



Distress Survey Quality Control

It's a complex issue:

“Quality control or quality engineering is a set of measures taken to ensure that defective products or services are not produced, and that the design meets performance requirements.”

It's a 2 step process:

- 1) Something (human being or machine) makes a decision about the type, severity and extent of a surface distress.
- 2) Something else (human being or machine) validates that decision.



Factors that Influence Quality

- Training
 - 1) Manuals
 - 2) Visual Aids
 - 3) “Living” Always Updating Reference Library

- Resolution of the System
 - 1) Progressive Scan Area
 - 2) Dual Camera
 - 3) Line Scan (1K, 2K, 4K)
 - 4) Robustness of Sensor Data

- Level of Detail in Defining:
 - 1) Distress Type
 - 2) Severity Level
 - 3) Extent Measurements



Factors that Influence Quality (cont'd)

- Sampling Rate
 - Network Level 2 to 50%
 - Project Level from 50 to 100%
- Mechanism
 - Manual
 - Semi-Automated
 - Fully Automated
- Levels of QC
 - Number of Initial Raters
 - Inter-Rater comparisons
 - Post Rater Verifications



Factors that Influence Quality (cont'd)

- Lighting

- 1) Natural Lighting

- Sun Position
- Cloudy vs. Bright

- 2) Artificial Lighting

- Light Intensity
- Shadows vs. Cracks

- 3) Auto Iris Capability

- 4) Night Collection (lose benefit of Roadway Images)

- Changes in terms of:

- 1) Collection Cycle (season)

- 2) Rating mechanism (human being or machine)

- 3) Maintenance



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- 3) Maintenance

- 4) Management Methodology



Features of a “Good” QC Program

- Quick Feedback of all necessary attributes (i.e. what mechanism was used, when and to what extent)
- Visual Feedback allowing every judgment to be viewed in an organized, easy to manage manner
- Verification accounts for types of error including:
 - 1) Missing Features
 - 2) Incorrectly Assigned Features
 - 3) Ghost Features



How to Quantify Quality (into a DRQI)

- Index Definitions

1) What's the best we can do? (DRQI value of 100)

- Every Required Distress is quantified and reported exactly according to client standards for distress, extent and severity definitions without the presence of missing features, incorrectly assigned or ghost features.

(i.e. What's on the road is exactly what's in the report)

2) What's the worst we can do? (DRQI value of 0)

- Not a single Required Distress is quantified and reported according to client standards for distress, extent and severity definitions, resulting in missing features, incorrectly assigned and/or ghost features.

(i.e. Nothing on the road is exact in the report)

3) What variables and weighting factors will determine everything in between?



How to Quantify Quality (into a DRQI)

•Client Specific

- 1) How will the data be used (by the client)
 - Project Level
 - Network Level
 - Combination

- 2) What factors are most important (to the client)
 - Distress Type (How many and how are they ranked for importance)
 - Severity and Extent (Some severity distinctions are more important)
 - Relative Sensor Indexes (IRI, Rutting, Texture, Faulting, etc)

- 3) What (if any) limitations exist in the data collection system
 - Image Resolution
 - Sensor Data Resolution
 - Sampling Interval

- 4) Rating System Used
 - Automated vs. Manual
 - Number of Raters Used, Quality Control Indicators (errors per /1000 ft., etc)



How to Quantify Quality (into a DRQI)

•Weighting Factors and Deductions

- 1) The most important distresses have higher deduction values for errors found.
- 2) Important Severity/Extent distinctions are also weighed more heavily
- 3) Limiting Factors such as image resolution, small sample size, number of raters used, etc. can affect maximum DRQI score.

Analysis Type	Network Level	Starting Value	100
Image Resolution	1.5K	Deduction -6	94
Sample Size	100%	Deduction -0	94
Number of Raters/Section	3	Deduction -0	94
Distress A	1 miscall errors/1000 ft	Deduction -5	89
Distress A Severity	0 miscall errors/1000 ft	Deduction -0	89
Distress A Extent	1 miscall errors/1000 ft	Deduction -1	88
Distress B	0 miscall errors/1000 ft	Deduction -0	88
Distress B Severity	1 miscall errors/1000 ft	Deduction -2	86
Distress B Extent	0 miscall errors/1000 ft	Deduction -0	86
Distress C	0 miscall errors/1000 ft	Deduction -0	86
Distress C Severity	0 miscall errors/1000 ft	Deduction -0	86
Distress C Extent	0 miscall errors/1000 ft	Deduction -0	86
Ghost Distress	0 miscall errors/1000 ft	Deduction -0	86
	Starting Value After Limiting Factors		94
	Minimum Acceptable Value		85
	Final Score/ Sample Status		86 -Pass



What Conclusions Can We Make?

- 1) Distress Rating is complex by nature, but its direct effect on maintenance decisions forces us to take steps to ensure we can trust the data.
- 2) There is no perfect index. DRQI is not standardized, it's customized to each specific project or client.
- 3) DRQI can serve as an excellent starting point for the client QA protocol.
- 4) Vendors want the same as you...Good data for good decisions. They will work with you!



Thank You!!

