Roadware’s Experience:
A Manufacturer's Perspective

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PIARC TC4.2 Workshop on Automated Crack Detection
Quebec City, August 13, 2006

In The Beginning

• Low resolution imaging
  – Analog cameras
  – Tape storage and retrieval
    • VHS → S-VHS → digital tape

• Image Processing – WiseCrax
  – Digitization of road images from tape
  – Crack detection

Technology Adoption Challenges

• Testing & Evaluation
  – Limitations vs. Capabilities.
  – What can’t be done instead of what could be done – tests were designed to fail.

• Implementation & Acceptance
  – Delayed due to black box approach and failure in testing.
  – Needed the ability to validate.

Technology Challenges

• Processor speeds
• Storage requirements / limitations
• Bandwidth
• Data capture & compression
• Resolution
• Manufacturer’s specifications

A Real Challenge

• User Expectations
  – 100% accurate
  – 100% repeatable
  – 100% of the time

• For their specific requirements

Development Challenges

• Satisfying everyone’s needs (wants)
• Maintaining maximum flexibility
• Single supportable application
The Real Challenges

- The User’s Real Needs
  - Summary of road condition for the network
  - Allocation of funding ($$$)
  - Maintenance strategies

An Interesting Question

- What is a crack?
  - a narrow break; fissure
  - weakness or flaw caused by decay
- Objective Measure
  - Length
  - Width
  - Depth
  - Straightness

A Crack is …

- According to AASHTO
  - 1 mm in width
  - 25 mm in length
- No reference to uniformity or depth

The Real Question

- When is a crack not a crack?
- When someone else is looking at it!

Political Challenges

- Re-inventing the wheel
  - Educational & research institutes
  - Government agencies
- Evaluation Trials
- Standards

At The Present

- More than 17 years of development
- More than 20 installation of WiseCrax, many more pavement imaging systems
- More than 100,000 km of road processed annually – many hundreds of thousands to date
Imaging: Data Collection

- **Improved Imaging**
  - Digital area scan camera: 2 mm pixel resolution
  - Auxiliary high-powered strobe lighting
  - 100% continuous lane width: approx 4 m
  - Direct to disk storage: 138 MB / km
  - Highway speeds: >100 km/h
  - Correlation to other data
    - GPS, macro-texture, profile, linear referencing
    - Used for crack detection processing

- **High Resolution Imaging**
  - Line scan camera: 1 mm pixel resolution
  - 100% continuous lane width: 4 m
  - Direct to disk storage: 550 MB / km
  - Highway speeds: >100 km/h
  - Precise correlation to other data
    - GPS, macro-texture, profile, linear referencing
    - Used for crack detection processing

WiseCrax: Crack Detection

- Crack detection
- Crack classification
  - Type
  - Severity
  - Extent
- Compliant with AASHTO and SHRP rating protocols

WiseCrax: Usage

- 0% manual intervention
- 100% manual intervention
- Everything in between
- Fixed parameter set(s)
- Automated parameter setting
- Lane width detection
- Zones within the lane – flexible classification

Outputs

- ASCII summary for database usage
  - Detail & summary levels
- Custom (SCANNER: U.K.)
  - Individual cracks (location, length, orientation)

Acceptance Testing

- Image resolution and synchronization
  - Is the image true (clear, precise) and where we expect it
- Ground Truth
  - Manual crack “detection” from digital images
- Iterations of algorithm testing
  - Two levels of testing – algorithmic and operational
  - Set of test data
The Future
- Improvements in image resolution
- 2D → 3D collection and analysis
- Enhanced algorithms
  – Improved performance
  – Additional distresses to be detected

The Holy Grail?
- Real-time crack detection
  – Lower costs
  – More timely data
  – Greater profits

The Real Holy Grail?
- STANDARDS
  – North American?
  – European?
  – Asia?
- ONE STANDARD?

... thank you.