



Contractor Mix Design Options

2018 in Review and a look ahead

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Cynthia Williams - *Illinois Tollway*

Deputy Chief of Program Implementation



About the Tollway

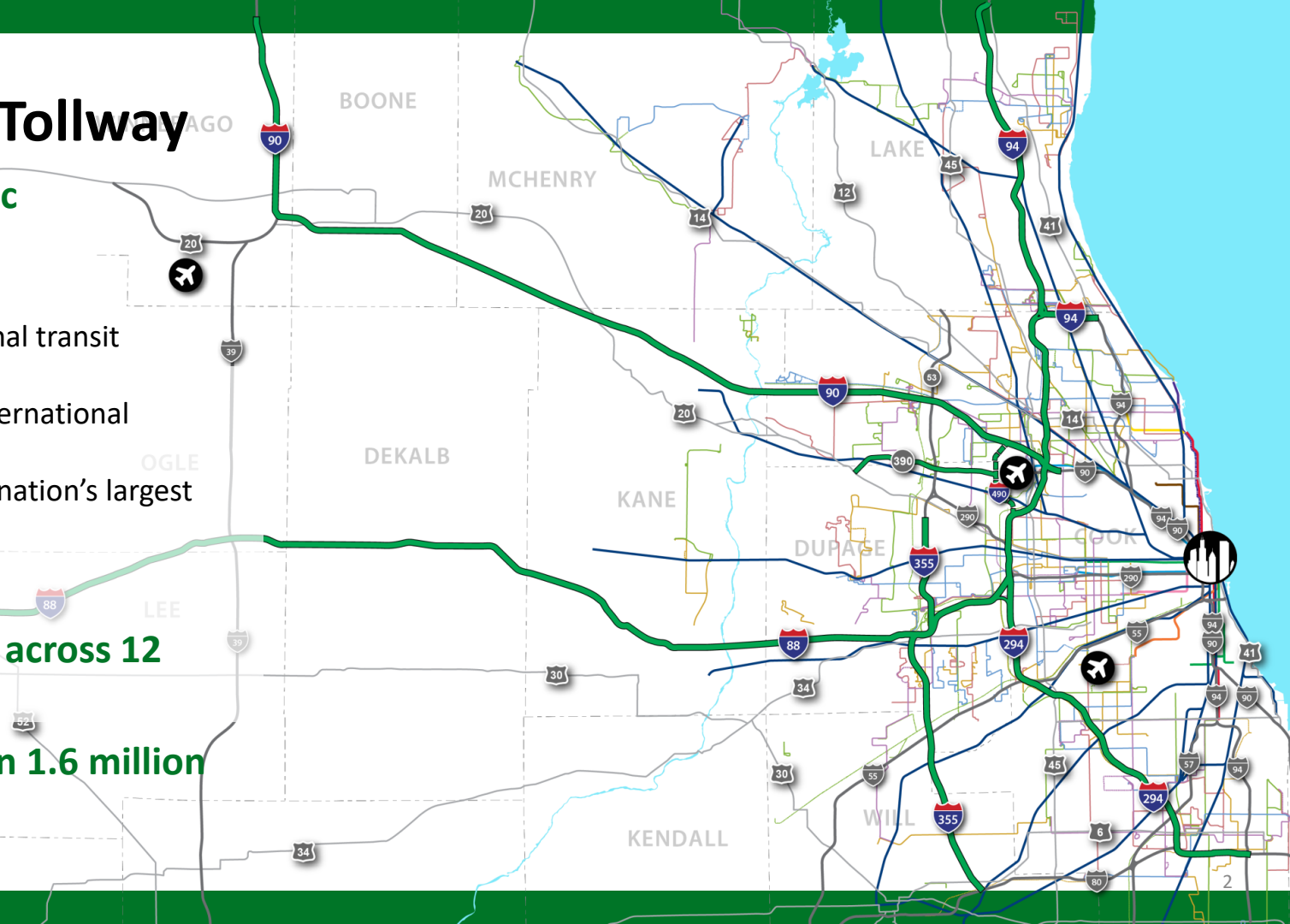
Part of a dynamic transportation network

- Connects to regional transit network
- Supports three international airports
- Part of one of the nation's largest interstate systems

Five roadways

294-mile system across 12 counties

Serves more than 1.6 million vehicles a day





The Tollway's SMA Innovation Evolution

- Implemented FRAP and RAS
- Higher asphalt binder replacement
- Implemented WMA
- Ground tire rubber
- Rejuvenators

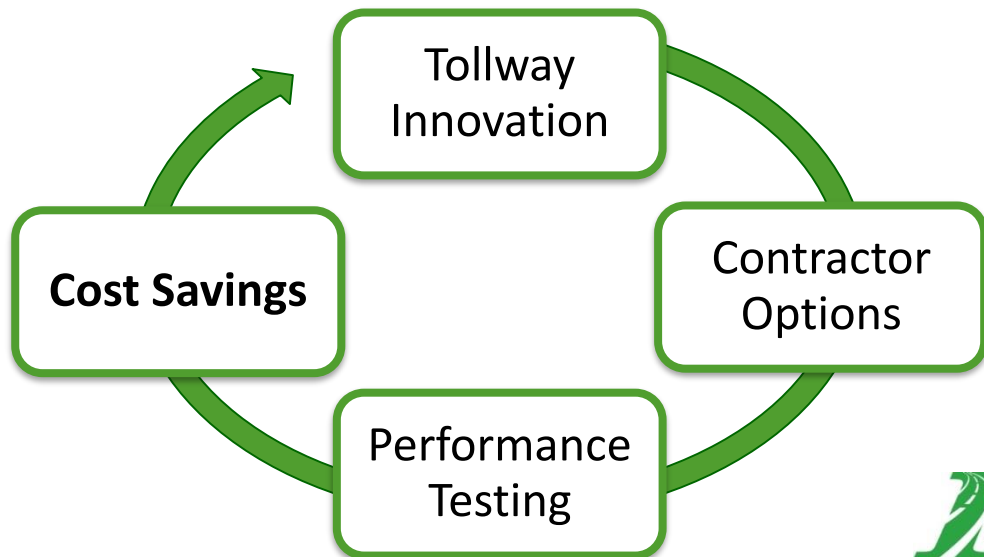


Cost Savings – Created by Innovations

Contractor options

- Asphalt binder replacement
- Ground tire rubber
- Rejuvenators
- Use of aggregates
- Performance testing

RESULT: Durable and affordable asphalt mixes





Tollway SMA

Stone-matrix asphalt (SMA) used for all mainline overlays

2008 to 2009 – Full-depth asphalt on the Jane Addams Memorial Tollway (I-90) in Rockford area

2015 – Reagan Memorial Tollway (I-88) rehabilitation

2018 – Veterans Memorial Tollway (I-355) overlay

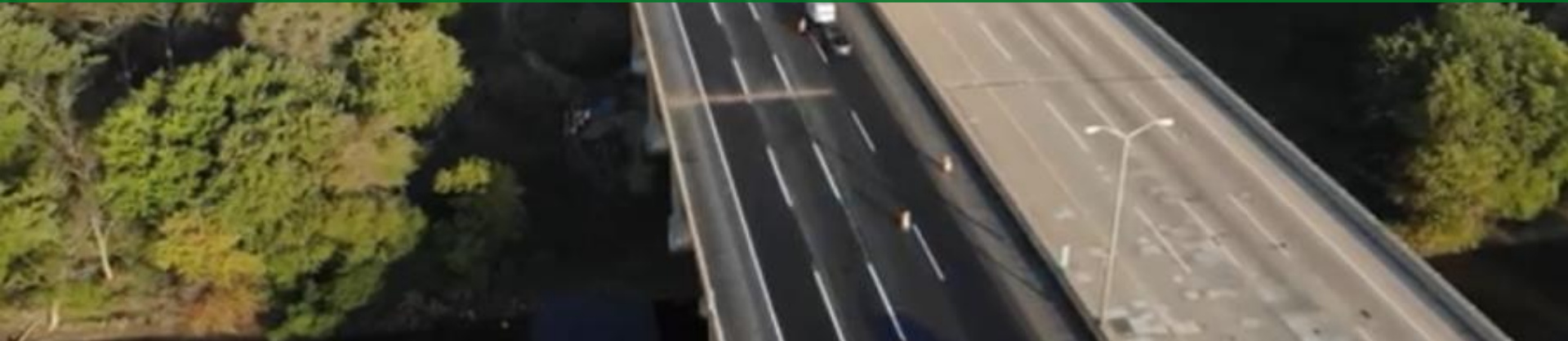
2018 – I-88 rehabilitation, Edens Spur, I-294 @ O'Hare

*Seven asphalt
producers*





A Look at What Got Us Here



Shoulders

The Tollway's
Sandbox





Coarse Aggregate for Tollway SMA

Friction Surface SMA

- High-traffic pavements and curves
- Coarse aggregate: quartzite, granite, diabase/trap rock, crushed steel slag

Binder SMA and Surface SMA

- Coarse aggregate: typically crushed gravel (also surface aggregates)
- 2008 friction evaluation – acceptable for tangents

Coarse Aggregates for Tollway SMA

- Friction aggregates – Non-Illinois sources, except slag
- Crushed gravel – Southern Wisconsin and Northern Illinois
- 2015 – Evaluated local crushed gravel and dolomite sources
- 2018 – Implemented aggregate testing, including coarse FRAP



Local Aggregates for Tollway SMA

2015 evaluation approach

- Aggregate breakdown – Micro-Deval
 - Mini LA abrasion
 - Compares to national research

Category I & II FRAP

- Extract using the analyzer
- Run through the Micro Deval



2018 – Micro-Deval specifications for coarse aggregates and FRAP



RAP/FRAP for Tollway Asphalt

Quality sources

- Tollway requires documentation of the RAP source
- Tollway mainline RAP is separated from shoulder or IDOT mixes*

RAP and FRAP production

- RAP/FRAP stockpiles must be tested at a required interval
- All gradation and percent AC must be within a tolerance of mix design JMF targets

RAS



Quality sources

- Guidelines developed with IEPA
- Source and contractor testing
- Option for up to 5 percent RAS in mixes

Asphalt Binder Replacement – 2009 SMA

- This table was introduced into Tollway specifications in 2009 – and was for SMA mixes only
- The intent was to incentivize fractionalization of RAP and use of RAS

Reclaimed Material	Binder Replacement %	Asphalt Binder Options
Category I FRAP only	0 - 20	SBS PG 76-22
Category I FRAP only or with RAS	21 - 30	SBS PG 70-28
Category I FRAP & RAS	31 - 50	SBS PG 64-34

Asphalt Binder Replacement Now

Reclaimed asphalt material (as allowed in Tollway Tables 7 & 8)		RAP ¹ //FRAP/RAS	FRAP only or with RAS	Category 1 FRAP with RAS
ABR		0-17%	18-33%	34-50%²
Allowable Mix Options	SMA and IL-4.75	SBS 70-28 GTR PG 70-28 PG 58-28 10% Dry GTR	SBS 64-34 GTR PG 64-34 PG 52-34 ³ / 10% Dry GTR	
	Binder and surface course	PG 58-28	PG 52-34 ³	
	Asphalt stabilized subbase	PG 58-28 ⁴		

¹/ RAP not allowed in SMA

²/ Allowed up to 60 percent ABR on N50 IL 19.0mm binder

³/ PG 46-34 shall be considered an equivalent to PG 52-34

⁴/ Allowed up to 65 percent ABR on asphalt stabilized subbase



Tollway's Approach to Equivalent Performance *Balanced Mix Design*

Rutting

Hamburg @
20,000 passes
SMA < 6.0mm



Contractor Options

Warm mix
ABR
PG binder grade
SBS polymer
GTR (terminal and dry process)
...and now,
Rejuvenators are coming soon...



Cracking

DCT
SMA ≥ 600 J/m²



2018 SMA Mix Designs

- Six contracts
- Seven producers
- 323,151 tons of SMA
- Five “local” sources used
- Micro Deval = 7.7 to 11.6
- 17 of 18 SMA designs used coarse FRAP



Good Quality RAP

N80 IL 12.5 REC SMA - Performance

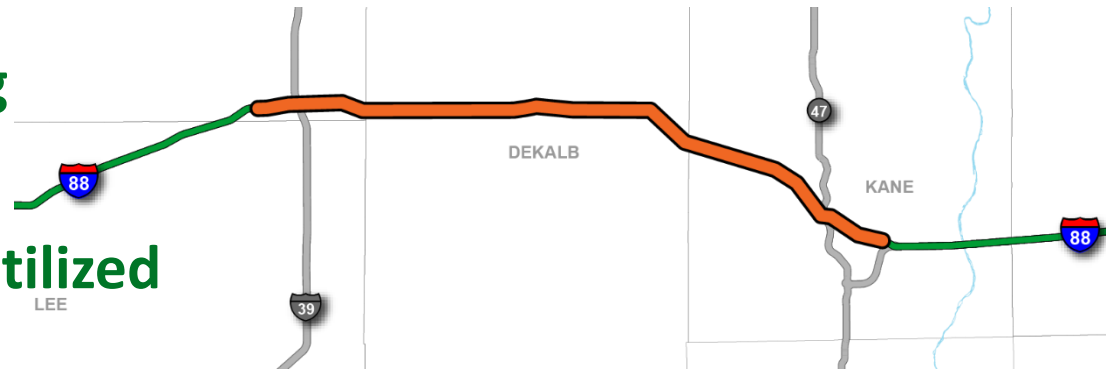
Contractor	Tollway Mix #	Mixture Description	ABR	Modification	DCT	Hamburg
Plote	90WMA 1841	Binder	50.1	PG 46-34 +10% ECR (dry process)	652 J/m ²	-1.83 @20,000
Curran	90WMA 1833	Surface	37.1	PG 46-34 +10% ECR (dry process)	1510 J/m ²	-5.92 @20,000
Geneva	90WMA 1839	Friction surface	25.8	PG 58-28 +12 GTR (terminal)	967 J/m ²	-4.61mm @20,000
Rock Road	90WMA 1824	Friction surface	37.6	SBS PG 64-34	904 J/m ²	-3.36mm @20,000

I-88 Innovation Success Story

Mill and overlay of existing composite pavement

Contractor options being utilized

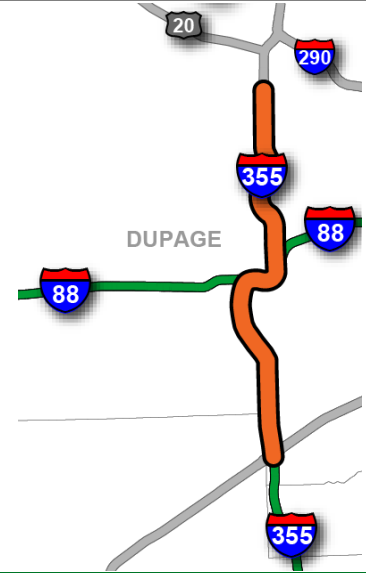
- Mainline options
 - Dry-process GTR
 - Terminal GTR
 - Hybrid GTR/SBS
 - SBS polymer
- Shoulder
 - Option for use of rejuvenators



Inside Shoulder Reconstruct WMA 9"	Mainline Overlay SBS or GTR WMA 2"	Outside Shoulder WMA 4"
9.5 N70	SMA Friction 12.5 N80	9.5 N70
19.0 N50	SMA 12.5 N80	19 N50
19.0 N50		

Cost Savings on I-355

Shoulder Overlay VMA 1.75"	Mainline Overlay Army Trail SBS or GTR VMA 2.5"	Mainline Overlay Lane 1 SBS or GTR VMA 4"	Mainline Overlay All Other SBS or GTR VMA 4"	Add-A-Lane SBS or GTR VMA 14"	New Shoulders VMA 9"
9.5 N70	SMA Friction 12.5 N80 4.75 N50	SMA Friction 12.5 N80	SMA Friction 12.5 N80	SMA Friction 12.5 N80	9.5 N70
		SMA 12.5 N80	SMA 12.5 N80 4.75 N50	SMA 12.5 N80 4.75 N50	19.0 N50
				19 N90	19.0 N50
				19 N70	
				19 N50	



Substantial overlay from I-55 to Army Trail Road

4 inch SMA over existing PCC

Full-depth asphalt add-a-lane

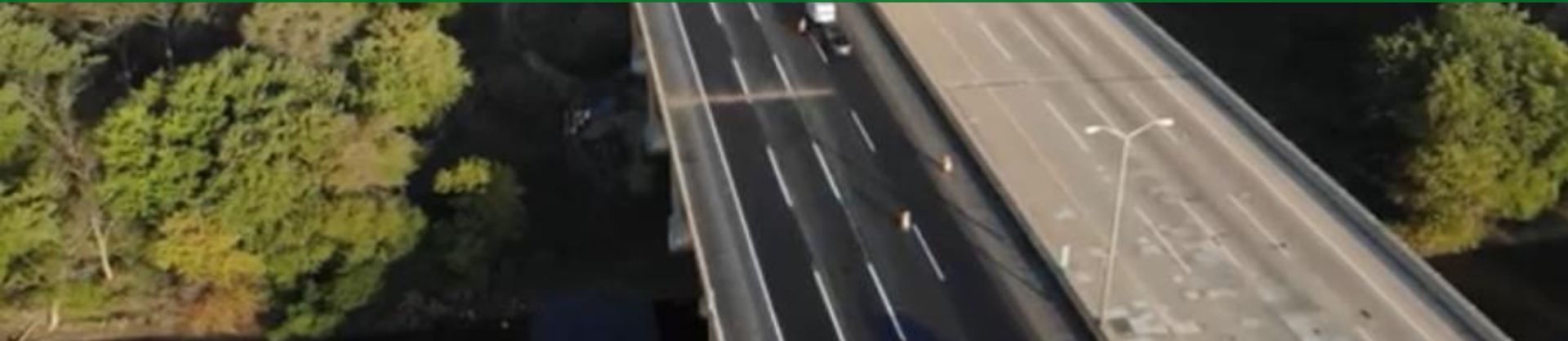


Systemwide Cost Savings Realized

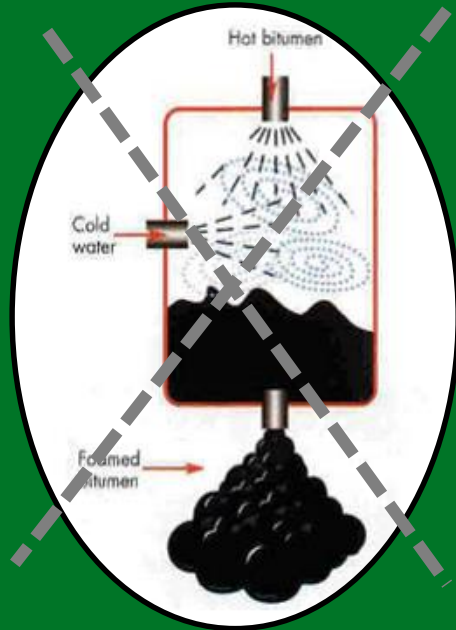
Item	Depth, inch	Layer Description	Tons	\$/Ton
1	2	Stone matrix WMA surface friction course, IL-12.5, N80 (135 Lb/SY/In)	204,771	\$81.02
2	2	Stone matrix WMA binder course, IL-12.5, N80 (114 Lb/SY/In)	118,380	\$87.07
3	Var	Polymerized WMA binder course (112 Lb/SY/In)	93,782	\$80.09
4	Var	WMA surface course (112 Lb/SY/In)	100,596	\$93.87



Looking Ahead



Foaming Restrictions



Future Warm Mix changes

Contractor options

- 0-20 RAP – can use foaming
- Any FRAP, RAS or >20 percent RAP – chemical foaming required

Cold weather

- Chemical foaming only when beyond temperature specifications
- Increase 50 percent additive from mix design target

	WMA Binder Course	WMA Surface Course	WMA IL-4.75
Minimum Ambient Air Temperature (In shade)	32°F and Rising	40°F and Rising	50°F and Rising



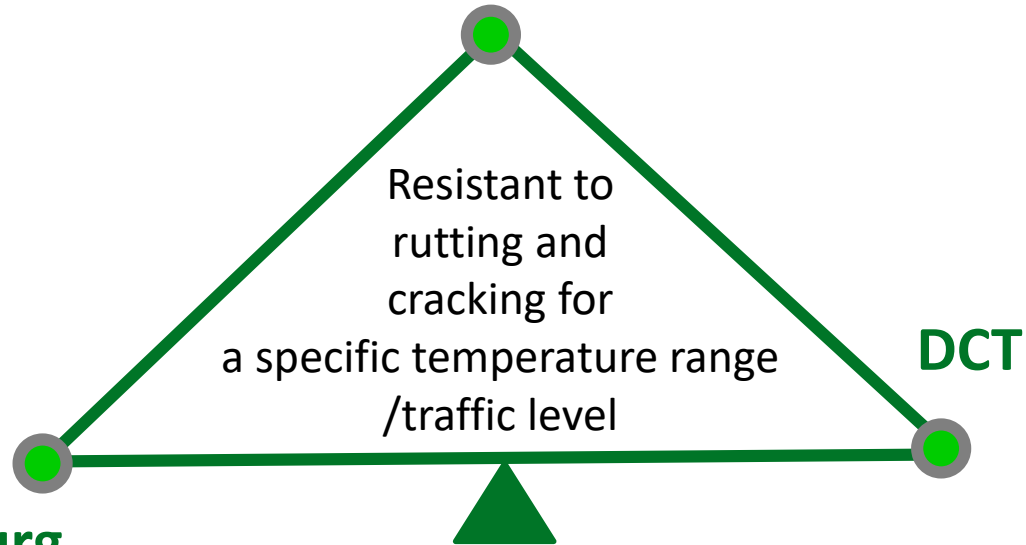
The Future of Balanced Mix Design

Where we are going...
you won't need
volumetrics!



Hamburg

Resultant Binder Testing



Recovered PG Grade of the Mix

Extraction, recovery and grading of each individual design

This is the **ONLY** way to know the final PG grade in the pavement

Factors that will affect PG grade

- ABR
- Source of RAS/FRAP
- Virgin binder
- Rejuvenator, warm-mix additive or modifier

Recovered Binders

Next step in performance testing

Targets

on recovered binders

Shoulders	PG 64-22
Mainline	PG 70-22
High volume	PG 76-22



What's the real PG in the road?



N80 IL 12.5 REC SMA – Recovered Grading

Contractor	Tollway Mix #	Mixture Description	ABR	Modification	Recovered Grading
Plote	90WMA 1841	Binder	50.1	PG 46-34 +10% ECR (dry process)	PG 72.5-24.9
Curran	90WMA 1833	Surface	37.1	PG 46-34 +10% ECR (dry process)	PG 70.1-23.2
Geneva	90WMA 1839	Friction surface	25.8	PG 58-28 +12 GTR (terminal)	PG 73.2-28.9
Rock Road	90WMA 1824	Friction surface	37.6	SBS PG 64-34	PG 78.9-30.2



THANK YOU

