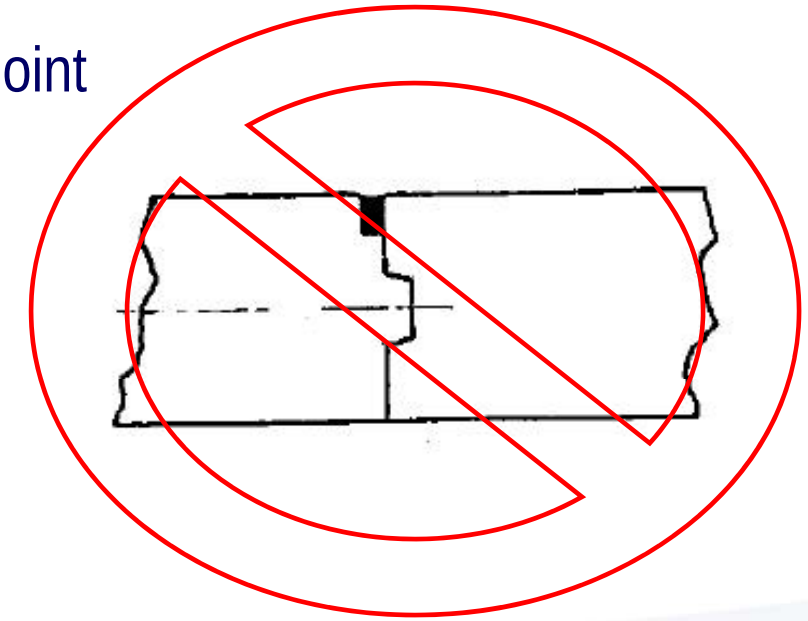
Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

- 5 joint types provided in 5320-6E
  - Isolation Joints
    - Type A – Thickened Edge
    - Type A-1 Reinforced Isolation Joint
  - Contraction Joints
    - Type B – Hinged
    - Type C – Doweled
    - Type D – Dummy
  - Construction Joints
    - Type E – Doweled



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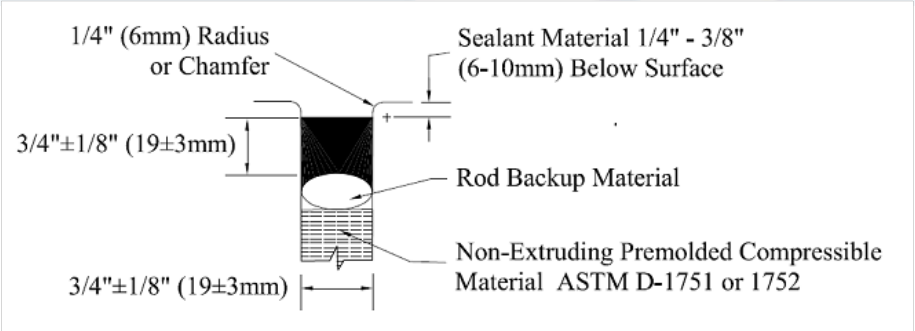
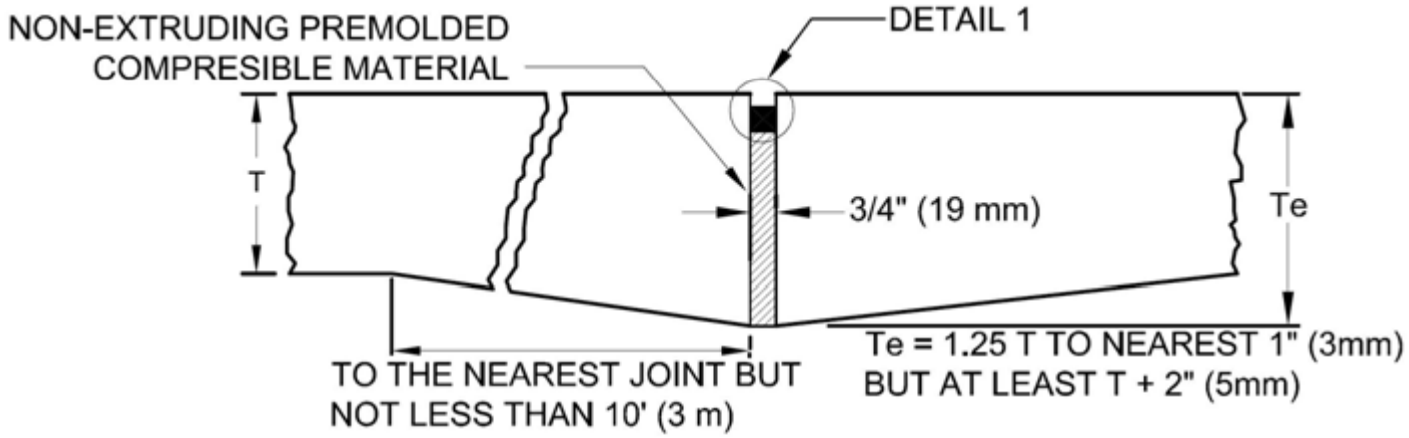
Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

- Isolation Joints
  - Type A – Thickened Edge





TYPE A THICKENED EDGE

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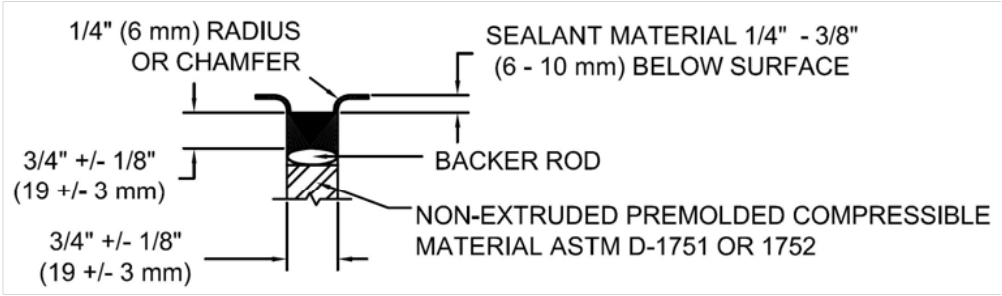
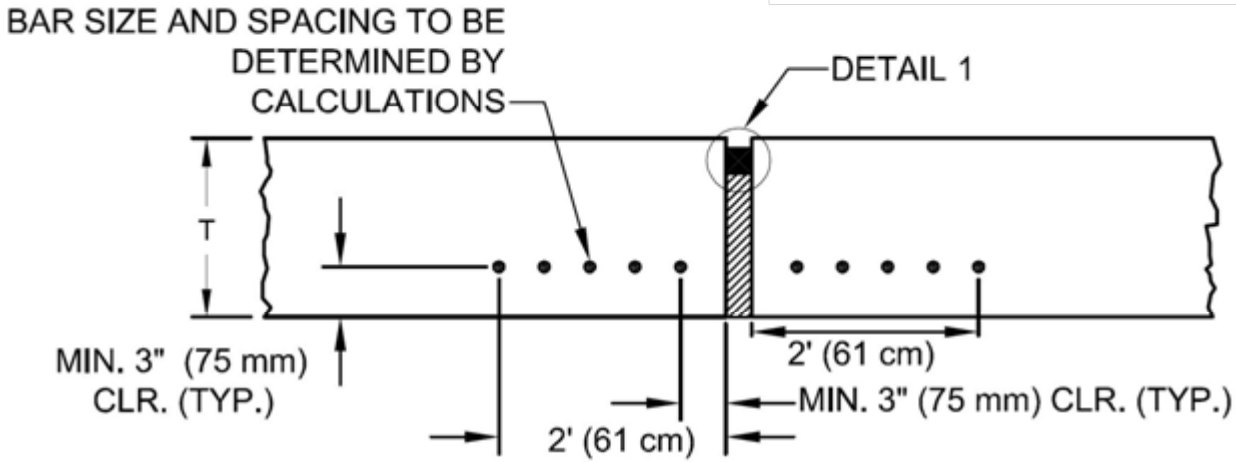
Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

- Isolation Joints
  - Type A-1 – Reinforced





TYPE A-1 REINFORCED

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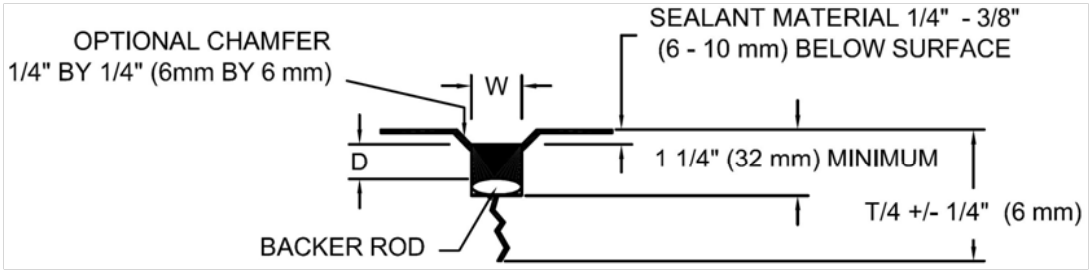
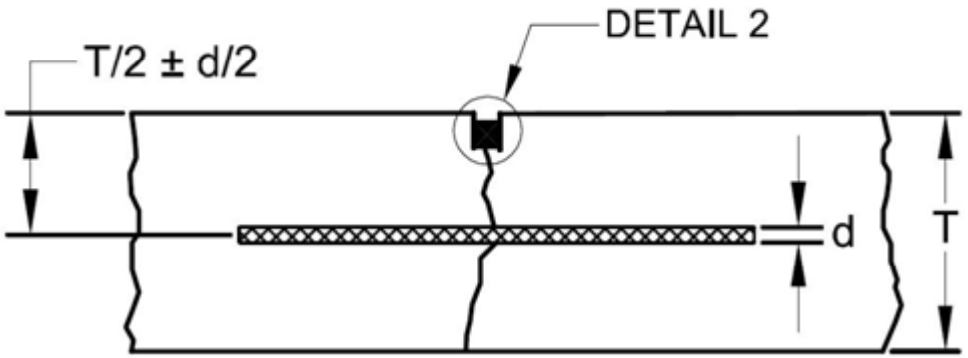
Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

- Contraction Joints
  - Type B – Hinged





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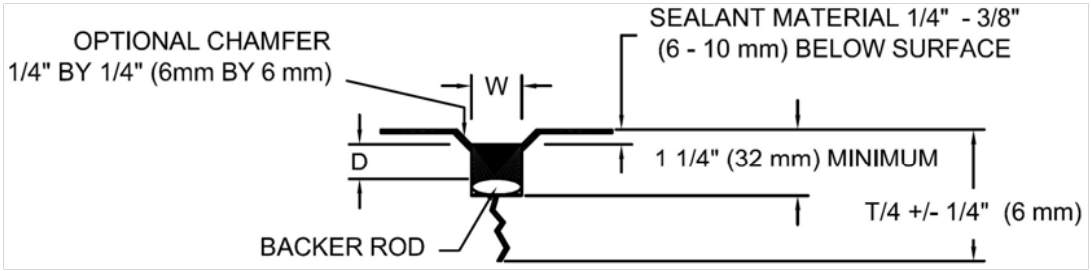
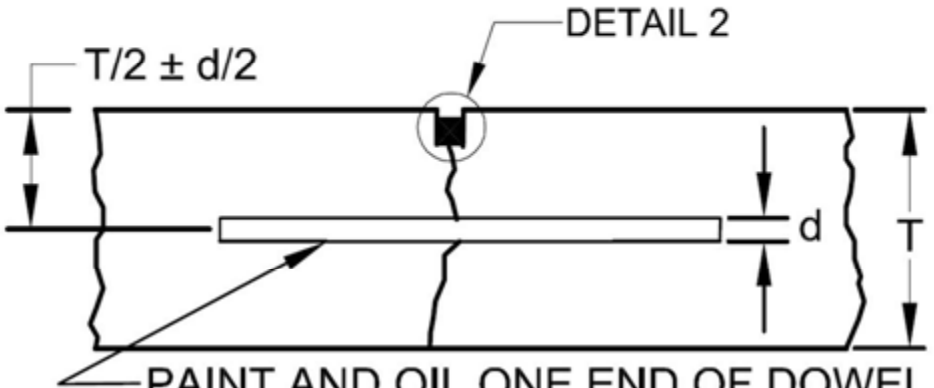
Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

- Contraction Joints
  - Type C – Doweled





TYPE C DOWELED

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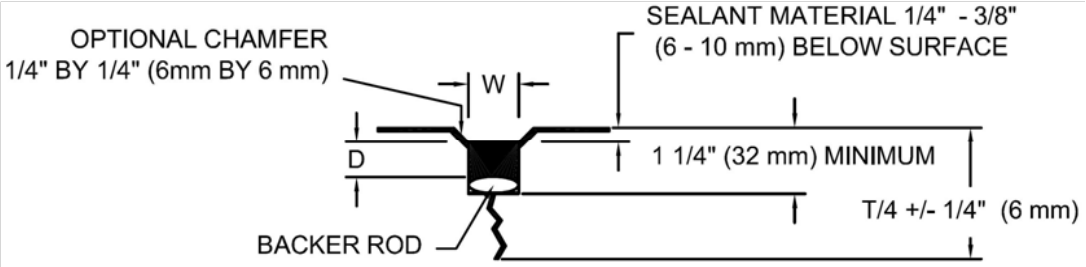
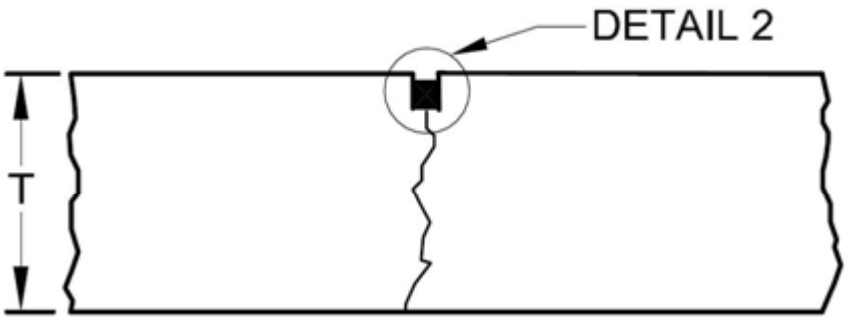
Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

- Contraction Joints
  - Type D – Dummy





TYPE D DUMMY

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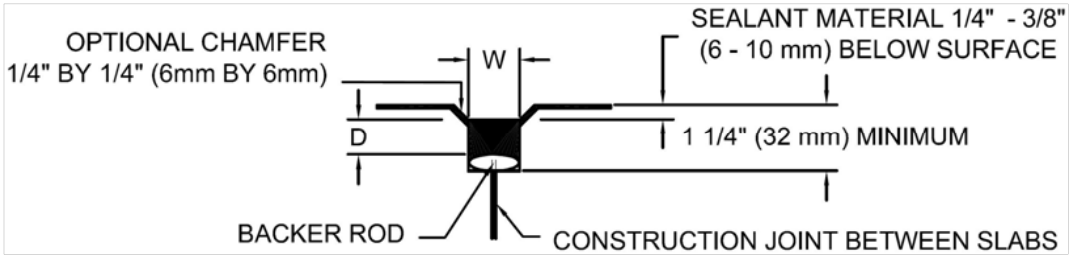
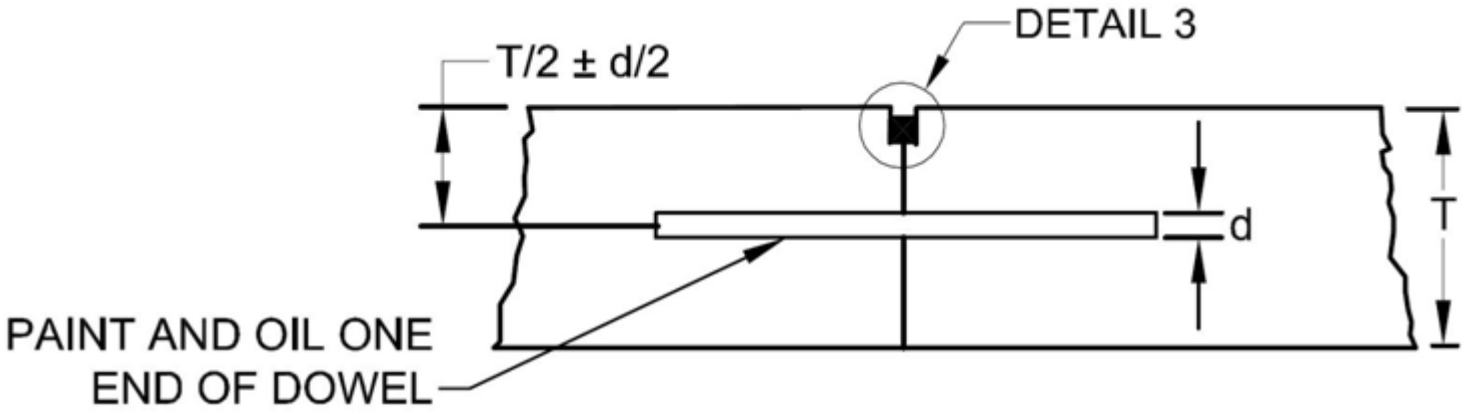
Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

- Construction Joints
  - Type E – Doweled





TYPE E DOWELED

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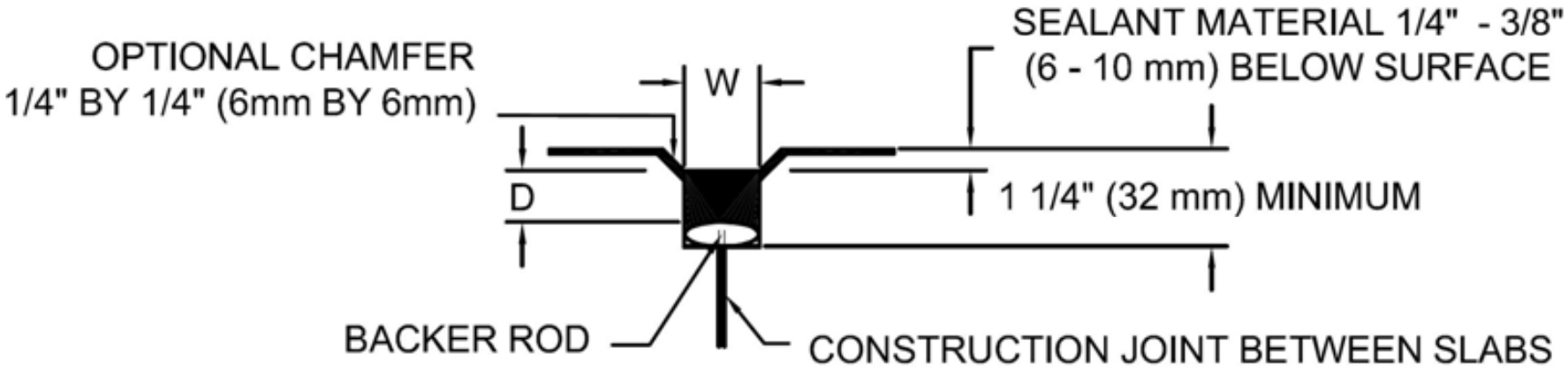
Chapter 3 Section 3 – Rigid Pavement Design

Rigid Pavement Joint Types and Details

- Beveled Joint Detail
  - Intended to reduce chipping and spalling attributed to snow plows



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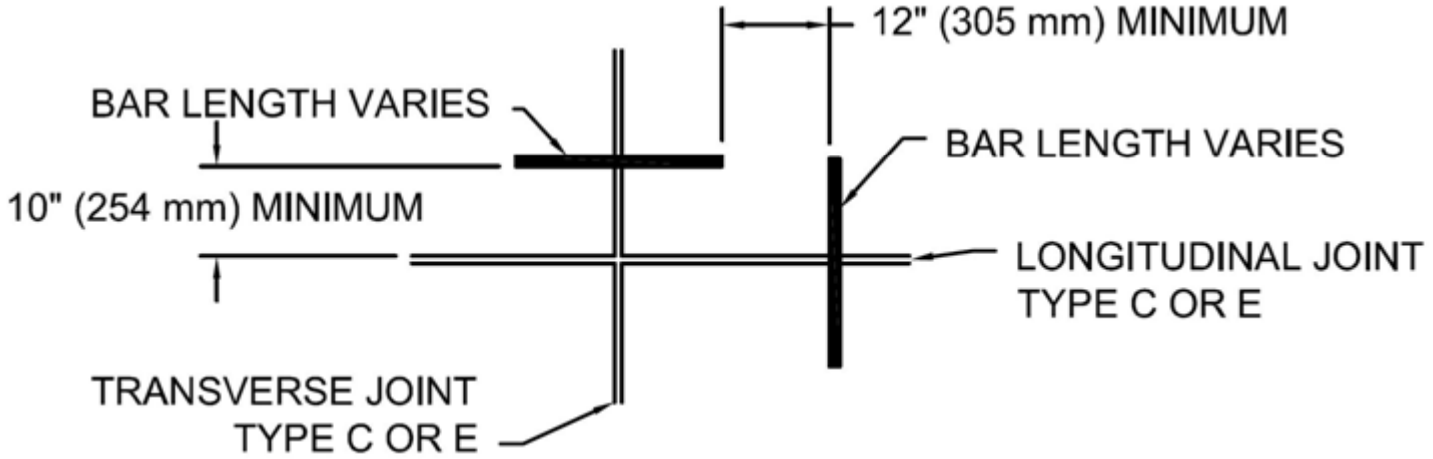
Chapter 3 Section 3 – Rigid Pavement Design

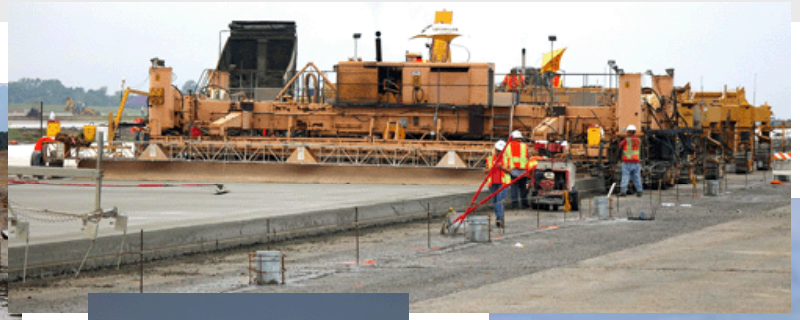
Rigid Pavement Joint Types and Details

- Dowel Bar Spacing at Slab Corner



CHAPTER 4

AIRPORT PAVEMENT OVERLAYS AND RECONSTRUCTION



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Chapter 5
Pavements for Light Aircraft

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CHAPTER 7

PAVEMENT DESIGN FOR AIRFIELD SHOULDERS

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Chapter 7 – Pavement Design For Airfield Shoulders

- Shoulders are primarily intended to provide
  - Protection from erosion and generation of debris from jet blast
  - Support for airplanes running off the primary pavement
  - Enhanced drainage

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Chapter 7 – Pavement Design For Airfield Shoulders

Shoulder must provide sufficient support for unintentional or emergency operation of any airplane in the traffic mix.

Must also provide support for emergency and maintenance vehicle operations

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Chapter 7 – Pavement Design For Airfield Shoulders

Shoulder Design Procedure – Material Requirements

- Asphalt
  - P-401/403 or similar local material specifications
  - Minimum compaction target density – 93% max theo. density
  - Minimum thickness = 3 inches
- Portland Cement Concrete
  - P-501 or similar local material specifications
  - Minimum flexural strength = 600 psi
  - Minimum thickness = 6 inches

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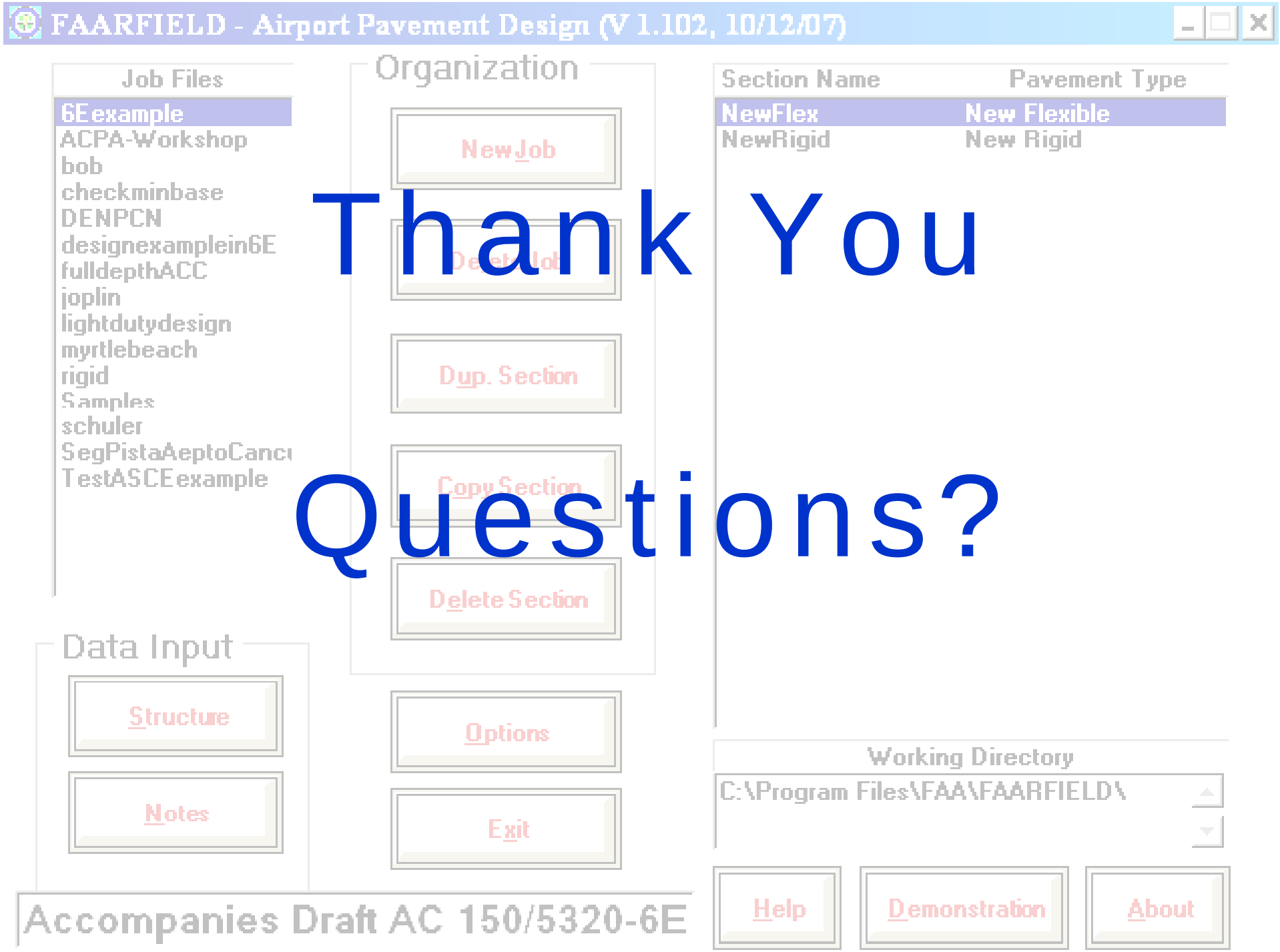

Thank You

Questions?