

Sustainable SMA in Urban Areas Chicago-Michigan Avenue

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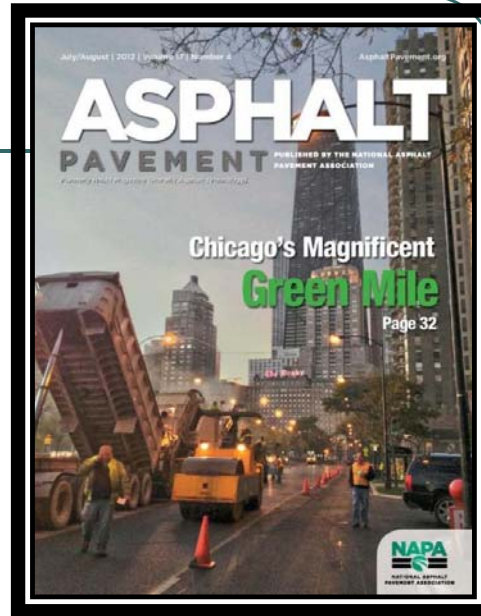


Environmental Leadership Award 2012 NAPA



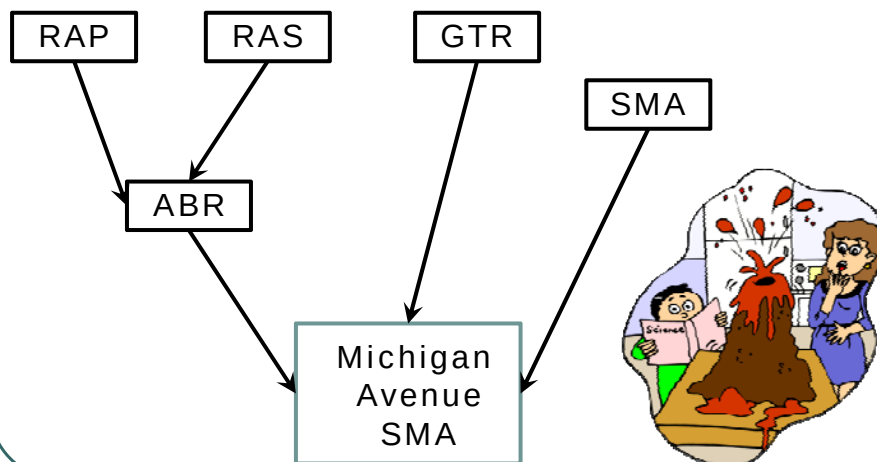
Agenda

- An Evolution
 - RAP/FRAP
 - GTR
 - RAS
 - SMA
- Michigan Avenue SMA



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Mich. Ave. SMA from Experience and Experiments



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GTR - Ground Tire Rubber Modified Asphalt



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No Draindown

Replacement for Fibers.

- Open Graded
- Pervious
- SMA



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Terminal Blended GTR

Original Formula

PG 64-22 Base

+ 12% GTR

≈ PG 76-22

Hi-Recycle Formula

PG 58-28 Base

+ 12% GTR

≈ PG 70-28



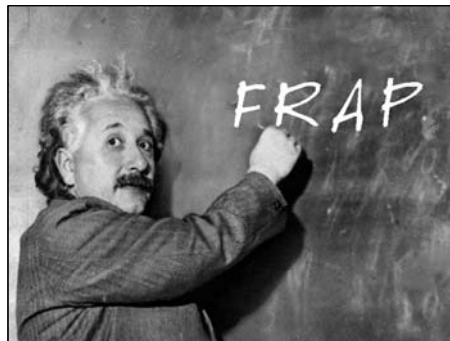
*Seneca Petroleum
Company*

- Consistent
- Stable
- Long Storage Time
- Locally Available

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FRAP - Fractionated RAP

- Old – RAP was bad
- Then – RAP is OK
- Now – FRAP is great



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IL FRAP Sizes (typical)



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RAS Recycled Asphalt Shingles



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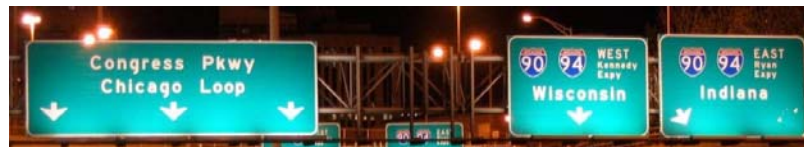
RAS = Quality HMA Ingredient

- **Consistent gradation**
 - 100% < 3/8 in.
 - 90% < #4
- **25+% High Quality AC**
- **30+% High Quality Fine Aggregate**
- **Mineral Filler**
- **Mineral/Organic Fibers**



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SMA - Working Hard since 1999



190,000 ADT
18,000 Trucks



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Characteristics of SMA

- **High Performance**
 - Friction
 - Strength
- **High Binder Content**
 - Durability
- **Relative High \$\$**
- **IDOT preferred Expressway surface for 3 decades.**
- **Traditionally Steel Slag**
- **Highest IDOT Friction**
- **Stability prevents rutting**
- **Durability gives long life**
- **SBS PG 76-22**
- **VMA > 17**

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SMA Bus Pad Retrofit



2009

- **1 night construction**
- **Crushed Gravel SMA**

6-inch Excavation

- **4.75mm level binder**
- **2 SMA lifts**

Traffic next a.m.

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After 3 Years of busses

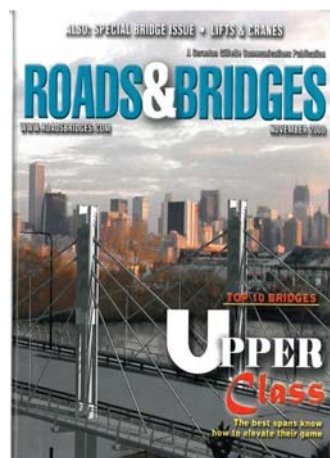


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Risk and Reward Top 10 Bridge



GTR / Diabase SMA
PG 64-22 Tack
GTR 4.75mm Binder



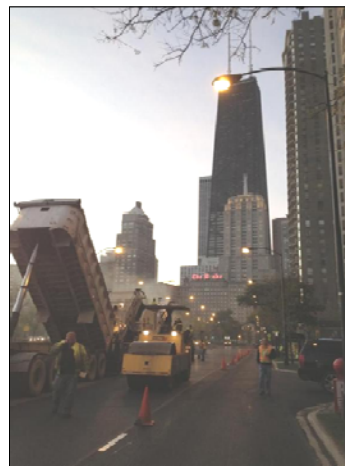
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5 years old



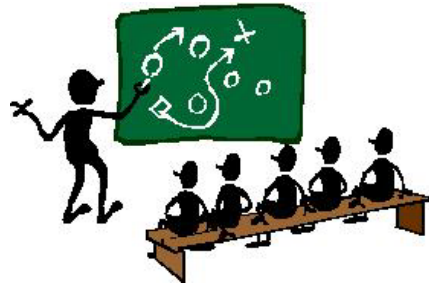
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Pulling it Together
Michigan Avenue SMA



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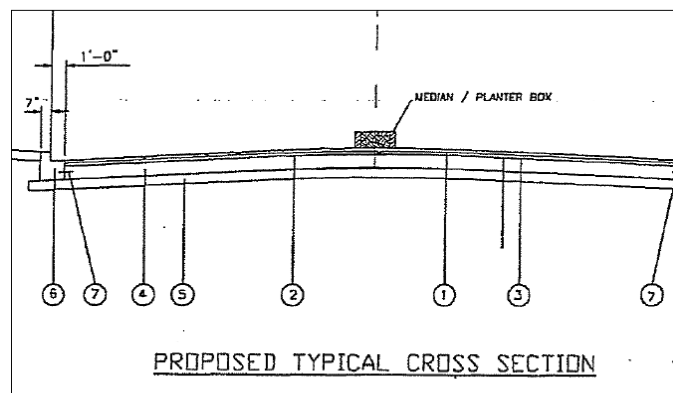
Original Play



BOOK 2
INSTRUCTIONS AND EXECUTION DOCUMENTS
CITY OF CHICAGO
ARTERIAL STREET RESURFACING
PROJECT NO. 52 (CENTRAL AREA)
C.D.O.T. PROJECT NO.: B-6-113
SPECIFICATION NO.: 77666
RFQ NO.: 3476
F.A. PROJECT NO.: M-6000 (301)
STATE JOB NO.: C-88-021-08
CITY SECTION NO.: 06-B6113-00-RS/Chicago
CITY OF CHICAGO
<u>RICHARD M. DALEY</u>
Mayor

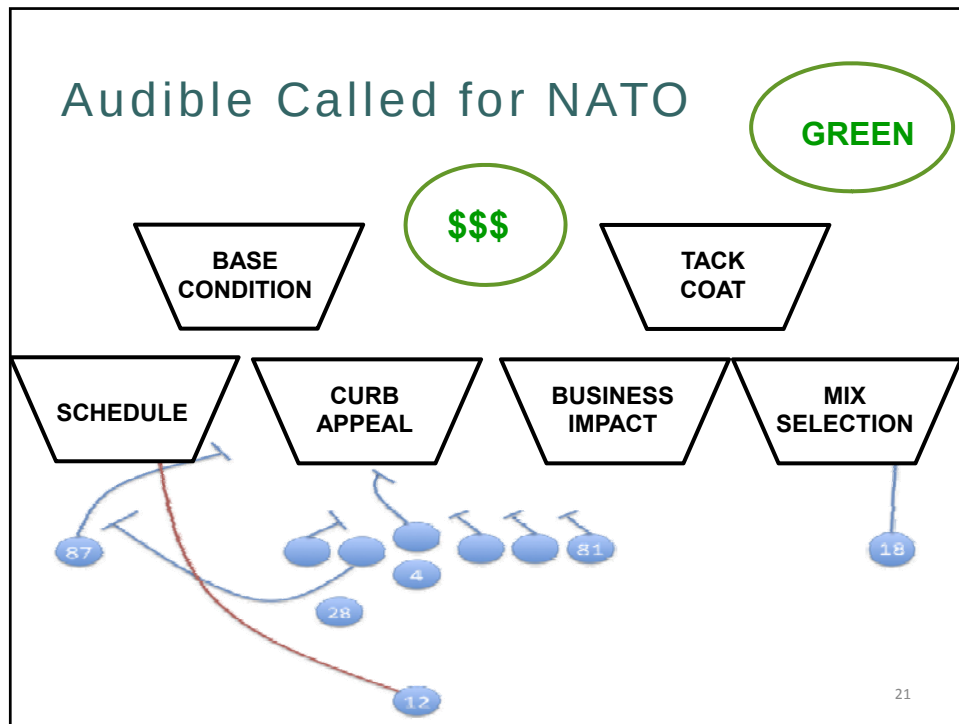
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Original Play



1.5" N70 Surface

1" Poly 4.75mm Level Binder



Examination

Given:

- Location
- Variable Base/Subbase
- 300 Structures to work around
- Time Constraints
- Green Objectives

Solve for:

1. Milling Thickness
2. Lift Thickness
3. Binder Mix
4. Surface Mix
5. Tack Coat
6. Paving Width
7. Maximum ABR

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Factors favoring Single SMA Lift

- **Uncertainty of Base**
- **Time**
- **Cost**
- **SMA Characteristics**



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Michigan Ave SMA Mix Design



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Mix Design Details

MIXTURE

Quartzite 12.5mm	50%	
Quartzite 9.5mm	24%	
FM01 & Mineral Filler	3.5%	
RAP < 9.5mm	15%	0.8%
RAS	7.5%	2.0%
PG 58-28 GTR+12	6.1%	3.3%
		<u>6.1%</u>

OIL

VOLUMETRICS

- $N_{DES} = 80$
- Voids = 3.5%
- VMA = 16.3%
- VFA = 78.5%

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Binder Replacement



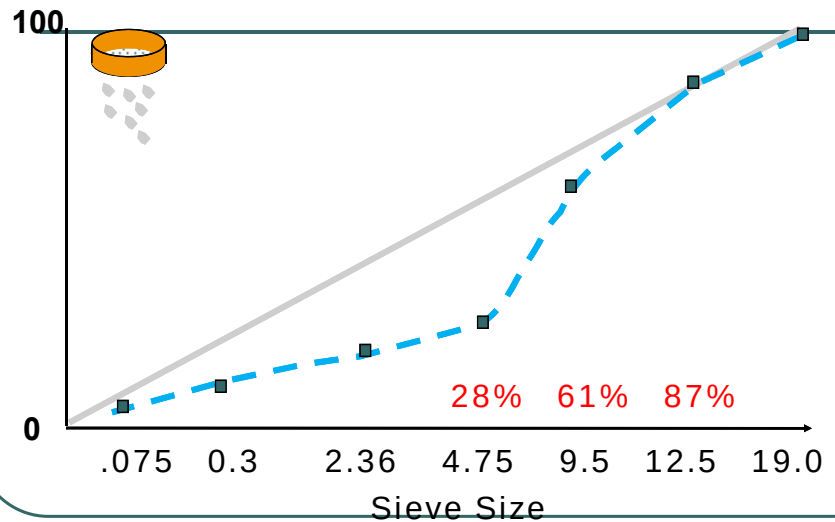
	% MIX	AC Content	ABR
RAP (3/8")	15%	5.2%	0.8%
RAS	7.5%	26%	1.9%
			<u>2.7%</u>

Design AC	6.1%
New AC	3.4%



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Gradation - Classic SMA



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Coarse Aggregate Structure



2 sizes Quartzite

- 50% 12.5mm NMAS
- 24% 9.5mm NMAS
- High Friction
- 1% Soundness Loss
- 23% LA Abrasion Loss
- <0.5% Absorption

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Torture Tested (cores)



**< 4 mm rut
@ 20,000 reps**

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Test Strip at Plant



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Paving



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Logistics & Traffic Control



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Sweeping for Prime was an Art in Itself



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+ Trackless Tack/Prime Coat




BLACKLIDGE
EMULSIONS, INC.

NTSS-1HM
TRACKLESS
TACK



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Completed in 6 consecutive nights of Paving



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Daily Temperatures

Oct-2011						
16	17	18	19	20	21	22
High 52°	53°	57°	61°	62°	54°	60°
Low 27°	27°	30°	27°	40°	31°	36°
Historic Averages						
54°/30°	53°/29°	52°/29°	52°/28°	51°/28°	50°/27°	50°/27°

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Compaction – 3 static 3-wheeled; Large Tandem Finish



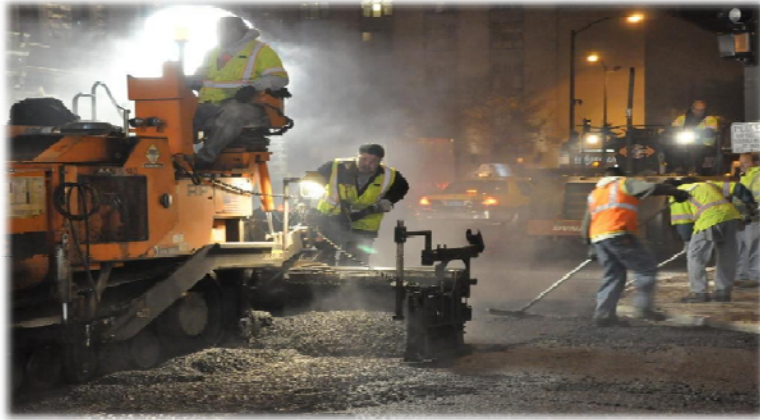
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Street Returns



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Hand Workable

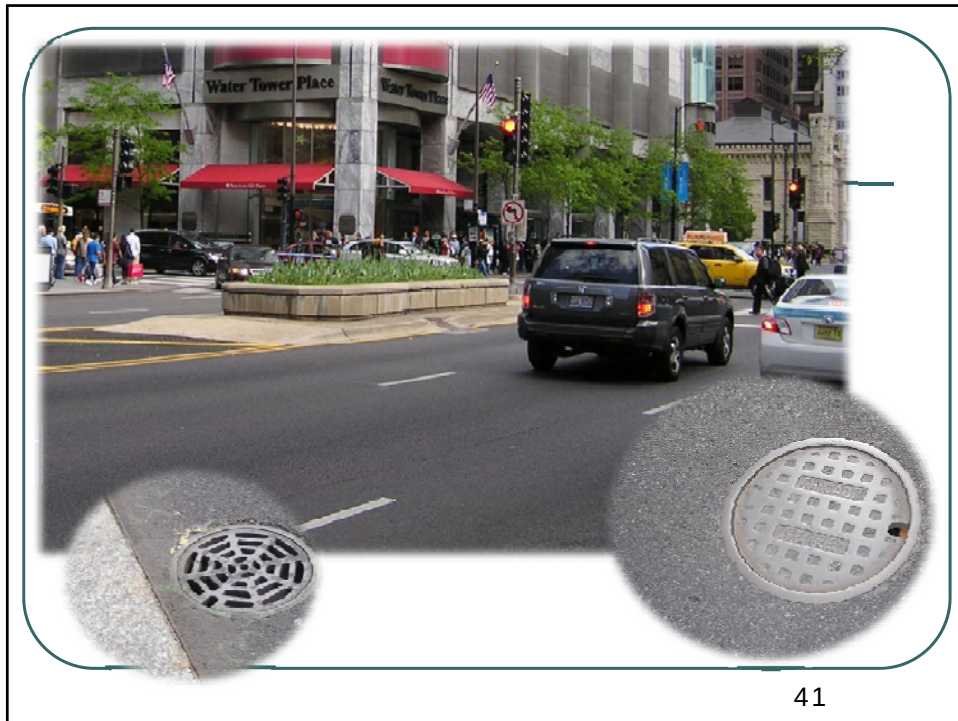


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Finished Product



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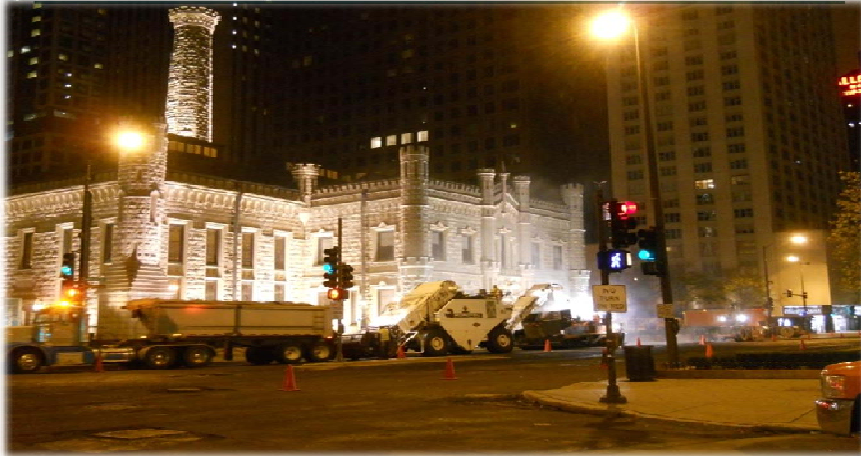
SMA Growing Up

- Expressways...now local streets, intersections, bridges
- RAP/FRAP, RAS, and GTR add economy
- Next? FRAC –
Friction Recycled
Aggregate
Component



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The End – Thank You



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