KEY INGREDIENTS FOR SUCCESSFUL IMPLEMENTATION OF PAVEMENT MANAGEMENT SYSTEMS

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

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IMPLEMENTATION SUCCESS?

They Vary Because of

Commitment

Understanding the Technology

Serving Users

Application Levels

Resources

Succession Planning

Serving Users
A brief look back

Successes / strengths (key ingredients; technical underpinnings)

Facing the key issues in implementation

Major needs in P.M. practice

Future expectations and opportunities
To Begin!

1960’s

Pavement Management Concept
Early Days!

Pavement Management Framework

- Design
- Construction
- Evaluation
- Maintenance
Today

Asset Management Systems Inc.

BMS  SMS  PMS  TMS
Tomorrow?

Asset Management Systems Inc.

Who Drives Now?
Evolution in the Modern Era

- AASHO Road Test (1958-61)
- Initiation of PM Process (1960’s)
- Early publications (1960’s and 70’s)
- Five International Conferences (1985-2001)
- Operating PMS’s (1970’s …)
- Integration with BMS, etc. (1980’s …) and then Asset Management (1990’s …)
Successes and Current Status of Pavement Management

(What Doesn’t Need to be Reinvented !)

- Basic lessons learned
- Comprehensive, generic framework - project and network levels
- Widespread implementation
- Key component technologies
Basic Lessons Learned

A Pavement Management Framework

- Generic framework characterizes process
- Flexibility exists for different models, methods and procedures
- Two basic operation levels are network and project
Basic Lessons Learned

B Technological Base

- Sound base is fundamental to Pavement Management
- Sufficient and reliable data is essential
- Need capability to evaluate alternatives, and have LCCA embedded in the PMS
Basic Lessons Learned

C Implementation

- Public sector user categories: legislative, administrative and technical
- Use staging and useable products after each stage
- Success requires key players and top level commitment
OVERALL ASSET MANAGEMENT OF THE INFRASTRUCTURE

Integration Platform

NETWORK / PROGRAM / SYSTEM WIDE LEVEL
- Data (sectioning, inventory, data acquisition and processing, etc.)
- Deficiencies / needs both current and future (based on criteria and performance / deterioration models)
- Alternative strategies and life-cycle analysis
- Priority programs and schedules

PROJECT / SECTION / LINK / LEVEL
- Data (detailed lab and field data)
- Design (within-project alternatives and life-cycle analysis; selection of optimal alternative)
- Implementation (construction and periodic maintenance)

ONGOING, IN-SERVICE MONITORING

FINANCING

Budgets

Policies

STANDARDS AND SPECIFICATIONS

Budget Limit

Environmental Regulations

DATA BASE

TMS, SMS

PMS

MMS, BMS

OVERALL ASSET MANAGEMENT OF THE INFRASTRUCTURE
Automated surveillance
Performance models
Life cycle analysis
User cost models
Prioritization methods

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TECHNOLOGY HIGHLIGHTS (Cont.)

- New maintenance treatments
- New materials characterization
- High capacity computing
PERFORMANCE MODELLING

- Empirical (e.g. regression)
- Mechanistic-empirical
- Subjective / experience based (e.g. Markov Bayesian)

Measure(s) of Serviceability or Deterioration

Age
Measure(s) of Serviceability or Deterioration

ENVIRONMENT
- Moisture
- Radiation
- Freeze-thaw Cycles
- Temperature (Min., Max, Days, etc.)

STRUCTURE
- Layer Thicknesses & Properties
- Variations in Thickness & Properties
- Subgrade Type & Properties

CONSTRUCTION
- Timing
- Methods
- Variance
- As-Built Quality

TRAFFIC
- Axle Group Loads
- Tire Types & Pressures
- Axle Spacing, Speed, Repetitions

MAINTENANCE
- Treatments
- Timing
- Methods
- Quality

Age
Measure of Serviceability or Deterioration

\[ P_T = \text{traffic loss} \]
\[ P_E = \text{environment loss} \]
\[ P_{T+E} = \text{interaction loss} \]

\[ P = \text{total loss} = P_T + P_E + P_{T+E} \]

Minimum Acceptable
LI FE CYCLE ANALYSIS

- Life-Cycle Period
- Measure of Serviceability or Deterioration
  - Minimum Acceptable
- Pavement Age

LIFE CYCLE ANALYSIS
USER COSTS

- Delays due to maintenance and rehabilitation
- Vehicle operating costs
- Accidents
- Discomfort, etc.
Optimal Combination of:

Which sections?

What treatments?

When (in program period), for funding level “i”?
Funding Level:

Average Network Status (IRI, PQI, PCI, .....)

Year
Backlog of Deficient km (% of Network)
1970's ... Effectiveness of crack rout and seal

1980's ... Large scale privatization of maintenance

1990's ... Demonstration of effectiveness of preventive maintenance treatments
High Speed Data Capture | Relational Databases and GIS Platform

Network Level Optimization | Analyses and Visual Interaction | Multi-Factor Sensitivity Testing
1. Institutional / administrative
2. Data
3. Database
4. Engineering
5. System

Facing the issues reduces the need for reinvention
1. Institutional

- Succession Planning
- Integrating PMS with Asset Management
- Adapting PMS to Privatization
2. Technical

- Interfacing Network and Project Levels
- Longer Lasting, Better Quality Pavements
- Performance Models Which Separate Traffic and Environment Effects
3. Economic and Life Cycle

- Quantifying Benefits
- Incentive Programs
- Very Long Term Life Cycle Analysis Protocols
Challenge!

“... Seize the opportunities and advance the process, technology and use of pavement management. Keep pavement management dynamic; innovate; resolve your institutional barriers; educate the new people including new administrators; strive for quality; communicate; take risks; be proactive, not reactive; and make pavement management a truly effective decision support tool for all agency levels.”

Realistic Expectations

- Increasing integration
- Most existing issues will remain, to varying degrees
- Progress will occur on reinvention / invention needs (how much incremental vs. how much quantum progress?)
Realistic Expectations (Continued)

- SHRP will provide technology benefits but cannot meet all needs
- Increasing challenge to justify C/E of data collection and effectiveness of PMS in preserving asset value
- Increasing globalization of technology transfer, marketing and web based availability of information and technology
More Idealistic Expectations

- Quantum increase in pavement life, lower maintenance and user costs
- Widespread adoption of succession planning strategies
- New SHRP program innovation, less short-term emphasis on “products”, construction technologies, etc.
More Idealistic Expectations (Continued)

- Substantial grant $$ for high risk, innovative ideas
- Comprehensive protocols for very long life cycle analysis
- Comprehensive protocol on long term performance specifications, and privatization
- Objective and widely accepted protocol for comparing rigid and flexible
A Key Opportunity:

Ensuring that asset management effectively incorporates existing, well established systems; eg., PMS and BMS
Pavement management has seen widespread and successful application. Key ingredients include a sound concept, learning from experience and a solid foundation of technology. Issues to be resolved are institutional, data, engineering and system based; also major reinvention / invention needs, which can be turned into opportunities. The future lies in continuing technology advances, risk taking and innovation and effective integration with overall asset management.