Pavement testing and inspection — information or punishment

By Steve Marvin, LaBelle-Marvin, Inc.

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Worlds collide as owners, contractors and engineers debate the need, cost and value of testing and inspection. While each concludes sound judgment should drive construction practice, the reason for collecting information remains in debate. Available information is often limited to the quantities of materials used and sketchy data relative to the qualities of those materials. The debate seldom includes the risks and rewards of obtaining, retaining and analyzing these same data. Often the intent of testing and inspection degenerates to 'catching the cheater', instead of enriching the database for future decisions.

In practice, we rely on tests and make judgments based on thousands of inspections each day. While driving, tests are performed on fuel levels, speed, temperature, oil levels, and the list goes on. Daily inspection of tire wear, condition of windows and windshields, windshield wipers, etc. is also performed. While we accept the inherent inaccuracies of the gas gauge and speedometer, few are willing to cover the instrument panel and travel without basic information.

We use the information provided and push the specified limits. Speedometer inaccuracies are known as we speed to our destination. Based on risk assessment we choose to travel faster than specified, either by some tolerable amount, by keeping pace with traffic, or choosing to travel just slower than the fastest vehicle we have observed.

We combine speed information with observed surface conditions such as dry or wet, ice or snow and adjust 'risk' or travel speed accordingly. The roadway conditions are combined with our most recent tire wear inspection and a final risk assessment performed. Where our estimates are reasonably accurate, a safe journey may be the reward.

The oil dipstick provides both a high and low specification. We tolerate running the engine one-quart low for a short time accepting some 'level' of risk. While the low oil level is no guarantee of engine failure, combining a number of variables such as heavy traffic, high temperatures, low coolant levels, heavy loads, steep grades, etc. each add risk until the combination results in failure.

Rational thinking in the pavement industry suggests the owner includes a careful review of construction records, inspection information and testing data compared to previous performance. The owner combines the information with Risk Assessment progressing through alternatives such as reconstruction, conventional asphalt concrete and rubberized asphalt concrete overlay, cold in-place recycling, full depth reclamation, slurry seals, chip seals, cape seals and micro-seals ultimately making a final selection. The owner also combines available data with subjective information such as recollection and rumor, desired performance level and tolerance for failure. Where data is absent, decisions are based on recollection, rumor and fear of failure.

We must overcome rumor, risks and fear with information and documentation. Given the variability of the products we deliver and the conditions over which we construct, such documentation is critical. When you run out of gas on the side of the road, the average fuel level in that tank, from beginning to end was half full.

Since we do not run out of gas every time we travel, the average fuel in your tank is always over half full. Would a gauge providing average fuel level be useful, or as with so many poorly documented projects, be accurate and useless?

We construct over old alignments which have been widened and realigned, patched, cut, overlaid, sealed, and restriped and have been subjected to countless repeated abusive loadings from trucks, buses and automobiles. Local roadways also serve as parade routes, playgrounds, gathering areas and the list goes on. Products have been applied to the roadway ranging from recycled glass, recycled aggregates, sound and unsound aggregates, modified binders, rubberized asphalt concrete, conforming and non-conforming asphalt concrete, effective and ineffective overlays, and still we move forward placing the next greatest material over what may have been somebody else's folly.

While these various products and methods have been evolving, the wheel loading and traffic volumes have changed even faster. Tire pressures increase, axle loads increase and trash truck lengths increase. Small diameter cul-de-sac streets provide 'heat island' relief while presenting real operational difficulties during construction and for large service vehicles using the streets.

We utilize products with related risks and benefits ranging from major rehabilitation, overlay, fog seals, slurry seals, cape seals and micro-seals.

Projects include conventional asphalt concrete overlays, rubberized asphalt concrete, latex modified binders, open grade asphalt, warm mix asphalt concrete and the list goes on. We must learn how these differing surfaces perform over time, and critically how it affects use of cost effective resurfacing processes such as slurry and chip seal. Will construction records exist, readily retrievable through modern technology, to evaluate the effectiveness of these products, or will resistance to testing, perceptions of testing and inspection, result in future decisions based on recollection, observed performance and rumor?

We must address the advantages of including cost effective surfacing treatments, while addressing budgeting for comprehensive testing and inspection programs. By the very nature of existing procedures, inspection is often reduced to monitoring resident notification procedures, roadway closure and opening times.

Reconstruction provides structural improvement and includes understood construction risks. Asphalt concrete and rubberized asphalt concrete overlays each present a measureable structural improvement and a finish surface consistent with public expectations.

Full depth reclamation provides structural improvement, and includes an understood new asphalt concrete wearing surface. Cold in-place recycling includes a new asphalt concrete wearing surface although structural improvement is not the necessary outcome. Costs for these alternatives may be slightly less than complete reconstruction, and the 'green' sustainable aspects overshadow the apparent risks of unknown construction duration and performance.

Wearing surface replacement does not necessarily include structural improvement and as such includes greater flexibility of choice and final surface characteristics. Slurry seals provide low cost improvement with a generally acceptable final wearing surface. Chip seals are a very effective wearing surface and provide a surface widely accepted in rural environments and roadways not serving as community meeting and play areas. Combining slurry and chip seals in a cape seal, provides the impression of a slurry seal surface acceptable under in many jurisdictions.

Chip seals and cape seals are very susceptible to rumors, and present the greatest challenges for testing and inspection when compared to total construction costs. As such, emphasis on testing and inspection often establishes 'average' conditions, pre-qualification of materials, etc. Where performance does not meet expectations, the overall product is 'blamed'. Since no significant 'after the fact' testing is possible for the plethora of pavement seals used, there is little recourse other than complete rejection of the product or procedure and another tool in the infrastructure toolbox is eliminated.

Perceptions regarding testing and inspection include 'facts' including it is not timely, it only catches cheaters, it complicates and penalizes a project and of course, it is expensive. If we view testing and inspection as a product only valuable for catching cheaters, it remains a cost, and the cost is high. Where testing and inspection is reduced to a minimum, yielding average values, the value is even less, not unlike a gas gauge, that provides average tank conditions over time.

Placing a value on documentation requires raising use of the information above the penalty phase and permitting understanding of the variables involved in construction. These variables include those over which we have some control, those for which we have little control and those over which we have no control. We must evaluate the risk of each variable, reducing the exposure of our products and processes to an acceptable level.

The value of documentation is to evaluate the variability of the product we provide and the variability of conditions under which we work. We must review the value of real and complete records. Compete records provide a level of comfort to the contractor, material supplier and the owner. Where the contractor and material supplier understand the risks, costs are reduced. Where the owner understands the risks, rational decisions result. The comfort provided from records is 'priceless'.

The image conscious environment where we live and work demands a higher level of product understanding. The Owner/Public is interested in appearance and does not tolerate excuses. The City Council must keep the Public satisfied and the City Engineer is tasked with understanding the Public, improving the streets and City infrastructure and keeping the City Council satisfied.

During the rehabilitation debate, we are not only competing project to project, but between departments, between Social Services, Fire and Safety and Public Works. During the process of Budget Evaluation and Risk Assessment, we must understand expectations and compromise and we must enter the debate with full and complete information. Judgment exercised by the owner should be based on perception, expectations and specific observations and measurements. Absent documentation, and the fact perception and expectations do not always match, the risks and rewards will be reduced to risks and rumors.