High Performance Grade (HPG) Binders

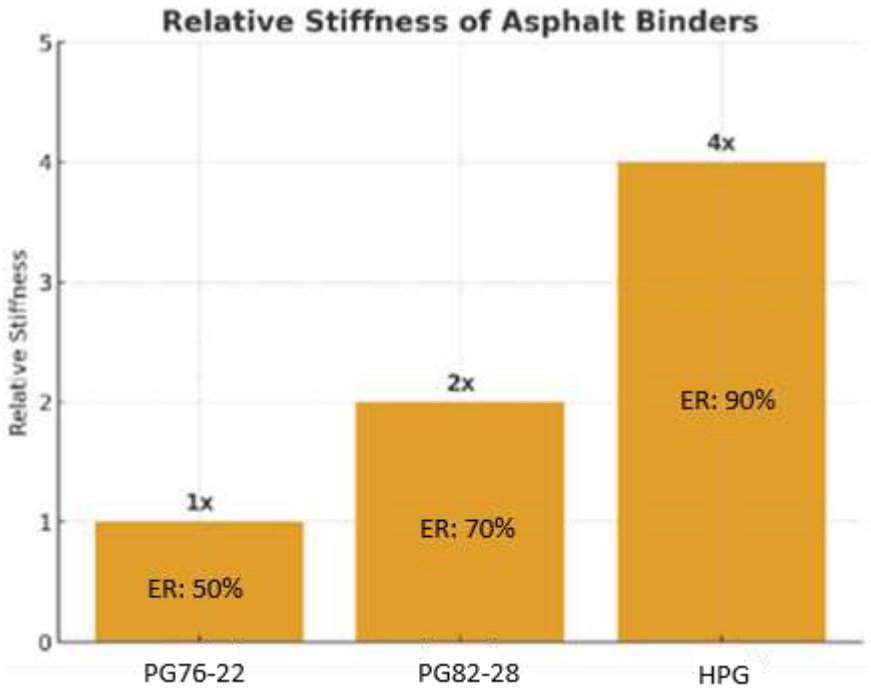
The DOs and DON'Ts

Jim Warren – APEX

Travis Patton, P.E. – 1836 Engineering

What is HPG Binder?

- **HPG = High Performance Graded Binder**
- HPG specification in OTU SP300-002
- Meets/exceeds PG82-28 per Item 300
- Not all PG82-28 qualify (higher elastic recovery/MSCR ≥90%)
- Many HPGs exceed PG88-28
- 4 approved suppliers in Texas



*Stiffness is highly dependent on temperature and loading conditions. This relationship may not be exact.

Performance Characteristics of HPG Binder

- **Increased Stiffness & Rut Resistance**
  Higher polymer content (~7.5% SBS vs. ~3%) → stiffer mix, resists rutting under heavy traffic.
- **Thinner Structural Layers**
  More efficient load carrying → reduced asphalt thickness & material savings.
- **Improved Fatigue Life**
  Maintains stiffness without brittleness → better resistance to cracking, ideal for perpetual pavements.
- **Hot Climate Performance**
  Holds stiffness in extreme heat → extends SMA performance, enables HMA use in high-traffic areas otherwise requiring concrete.

Why is TxDOT Using HPG Binder?

- Statewide need to extend abilities of HMA
- Alternative to CRCP
- AUS: IH-35 Sections
  - Current SMA – performing well with some shallow rutting
  - Traffic projections based on TPP report and WIM
  - 20-year ESALs
    - Section 1: 51.5M ESALs
    - Section 2: 79M ESALs

Exploring HPG Binder—What's the Best Path to Get Started?

Contact: Materials & Tests Division (MTD) – TxDOT

- Gisel Carrasco, Flexible Pavements Section: Gisel.Carrasco@txdot.gov
- Pravat Karki, Asphalt Section: Pravat.Karki@txdot.gov

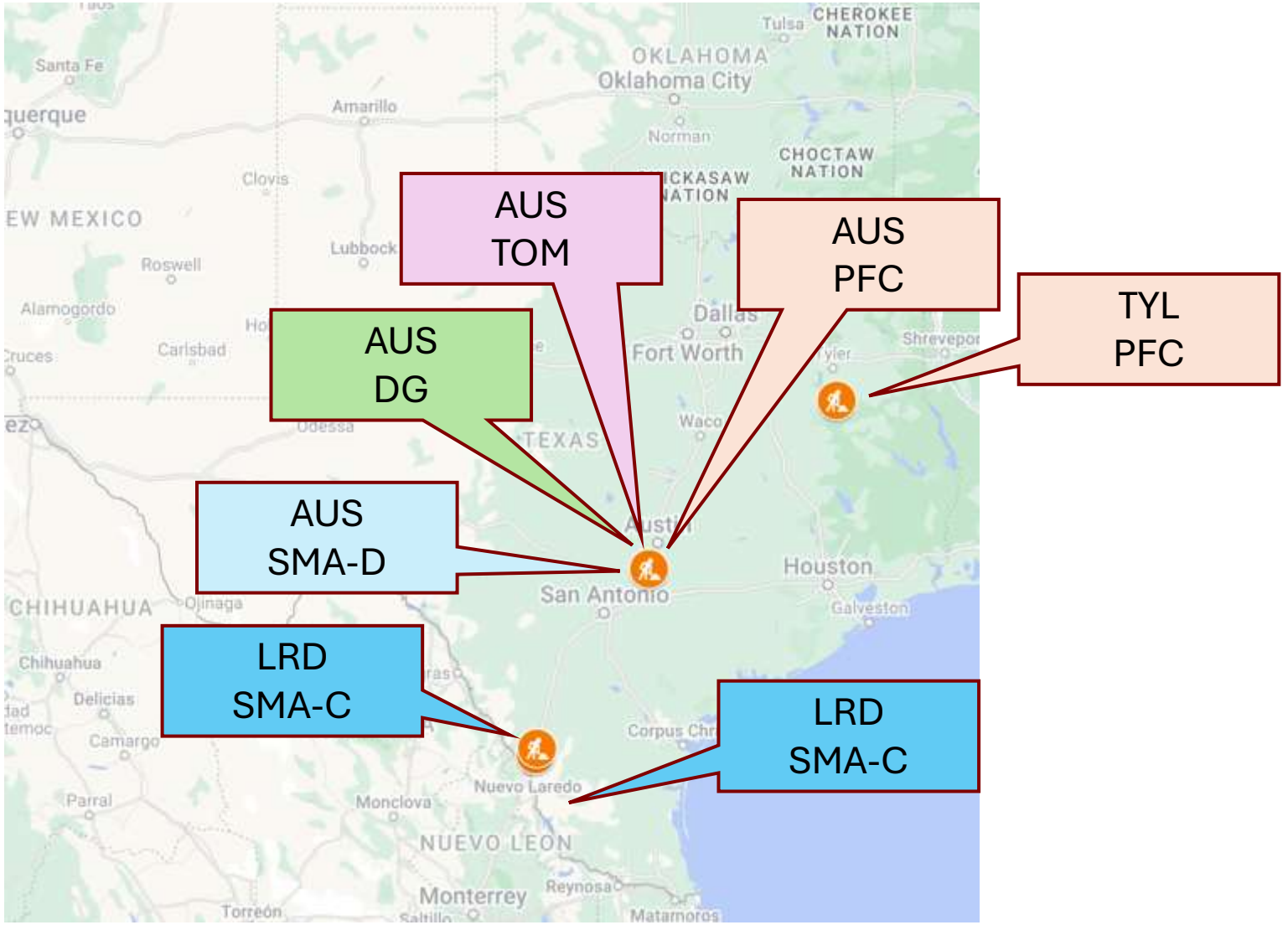
MTD Resources:

- Statewide HPG binder data & availability
- Contract with UT-CTR: Binder testing and spec development
- Contract with TTI: Hamburg testing at 70°C for improved rutting resistance
- Collaboration with Industry, TXAPA, and Academia → maintain best practices and planning guidance

Next Steps:

- Schedule a meeting with all stakeholders to determine if HPG is suitable for your project

Field Mixes


AUS
TOM
AUS
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DG
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SMA-D
LRD
SMA-C
LRD
SMA-C
Santa Fe
Amarillo
Oklahoma City
Norman
Clovis
Lubbock
Roswell
Alamogordo
Carlsbad
Odessa
Dallas
Fort Worth
Waco
Austin
San Antonio
Houston
Galveston
Corpus Christi
Chihuahua
Delicias
Camargo
Parral
Nuevo Laredo
Monclova
Monterrey
Reynosa
Matamoros
Torreón
CHEROKEE NATION
CHOCTAW NATION
OKLAHOMA
TEXAS
NUEVO LEON
CHIHUAHUA

Completed Projects within Texas

- **Tyler 1 – Longview Asphalt / Madden** (August, 2022)
  - PFC-C
  - No major issues in production or placement. Behaved the same as PG76-22.
- **Laredo 1 – Anderson Columbia** (Feb 27, 2023)
  - SMA-C
  - Minor workability concerns: mix slightly stickier at the back of the screed.
- **Laredo 2 – Texas Materials** (May 4, 2023)
  - SMA-C
  - Initial binder load fine.
  - Second binder load had workability issues, likely due to plant shutdown and cold mix on the road.

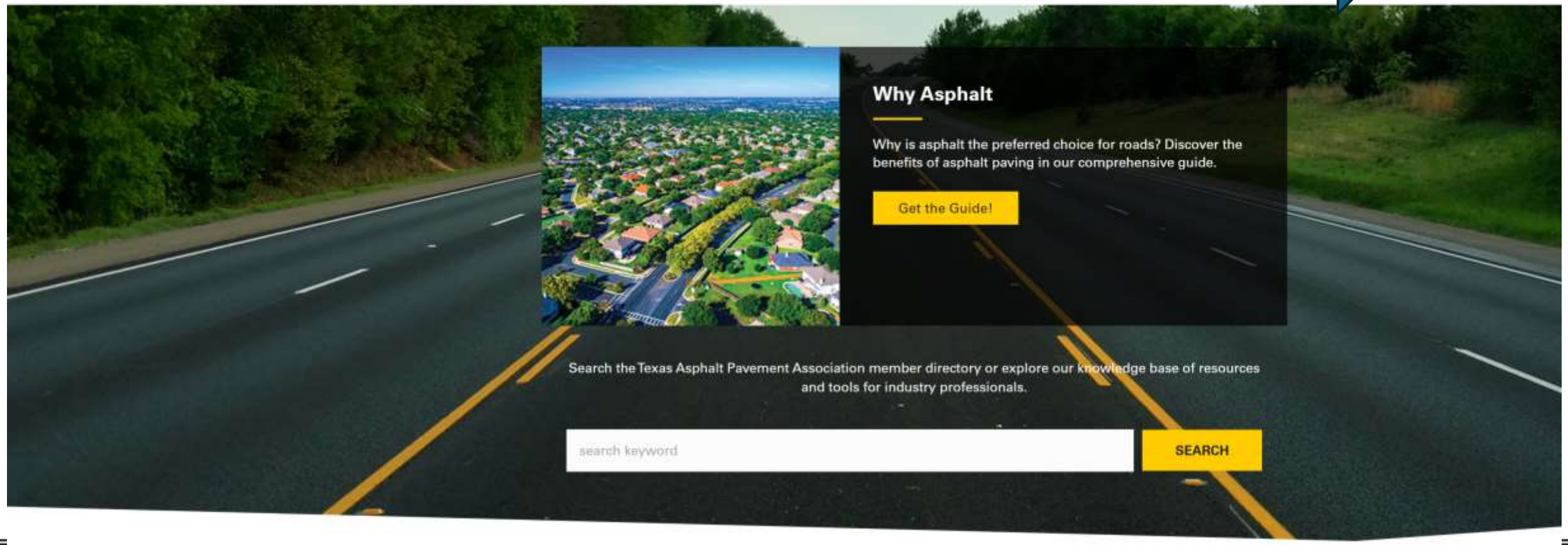
Completed Projects within Texas (cont.)

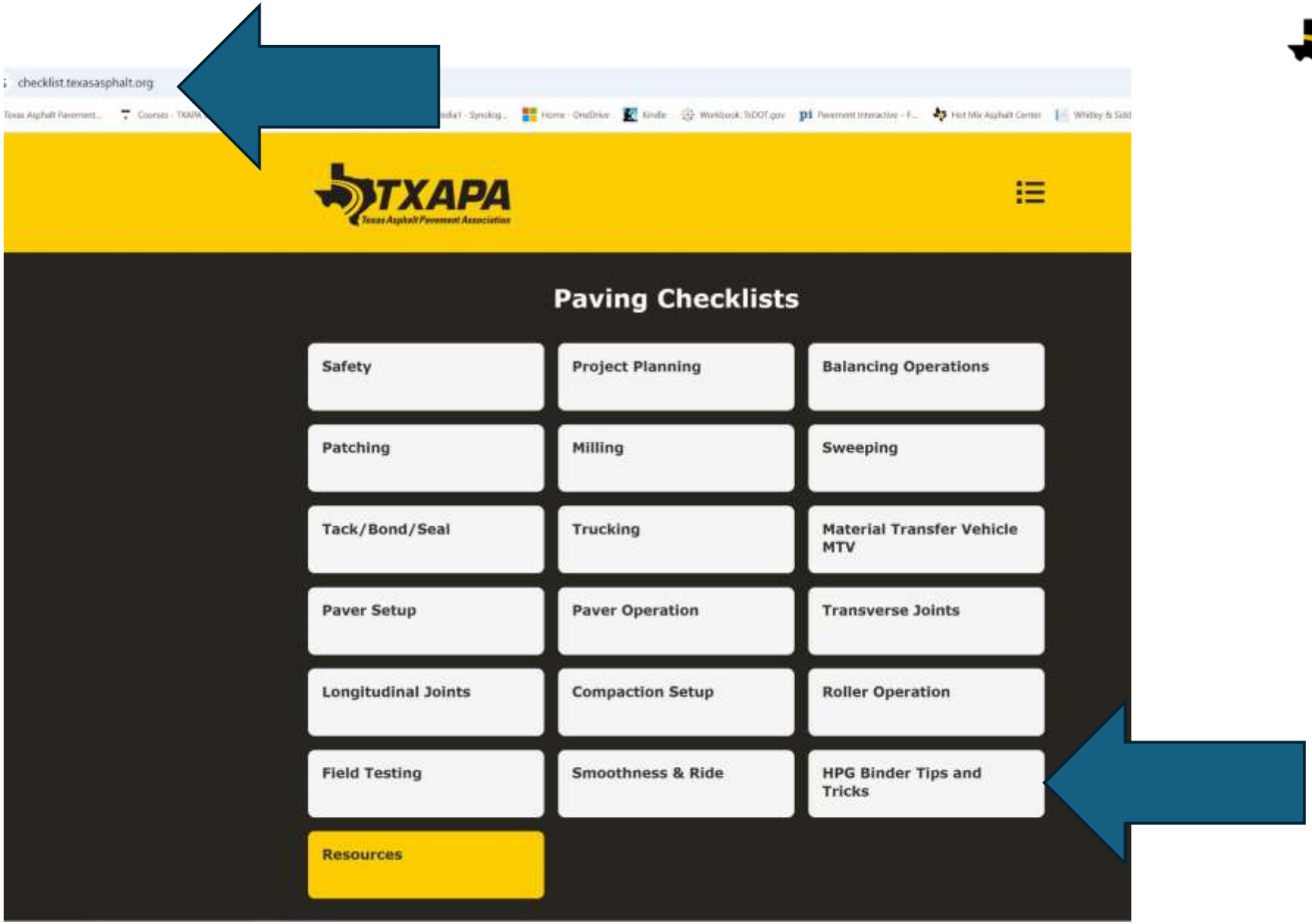
- **Austin 1 – Texas Materials** (May 22, 2023)
  - SMA-D I-35 Kyle
  - Windrow pick up issue when mix <270F.
  - Mix noted as slightly stickier.
- **Austin 2 – Lone Star Asphalt** (Fall 2024)
  - TOM Trial 130 Austin
    - Keep paver moving
  - 6-inch single Thick lift Demo SP – C Test Strip at Plant
    - No problems with density
  - PFC on 103 Austin
    - Keep plenty of trucks
    - Keep paver moving
- **Austin 3 – Hunter Materials** (Spring 2025)
  - Mill and SMA Fill – Downtown I-35
  - Minor fat spots
  - Looks good and rides good.

HPG Tips and Tricks

texasasphalt.org

RESOURCES




checklist.texasasphalt.org
TXAPA
Texas Asphalt Pavement Association
Paving Checklists
Safety
Project Planning
Balancing Operations
Patching
Milling
Sweeping
Tack/Bond/Seal
Trucking
Material Transfer Vehicle MTV
Paver Setup
Paver Operation
Transverse Joints
Longitudinal Joints
Compaction Setup
Roller Operation
Field Testing
Smoothness & Ride
HPG Binder Tips and Tricks
Resources

HPG BINDER
Tips and Tricks

Thanks to Anderson-Columbia, Hunter Industries, Lone Star Asphalt, Madden Contracting, and Texas Materials for their project feedback.

PLANNING:

- HPG should only be used on interstates, limited access roads, or straight runs. It doesn't rake or compact well in areas that must be hand worked.
- Ordering Binder
  - Check with supplier on lead time for ordering and during production.
  - Is there a minimum load order for HPG binder?
- Trial Batch: Find another section or mix to put remainder of trial batch binder in. Don't let sit in the tank for extended period.
- Production: Daily communication and feed from field to plant to supplier. Report any changes in consistency immediately to all. Keep binder supplier in the loop at all times, Group chat.
- Plan your work to run this mix daily until complete. Don't piece meal HPG mix.
- Repairs: have critical spares available for plant and field equipment.
- Debrief daily and after project ends

TEMPERATURES:

- Binder delivery – min of 350°F
- Binder Storage – 350-375°F
- Mix Discharge/Loadout: 340-350°F
- Windrow/Hopper –335-345°F
- Behind Screed – 300-310°F
- Ambient: Consider 80°F a minimum for thin layers or seasonal limitations.

ASPHALT PLANT:

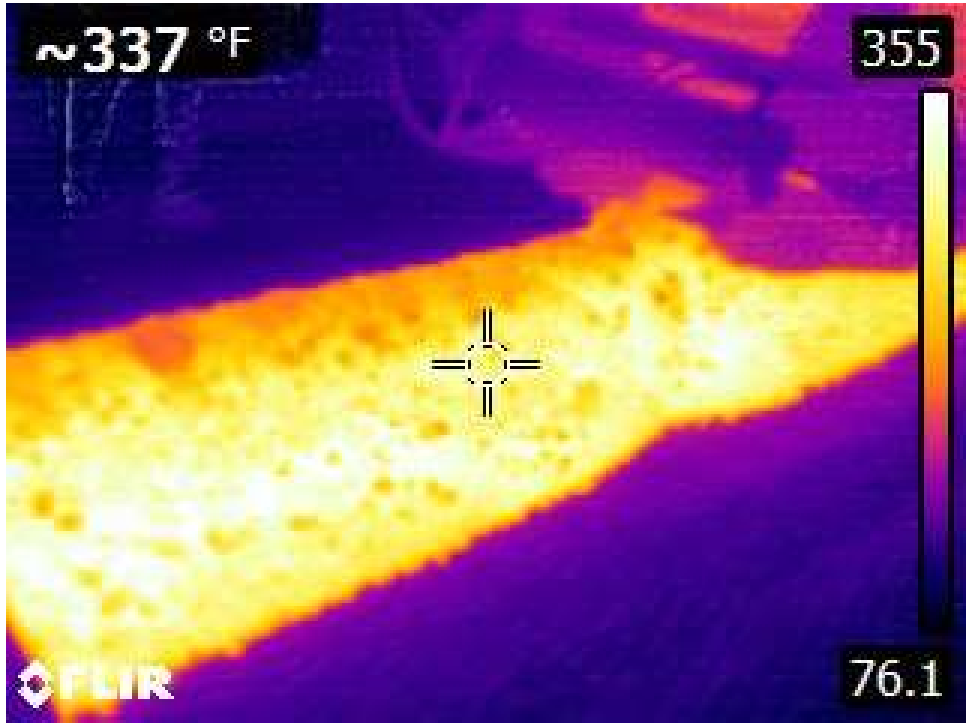
- Equipment: Pumps, Piping, Meters, Motors, and Maintenance. Make sure the piping, pumps, and meters can handle very high viscosity liquids. LS: 3 inch pump worked.
- HPG can be 4 times as stiff as a PG 76-22. Make sure your plant is well maintained as HPG binders are stiff, cool rapidly, and create extra stress on plant components.

HPG Project Planning Guidelines

- **Usage**
  - Interstates, limited-access roads, straight runs only
  - Not for hand-worked areas
- **Binder Ordering**
  - Confirm lead time & minimum load with supplier
- **Trial Batch**
  - Use remainder on another section/mix
  - Don’t let sit in tank
- **Production**
  - Daily communication: Field ↔ Plant ↔ Supplier
  - Report consistency changes immediately
  - Keep supplier in group chat
- **Work Schedule**
  - Run HPG mix daily; no piecemeal application
- **Repairs**
  - Keep critical spares ready for plant and field equipment
- **Debrief**
  - Daily and post-project reviews

HPG Temperature Guidelines

- **Binder**
  - Delivery: ≥ 350°F
  - Storage: 350–375°F
- **Mix Handling**
  - Discharge/Loadout: 340–350°F
  - Windrow/Hopper: 335–345°F
- **Placement**
  - Behind Screed: 300–310°F
- **Ambient Consideration**
  - Minimum 80°F for thin layers or seasonal limitations



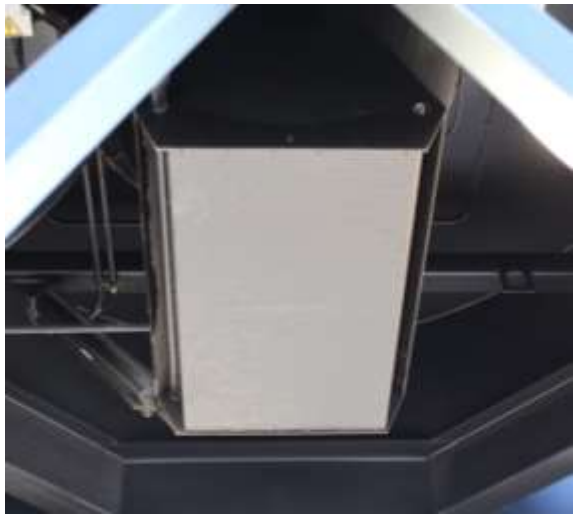
HPG Asphalt Plant Guidelines

- **Equipment & Maintenance**
  - Ensure pumps, piping, meters & motors handle high-viscosity liquids
  - HPG = 4× stiffer than PG 76-22 → maintain plant, monitor stress
  - Watch amp draw on drag slat; avoid overloading drum/conveyors
- **Binder Handling & Storage**
  - Unloading: 2–3 hrs; reheat as needed
  - Storage: Use within 2–5 days; stiffness rises after day 5
  - Circulation: Follow supplier guidance
  - Calibrate AC meter; oversize strainer

HPG Asphalt Plant Guidelines (cont)

- **Mix & Production**
  - Test & monitor aggregate moisture; avoid running in rain
  - Heat equipment & aggregate before AC pump on
  - One mix per shift; steady production 175–200 tons/hr
  - High binder mixes (PFC, SMA) are sticky
  - Do not store mix >1 hour; use one silo; load trucks in multiple drops

- **Daily Checks & Procedures**
  - Inspect batcher & silo gates; remove buildup immediately
  - Balance plant/trucks/paver/roller
  - Start-up & shutdown per procedure
  - Shutdown cleanup: run another mix or precoat aggregate through hot drum to help clean out.



HPG Mixture Trucking Guidelines

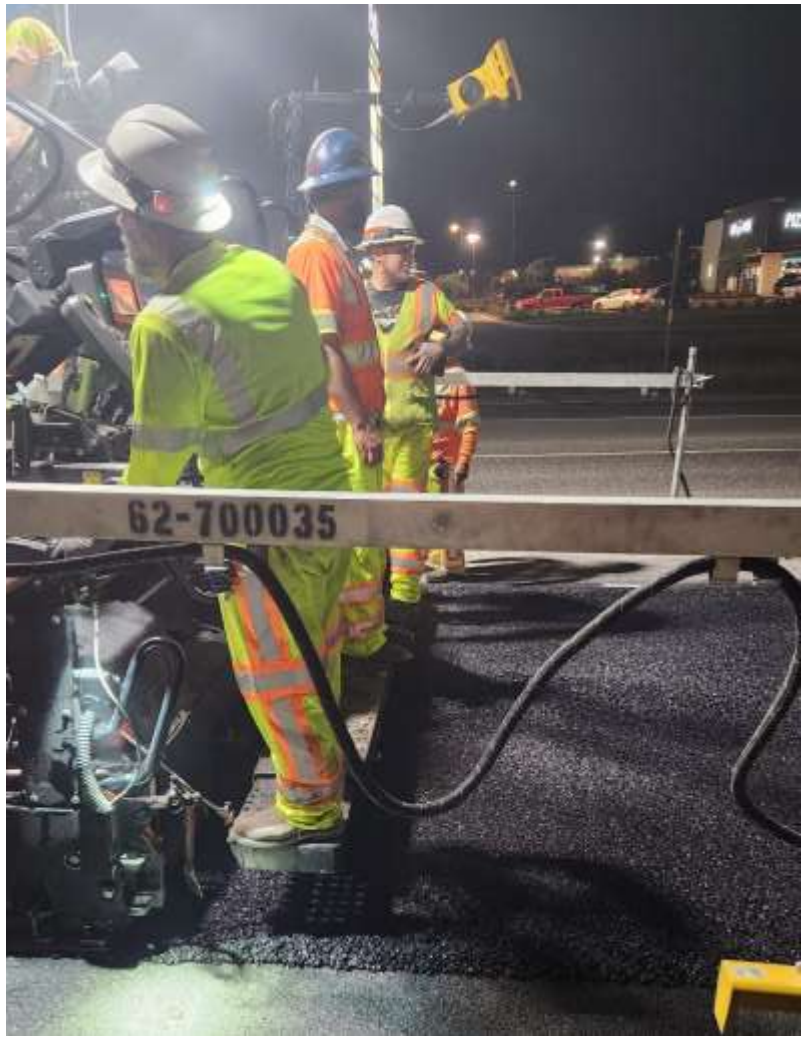
- **Truck Prep & Cleanliness**
  - Ensure trucks are clean before loading
  - Use a truck bed inspector; carry extra release agent
  - Clean buildup immediately; monitor belly dumps for buildup
- **Release Agents**
  - Approved in accordance with DMS-6410
  - Proper type & rate critical
  - No diesel; dry detergent option possible
- **Tarps & Handling**
  - Use tight, waterproof tarps; keep tarped until unloading
  - HPG asphalt chunks (with fibers) don't remelt easily, especially PFC
- **Plant-Truck-Paver Coordination**
  - Ensure enough dedicated trucks; avoid under-trucking
  - Belly dump: unload ½–1 load at a time
  - Overlap windrow between loads for smooth paving

HPG Material Transfer Vehicle Guidelines

- **Mix Characteristics**
  - PFC & SMA mixes are sticky and stiff; thin layers in cool weather are challenging
  - Mix cools quickly; discharge windrow target: 335–345°F
- **Shuttle Buggy & Windrow Handling**
  - Use windrow insert/funnel for smooth pick-up
  - Dump half load at a time; overlap next load for consistency
  - Avoid extended stops with mix in MTV or paver
- **Equipment & Operations**
  - Don’t overfill MTV/paver hoppers → mix can set up, overload motors, overheat equipment
  - Have backup equipment or onsite mechanic during initial operations
  - Use lump breaker if using windrow elevator/Co-Cal
  - Clean thoroughly each day!
- **Special Conditions**
  - For Hot Applied underseal, ensure shuttle buggy water spray is working to avoid pickup

HPG Paver Guidelines

- **Cold Weather Techniques**
  - Use winter paving methods, not summer techniques
  - High binder mixes (PFC, SMA) are sticky and stiff
- **Temperature & Flow**
  - Optimum mix temp under screed: 300–305°F
  - Keep mix flowing continuously through MTV and paver
  - Avoid extended stops (>5 min) to prevent thermal segregation & bumps
- **Paver Speed & Truck Coordination**
  - Maintain 20–30 FPM for SP and SMA; too slow → mat pull/tear, screed rise
  - Ensure enough trucks to keep paver moving; minimize waiting
- **Setup & Handwork**
  - Set screed & electronics before hitting joint
  - Don’t unload trucks until paver ready and on joint
  - Handwork difficult due to rapid cooling and stiff binder
  - Clean equipment thoroughly each day!
- **Problem Management**
  - Have skid steer/loader for extended stops: remove cooled mix, reset, and continue
  - Emphasize proper transverse joints; compact quickly
  - Check ride quality daily



HPG Compaction Guidelines

- **Mix Characteristics**
  - Cools quickly; stiffer than conventional mixes
- **Roller Setup & Operation**
  - Follow proper roller setup (see Paving Checklists)
  - Run rollers in echelon; keep tight to paver
  - Steel wheel roller stays with paver; don’t set back
  - Dual rollers preferred for breakdown
- **Density & Temperature**
  - Target density: 230–250°F
  - Finish rolling can occur at lower temperatures
- **Additional Tips**
  - Use Dawn dish soap in roller tanks
  - Confined joints: pinch; unconfined joints: hang drum over joint
  - Allow mix to cool before opening to traffic

HPG Mixture Testing Guidelines

- **Mix Handling**
  - Sample and split while hot; mix sticks to tools and pans
- **Coring**
  - Add dish soap to core drill water to prevent cores from sticking
- **Temperature Control**
  - Mix cools rapidly; keep operations moving to minimize thermal segregation

What Have We Learned?

- **Cost**
  - Higher initial cost (7–8% polymer vs. 2.5–3.5%)
  - Offset by longer life & lower maintenance
- **Production & Handling**
  - Higher viscosity → plant adjustments such as increased temperature needed: 325°F – 345 °F
  - Risk of storage/phase separation → 5-day window to use binder
  - Lower production rate ~ 200 tons/hour
  - Better control on trucking

What Have we Learned? (cont)

- **Construction**
  - Reduced workability, short compaction window
  - Difficult in thin overlays & handwork areas
  - Dump half load when using windrows to conserve temperature
  - Keep paver moving → 20 to 30 ft/min for structural mixes, PFC can run faster.
  - Over truck job.
  - Rollers need to stay close to paver
  - Mix needs to cool before opening to traffic → avoid pickup issues


Quiz!

Quiz: Question 1

What color is HPG Binder?

a. Black

b. Deep Dark Blue

c. Rich Brown with hints of Grey

d. Dark Grey

Quiz: Question 2

What's the actual PG grade of HPG?

a. PG 82-22

b. 10-40 weight

c. PG 88-22

d. PG 88-28

Quiz: Question 3

What's the minimum elastic recovery % of HPG binder?

a. 76

b. 82

c. 88

d. 90

Quiz: Question 4

How sticky are HPG binders?

a. Like 90 weight gear oil

b. Like WD40

c. Like molasses in the wintertime

d. Like picking a gummy bear off your truck seat on a hot day.

Quiz: Question 5

What the minimum surface placement temperature should be considered reasonable for HPB mixes?

a. 45 and rising

b. 55

c. 60

d. 70

Quiz: Question 6

How long can I store HPG Asphalt Mix in the silo and still be workable?

a. 1 hour

b. 3 hours

c. 12 hours

d. 1 day

Quiz: Question 7

What is an optimum paving speed for paving SP or SMA HPG mix?

a. Less than 20 FPM
b. 20-30 FPM
c. 30-40 FPM
d. Greater than 40 FPM

Quiz: Question 8

What should the target temp be right behind the screed when paving with an HPG?

a. 250F

b. 275F

c. 300F

d. 350F

Quiz: Question 9

What cutting/cooling liquid is best used with the core drill for HPG Mix samples?

a. Dihydrogen Monoxide
b. Soapy Water
c. Salt Water
d. Diesel

Quiz: Question 10

What's the melting point of SBS?

a. 240-270F

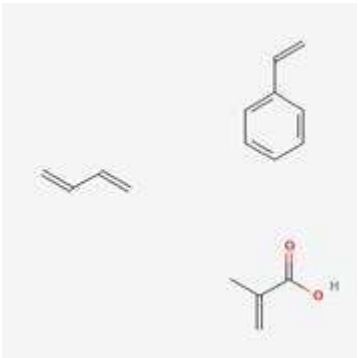
b. 270-320F

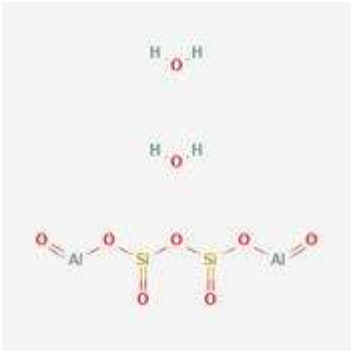
c. 320-400F

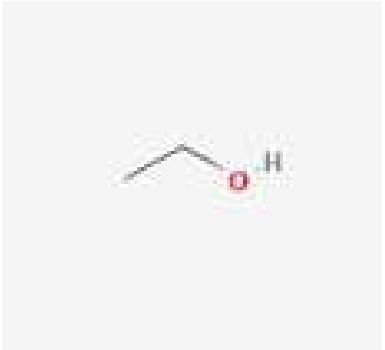
d. Greater than 400F

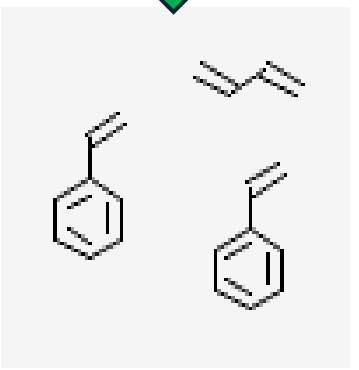
Quiz: BONUS Question

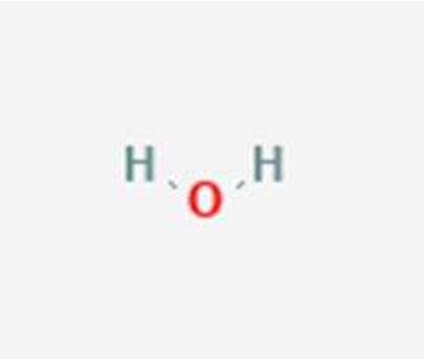
What chemical composition/form best represents the polymer SBS used in HPG.











A. ***B.*** ***C.*** ***D.*** ***E.***

How did you do?

3? .. or less .... Oh my! Bless your heart.
4? .. You should consider a career in Landscaping.
5? .. You're lucky we are grading on a curve!
6? .. You got potential pilgrim! Carry on!
7? .. You have an eye for asphalt. Download HPG Tips and Tricks!
8? .. Great job. Feels good to pay attention doesn't it?
9? .. HPG Brown belt status.

10?.. You are awesome! HPG Jedi Bindermaster status.

HPG Take-A-Ways

- ✓It can be done. *Attention to details matters*.
- ✓It has a place (NOT EVERY PLACE). *It's another tool in the toolbox for heavy duty severe loading applications*.
- ✓Proper Scoping and Planning is a must.
- ✓Proper equipment maintenance is critical.
- ✓Don’t get crazy – *slow and steady wins the race*.
- ✓HG Binders, used in the right application, can add tremendous performance and value to asphalt pavements.