2021 NORTH DAKOTA ASPHALT PAVING VIRTUAL MEETING

APRIL 6-7, 2021

ROBERT C. REA, NDOT - MATERIALS AND RESEARCH

THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA
SKILL RESPONSIBILITY INTEGRITY

NEBRASKA
Good Life. Great Journey.
DEPARTMENT OF TRANSPORTATION

DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

UNIVERSITY OF Nebraska Lincoln


93 Counties
Population 1.92 Million
Cattle 6.64 Million
Land Mass of 77,421 sq miles
Approximately 10,000 miles of NDOT Roadways
Approximately 85% Asphalt and 15% Concrete

TIMELINE

1998

2008

1988

2010

2020

TIMELINE

1988

Increasing Truck Volumes

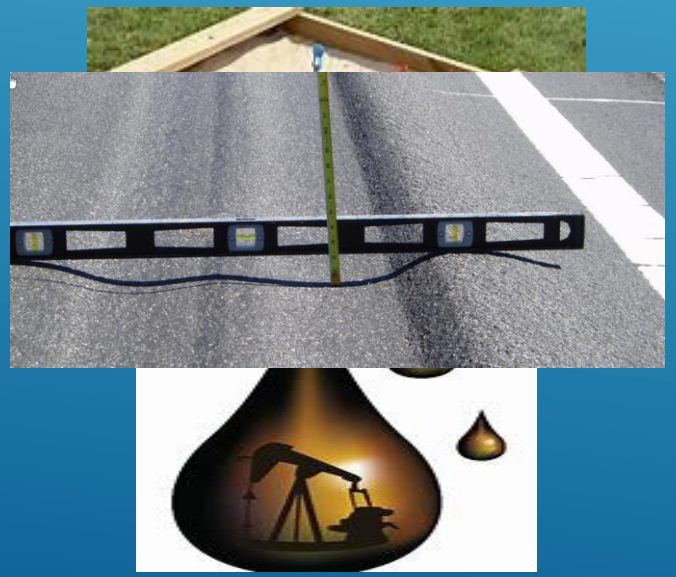
1993

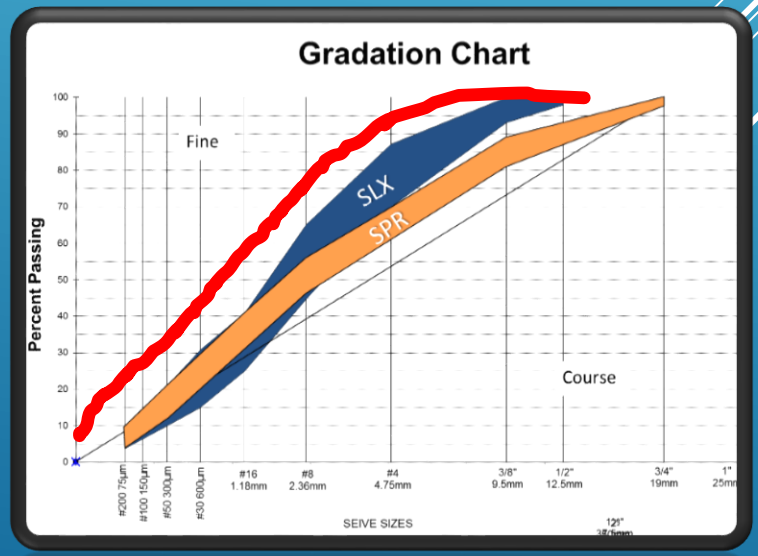
Higher Tire Pressures, Steel Wheels

High Asphalt Mixes, Modified Binders Just Arriving on Market

1998

Low Angularity Low Dust Sandy, Marshall Mixes





TIMELINE

1998

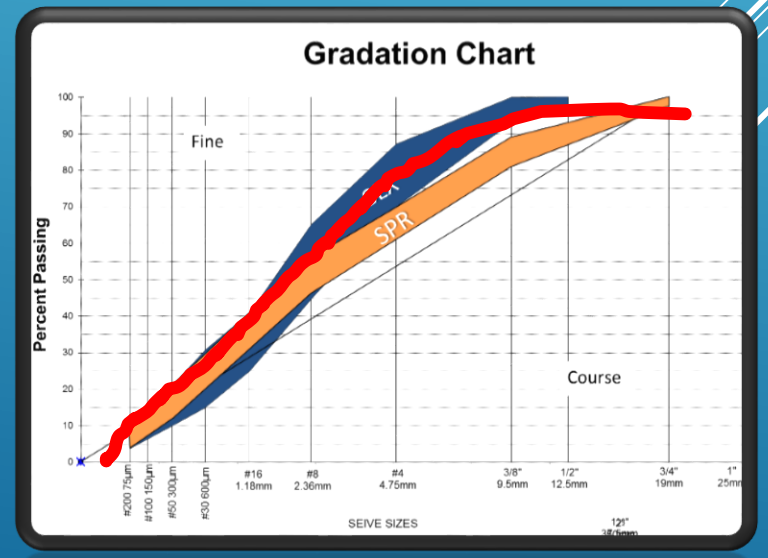
2008

Increased use of Polymer Modified Binders

High Angularity Highly Crushed Aggregates

Higher dust content and dust with angularity

Minimized Natural Sand Content and Coarser mixes

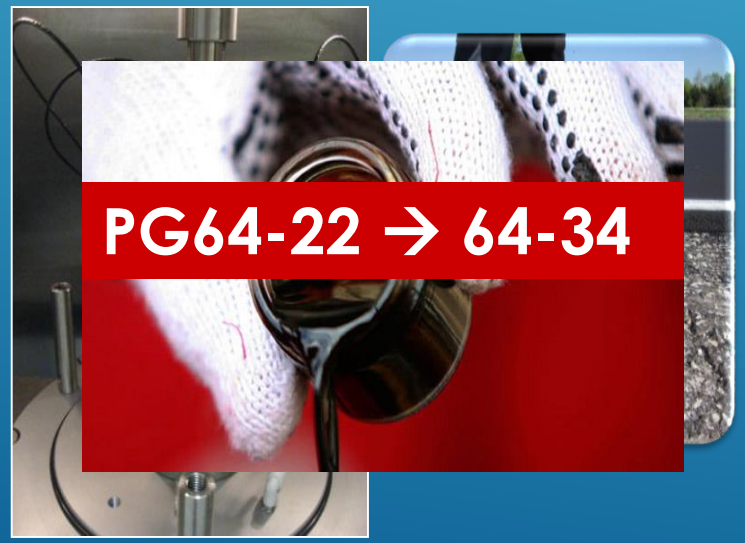


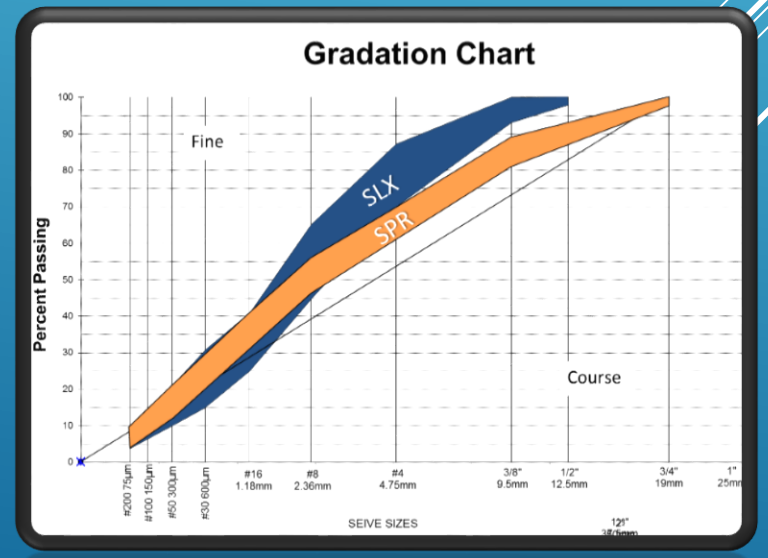
TIMELINE

2008

2020

- Polymer and Binder Shortages Globally. Prices Tripled
- Focus Design Ideology on RAP Optimization
- While maintaining overall mix quality and much softer binder grades
- Created
  - SPR
  - SPS
  - SPH
  - SRM
  - SLX





TIMELINE

2008

Millings Stockpiles scattered all around the state

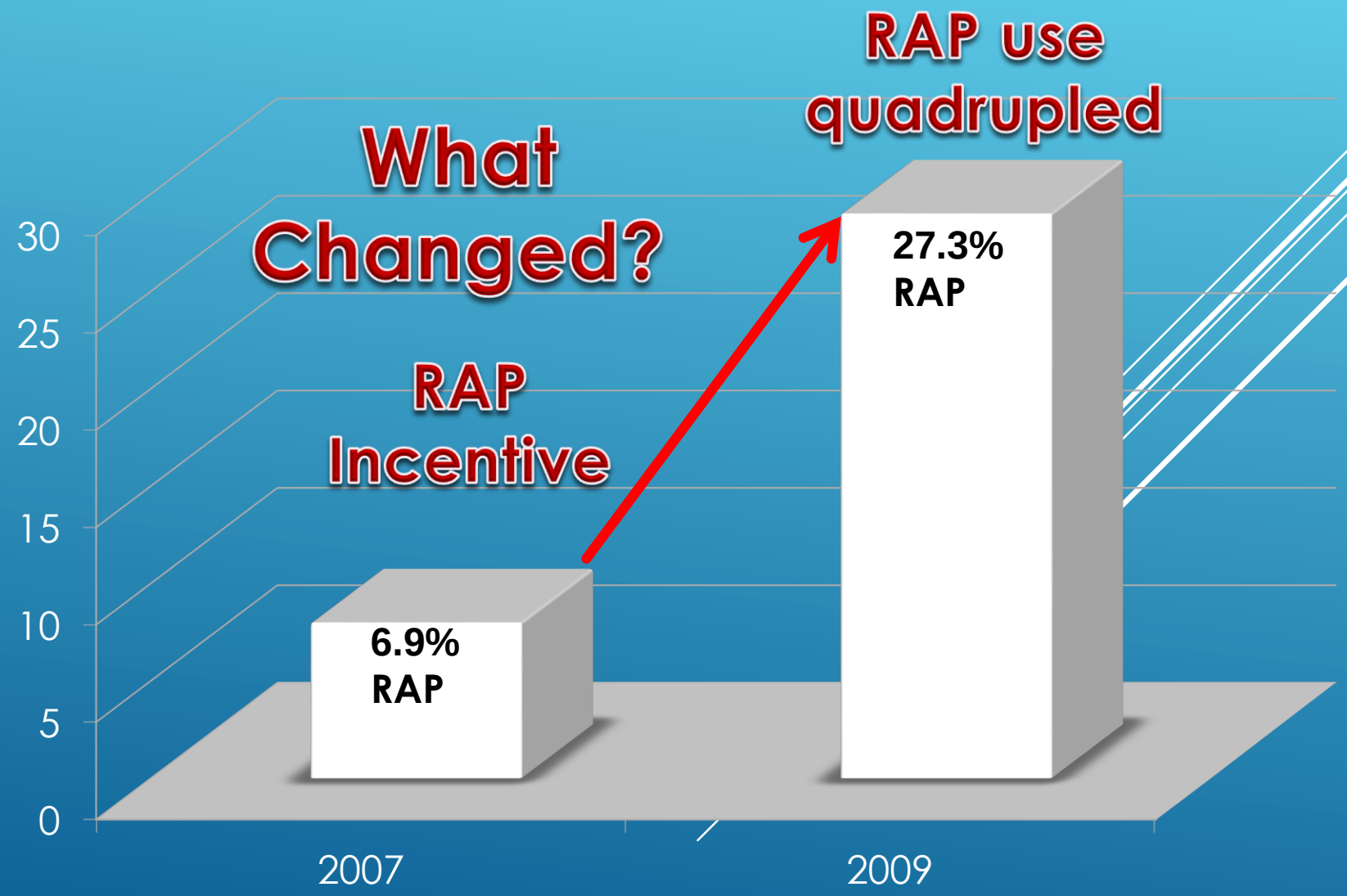
As many as 75 Large Stockpiles

Referred to as ‘Mountains of Millings’

‘Couldn’t store any more, give it away.’

2020

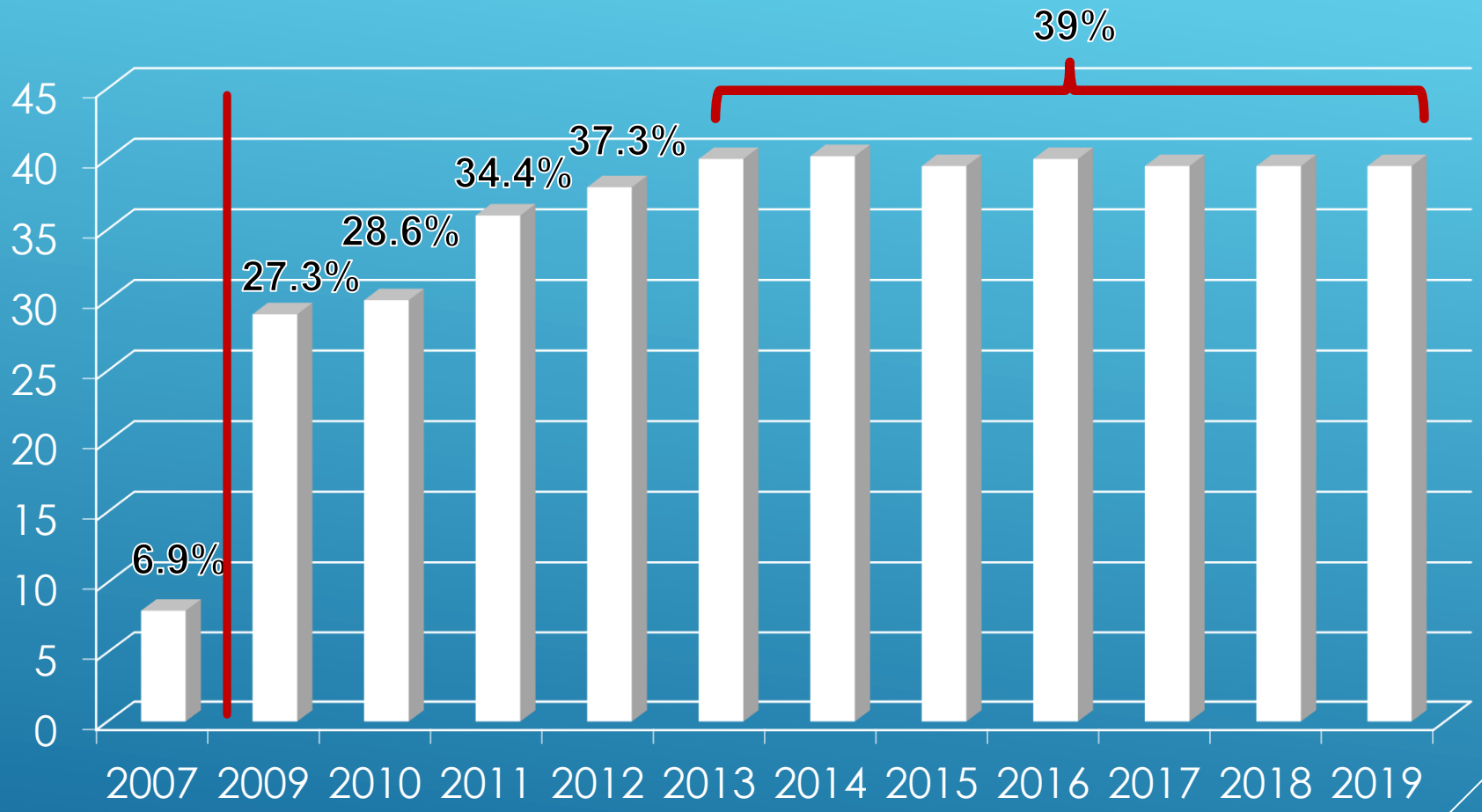
Average RAP Content



Share the binder cost savings

15% Contractor
85% NDOT

Average RAP Contents



TIMELINE

2008

2020

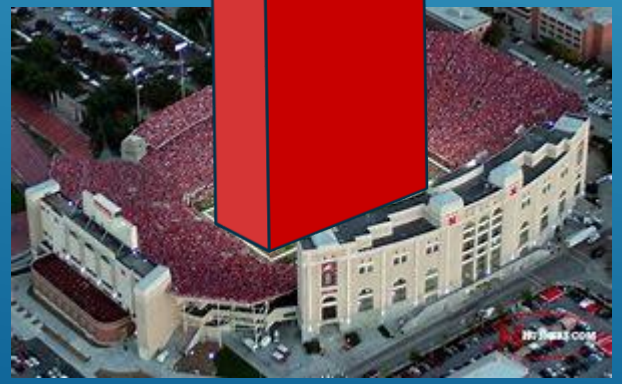
llion of gate led

37,279 feet = 7 Miles

498,000 Tons of Asphalt binder equivalent to Refining 93 Million Barrels of Raw Crude

That is 124 loads of these AfraMax Class Oil Freight Ships

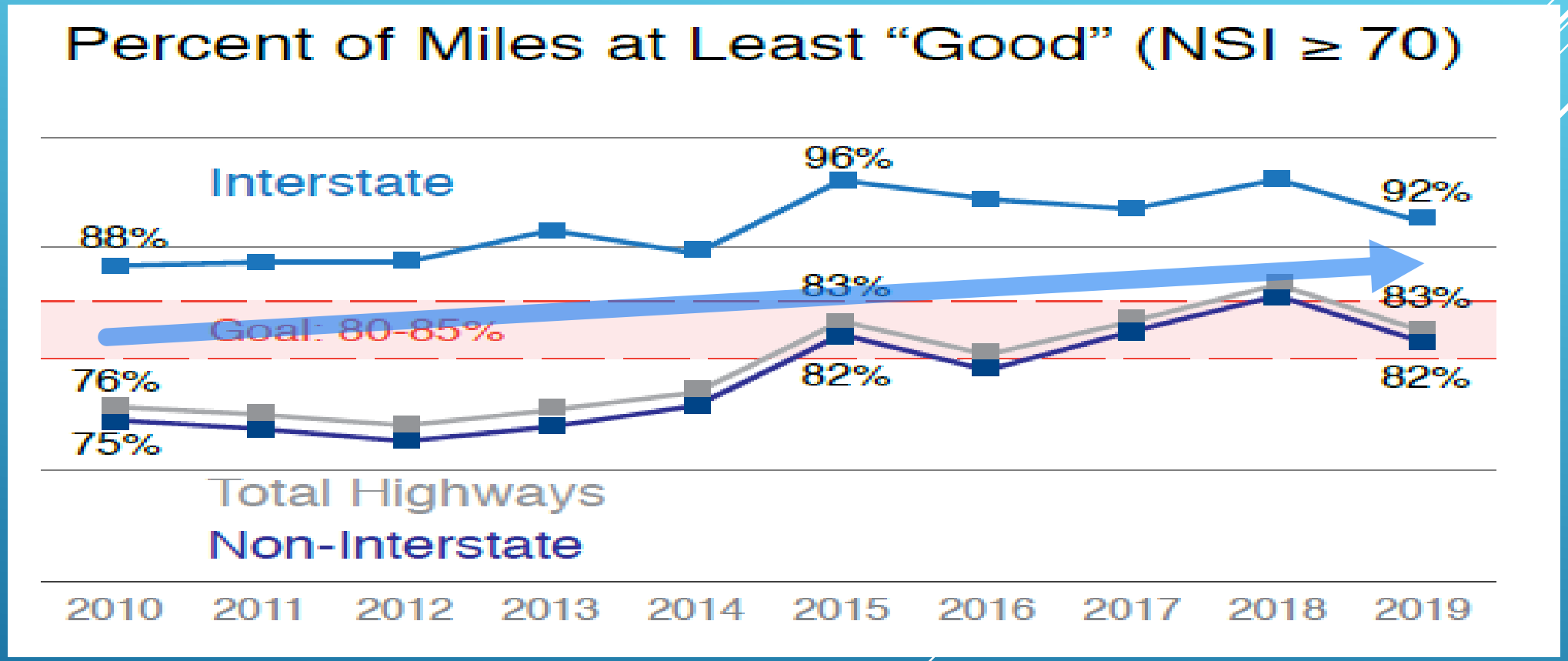
Total Savings of $458 M in binder and aggregate



Averaging $30 to 40 Million in savings every year

SERVICEABILITY INDEX

Cracking
Rutting
IRI (smoothness)



NEBRASKA
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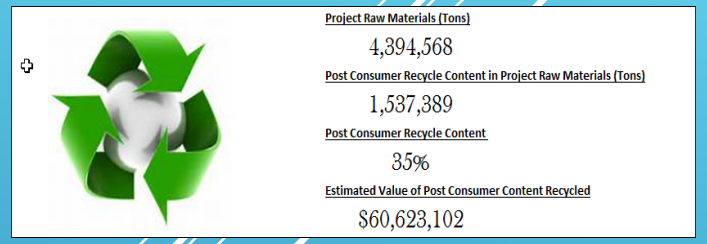
DEPARTMENT OF TRANSPORTATION

POST CONSUMER CONTENT LABEL

- Began using in 2014
- In plan sets and Annual Report
- Show NDOT's and the Industry's commitment to recycling and environmental stewardship
- Based on quantities of Asphalt and Concrete and calculated recycled contents



DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

NEBRASKA
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THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA
A G C
SKILL RESPONSIBILITY INTEGRITY

POST CONSUMER CONTENT LABEL

Project Raw Materials (Tons)

4,394,568

Post Consumer Recycle Content in Project Raw Materials (Tons)

1,537,389

Post Consumer Recycle Content

35%

Estimated Value of Post Consumer Content Recycled

$60,623,102

NEBRASKA

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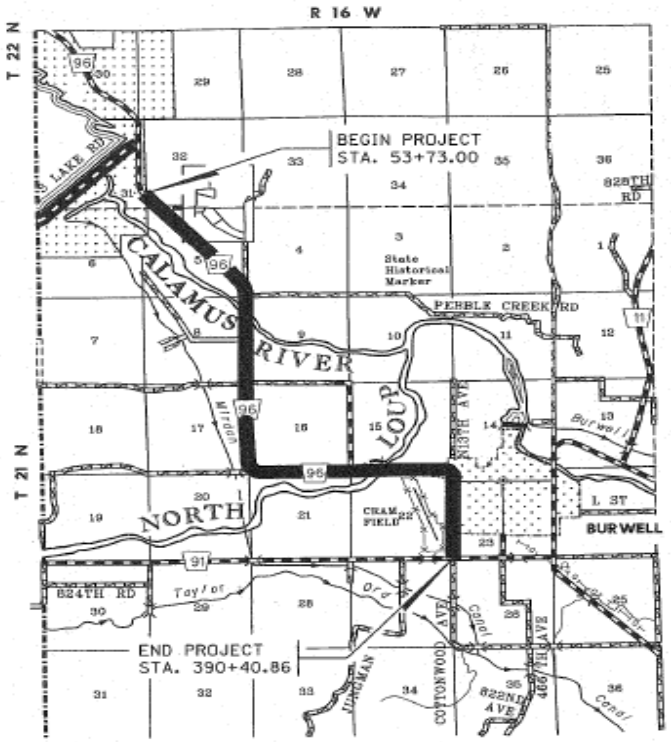
DEPARTMENT OF TRANSPORTATION

PROJECT NO.	SHEET NO.
RD-96-4(1001)	1
◣ CONTROL NO. 80709	
▲ CONTROL NO.	
■ CONTROL NO.	

STATE OF NEBRASKA
DEPARTMENT OF TRANSPORTATION

PLANS FOR CONSTRUCTION

BURWELL WEST
GARFIELD COUNTY



THE 2017 EDITION OF THE NEBRASKA STANDARD SPECIFICATIONS AND THE SPECIAL PROVISIONS APPLY TO THIS PROJECT.

THE WORK ON THIS PROJECT CONSISTS OF GROUPS
1-GRADING, 4-CULVERTS, 5-SEEDING,
6-BRIDGE, 6A-BRIDGE, 7-GUARDRAIL,
9-BITUMINOUS & 10-GENERAL

◣ GROUPS 1, 4, 5, 6, 6A, 7, 9 & 10 ARE INCLUDED
IN THE LETTING OF February 28, 2019

▲ GROUPS _____ ARE INCLUDED
IN THE LETTING OF _____

■ GROUPS _____ ARE INCLUDED
IN THE LETTING OF _____

STA. 117+72 TO STA. 156+91
STA. 285+50 TO STA. 318+00

DESIGN DESIGNATION
NEW OR RECONSTRUCTION
RURAL
TRAFFIC

YEAR:	2018	2038
ADT:	810	810
DHV:	220	220

STA. 334+68.29 TO STA. 378+73.44

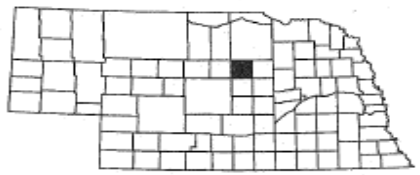
DESIGN DESIGNATION
3R MUNICIPAL
TRAFFIC

YEAR:	2018	2028
ADT:	810	810
DHV:	220	220

DESIGN DESIGNATION
3R RURAL
TRAFFIC

YEAR:	2018	2028
ADT:	810	810
DHV:	220	220

T= 10 % D= - %



Project Raw Materials (Tons)
43,000
Post Consumer Recycle Content in Project Raw Materials (Tons)
27,053
Post Consumer Recycle Content
40%
Estimated Value of Post Consumer Content Recycled
$684,869

CONVENTIONAL SIGNS

FENCE R.O.W. OR WIRE
GUARDRAIL
TRAVELED WAY
DIKE
CULVERT
POWER POLE
TELEPHONE POLE
MAILBOX
RAILROAD TRACKS
MARSH
TREE - CONIFEROUS
TREE - DECIDUOUS

R.O.W. LEGEND

NEW CONTROLLED ACCESS
PREVIOUS CONTROLLED ACCESS
LIMITS OF CONSTRUCTION
PREVIOUS R.O.W.
NEW R.O.W.
EXISTING PERMANENT EASEMENT
TEMPORARY EASEMENT
EXCESS TAKING
PERMANENT EASEMENT
EXISTING RAILROAD EASEMENT
NEW RAILROAD PERMANENT EASEMENT
NEW RAILROAD TEMPORARY EASEMENT

REFERENCE POST NO. 13+55 TO REFERENCE POST NO. 20+02

EXCEPTIONS: FROM STA. TO STA.

TOTAL NET LENGTH OF PROJECT: 33,667.86 FEET 6.377 MILES

COORDINATING PROFESSIONAL

ROADWAY DESIGN DIVISION

Computer: NDOTDESIGN61

Date: 1/8/2018 08:53

File: 80709G_NDOT_Title_Sheet_2018.dgn

Scale: 1:100

AS PROMISED……

How do we get there ?

1. Mix Design Changes

2. Plant Modifications

How do we get there ?

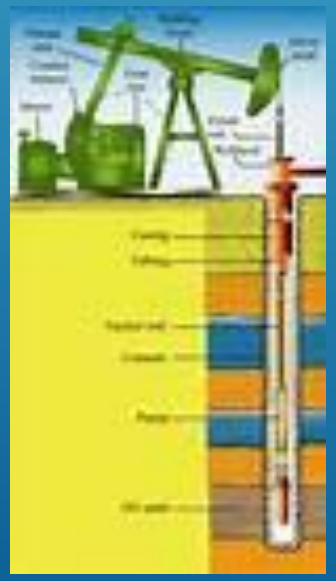
Mix Design Changes

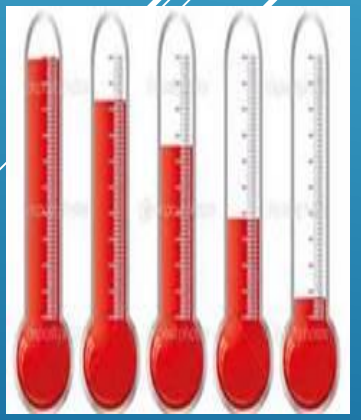
1. Softer binders PGXX-34
2. Lower Air Voids @ Ndes = 1.5 to 2.5 %
3. VMA Allowances
4. Dust to Asphalt Ratios
5. Minus #200 Material

BINDERS

Mix Design Changes

1. Stiff RAP Binder PG86-16
2. High Temp is already covered
3. Low Temp needs repair -34 grades
4. 58-34 and 64-34's (both contain polymer)
5. We use Warm Mix Additives at min. 0.7% in all mixes





AIR VOIDS

Mix Design Changes

1. Lower Air Voids @ N_{des} = 1.5 to 2.5
2. Higher Density & Less Permeable
3. Higher Strength
4. Typically more dust

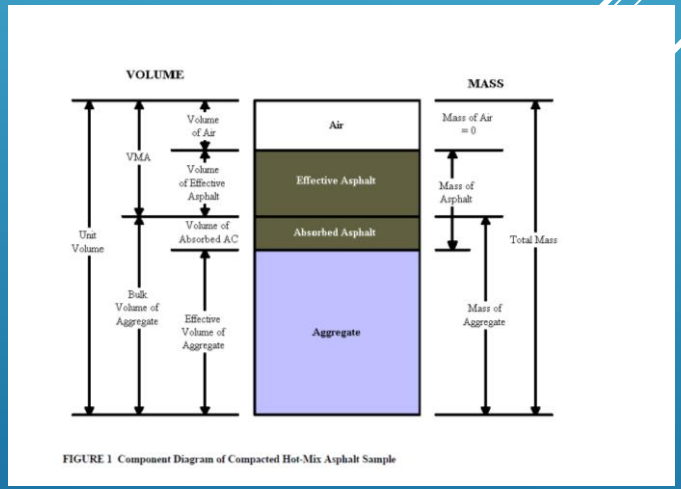


FIGURE 1 Component Diagram of Compacted Hot-Mix Asphalt Sample

VMA

Mix Design Changes

1. VMA Calc → Big Problem
2. With 50% RAP ignition oven
3. Gravity is largely affected → Lowered
4. Lowers calculated VMA by up to 3%
    - Fixed Gravity Value for aggregate
    - Backcalculate from Gse
    - Go to minimum binder or film thickness

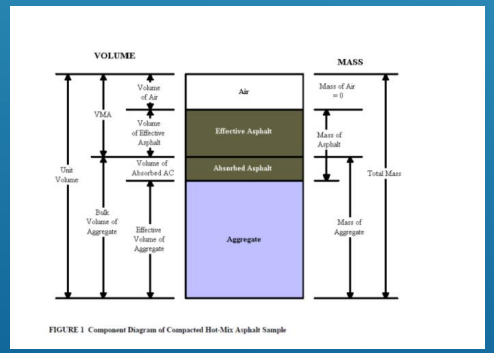
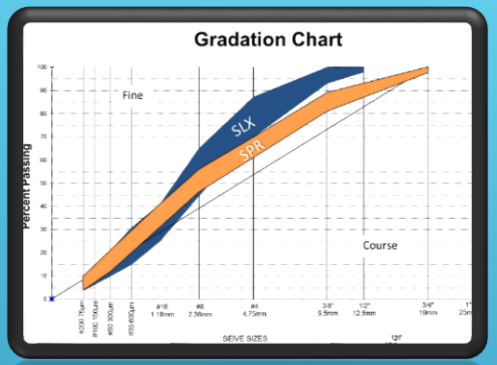


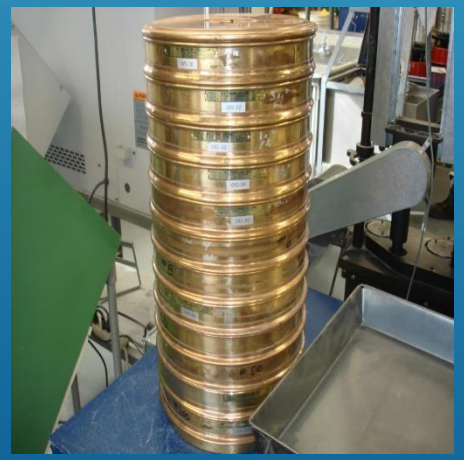
FIGURE 1 Component Diagram of Compacted Hot-Mix Asphalt Sample

DUST – Minus #200 Material

Mix Design Changes



1. RAP millings have more #200 sieve
2. Widened grading band to allow minus #200
3. VMA Allowances – Dust as binder extender
4. Dust to Asphalt Ratios spec at 0.6 to 1.6
5. Minus #200 material metered at plant



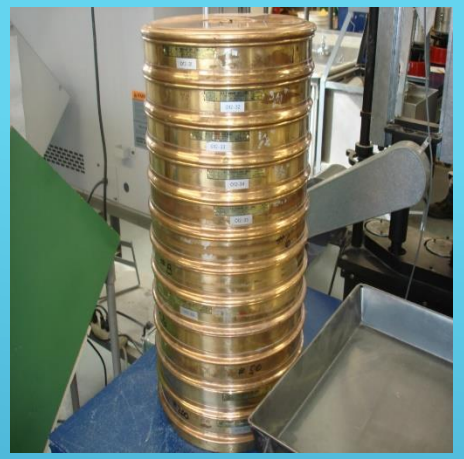
How do we get there ?

Plant Modifications

1. Stockpile management
2. #200 Sieve Material Management
3. Variable Frequency Drive Motors
4. Dual RAP Bins
5. Screening Units/Grizzly
6. RAP Processing

STOCKPILE MANAGEMENT

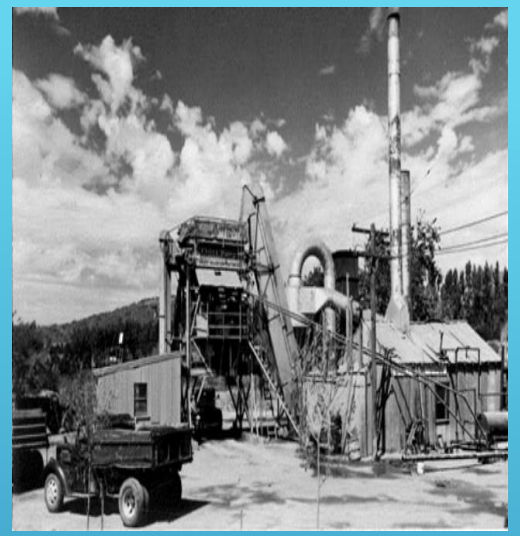
Plant Modifications



1. Stockpile care
2. Run Gradations and Binder Contents
3. Lot of immediate or 'hand to mouth' RAP use

#200 MATERIAL

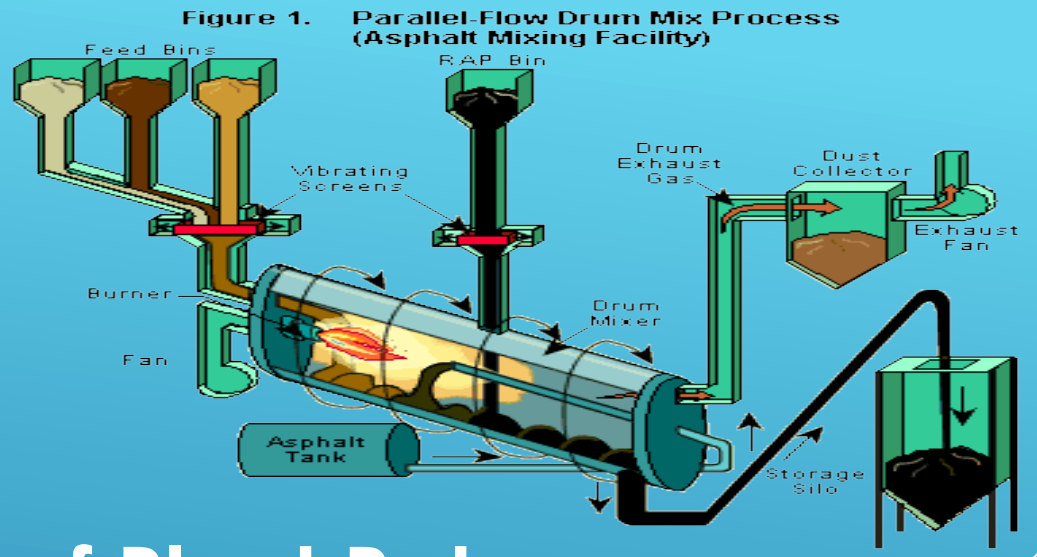
Plant Modifications



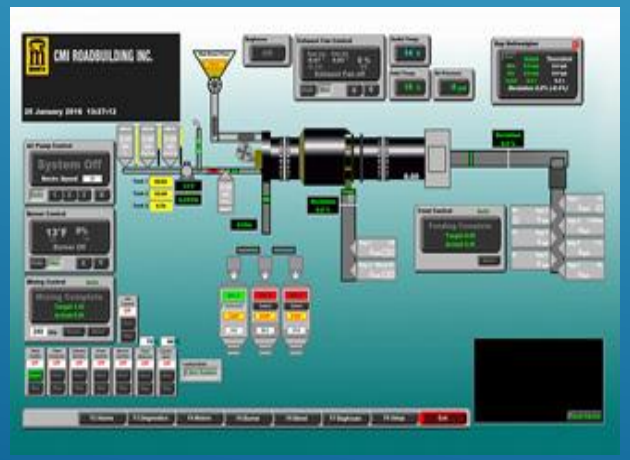
1. Metered fines from baghouse with Silo
2. Drop Dust from Plant

VFD PLANT CONTROLS

Plant Modifications

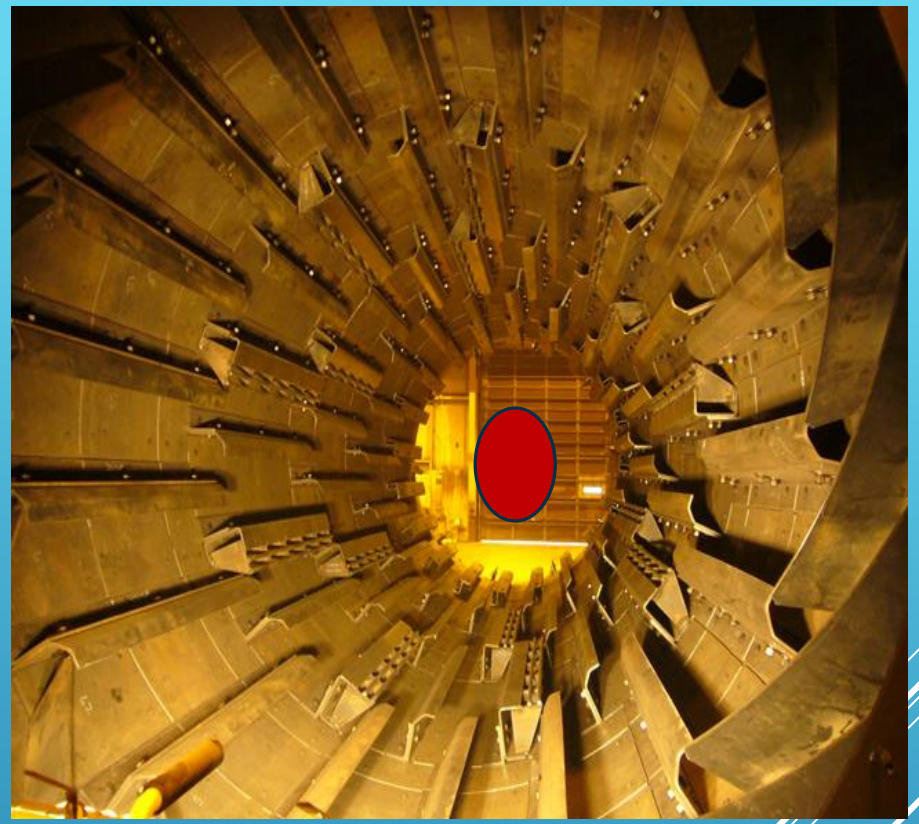


1. Precision Control of Plant Rate
2. Drum
3. Baghouse exhaust
4. Cold Feed Bins
5. RAP Bins



VFD's
FLIGHTS
&
VEILING

Plant Modifications

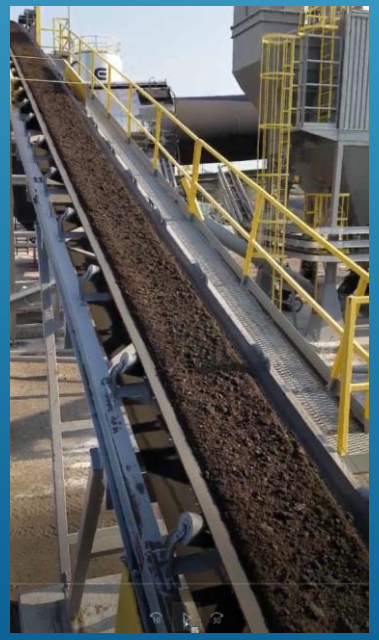


1. Flight changes
2. To Superheat 50% Virgin
3. Drum Plants max 50-65% RAP
4. Batch Plants max 35% RAP

DUAL RAP BINS

Plant Modifications

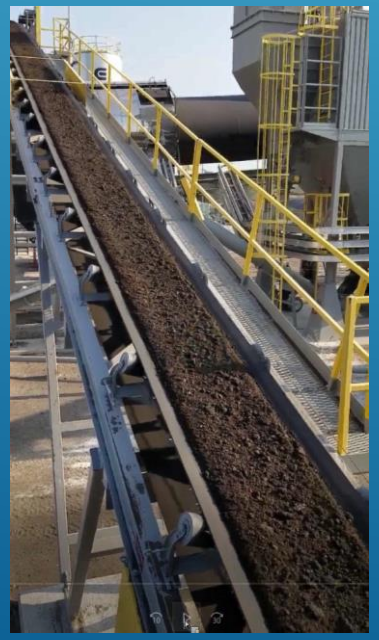
1. Dual RAP Bins – only the last couple years
2. Better handles large volume 50% RAP
3. Feed 2 Different RAP's – Gradation/Binder



SCREENING UNITS

Plant Modifications

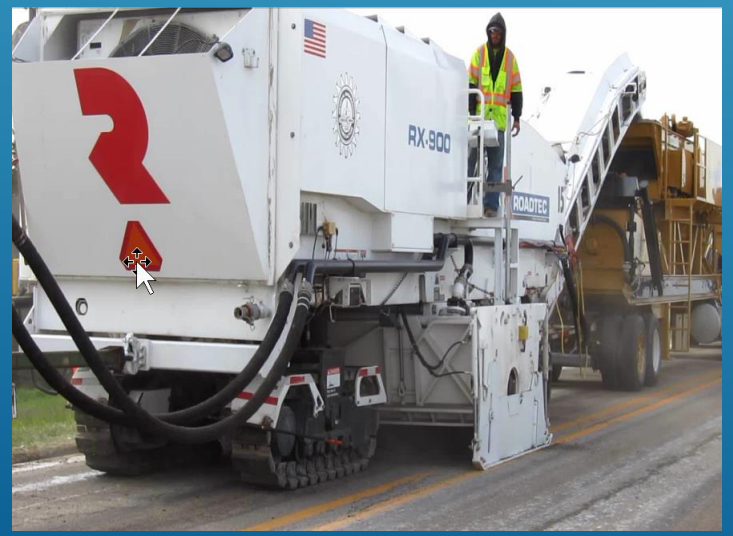
1. Selection of Sizes and Types
2. Sometimes 2 screens in a series



RAP PROCESSING

Plant Modifications

1. Best Mill and straight to plant
2. Preprocess/Crush/Screen – Gator or Screen
3. Fractionate – We Don't yet



How Long
Does it Take ?

Together you could do some this year

Do some recycling
& save some money

Today's Typical Mix Design

- Over 1000 of these mixes produced
- Comprising approx. 20 million tons
- No Failures

State of Nebraska

Department of Transportation
Asphalt Concrete Design

#1-51392-SPR(WMA)-21-MD

Project Manager: James Johnson
Project No: STP-92-1(124)
Name of Road: N-92, Wyoming State Line East
Type of Asphalt Concrete: SPR
Design No: 2021-1

Date: 02/26/21 Approved

ASPHALT BINDER
Source: Suncor
Grade: PG 58H-34 w/0.7% AD-here
ArrMaz

GRADATION OF MATERIALS PROPOSED						SIEVE ANALYSIS (WASH)								
MATERIAL		PIT LOCATION				19.0	12.5	9.50	4.75	2.36	1.18	600	300	75
	%	1/4	SEC	T	R	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#200
3/4" Rock	10	Martin Marietta Guernsey				100.0	72.0	41.0	4.0	3.0	3.0	3.0	3.0	1.0
3A Crushed Gravel	40	SE	12	21N	54W	100.0	100.0	100.0	95.4	68.4	45.6	29.6	18.2	7.1
2A Gravel	5	SE	12	21N	54W	100.0	98.0	94.0	75.0	30.0	12.0	9.0	3.0	1.0
RAP	45	On Project				100.0	95.2	88.9	77.1	55.4	40.2	27.6	17.1	5.8
		COMBINED GRADATION				100.0	94.9	88.8	77.0	54.1	37.2	25.0	15.4	5.6
		SPECIFICATION RANGE				98		81		46			12	4
						100		98		56			21	

JOB MIX IDENTIFICATION			
JMF #	8		
TOTAL BINDER	5.20%		

CONSENSUS PROPERTIES		FAA SP.GR.
FAA Results	43.5	2.585
CAA Results	95	
Dust to Asph. Ratio	1.08	
Design Gsb	2.585	

Addition of 2.89% of type PG 58H-34 asphalt binder for a total of 5.20% (by wt.of mix) has been selected by the contractor to be the target asphalt binder content.

No Hydrated Lime will be necessary for this design due to the use of 0.7% AD-here Ultra 1.

This constitutes verification of the job-mix gradation and superpave criteria values proposed by the contractor. If it is necessary to change the job mix either before or after the job starts, including the asphalt binder %, the contractor shall notify the P.E. / P.M.

cc: Werner Construction, Inc.
Jerry Isom
Andy Dearmont
Robert Rea

REMARKS: Please use a +0.1% correction for the asphalt binder content during construction. RR/jp

Validated by Robert C. Rea & Materials and Research Division
Fax (402) 479-3882

THANK YOU !

ANY QUESTIONS ?