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Permeable Friction Courses Texas Perspective

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TxDOT Vision Statement

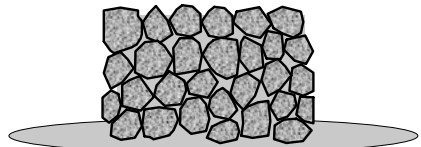
The vision of the Texas Department of Transportation is to provide transportation systems and alternatives that are comfortable, safe, durable, cost-effective, accessible, environmentally sensitive and aesthetically appealing.

TxDOT Vision Statement

The vision of the Texas Department of Transportation is to provide transportation systems and alternatives that are **comfortable, safe, durable, cost-effective**, accessible, environmentally sensitive and aesthetically appealing.

PFC Features

- Open-graded aggregate
 - high volume of voids ($\geq 18\%$ air voids, in place)
- Thick asphalt binder coating



PFC Benefits

- **Comfort**
 - Lower pavement noise levels
 - Improved ride quality
- **Safety**
 - Improved visibility
 - Minimized hydroplaning
- **Durability**
 - Improved asphalt binder technology

Comfort

USA Criteria

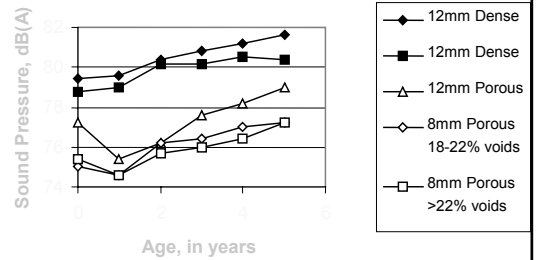
- Category A: significant need for serene, quiet conditions, 60 dBA (exterior)
- **Category B: developed areas and recreation areas not included above, 70 dBA (exterior)**
- **Category C: developed areas not included above (e.g. industrial), 75 dBA (exterior)**
- Category D: undeveloped lands not planned for human habitation or use or without other special requirements, ---
- Category E: Residences, schools, churches, etc., 55 dBA (interior)

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Noise Reduction

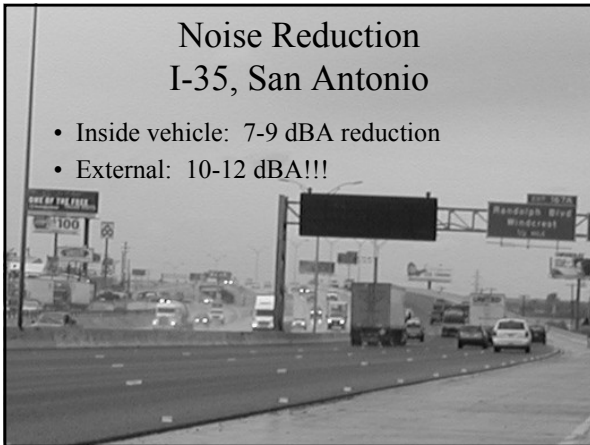
- Less sound pressure generated at pavement surface
 - reduced at highway speeds by 3.0 dB(A) compared to dense asphalt surface
- Muffles engine noise by a similar amount for stationary vehicles

Noise Reduction



Noise Reduction I-35, San Antonio

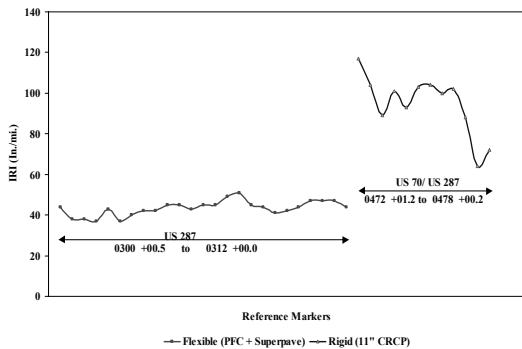
- Inside vehicle: 7-9 dBA reduction
- External: 10-12 dBA!!!



Ride Quality

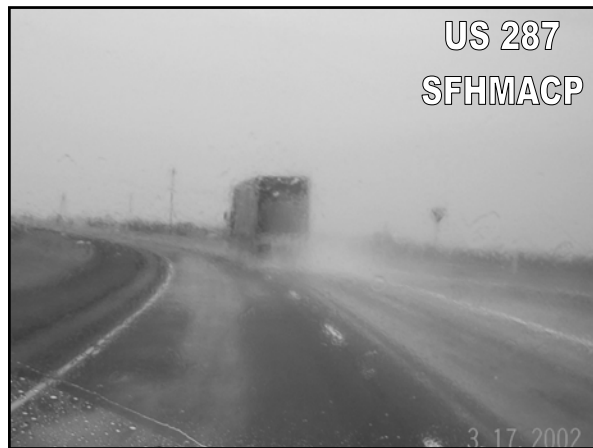
- Appears to provide better ride quality than other mixtures due to compaction
- Consistently achieve lower IRI values
 - Single lift (1.5 inches) reduced average IRI from 200 to 80 in San Antonio!
- Is it a coincidence that the states with the best ride quality make the greatest use of PFC?

US 287 (Wichita Falls District)
International Roughness Index (IRI)
Comparison of 2 Projects Completed in the Fall of 2001



Project Location	IRI		IRI Reduction %
	Pre Construction	Post Construction	
IH 10- Yoakum- Gonzales & Fayette counties (Right Lane)	114	56	51%
IH 10- Yoakum- Gonzales & Fayette counties (Left Lane)	81	52	36%
IH 20- Odessa- Midland county (Right Lane)	93	61	34%
IH 20- Odessa- Midland county (Left Lane)	96	57	41%
IH 20- Abilene- Howard county (Right Lane)	87	54	38%
IH 20- Abilene- Howard county (Left Lane)	122	58	53%
US 287- Wichita Falls- Wilbarger county (Right Lane)	92	43	53%
US 90- El Paso- Presidio county (Left Lane)	140	67	52%
Average	103	56	45%

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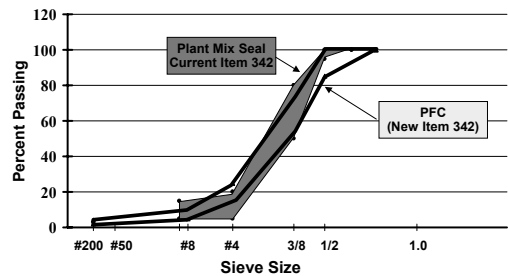
Modifications in PFC approach

- Emphasis on high air voids content
 - as designed and constructed
- Larger aggregate size
 - larger pore spaces, less clogging
- Thicker lifts
 - accommodate larger aggregates, greater volume of void space within mix
- Improved binders
 - polymer or crumb rubber modifiers
 - fiber additives

PFC -Vs- Plant Mix Seal

- Plant Mix Seal (Item 342 in 1993 Spec.)
 - Typically placed less than 1 in. thick
 - 10 - 15% in place air voids
 - Produced @ < 220F
 - AC 20, no fibers
 - Design life approximately 5 years +/-
- PFC (Item 342 in 2003 Spec. Book)
 - Typically placed 1.0-2.0 in. thick
 - 17-22% air voids
 - Produced @ 300F to 330F
 - Polymer modified PG 76-22 plus fibers
 - Design life 12 years +/-

Gradation Bands, PFC -Vs- Plant Mix Seal



TxDOT Item 342, 2003 Standard Specifications

Property	Test Method	Specification Requirement
Coarse Aggregate		
Surface Aggregate Classification	Department AQMP ¹	As shown on plans
Deleterious Material, % Max	Tex-217-F, Part I	1.0
Decantation, % Max	Tex-217-F, Part II	1.0
Los Angeles Abrasion, % Max	Tex-410-A	30
Magnesium Sulfate Soundness Loss, 5 Cycle, % Max	Tex-411-A	20
Micro-Deval Loss ² , % Max	Tex-461-A	See note 2
Coarse Aggregate Angularity 2 Crushed Faces, % Min	Tex-460-A, Part I	95
Flat and Elongated Particles @ 3:1, % Max	Tex 280-F	10

1. Aggregate Quality Monitoring Program
 2. To be tested by the Engineer approximately once every 10 days of production. Results are used as a screening test to determine the need for magnesium sulfate soundness testing. The testing frequency may be reduced or eliminated based on a satisfactory test history.

PFC Gradations

Table 3
Master Gradation Band and Binder Content

Sieve Size	% Passing	
	PG 76 Mixtures	A-R Mixtures
3/4"	100.0	100.0
1/2"	80.0 – 100.0	95.0 – 100.0
3/8"	35.0 – 60.0	50.0 – 80.0
#4	1.0 – 20.0	0.0 – 8.0
#8	1.0 – 10.0	0.0 – 4.0
#200	1.0 – 4.0	0.0 – 4.0
Binder Content, %	5.5 – 7.0	8.0 – 10.0

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