



# Slurry/Micro Mix Design Procedure

## Project Update

## Midwestern Pavement Preservation Partnership



Indianapolis, Indiana

February 1, 2006



# Introduction to Project

## □ Goals

- **Develop, Analyze, and Validate an improved mix design procedure for slurry surfacings**

## □ Objectives/Tasks

- **Phase 1-Literature review and work plan development**
- **Phase 2-Laboratory phase**
- **Phase 3-Field validation, Guidelines, and Specifications**



# Phase I

- Phase I Complete**
- Final Report and Plans for Phases II and III prepared**



## Phase II

### □ Subtasks

- **Develop and evaluate new or improved test procedures**
- **Analyze the results of the test methods**
- **Prepare test protocols**
- **Conduct ruggedness testing of equipment**



# Laboratory Phase Outline

- Testing philosophy
- What do existing tests tell us?
- Proposed new tests



# Philosophy Of Approach

- Performance-related tests**
  - **Address failure modes**
  - **Simulate field conditions**
  - **Measures cohesion, adhesion, and abrasion resistance**
- Stages to be evaluated**
  - **Mixing**
  - **Setting and curing**
  - **Long-term performance**
- Tests that can be used for all slurry systems and to evaluate mix variables**



# New Mix Design Procedure



- Materials selection**
- Create matrix of mix proportions**
  - **Measure short-term constructability**
  - **Select optimum binder properties**
- Measure long-term performance**
- Iterative process - feedback controlled**
- Evaluate finished product using field control tests**



# Drawbacks of the Current System

- Technology and reproducibility of tests**
- Limited data set (aggregates and binders)**
- Inability to simulate road conditions**
- Inability to address various traffic conditions**

# New Mixture Tests

## Mixing Test

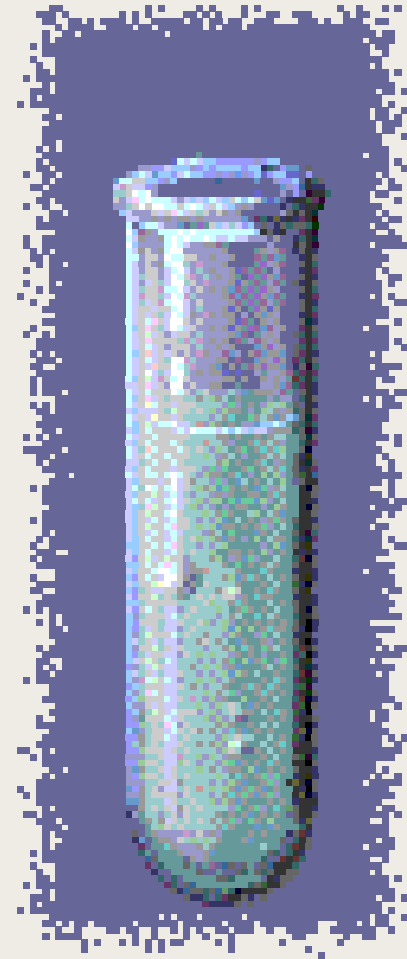
- Developed in Germany
- Modified during the project

## Setting and Curing

- New development

## Abrasion/Cohesion Test

- Developed in France
- Modified during the project



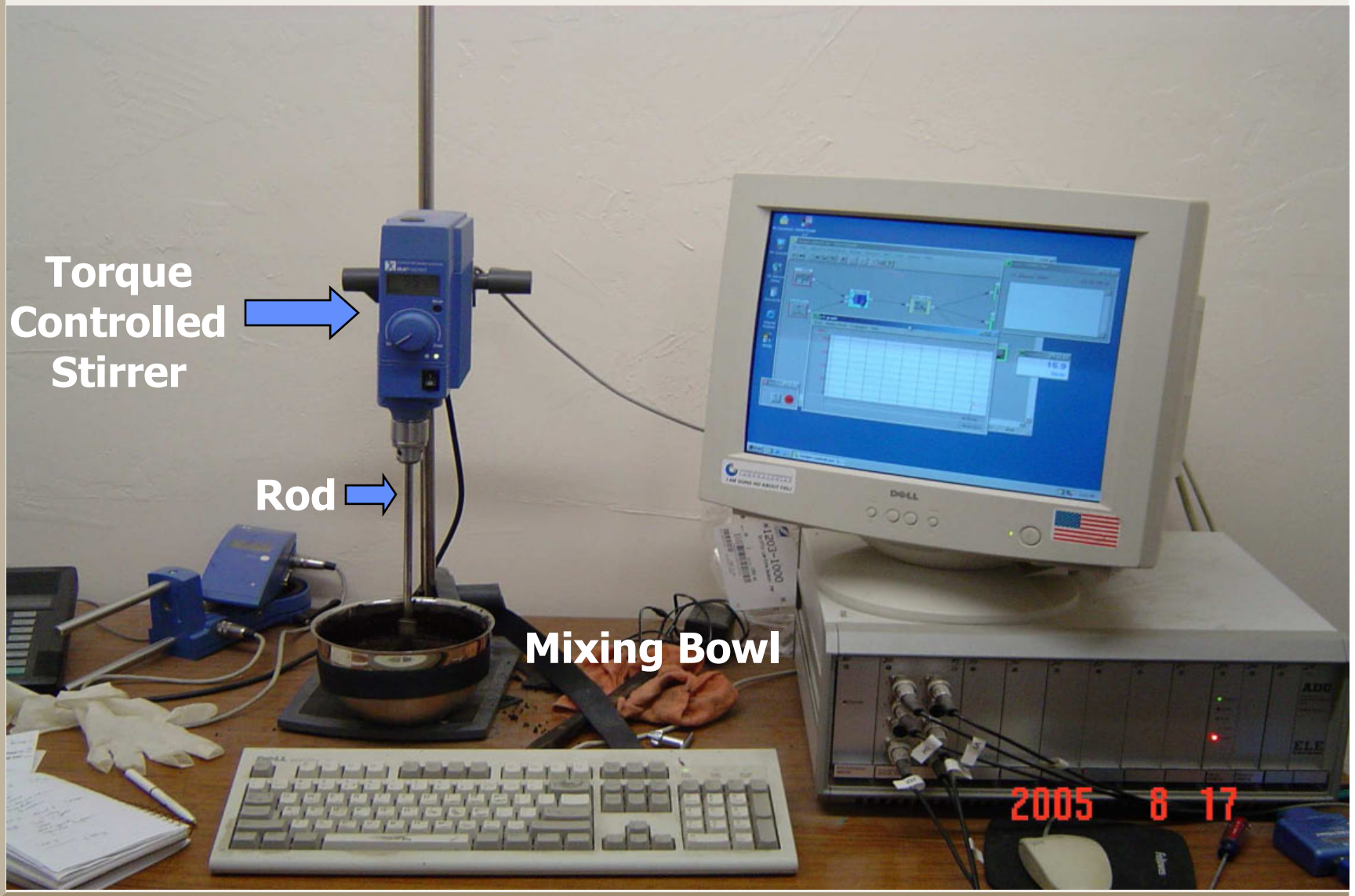


# New Mix Test

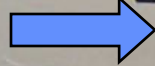
- Allows selection of materials and initial ratios of components**
- Allows examination of effects of different components and additives**
- Relates to initial constructability**
- Measures mix stiffness and effect of mix conditions**
- Provides the answer to "will it mix and will it spread?"**



# Mix Test Setup



Torque  
Controlled  
Stirrer



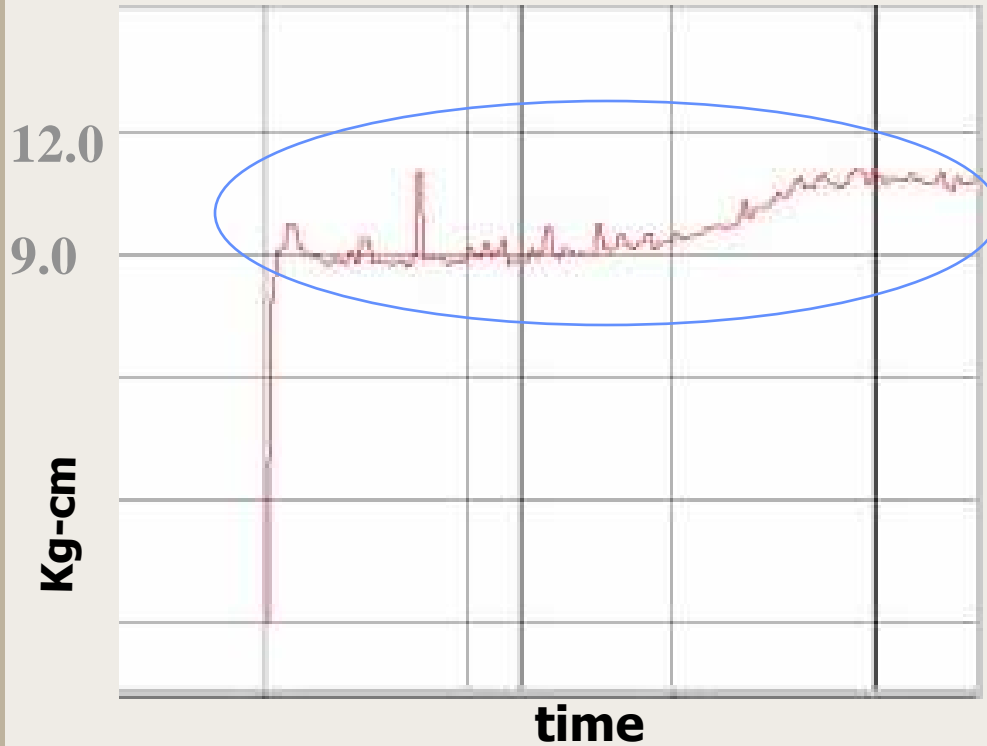
Rod



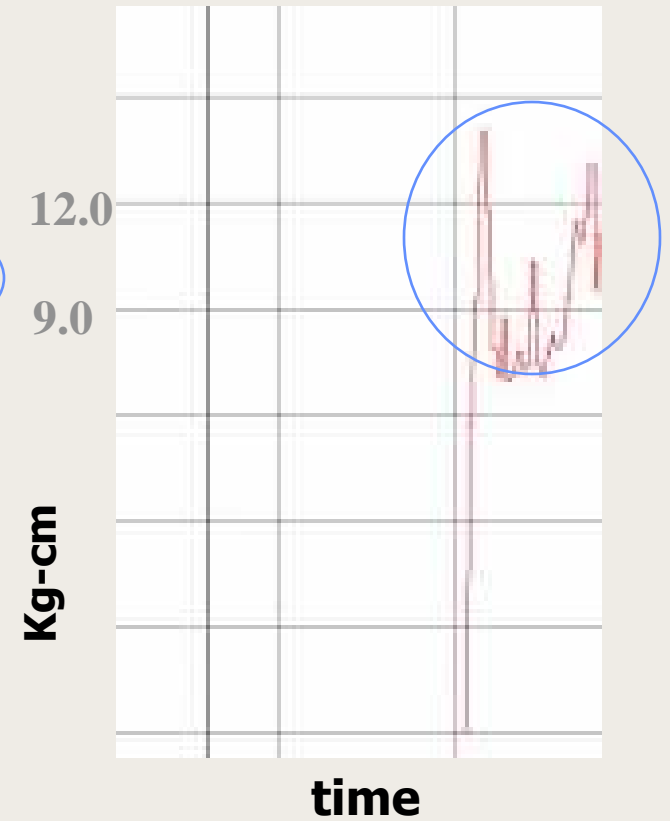
Mixing Bowl



# Outputs - Mixing and Workability



**Stabilized - quick set**



**Micro - fast set**



# Constructability - Short Term Performance Test (CAT)

- A form of cohesion test (French WTAT)**
- Can be performed on both curing and cured samples**
- Allows simulation of field conditions and physical effects such as compaction**
- CAT at different cure and soak times**



# New CAT Test

- Rise in cohesion measured for different mixes under different curing conditions
- Uses full mix gradation
- Can be performed under water

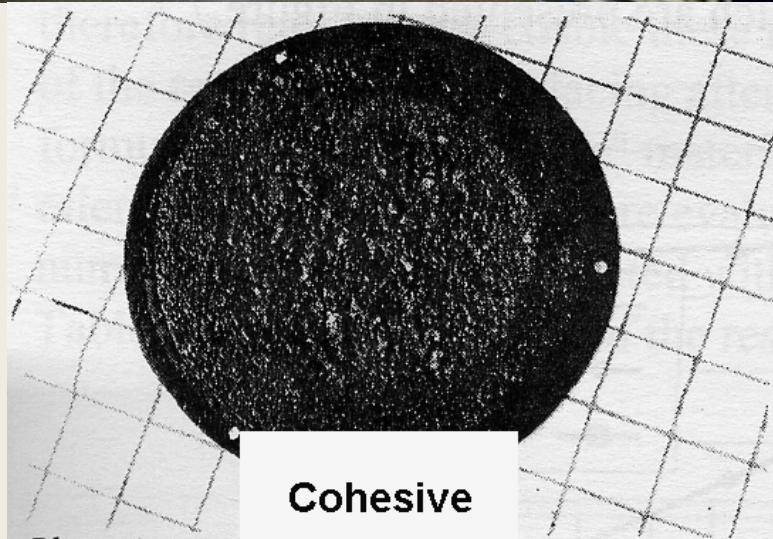


# CAT Setup

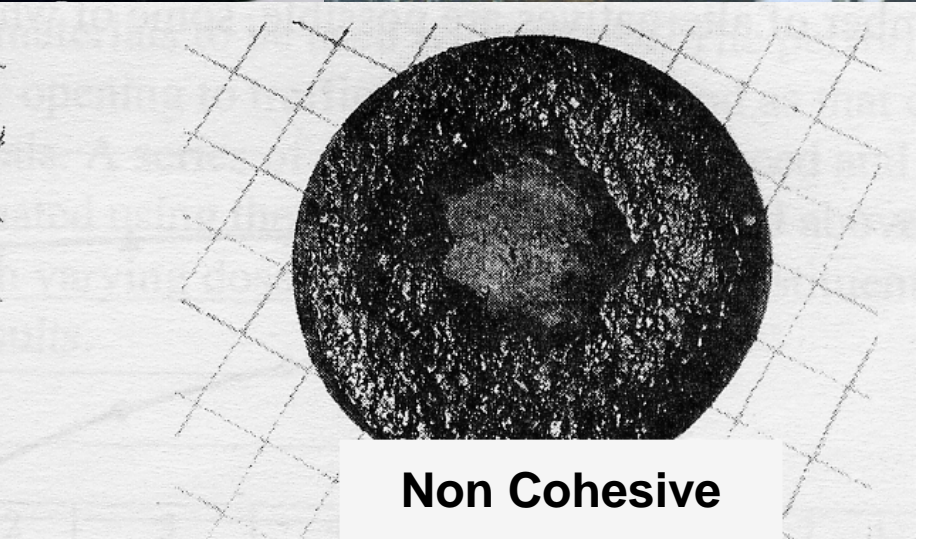




# CAT Process



**Cohesive**



**Non Cohesive**



# Strawman Spec v. 3

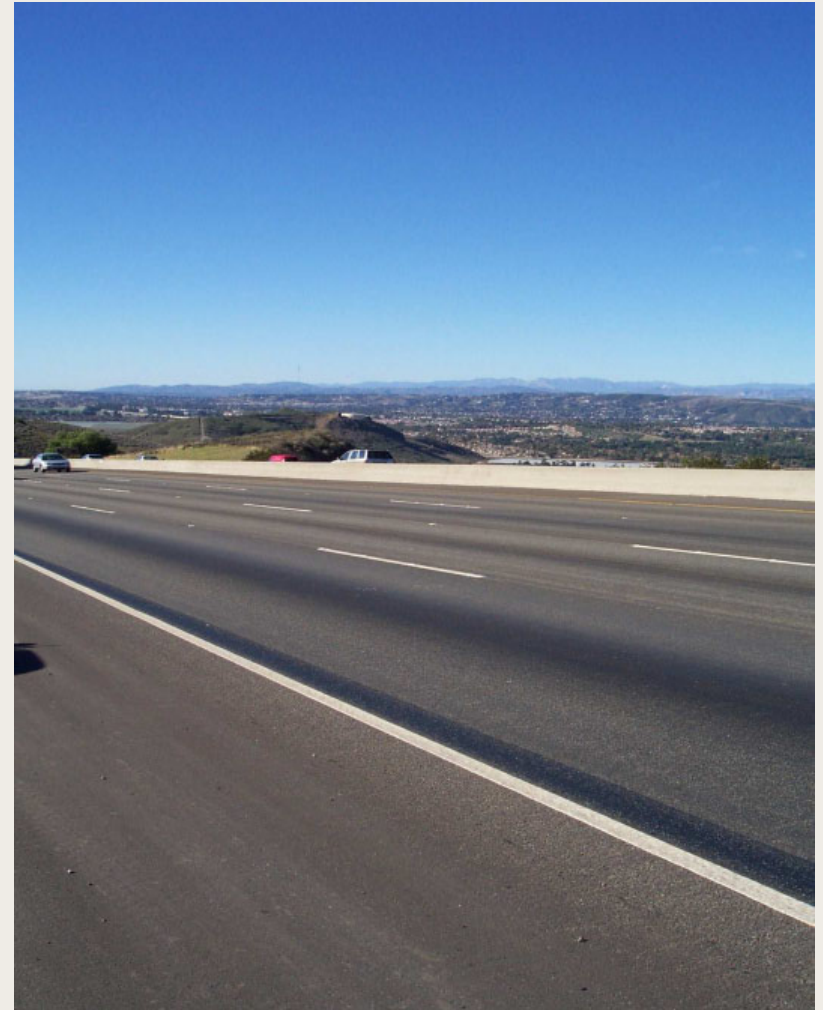


Set Time	Test or field Condition	Units	Traffic			Temperature			Humidity	
			Hi	Med	Low	Hi 35 C	Med 25 C	Low 10 C	Hi 90%	Normal 50%
Rapid	<b>PFS-1 (Mixing)</b>									
	Mixing Torque - maximum	kg-cm	9	9	9	9	9	9	9	9
	Mixing time - minimum	sec.	120	120	120	120	120	120	120	120
	Spread index - maximum @ 120 sec.	kg-cm	12	12	12	12	12	12	12	12
	Blot test - 30 sec.	-	clear water	clear water	N/A	clear water	clear water	clear water	clear water	clear water
	Coating	-	100%	100%	95%	95%	95%	100%	100%	95%
	<b>PFS-2 (Wet Cohesion)</b>									
	30 min. cohesion - minimum	kg-cm	12	12	12	12	12	12	12	12
	60 min. cohesion - minimum	kg-cm	23	20	20	20	20	20	20	20
	90 min. cohesion - minimum	kg-cm	25	25	25	25	25	25	25	25
	12 hr. cohesion - minimum	kg-cm	28	28	28	28	28	28	28	28
	<b>PFS-3 (Abrasion Loss)</b>									
30 min. loss - maximum	g/m <sup>2</sup>	200	200	400	300	300	300	300	300	
1hr. loss - maximum	g/m <sup>2</sup>	100	100	300	100	200	100	100	200	
3 hr. loss - maximum	g/m <sup>2</sup>	100	100	200	100	100	100	100	100	
Slow	<b>PFS-1 (Mixing)</b>									
	Mixing Torque - maximum	kg-cm	9	9	9	9	9	9	9	9
	Mixing time - minimum	sec.	120	120	120	120	120	120	120	120
	Spread index - maximum @ 120 sec.	kg-cm	12	12	12	12	12	12	12	12
	Blot test - 30 sec.	-	clear water	clear water	N/A	clear water	clear water	clear water	clear water	clear water
	Coating	-	100%	100%	95%	95%	95%	100%	100%	95%
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# Phase III Activities

- Project Selection Guidelines**
- Candidate Field Sites**
- Construction and monitoring of sites**
- Specifications**
- Training**





# Site Selection

- Construction is planned for 2006**
- Funding of sites needs to be secured in advance**
- Fugro needs to be involved with site selection**
- Targeting ~8-12 sites (2-3 per LTPP region)**



# Recommended Pilot Project Layout



Lane Width	Transition	ISSA	Transition	Control	Transition	New Mix Design	Transition	ISSA	Transition	CONTROL	Transition	New Mix Design	Transition
	100 ft	500 ft	100 ft	500 ft	100 ft	500 ft	100 ft	500 ft	100 ft	500 ft	100 ft	500 ft	100 ft
	30 m	152 m	30 m	152 m	30 m	152 m	30 m	152 m	30 m	152 m	30 m	152 m	30 m



# Key Training Deliverables



- 1.5-Day Training Course**
  - Reference Manual**
  - Visual Aids**
  - Instructors Guide**
- Pre-Job Training Module**
  - Pocket Guide**



# Project Summary

- Phase I is complete**
- Phase II, initial testing is complete**
- Phase III is underway, but we need candidates for field projects**
- Pilot projects are to be constructed in 2006 so they have at least one year to be monitored for performance**



# Question/ Answer Period

