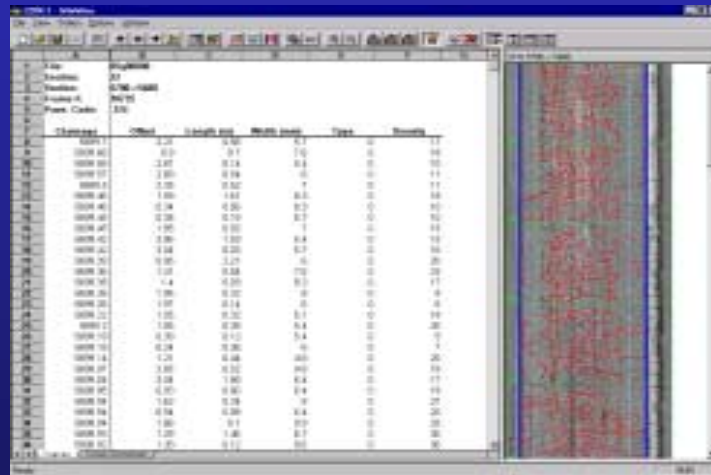# Implementation of Network Level Cracking Performance Measures

**2002 Southeastern Pavement Management
and Design Conference
Nashville, TN
June 23-26, 2002**

**Jonathan L. Groeger
Axiom Decision Systems, Inc.**
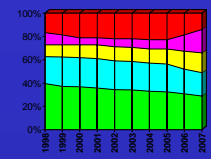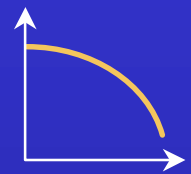
In association with

**Maryland State
Highway Administration**

Overview

- MD SHA PMS Capabilities

- Problem Statement

- Approach

- Network Level Cracking Process

- Keys to Success

Performance Models: The Heart of PMS

Budget Goals

Performance Modeling

Preprograms Analysis
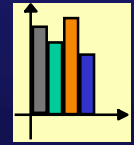
Network Optimization

Data
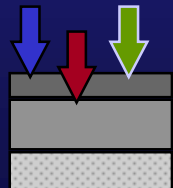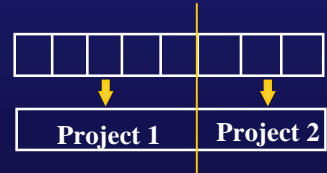
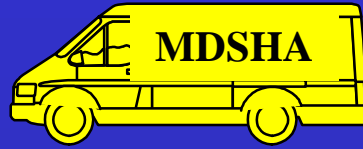MD Expertise

Management Process

Decisions

Reports

Project Selection

Treatment Assignment

Life Cycle Analysis

Project 1 Project 2

Benefit/Cost Ratio

Example Models

Expert Knowledge

Performance Data

MDSHA

	Thick Overlay	Medium Overlay	Thin Overlay
A - Excellent	4.5	3.5	2
B - Very Good	3.5	2	1.5
C - Good	3	2.5	2
D - Fair	4.5	4	2.5
Total	15.5	12	8

Thick Overlay Matrix

	A	B	C	D	E
A	0.85	0.09	0.03	0.02	0.01
B	0.00	0.73	0.22	0.04	0.01
C	0.00	0.00	0.71	0.24	0.05
D	0.00	0.00	0.00	0.75	0.25
E	0.00	0.00	0.00	0.00	1.00

Performance Modeling: Deterministic Curves

(Flexible Pavement with High Level of Traffic)

Pavement Performance

Excellent

Very Good

Good

Fair

Poor

Age
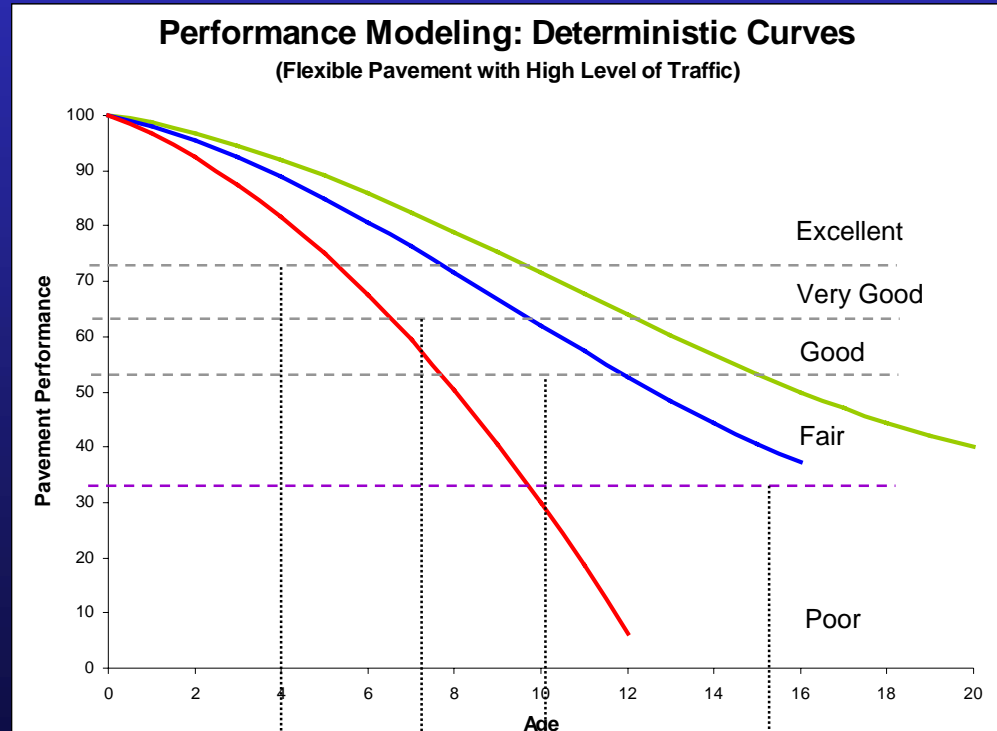
Problem Statement

- Cracking data not collected recently

- Data needed for PMS performance modeling

- Very limited resources

- Existing technology not proven

- Quality is #1

Existing Resources

- ARAN data collection vehicle

- WiseCrax crack detection software

- AASHTO Cracking Protocol and PCI Procedures

- Pavement Management Division staff

- Consultant resources

Process

- Affirmation from Connecticut DOT

- Pilot Study

- Benchmark Survey

- Production Testing

Pilot Study
Goals

- Goals
  - Gain experience with Wisecrax
  - Gain experience with AASHTO cracking protocol
  - Determine condition rating scheme
  - Compare automated versus manual surveys

Bottom Line: Can we obtain quality network level cracking data using existing tools?

Pilot Study

- Process
  - Developed crack detection procedure
  - Used data from 1999 data collection season
  - FY2002 "Fund 77" projects
  - Developed sampling template to assure diverse sample population
  - Performed automated cracking evaluation
  - Output data in AASHTO and PCI format
  - Reviewed results

Pilot Study

- Results
  - ✓ Gained experience with Wisecrax
  - ✓ Gained experience with AASHTO cracking protocol
  - ✓ Determined tentative condition rating scheme
  - ✓ Hardware problems
  - ✓ More work to be done!!!

Benchmark Survey

- Goals
  - Benchmark performance of ARAN
  - Benchmark performance of WX
  - Verify MD process was comparable to manufacturer
  - Decide on final performance rating scheme
  - Verify automated versus field results

Benchmark Survey

- Process
  - 29 projects selected (220 miles)
  - Central portion of state
  - Manufacturer collected data
  - Data collected in September 2000
  - Processed by MD SHA staff and manufacturer independently
  - Subsection (11) verified in the field

Benchmark Survey

- Results
  - ARAN is viable data collection platform
  - WX is viable processing tool
  - Manufacturer versus MD SHA results similar
  - AASHTO protocol "with a twist" chosen as data processing method
  - Field versus automated comparison very encouraging

Production Testing

- Goals
  - Dry run of procedures
  - Iron out bugs
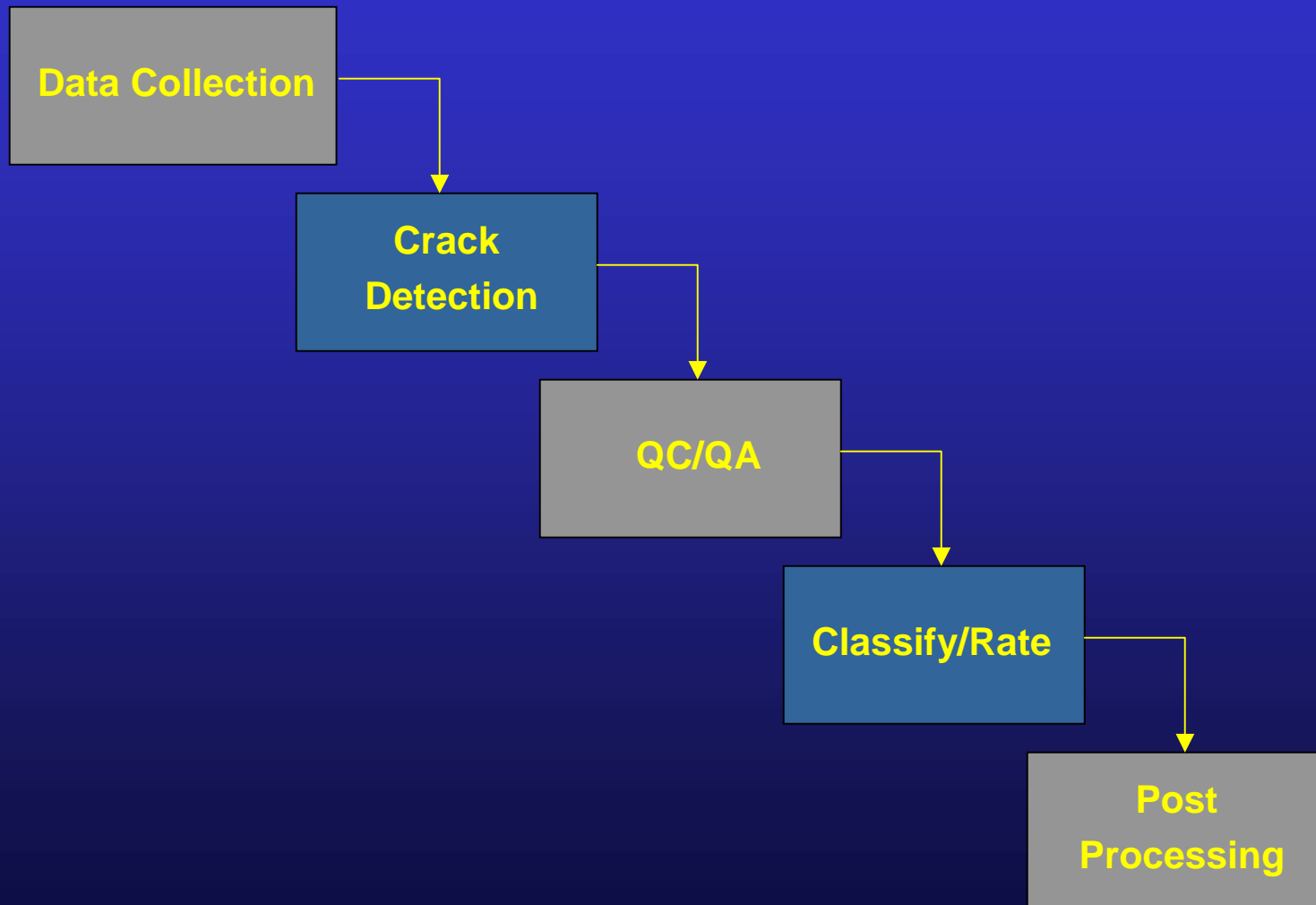 - Prepare for 2001 data collection
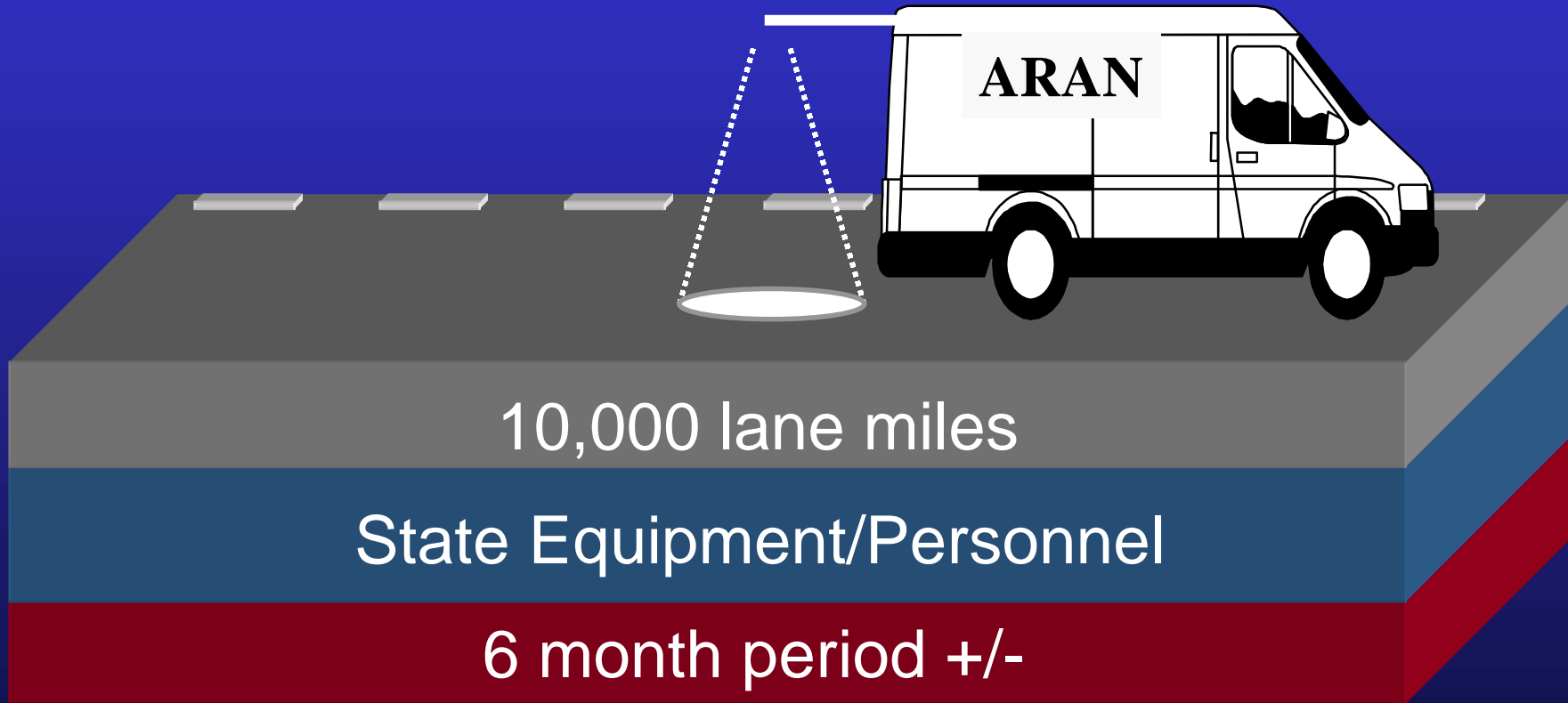
Production Testing

- Process
  - Perform crack survey for one district
  - Submit to district personnel for validation

- Results
  - Validated processes
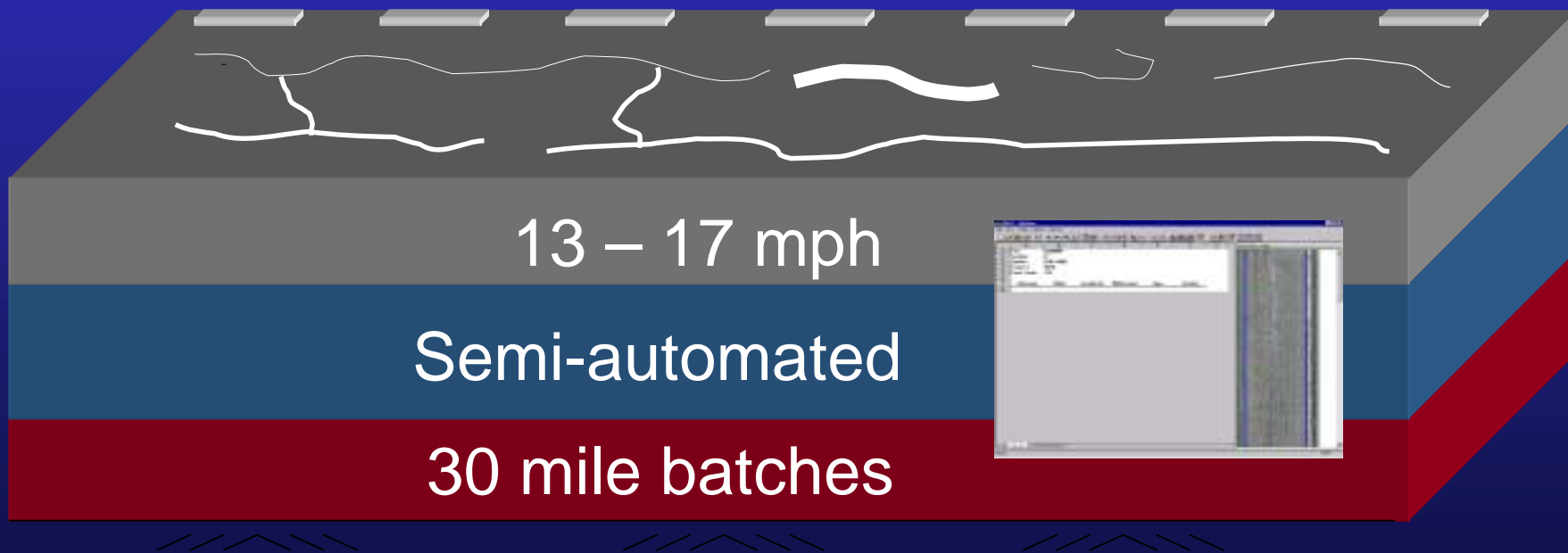 - Data deemed reasonable
  - Ready to Roll!

5 Step Process
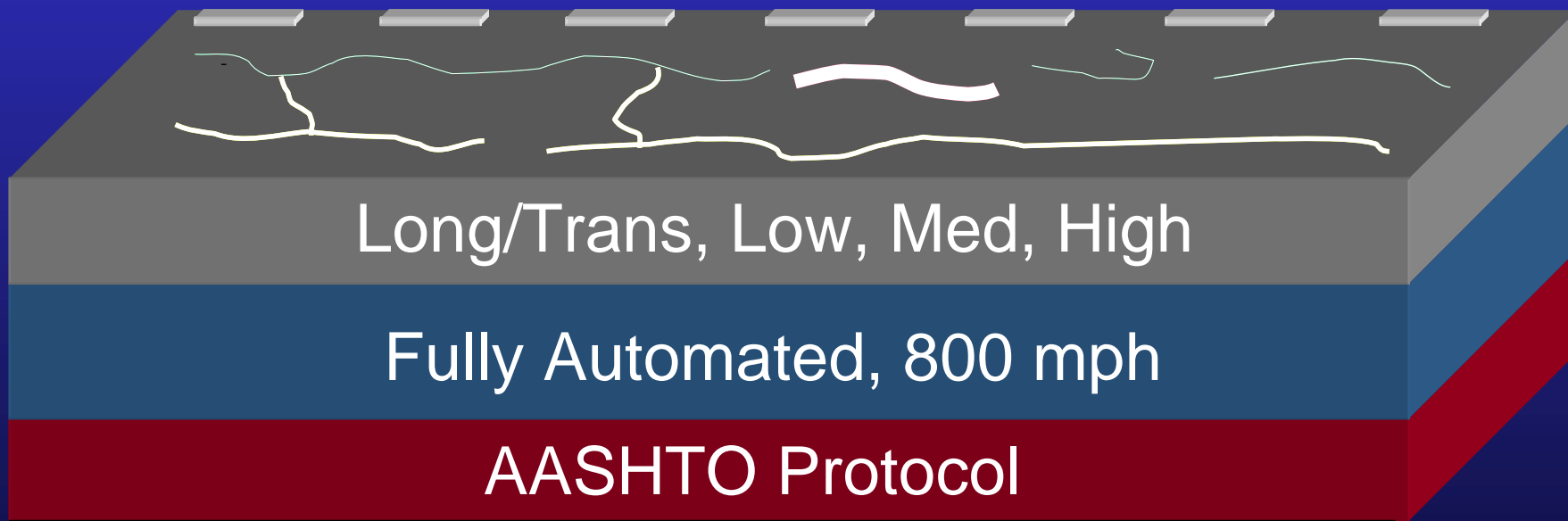
Data Collection

Crack Detection

QC/QA

Classify/Rate

Post Processing

Data Collection

ARAN

10,000 lane miles

State Equipment/Personnel

6 month period +/-

Crack Detection

13 – 17 mph

Semi-automated

30 mile batches

QC/QA

Sampling Approach

Completeness

Quality (> 80% crack detection)

Trends

Classify/Rate

Long/Trans, Low, Med, High

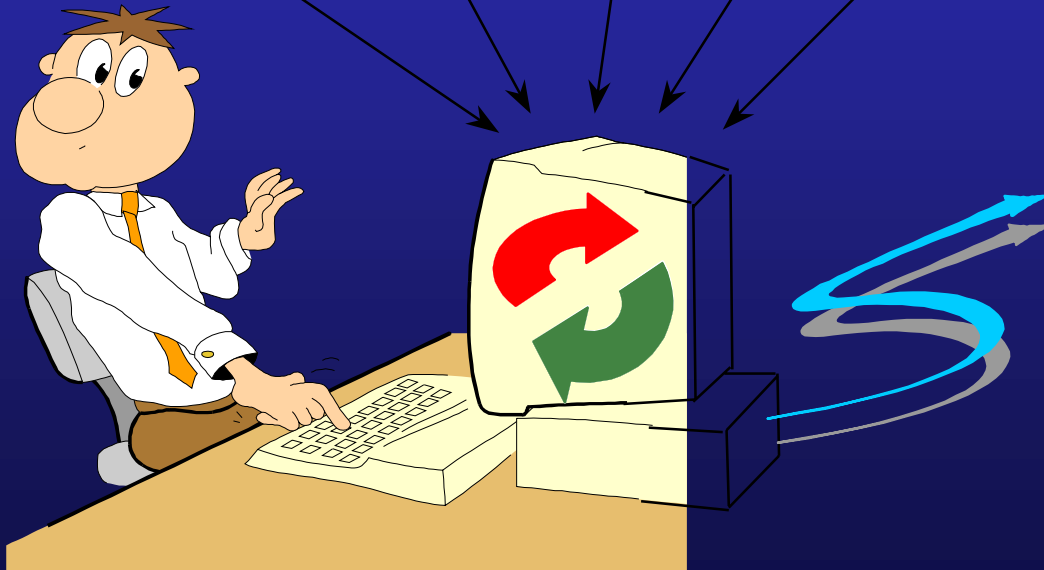Fully Automated, 800 mph

AASHTO Protocol

Post Processing

Summarize to 0.1 mile

Assign Condition State

Output to PMS

QA/QC

Progress Reports

Cracking Data

✓ Data Completeness

✓ Range Checks

✓ Logic Checks

✓ Trend Analysis

Processing/Progress Reports

Axiom Decision Systems, Inc.

Lessons Learned

- "Automated" crack detection viable
- Large resource commitment
- Rigorous QC/QA a must
- AASHTO cracking protocol viable
- Sealed cracks a problem

Keys to Success

- Phased approach
- Commitment from above
- Partnering approach
  - State forces, manufacturer, consultant
- Keep it simple

Questions?