AMAP 2002-San Antonio, Texas

Grade Bumping: General Recommendations and Practical Considerations

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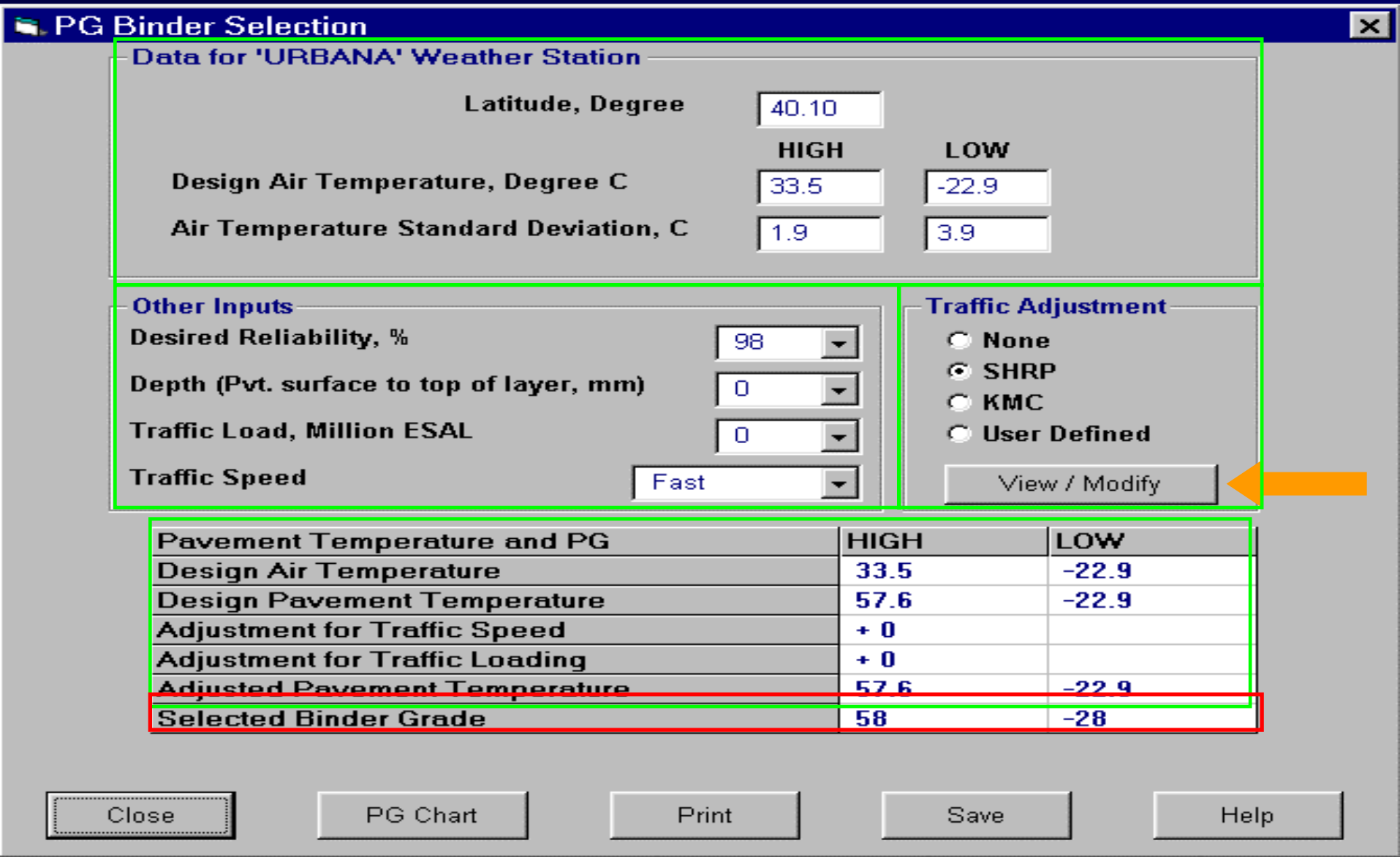
Presentation Topics:

- Standard grade bumping criteria
- Considerations for:
  - Traffic control
  - Perpetual pavement concept
  - Thin-surfaced pavements

Binder ETG White Paper,
17 April 2001

- Refers to LTPPBind Software (Vers. 2.1)
  - ETG recommends min. reliability of 98% for 20 year traffic exceeding 300k ESAL
- Allows user to select algorithm
  - SHRP
  - Koch Materials Company (KMC)
  - User defined

PG Binder Selection Screen



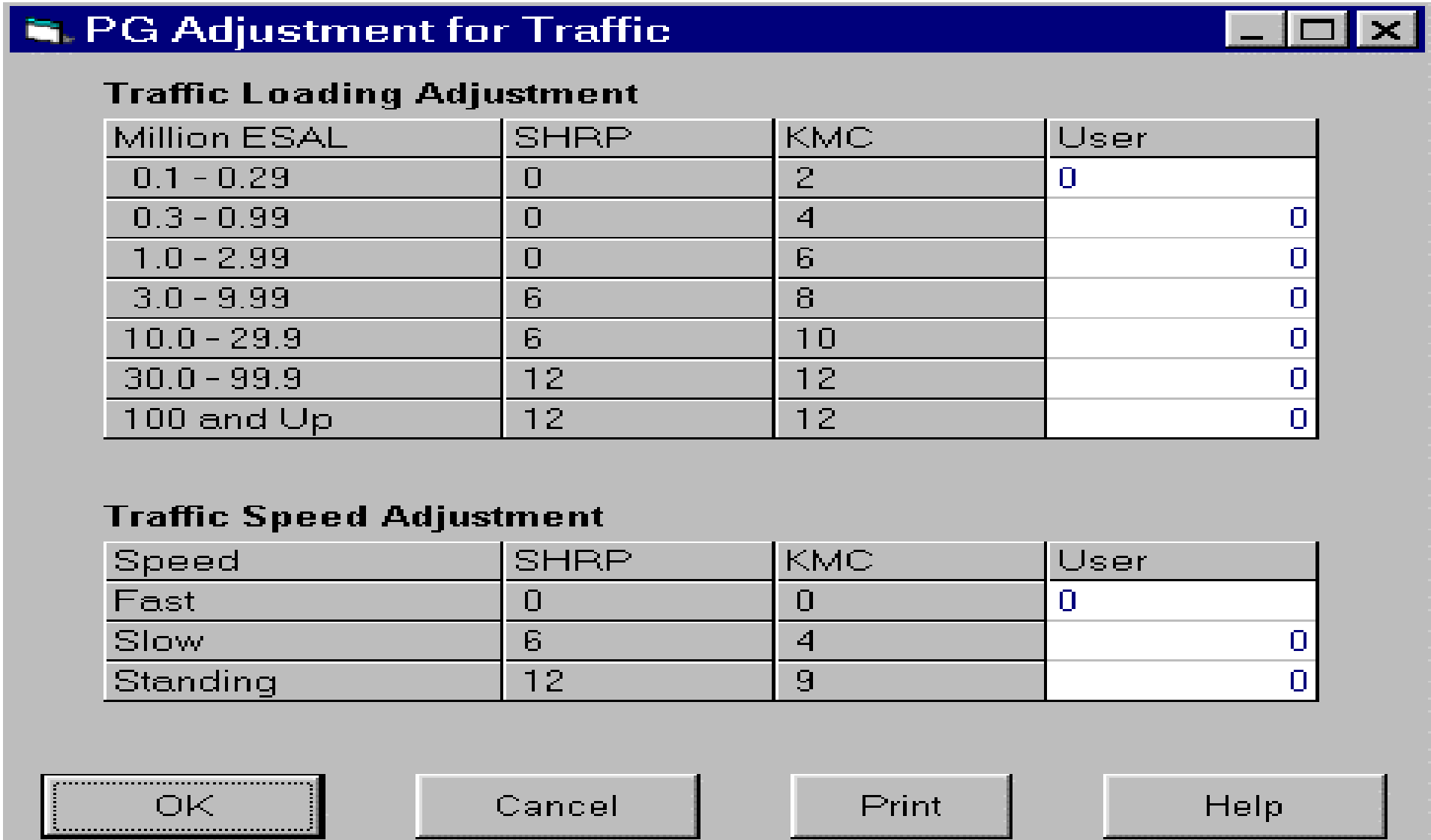
SHRP Recommendations

- Based on:
  - Anticipated traffic loading (ESAL)
  - Traffic speed
- Increased loading levels result in “bumped” high temperature grades
  - > 3 million ESAL…increase one grade
  - > 30 million ESAL…increase two grades
- Slow moving loads…increase one grade
- Standing loads…increase two grades

KMC Recommendations

- Effectively increases pavement temperature for traffic amount and speed
- Adds 4° C for 10-fold increase in ESAL beginning at 100,000 ESAL
- Adds 4°C for slow moving traffic, 9°C for standing traffic

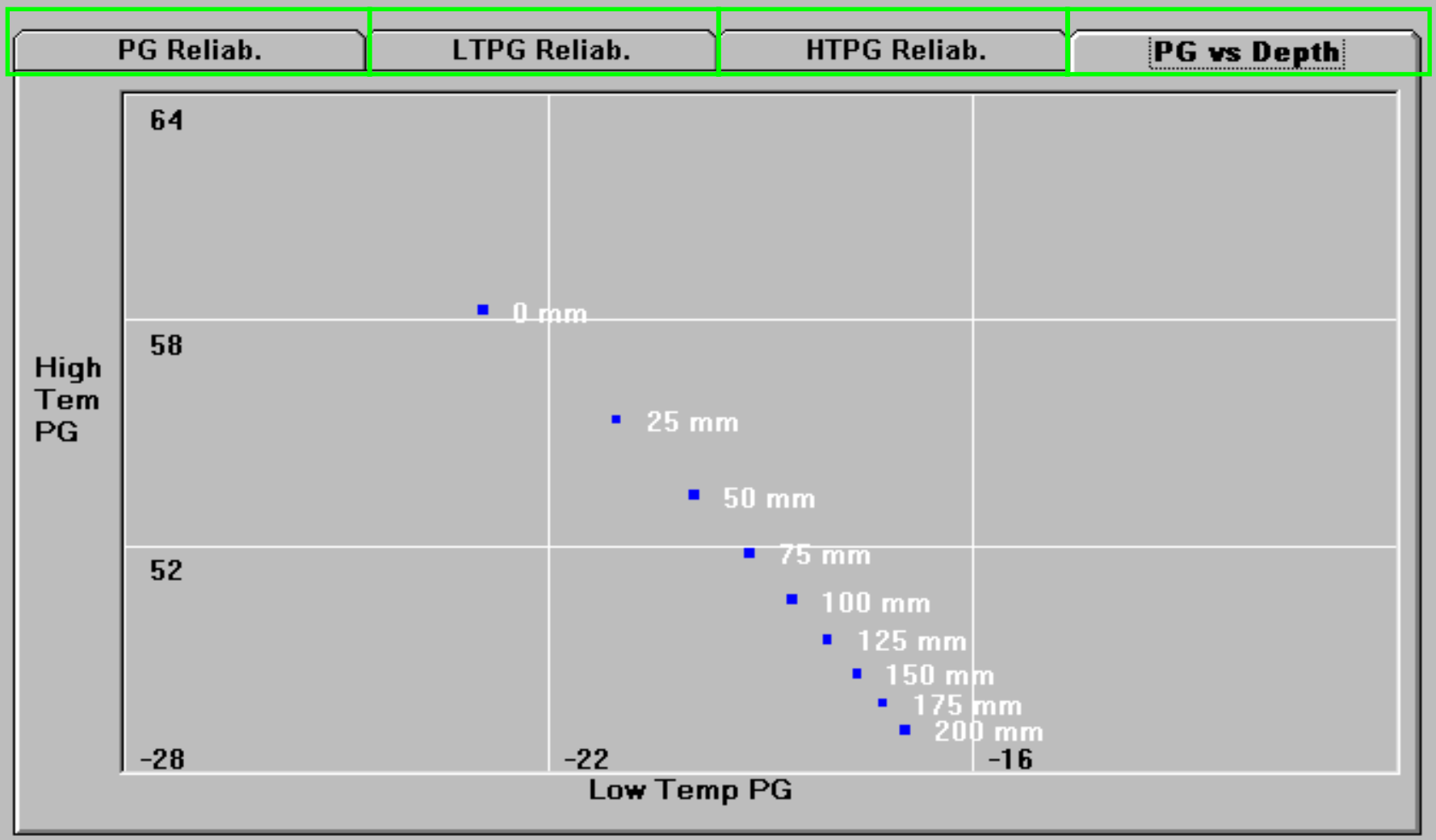
PG Adjustment (Grade Bumping)



Variation with Depth

- As temperatures moderate below surface, binder grades can be selected accordingly
- “Bumped” HT grades usually recommended for upper 100 mm (4 inches) of pavement

PG versus Depth



What other conditions may warrant grade bumping?

- Construction sequence, stage construction
- The need to stiffen HMA layers to reduce total thickness
  - Concept employed in Europe, likely to be applied with “Perpetual Pavements”
  - Stiff structure, stiff binder approach
- Does “bumping” only apply to high temperature grade?

Construction Considerations

- Most construction involves rehabilitation/ reconstruction of existing pavements
- Necessary to utilize newly placed intermediate layers for handling traffic

US-40 Intersection Reconstruction
Elkton, MD

I-40 PCC Stabilization, Overlay
N. Little Rock, AR

Perpetual Pavement Concept

- Limit flexural strain @ bottom of asphalt layer and vertical strain @ top of subgrade
- Result: Indefinite fatigue life, no rutting in subgrade

Perpetual Pavement Concept

ASPHALT INSTITUTE

I-35, Waco

1.5-3 in. OGFC, SMA, etc. — PG 76-22

3" to 6" *High Shear Zone* — PG 76-22

High Modulus Rut Resistant Material (Varies As Needed) — PG 70-22

Flexible Fatigue Resistant Material ~25% of total thickness — PG 70-22

Max Flexural Strain

Vertical Compressive Strain

Pavement Foundation

Binder Grade Selection Considerations

- Binder stiffness greatly affects mixture stiffness
  - Doubling binder stiffness increases mixture stiffness from 35-50%
- Increase mixture stiffness…reduce critical strains
- Optimize pavement structural design by requiring stiff surface and base layers to reduce total thickness
- AASHTO 2002 Guide appears to be moving toward the use of a stiffness measure (E*) as the link between materials and pavement structural design

Consider the opposite end of the pavement spectrum…

Thin-Surfaced Flexible Pavements

- **Surface must effectively seal underlying base**
  - **Aggregate base is the pavement structure for this type of system**
- **Surface must resist cracking due to:**
  - **Low/cycling temperatures**
  - **Pavement deflection**

Concerns about Grade Bumping

- Not tied to pavement structural design
  - Should consider pavement thickness/performance mode (I.e., thick HMA or thin-surfaced flexible pavement)
- May provide false confidence
  - Binder properties are not the only thing affecting performance!!!
  - Some agencies have not adopted Superpave mixture design system
- What about non-dense graded mixtures?
  - SMA
  - OGFC

Questions, comments?

Teotihuacán, 18 Enero 2002