We're going to look at the following:

- IDOT recycling initiatives.
- Total Recycled Asphalt.
- "D" Construction Perspective
- Future of TRA.

Recycled and Reclaimed Materials Utilized in Highway Construction

- Air-Cooled Blast Furnace Slag
- By-Product Lime
- Crumb Rubber
- Fly Ash
- Glass Beads
- Glass Cullet
- Ground Granulated Blast Furnace Slag
- Microsilica
- Reclaimed Asphalt Pavement
- Reclaimed Asphalt Shingles
- Recycled Concrete Material
- Steel Reinforcement
- Steel Slag
- Wet-Bottom Boiler Slag

Variety of recycled materials used:

AGGREGATES:

- Embankments
  Crushed concrete, RAP, ACBF slag aggregate.
- Aggregate base lift over subgrade
  The aggregate bases can have up to 100% crushed concrete aggregate, crushed ACBF slag or RAP mechanically blended with crushed concrete.

Recycled materials used in roadway construction

CONCRETE MIXTURES:

- Up to 35% of cement can be replaced with slag cement.
- Up to 30% of cement can be replaced with fly ash
- Up to 100% of the coarse aggregate can be ACBF slag or crushed concrete aggregate .

  Must meet requirements of freeze thaw tests.
- At the present time, the District is conducting a trial test for the use of 100% green water in concrete mixes. Green water is the washout water generated by concrete plants.

HMA Mixtures:

The Asphalt Binder Replacement (ABR) ranges from 10% up to a maximum of 50% depending on the type of HMA mixture and type of roadway.

- Grade bumping is required by Specifications when the ABR exceeds15%.
- Both the high and low temperatures are reduced one grade.

HMA Mixtures:

CONTINUE:

- Level Binder Mix allows up to 40% ABR
- Surface Mix allows up to 30% ABR
- In addition to RAP and RAS in HMA the use of crushed concrete, ACBF slag or steel slag aggregate is also permitted.
- The use of Ground Tire Rubber (GTR) Asphalt Cement is allowed in a variety of HMA mixtures.
- Hot In Place Recycling or Reheat process, is permitted either as a leveling binder coarse or as a surface lift in HMA

Stockpiles of FRAP and Concrete

Crushed Concrete

Processed FRAP

Other available recycled material

RAS

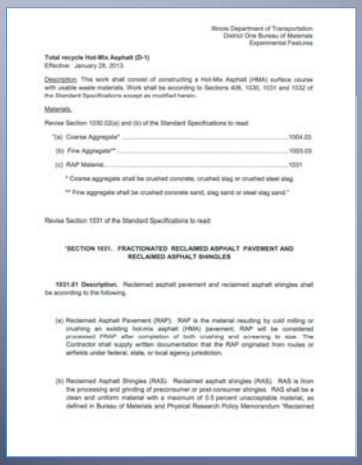
Steel slag aggregate

TOTAL RECYCLE ASPHALT

Description

- This work shall consist of constructing a Hot-Mix Asphalt (HMA) surface course ***with usable waste materials***. Work shall be according to Sections 406, 1030, 1031 and 1032 of the Standard Specifications except as modified herein:

Special Provision for Total Recycle Hot-Mix Asphalt (D-T)



Illinois Department of Transportation
District One Bureau of Materials
Experimental Features

Total recycle Hot-Mix Asphalt (D-1)
Effective: January 28, 2013.

Description. This work shall consist of constructing a Hot-Mix Asphalt (HMA) surface course with usable waste materials. Work shall be according to Sections 406, 1030, 1031 and 1032 of the Standard Specifications except as modified herein.

Materials.

Revise Section 1030.02(a) and (b) of the Standard Specifications to read:

"(a) Coarse Aggregate* 1004.03
(b) Fine Aggregate** 1003.03
(c) RAP Material 1031
* Coarse aggregate shall be crushed concrete, crushed slag or crushed steel slag.
** Fine aggregate shall be crushed concrete sand, slag sand or steel slag sand."

Revise Section 1031 of the Standard Specifications to read:

"SECTION 1031. FRACTIONATED RECLAIMED ASPHALT PAVEMENT AND RECLAIMED ASPHALT SHINGLES

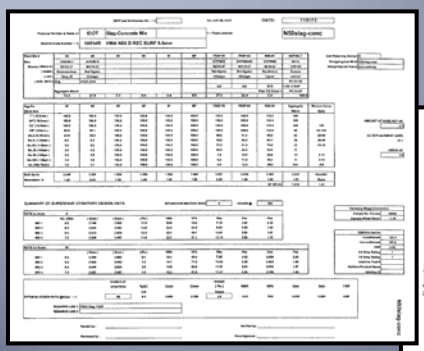
1031.01 Description. Reclaimed asphalt pavement and reclaimed asphalt shingles shall be according to the following.

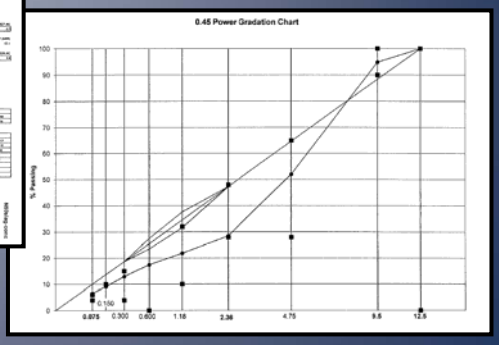
(a) Reclaimed Asphalt Pavement (RAP). RAP is the material resulting by cold milling or crushing an existing hot-mix asphalt (HMA) pavement. RAP will be considered processed RAP after completion of both crushing and screening to size. The Contractor shall supply written documentation that the RAP originated from routes or airfields under federal, state, or local agency jurisdiction.

(b) Reclaimed Asphalt Shingles (RAS). Reclaimed asphalt shingles (RAS). RAS is from the processing and grinding of preconsumer or post-consumer shingles. RAS shall be a clean and uniform material with a maximum of 0.5 percent unacceptable material, as defined in Bureau of Materials and Physical Research Policy Memorandum "Reclaimed

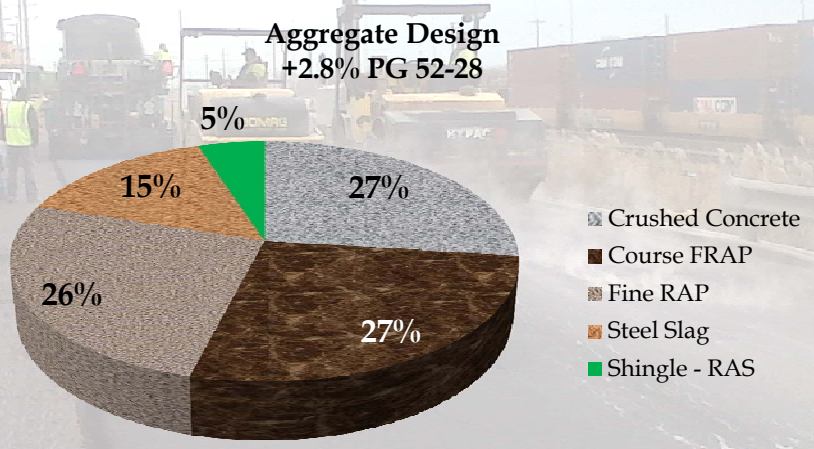
- Allows up to 5% RAS material and unrestricted amounts of Recycled Concrete or Recycled Asphalt Pavement as long as they result in asphalt binder replacement within acceptable range.
- ABR range determines asphalt binder grade to be used.
  - Below 40% ABR, use PG58-28
  - Above 40% ABR, use PG52-28
  - Max ABR is 60%.
- 200 PSI is the max tensile strength permitted, AASHTO T 283
- volumetric parameters during mix design phase, a 2hr and a 4hr cure are required.
- Ensure a silo storage and haul time combined, is not less than 2 hrs.

Total Recycle Asphalt (TRA) Mix Design





Mix Details

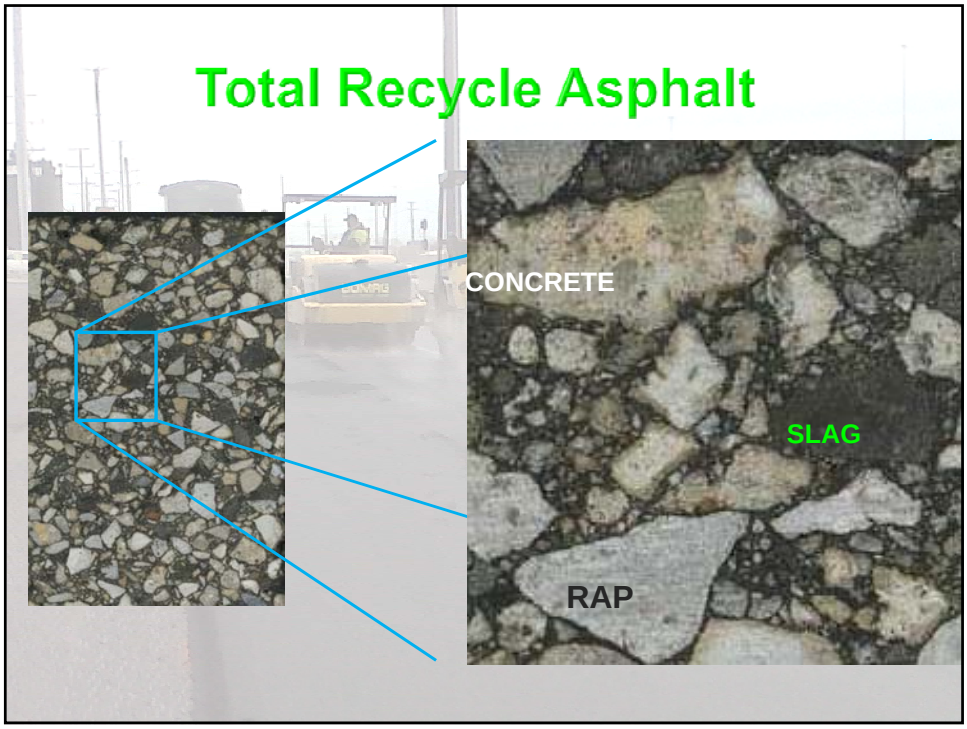


Total Recycle Asphalt (TRA) Mix Design

- Sustainability Features
  - Over 97% recycled material (no mined material)
  - 57% Asphalt Binder Replacement (ABR)
- Engineering Features
  - 9.5 mm, N50, Surface Mix "D"
  - PG52-28
  - TSR = 124.3/141.0 = 0.88
  - Hamburg – 1.7mm Ave @ 10,000 Passes

SLAG	CRUSHED CONCRETE	FRACTIONATED RAP	FRACTIONATED RAP	RAS	VIRGIN ASPHALT BINDER
039CM13	039CM16	017FM3804	017FM0400	017FM98	10124
15.0%	27.0%	27.0%	26.0%	5.0%	PG52-28
					2.8%
AC in asphalt recycled material		2.8%	6.0%	27.5%	
Bulk Specific Gravity					
3.446	2.301	2.951	2.624	2.500	

Optimum Design DATA					
% AC	Gmb	Gmm	% VOIDS	VMA	Gsb
6.5	2.450	2.526	3.0	14.9	3.008


Total Recycle Asphalt
CONCRETE
SLAG
RAP


Reliable Ogden Materials
S.T.A.T.E. Testing LLC
Bluff City, Southwind RAS
Late 2012

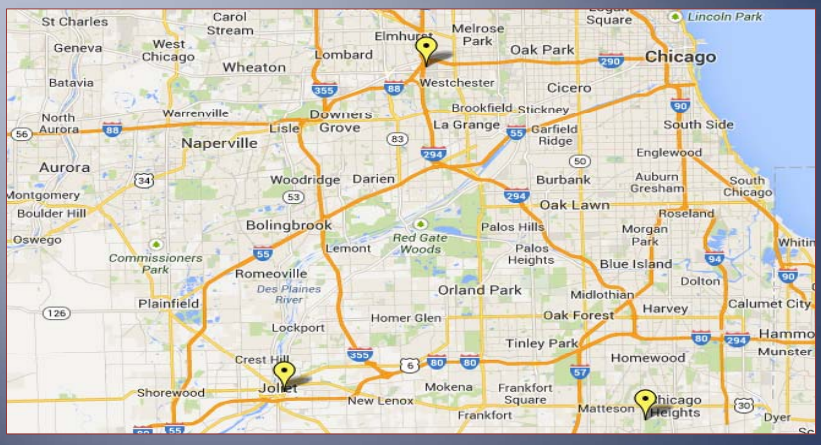
Total Recycle Asphalt (TRA) Field Results

	Design	IDH 12697 Sample # 1 - 2 hr Silo Cure	IDH 12698 Sample # 2 - 4 hr Silo Cure	Sample # 1 - Centerfuge 2 hr Silo Cure	Sample # 2 - Centerfuge 4 hr Silo Cure	IDOT - 6" Core Cut	STATE Testing - 6" Core Cut	STATE Testing Reflux
Gmm	2.528	2.508	2.500					2.497
Gmb	2.450	2.449	2.436					2.440
Voids	3.0	2.3	2.6					2.3
AC Ign Corr Factor		0.6						
AC - Centerfuge				6.2	6.1			
AC - Reflux	6.5	6.4	6.5					6.7
1/2	100	100	100	100	100			100
3/8	95	96	96	96	96			95
#4	52	62	59	61	59			52
#8	28	34	33	33	33			28
#16	22	25	25	25	25			22
#30	17	20	20	20	20			17
#50	13	14	14	14	15			13
#100	9	9	9	9	10			9
#200	6.6	7.3	7.3	6.9	7.5			6.6
Wheel Rut @ 10,000 passes	-1.70	-2.50				-3.90	-3.52	
Wheel Rut @ 20,000 passes	-1.90	-3.10				-5.40	-5.26	
TSR	0.88	0.91						
Cond TS	124.3	109.5						
Uncond TS	141.0	120.4						
Average Density						95.6	< 12.0mm	
Mix % Moisture		0.03						

Total Recycle Asphalt (TRA) Field Results

- Sustainability Features
  - Over 97% recycled material – no mined material
    - Concrete Aggregate
    - Slag
    - FRAP
    - RAS
  - 57% Asphalt Binder Replacement (ABR)
- Engineering Features
  - N50 Mix “D” Surface
  - PG52-28
  - TSR = 109.5/120.4 = 0.91
  - Hamburg - 5.3mm Ave @ 20,000 Passes
  - ASTM D 7313-07 Disk-Shape Compact Tension Geometry DCT -12 C 494 J/m2

Total Recycled HMA 2013 Contracts



Letting April 26, 2013
Contract Information

Resurfacing

- 60M30 –
  Wolf Rd
  from Harrison to IL 38
  (Hillside)

Total Recycle Asphalt

- 60L62 –
  26th St
  from Western Ave to East End Ave
  (Chicago Heights)
- 60N67 –
  Harrison St
  from IL 38 to Wolf Rd
  (Hillside)
- 60P70 –
  Richards St
  from Manhattan Rd to 5th Ave
  (Joliet)

Letting April 26, 2013
Bid Prices

- 60M30 – Wolf Rd
  HMA SC N70 – 1,382 tons
  High bid - $85.00
  Low bid - $68.00*

  8 pickup / 8 bidders
  ***K-Five Construction Corp.**

- 60L62 – 26th St
  HMA SC N50 – 3,060 tons
  High bid - $142.50
  Low bid - $59.50*
  6 pickup / 3 bidders
  ***D Construction Inc.**

- 60N67 – Harrison St
  HMA SC N50 – 2,131 tons
  High bid - $83.00
  Low bid - $65.00*
  6 pickup / 6 bidders
  ***K-Five Construction Corp.**

- 60P70 – Richards St
  HMA SC N50 – 2,223 tons
  High bid - $146.50
  Low bid - $62.00*
  6 pickup / 4 bidders
  ***Austin Tyler Construction**

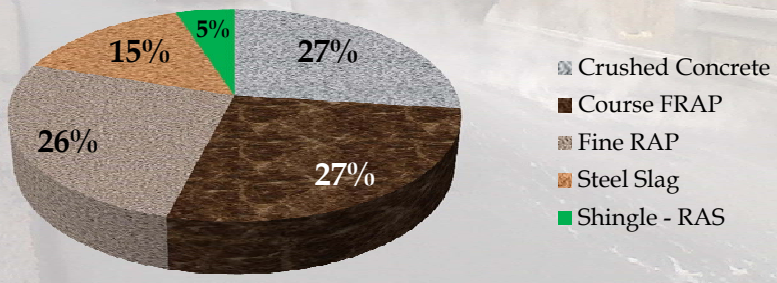
Cost Comparison:

- The average cost per ton for the 2013 TRA contracts $ 59 compared with $ 74 for a similar quantity standard spec HMA.
- This is a substantial $ $ $ $ saving.

- ***The Plant is a 400 ton per hour counter flow Dual drum plant, that has a drying drum and separate mixing drum***
- ***The plant is also equipped with a positive dust control unit***
- ***No modifications were required to produce this mix***

Mix Details

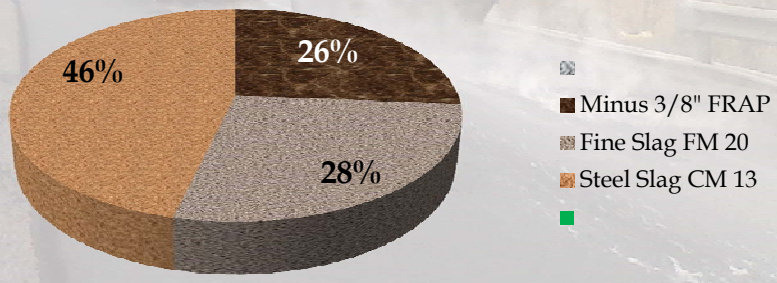
Contract 60N67, Harrison St Hillside
Contractor: K-Five Project
Design Total AC 6.5%, ABR 56%
Virgin AC, 2.8% PG 52-28



Joliet Asphalt
Astec Double Barrel, Drier Drum 400

Mix Details

Contract 60P70, Richard St Joliet
Contractor: Austin Tyler
Design Total AC 5.4%, ABR 37%
Virgin AC, 3.4% PG 58-28

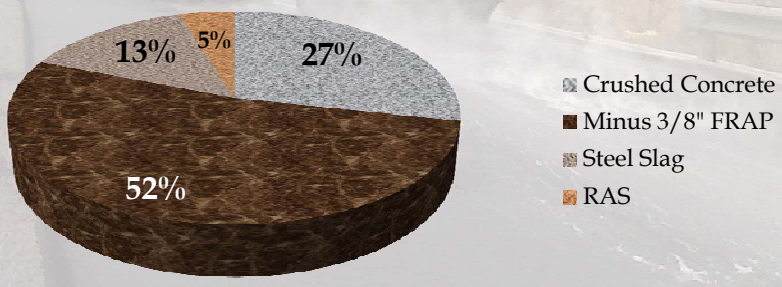


Terry Papp Jr
Plant & Laboratory Manager East Operations
"D" Construction, Inc.

D Construction
Sandeno East Plant,
East Hazelcrest
Gencore Model 400
Ultra drum

Mix Details

Contract 60L62, 26th, Street, Chicago Heights
Contractor: "D" Construction
Design Total AC 6.7%, ABR 60%
Virgin AC, 2.7% PG 52-28



TOTAL RECYCLED ASPHALT

"D" Construction was excited to be involved in constructing a Total Recycled Asphalt and working with IDOT toward Green Construction.

Our Sandeno East Plant located in East Hazel Crest was used to produce our TRA. We also crushed our Slag RAP and Crushed Concrete at our on site crushing operation.

We decided to produce our own Crushed Concrete CM16. We stockpiled clean concrete from a bridge deck replacement to ensure quality and low fines.

We ran a double deck on our screen unit using a 3/8" Screen on top deck and a 3/16" Z Screen on bottom deck.

We were very happy with end result. Dust was kept at approximately 2%. Aggregate had good angularity and met the Micro-Deval requirement of less than 15% weight loss consistently.

Modifications for future production will be required to increase production.

Plant Production

No modifications were made to the plant. Positive dust control system was utilized and NO dust was added back to the mix.

SLOW PLANT SPEED!

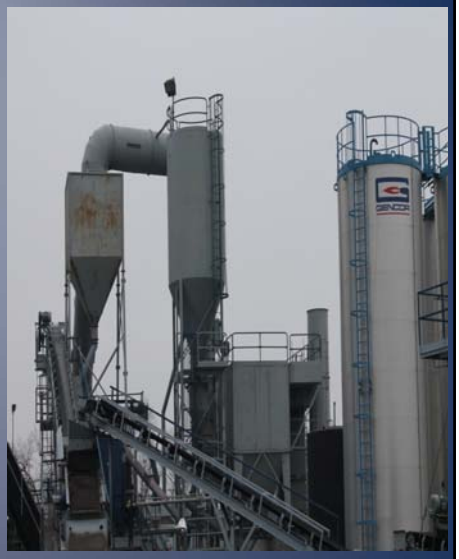
We ran at a steady 250 TPH. We started off on a high Rec. Private mixture to help bring up heat. A discharge temperature of 340 F was consistently maintained. Moisture content was measured at less than 0.1%.

Bag House

Maintain and manage heat to bag house. Our inlet temperature was maintained at 375 F and our outlet was 290 F. The Bulkhead in drum was appr. 420 F.

The burner was run at 70%. We did not see a significant increase in therms.

The back door of drum was opened appr. 2" to allow increased fresh air.



Recommendations

Maintain Dry Stockpiles

We keep our RAS under a canopy as well as our Slag RAP stockpile tarped.

Laboratory

I recommend batching in smaller quantities. With the high percentage of RAS and RAP I had an issue having the mixture turning clumpy and not having a homogeneous consistency. Mixing in smaller batches alleviated this issue.

Jobsite

The TRA mix was installed per plan at 1.5” over ¾” of Poly Level Binder Sand Mix.

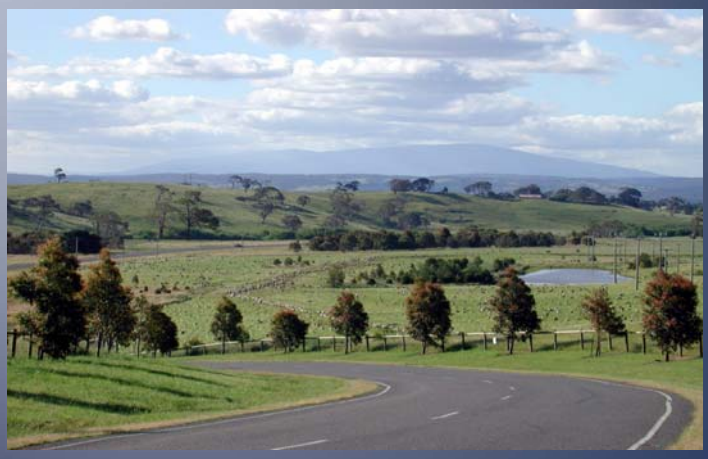
The paving train was a standard train utilizing a Paver, 2 Breakdown Rollers, and 1 Finish Roller

The TRA mixture laydown went very smoothly. The mixture rolled out very nicely with no pushing or flushing. The rollers used the same pattern as a standard N50 Surface with a total of 7 passes resulting in an avg. density of 95%

The future for TRA

- ***Will continue to monitor and evaluate the mix performance.***
- ***Develop a shadow specification (similar to the Warm Mix Specification) and offer it as an option and a substitute to a standard specification mix in the near future.***

QUESTIONS



Credits and REFERENCES:

- *Various data provided by, IDOT BMPR, David Lippert, P.E.; Matt Mueller, P.E.; Vickie Prill, P.E.*
- *Tim Murphy, PE, Murphy Pavement Technology*
- *ICT-12-018, R27-SP19, Laboratory Evaluation of High Asphalt Binder Replacement with RAS, H. Ozer, I.L. Al-Qadi, and A. Kanaan*
- *STATE Testing, LLC East Dundee, IL.*
- *National Asphalt Roadmap, Full report, June 07,www.hotmix.org*