Gyratory Superpave Mix Design for Local Governments for Low Volume Roads

Iowa Department of Transportation

Implementing the Gyratory Mix Design System for Low Volume Routes

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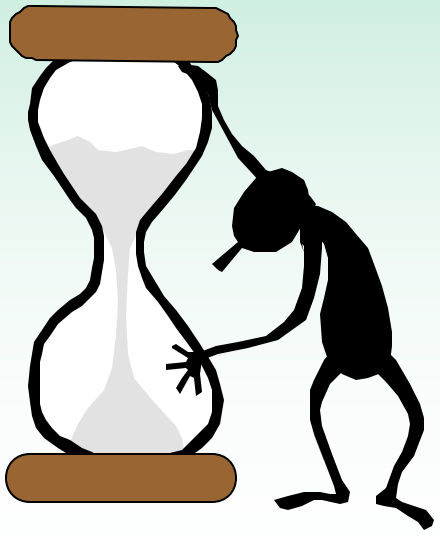
Why change to gyratory?

- Superior mix design process
- Eliminate duplicate design systems

Iowa Gyratory System Implementation

PG-Binder *Full Implementation* *Jan 1997*

- *Mix Design* *State Routes* *'97 - 10%*
  '98 - 25%
  '99 - 50%
  '00 - 100%



All other routes *2004*

Iowa's Implementation Process

- 1999 Identified need, formed team
- 2000 Data collection
- 2001 Analysis, develop guidelines

Team Approach

- DOT/County/industry
- Agency concerns
- Industry practice
- 7 activities outlined

- Training
- Public relations
- Mixture analysis
- Quality control
- Constructibility
- Cost
- Plan validation

Gyratory System for Engineers & Designers

TRAINING

PUBLIC RELATIONS

No. 6 - Mix Selection Guide

No. 5 - Specification

No. 4 - Mix Analysis

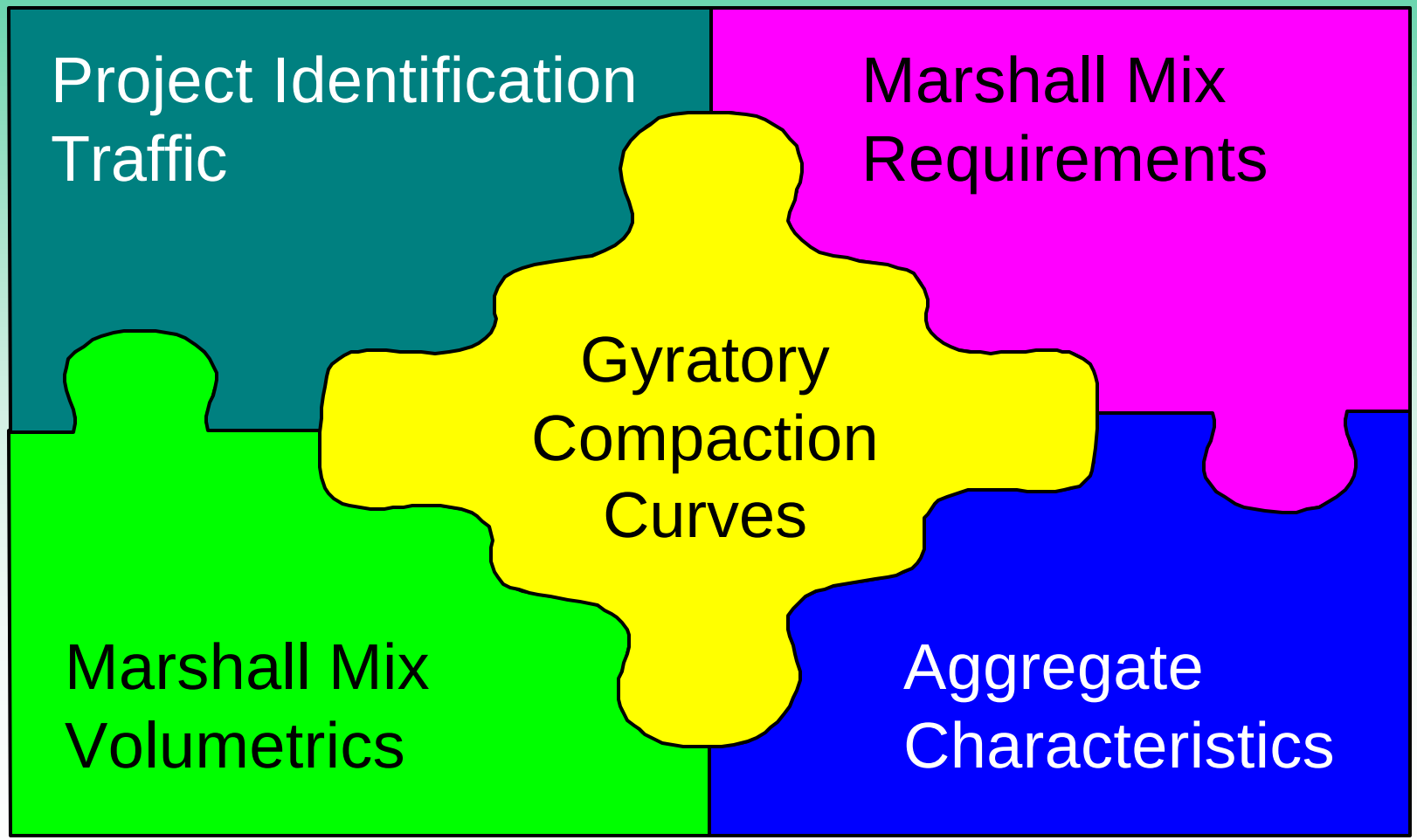
No. 3 - Send Marshall Mixes

No. 2 - Training Sessions

Implementation Bulletin

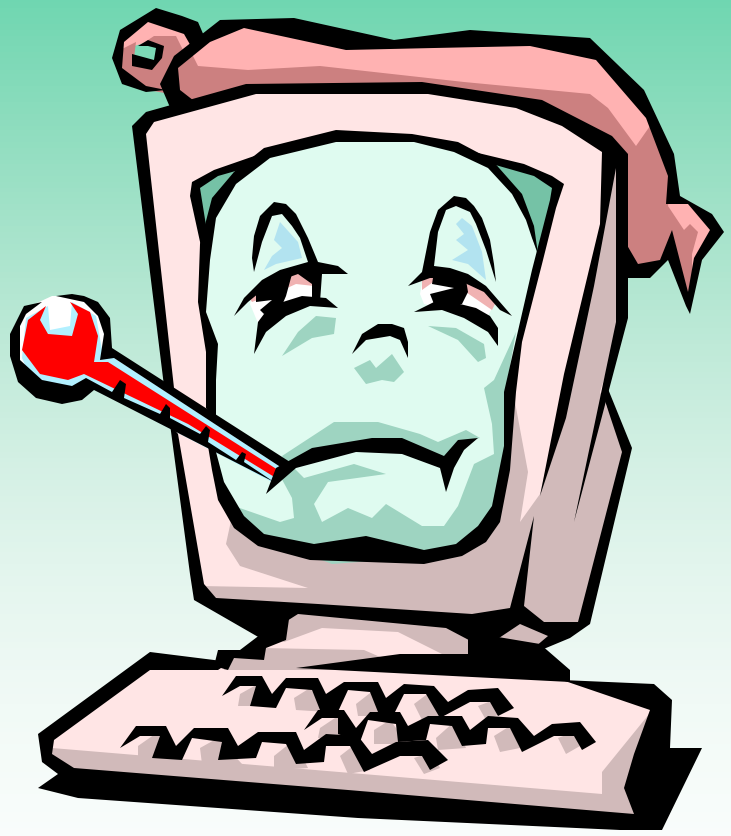
No. 1 - The Plan

Mixture Analysis Input Data Fields

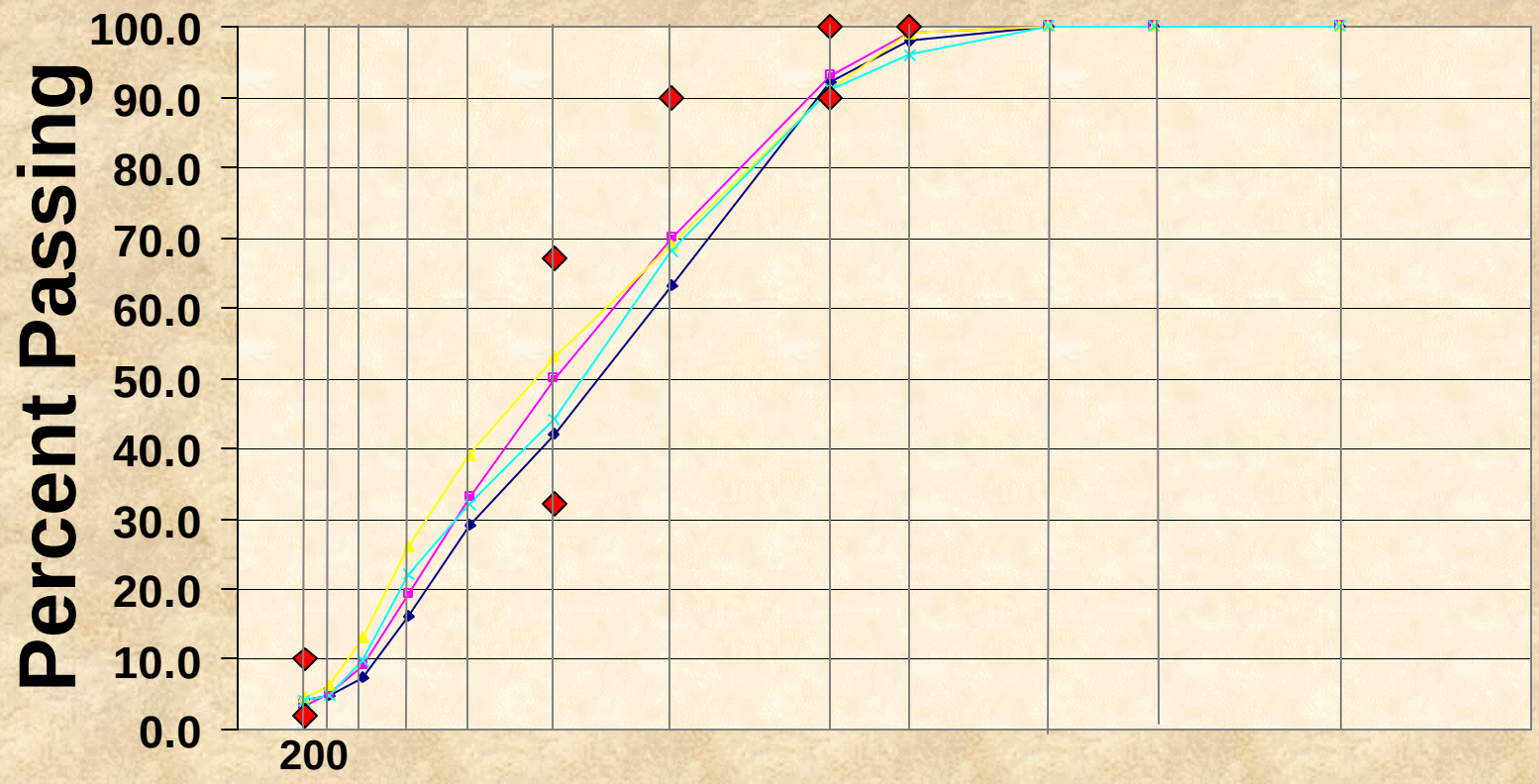


Getting the Data!

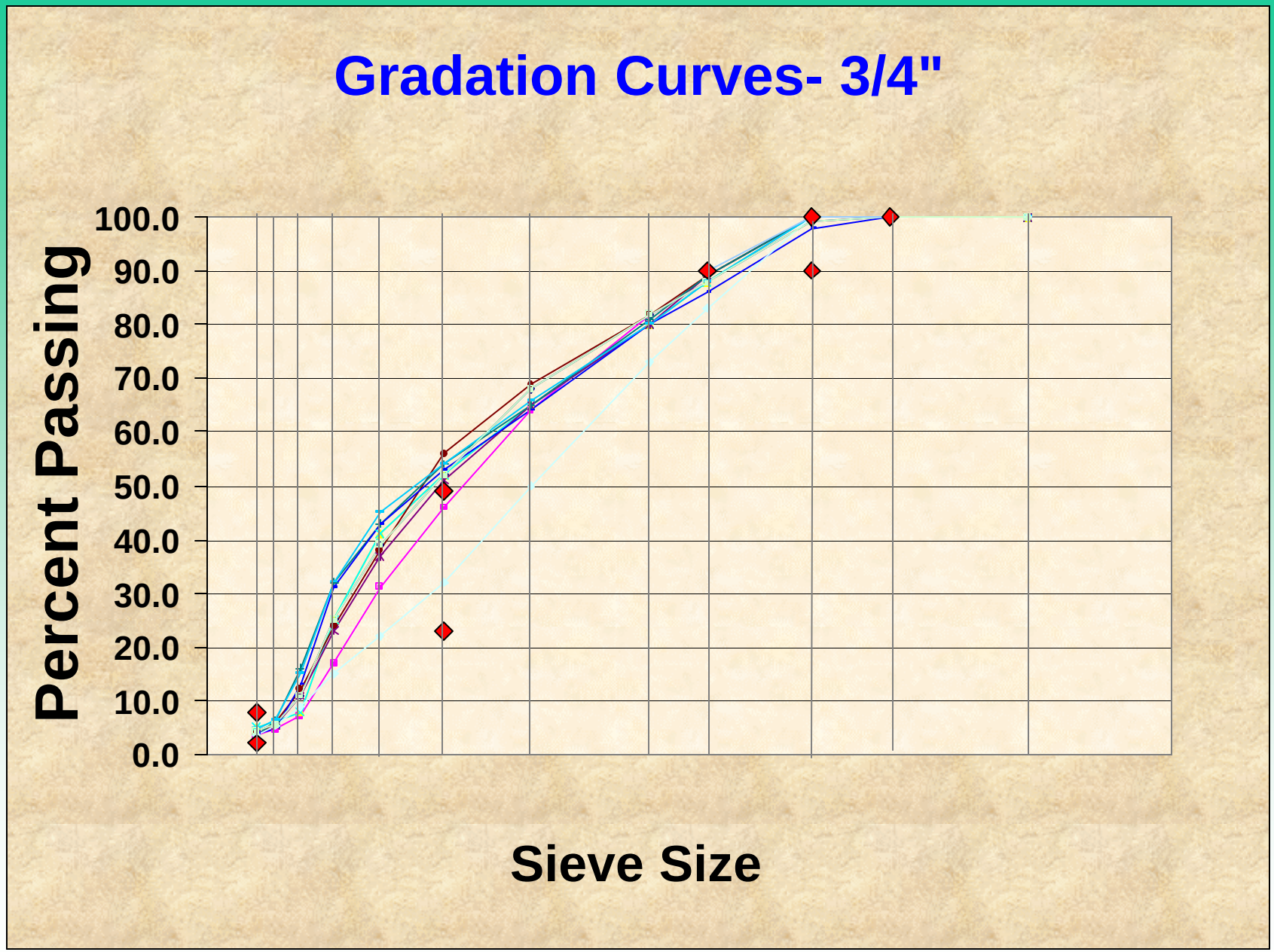
- 102 Mixes
- 170 Split Samples
- Huge Data Base
  - 8500 Data Entries
  - 16200 Calculations
- Over 2000 hours of work



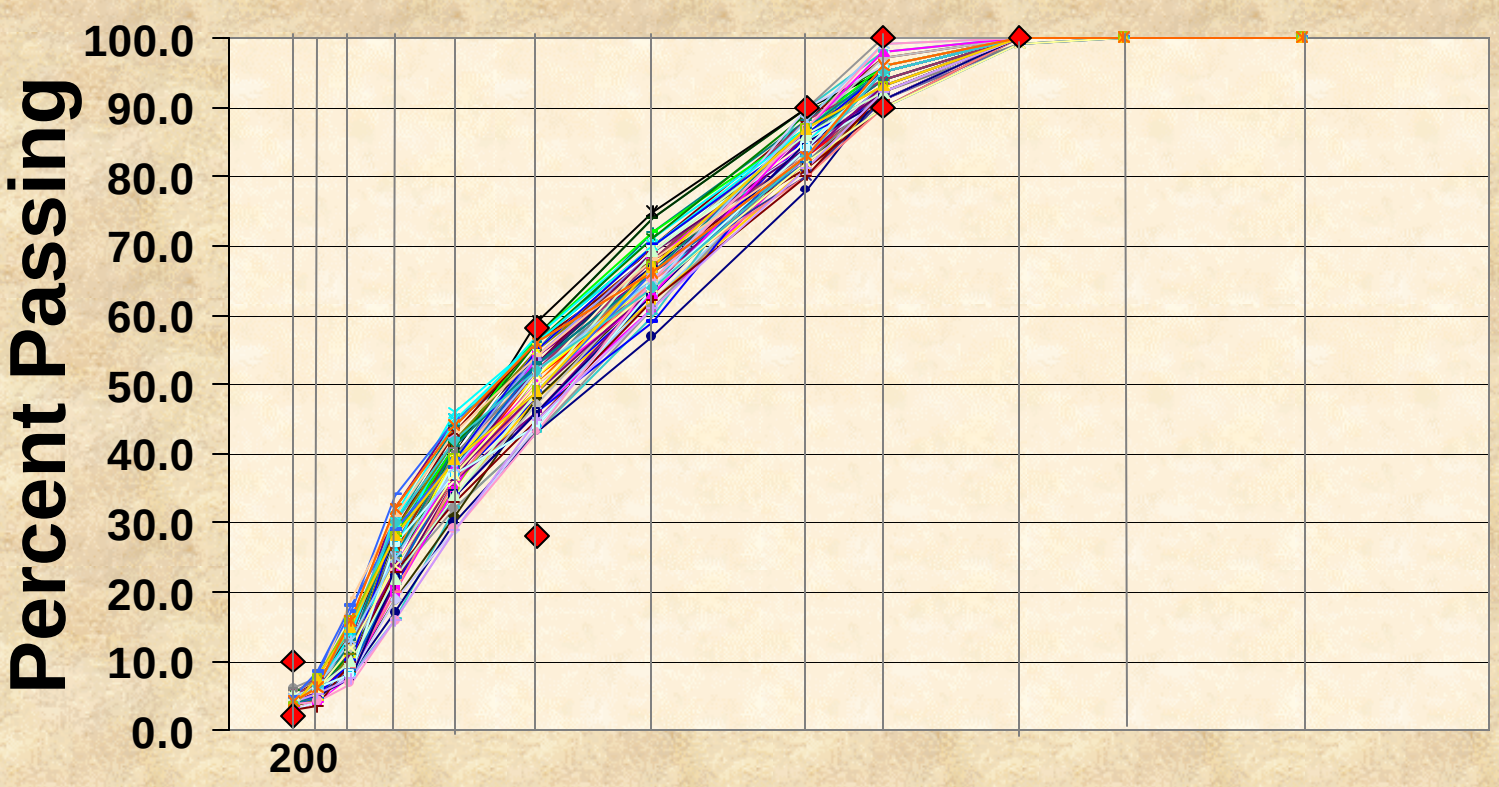
Gradation Curves- 3/8"

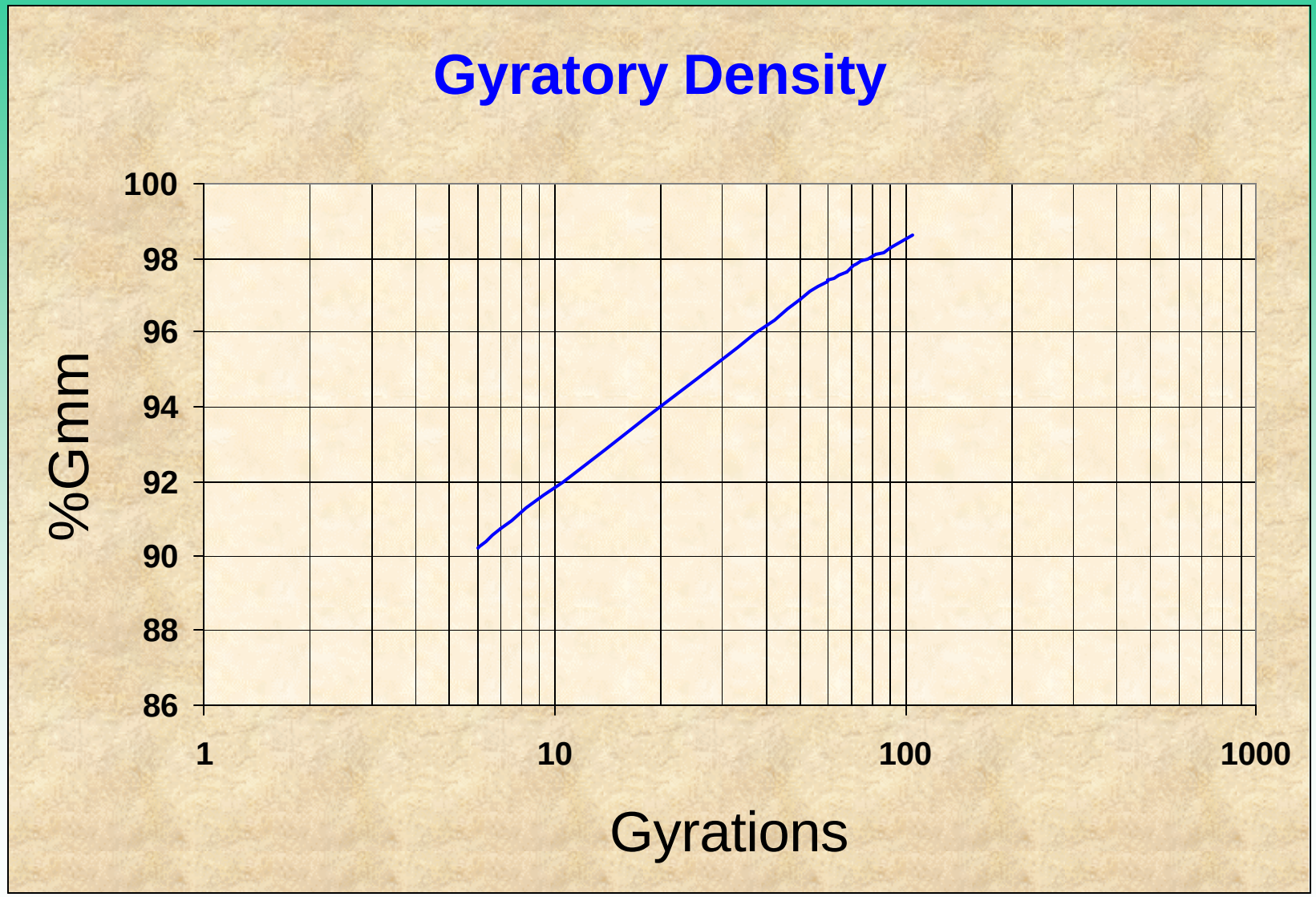


Gradation Curves- 3/4"

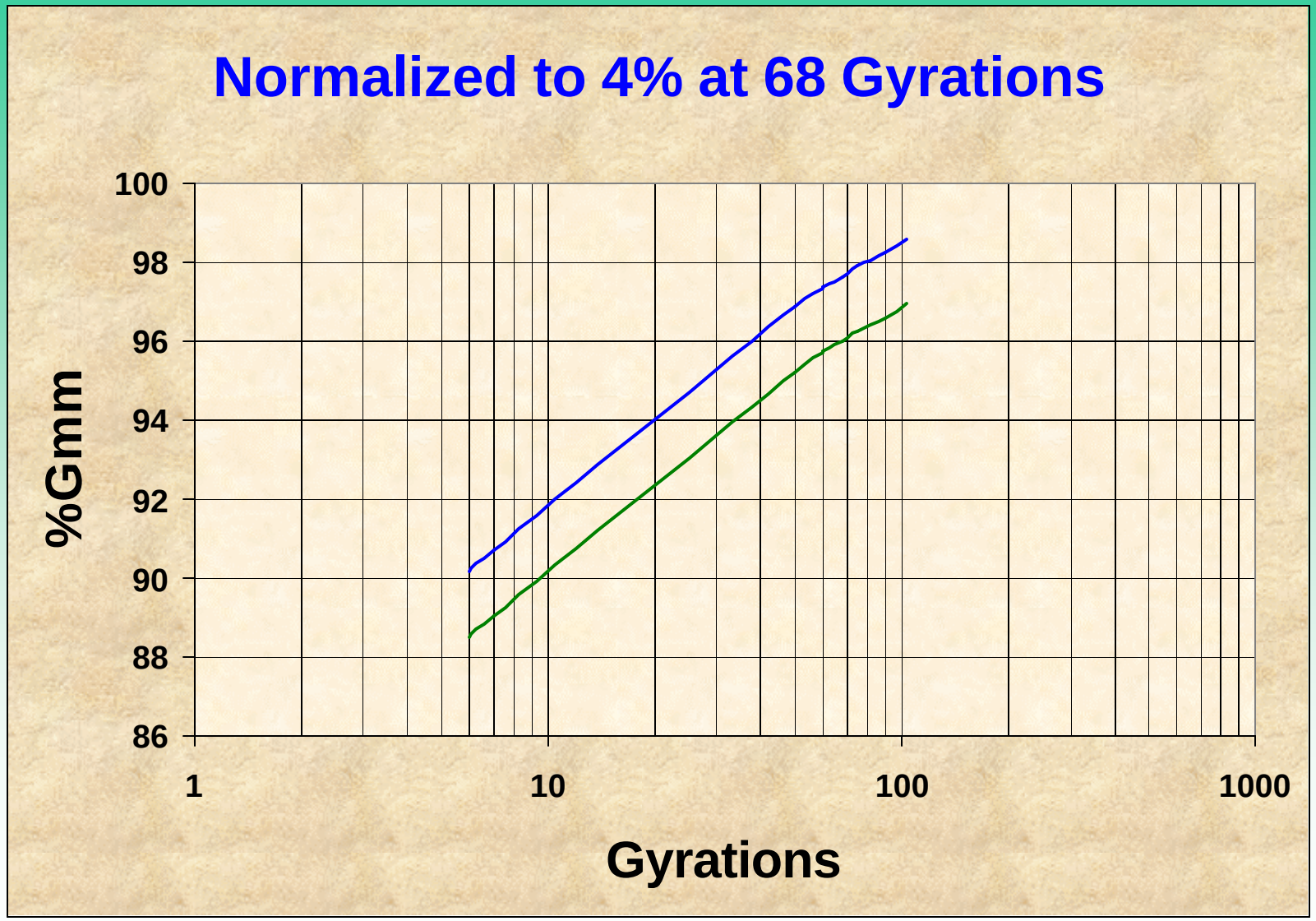


Gradation Curves- 1/2"

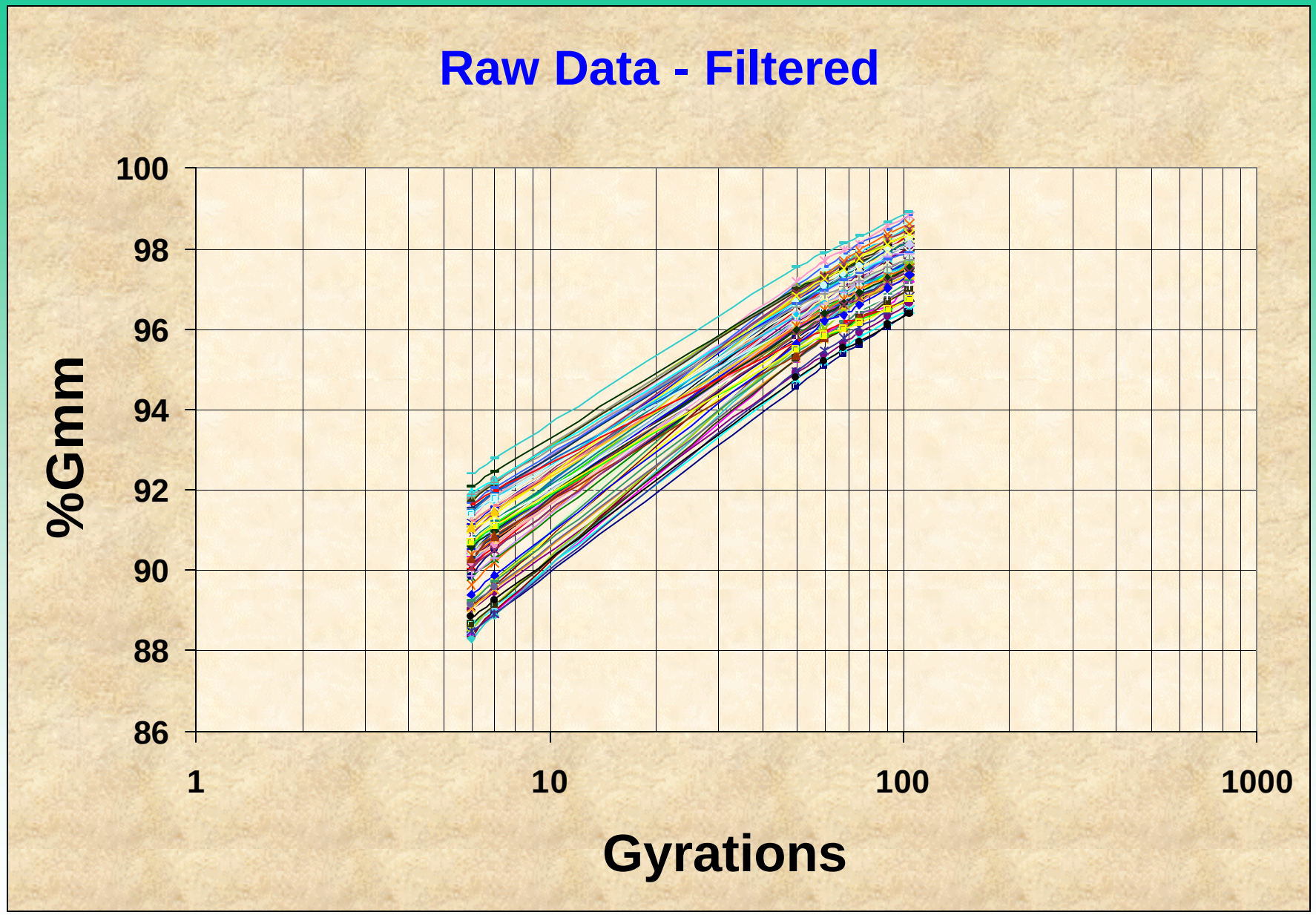



Gyratory Density
100
98
96
94
92
90
88
86
%Gmm
1
10
100
1000
Gyrations

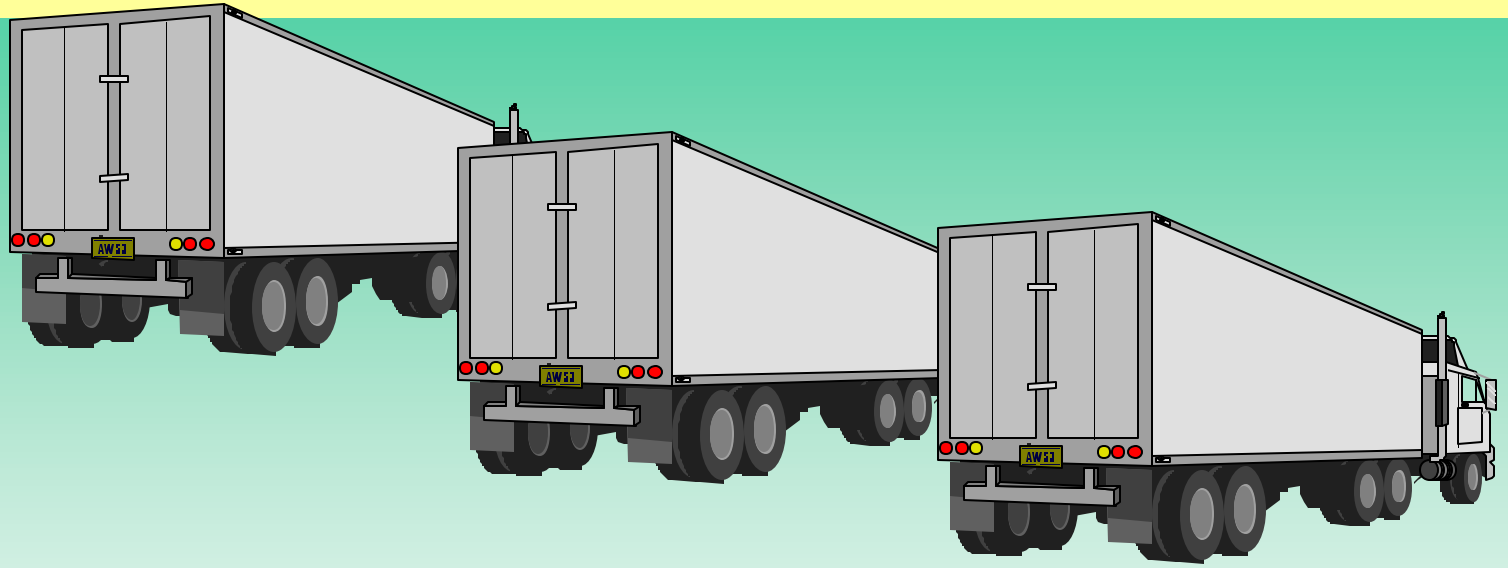
Normalized to 4% at 68 Gyrations



Raw Data - Filtered



Mixture Levels



Less than 100,000 ESALs (40 trucks/day)

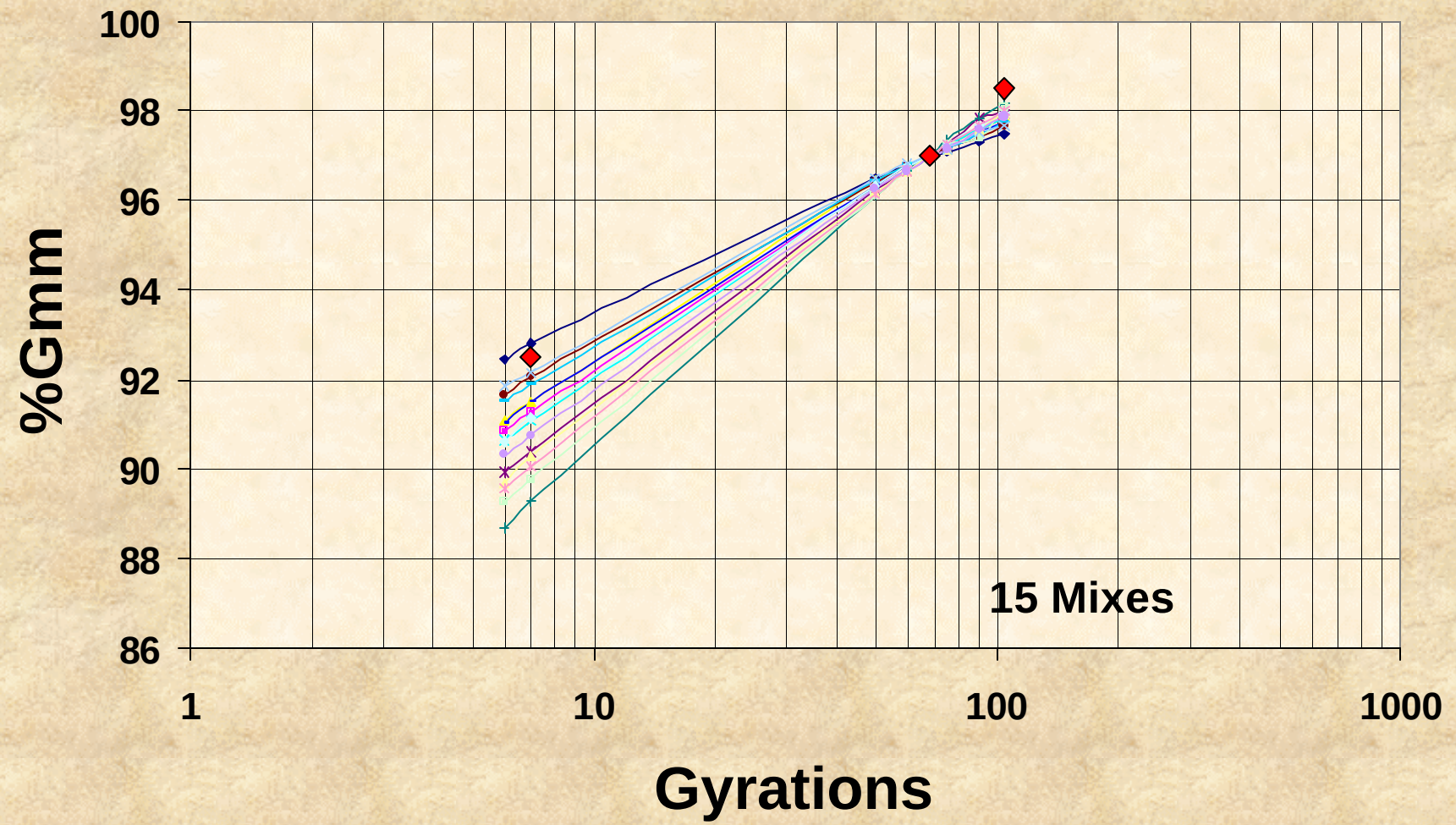
100,000 to 300,000 ESALS (40-125 T/day)

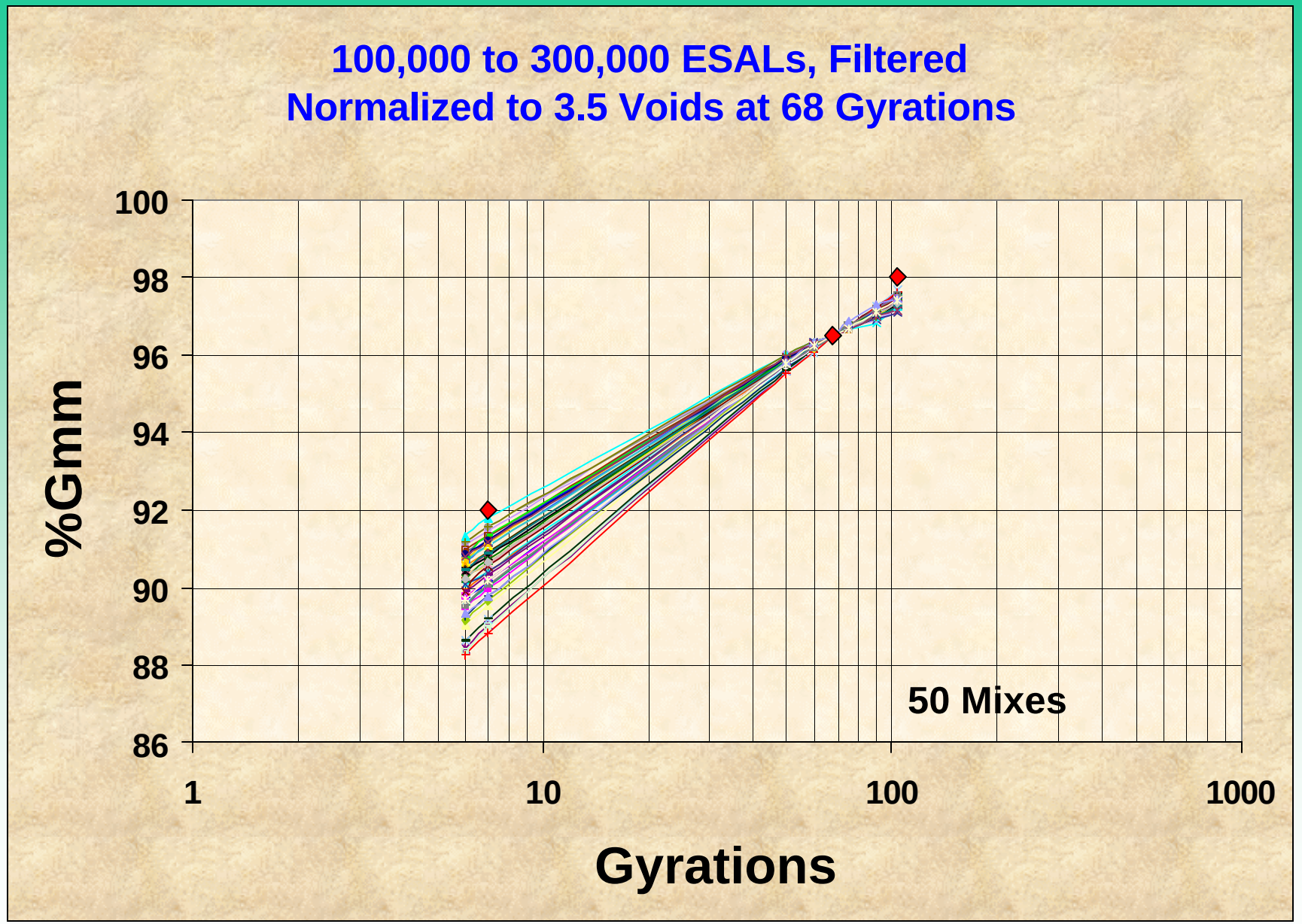
300,000 to 1,000,000 ESALS (125-350 T/day)

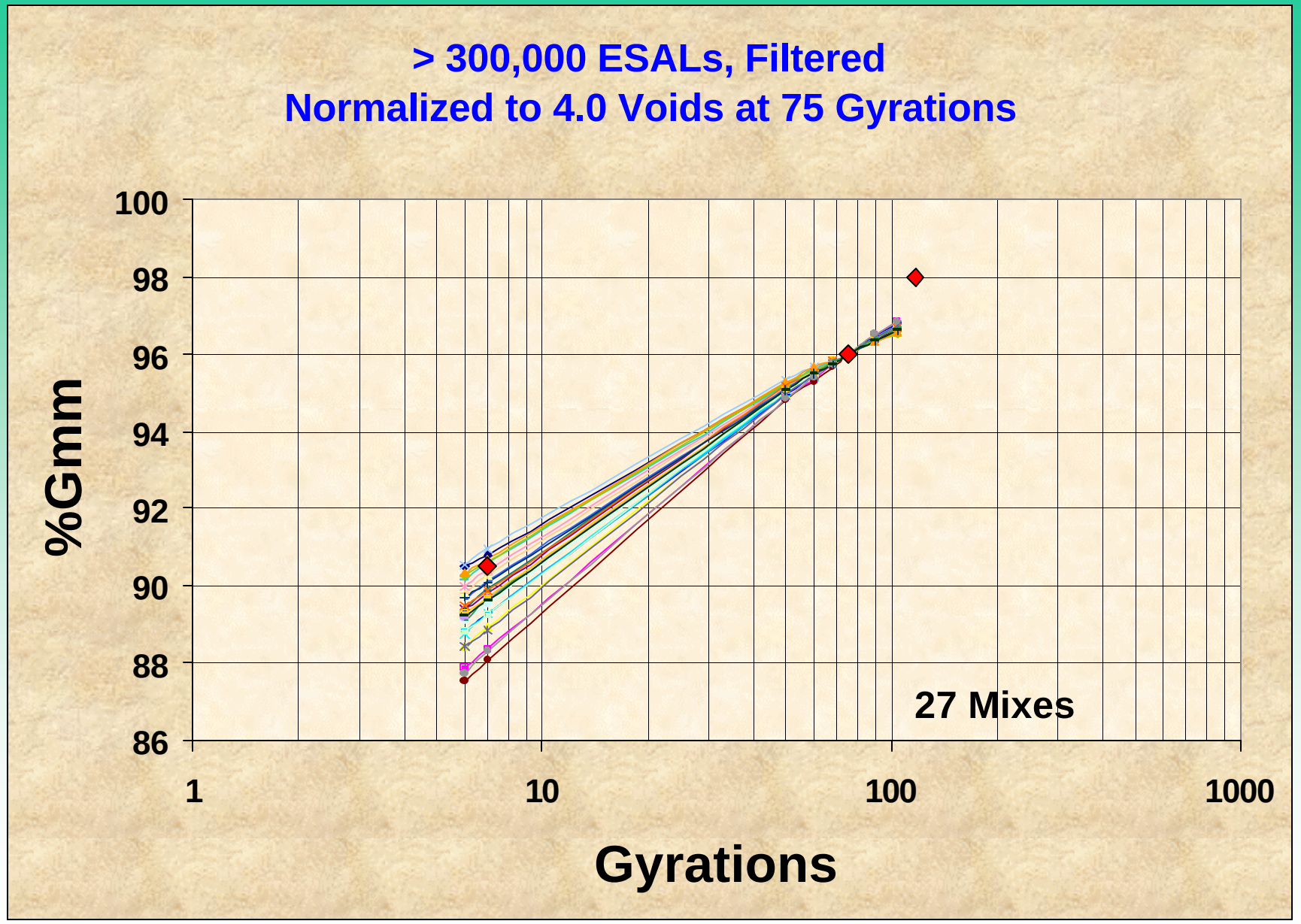
Normalizing the Database

	N-DESIGN			
VOIDS	50	60	68	75
4.0				✓
3.5			✓	
3.0			✓	

< 100,000 ESALs, Filtered
Normalized to 3.0 Voids at 68 Gyrations




100,000 to 300,000 ESALs, Filtered
Normalized to 3.5 Voids at 68 Gyrations
%Gmm
100
98
96
94
92
90
88
86
1
10
100
1000
Gyrations
50 Mixes


> 300,000 ESALs, Filtered
Normalized to 4.0 Voids at 75 Gyrations
%Gmm
100
98
96
94
92
90
88
86
1
10
100
1000
Gyrations
27 Mixes

Mix Criteria for Lab Density
Surface and Intermediate Lifts

ESALs	Nini	Ndes	Nmax	Nini	Ndes		Nmax
<100k	7	68	104	92.5	97	**3%**	98.5
100k – 300k	7	68	104	92.0	96.5	**3.5%**	98
>300k	7	76	117	90.5	96.0	**4%**	98

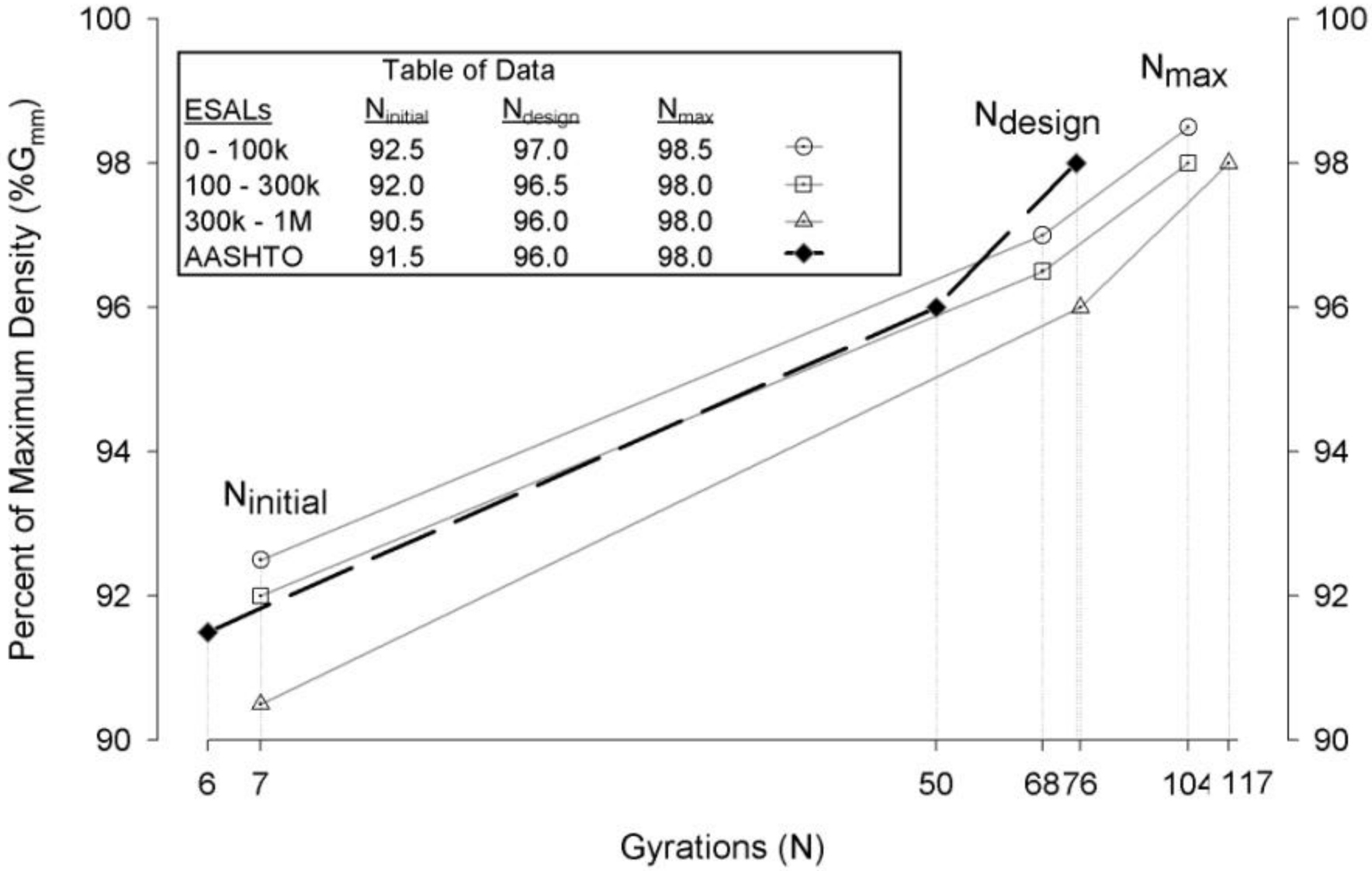


Table of Data
ESALs | Ninitial | Ndesign | Nmax
0 - 100k | 92.5 | 97.0 | 98.5
100 - 300k | 92.0 | 96.5 | 98.0
300k - 1M | 90.5 | 96.0 | 98.0
AASHTO | 91.5 | 96.0 | 98.0
Ninitial
Ndesign
Nmax
Percent of Maximum Density (%Gmm)
100
98
96
94
92
90
6
7
50
68
76
104
117
Gyrations (N)

Gyratory Mix Design System

Material Selection Guide

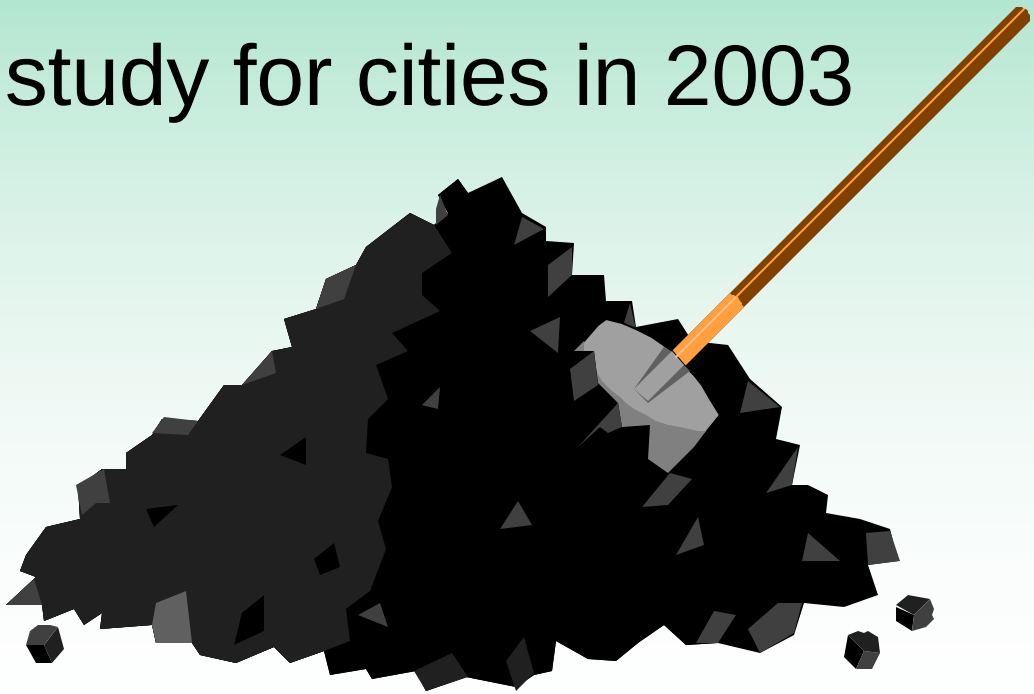
- Part 1- Design Checklist
- Part 2- Material Properties
- Part 3- Mixture Guide Overview
- Part 4- Example Plans
- App A- Terms & Definitions
- App B- Determining ESALs
- App C- Mixture Selection Guide
- App D- Bid Item List

Mix Selection Guide

- Design Checklist - 8 step process
  - Step 1 - traffic forecast
  - Step 2 - pavement rehabilitation strategy
  - Step 3 - climate
  - Step 4 - 20-year pavement loading
  - Step 5 - special conditions
  - Step 6 - select mixture criteria
  - Step 7 - check for non-standard criteria
  - Step 8 - prepare plans & proposal

Implementation Progress

- 5 pilot projects in 2001
- 40+ projects in 2002
- Initiate study for cities in 2003



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