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Only Assessing Nominal Safety . . . Are You Missing the “Safety Boat”?

By Russell Brownlee:

Any transportation system is made up of vehicles, users, the transportation facility and the environment. They all have a factor in determining the efficiency and safety performance of a system. Human errors account for a large percentage of collisions, injuries and fatalities on our transportation systems; however, they do not act alone. It has been estimated that roadway environment may be a contributory factor in more than 30% of roadway collisions. Our role as professionals is to determine if one or more of these contributed to a collision, and to what extent.

Nominal safety is a measure of a transportation facility design's compliance with prevailing design standards, warrants, guidelines, and jurisdiction specific policies and procedures. In undertaking an in-service safety review of a particular roadway, or a collision investigation, the “compliance check” (the nominal safety measure) is only one component of the overall review. The remainder of the review should involve human factors, positive guidance and a substantive safety assessment. We will get to each of these in a minute, but first let's finish off the nominal side of the discussion.

So why do many agencies, practitioners and experts only direct their attention to nominal safety measures? There are a number of potential reasons. In many cases, it requires the least effort and time. Secondly, it does not require defense of a professional opinion that lies outside design minimums, warrants, and policies. Nominal safety is an absolute. Either the roadway design and traffic control devices meet the standards of the day or do not. Lastly, some individuals and agencies do not have the training, experience or data systems to apply substantive safety measures or venture outside the design domains.

Common Problems with Nominal Safety Measures

Before we go too far down the road, don't misunderstand my point. I am not suggesting that abiding by a set of



standards is a poor or negligent action. It is generally the best starting point. However, in applying nominal safety, one must recognize where it falls short in ensuring a higher level of safety.

Firstly, road users do not read road design manuals! They take a provincially-issued driver test from a handbook that begins on Page 1 with: “This booklet is a guide only”, and specifies the need to read several other lengthy Acts including the Highway Traffic Act. I would venture to say only the most conscientious learners bothered to crack open a copy of the HTA, let alone the OTM or the Geometric Design Standards for Ontario Highways. In short, drivers do not care that they just drove off a perfectly designed spiral curve, signed in accordance with OTM; their focus is on the fact their vehicle is severely damaged and that emergency services are tending to their needs.

Therefore in carrying out their daily duties, the transportation practitioner must take on the mindset of the typical road user from time to time to understand their experiences, expectations and decision “tools” they are using to attempt to safely use a transportation facility.

Secondly, the manuals and standards available to us are intended to give minimum typical conditions and are necessarily general because they cannot incorporate all site-specific conditions. This is particularly apparent in established urban areas, in unique topography zones, and in challenging work zones. There are less “cookie cutter” situations in transportation planning and design/maintenance than one might expect. Design dimensions and operating conditions that do not meet the standards do not automatically point to an operational or safety concern.

Finally, when determining causal factors associated with a specific collision, the transportation facility design may be held to a different “standard” or criteria (compared to those in our manuals) when assessing the:

- **Road users “opportunity to avoid”.** There will be situations whereby a prudent road user had the ability to properly assess the ensuing conflict and avoid the collision, notwithstanding the deficiencies associated with the roadway facility.
- **Road authorities’ knowledge of, and planned or actual response to a specific hazard or deficiency;**
or

- **Performance of a lawful action in an improper manner,** i.e., applying an approved standard incorrectly or without explicit consideration for its safety implications. Blindly following a provincial justification, a municipal policy or corporate procedure, may not be a good legal defense.

The following are three critical components of a safety review or a collision investigation that should be considered in addition to ‘nominal safety’.

Substantive Safety

There is no such thing as “perfectly safe” in transportation. Unfortunately, unavoidable hazards and conflicts are a negative byproduct of mobility that will ultimately result in some collisions. The operative word is “reasonably safe”. A firm understanding of expected safety performance and relative safety is required to properly assess a transportation facility and its role, if any, in a specific collision. Substantive safety analysis answers such questions as:

- **Should the facility owner or operator have known of the safety issue?**
- **Did the transportation authority have a strategy to identify, program and fund safety improvements?**
- **Were localized or systemic safety issues addressed with useful countermeasures or remedial action?**
There have been cases where overzealous politicians, transportation practitioners and sign crews have applied remedial measures in the name of safety, resulting in a negative effect on safety.

For existing transportation facilities, the best practice is to compare the actual safety performance of a roadway with the expected performance for that facility type. One must understand the frequency and types of collisions that are occurring at a specific site, whether it is beyond that expected, and which types of collisions are over-represented. With further advancements and awareness, including the 2009 release of the Highway Safety Manual, it will be increasingly difficult for transportation practitioners to plead ignorance to safety performance on their roadways.

For proposed facilities or for remedial improvement evaluation, the net safety improvement expected should be incorporated into the decision process and the assessment of alternatives. Emerging research and tools are becoming available that allow the transportation practitioner to assess the safety implications of their decisions.

Human Factors and Positive Guidance

As mentioned above, the road user is a major contributory factor in collisions on our transportation systems. Unfortunately, the public generally chalks this up to road users that are incompetent, impaired, aggressive, tired, speeding, inexperienced, distracted, etc. Why else would a motorist rear end another vehicle on the approach to a major intersection under clear, dry conditions? This was a facetious question from someone who has investigated a wide range of circumstances that have contributed in part to our “road user error”. In reality, the contribution of human factors to everyday collisions applies to experienced, capable and alert drivers as well as those characterizations list above.

Examples of positive guidance issues that may be contributing error may include, but are definitely not limited to:

- Combination horizontal and vertical curves that conceal the severity of the alignment;
- Challenging roadway characteristics that divert the road user’s attention away from other hazards or conflicts, instead of toward them;
- Unexpected and atypical traffic control devices or ROW assignment;
- Poorly identified transition areas on urban boundaries, at lane terminations, or approaching intersections; and
- Ambient lighting conditions that distracts the motorist, impairs visibility or conceals potential hazards.

When designing a new facility or when making physical or operational changes to an existing one, the effects of human factors and positive guidance need to be fully understood and integrated into the analysis and decision process.

Summary

In closing, the next time your staff or consultants tell you that everything is “safe” because the radius of the curve corresponds with the manual, you might want to probe a little further into their assessment. Is the assessment based on nominal safety alone, or has the greater safety picture been taken into account? The evolution of safety research is providing us with more “tools” to assess safety throughout the life cycle of a transportation facility. Has your team employed all the tools available to them?

About the Author:



Russell Brownlee, B.Sc., M.A.Sc., FITE, P.Eng., is the Head of the Road Assessment team and is a Transportation Safety Engineer at Giffin Koerth Forensic Engineering and Science. Russell has over 13 years of public and private sector experience in the areas of road user safety, rail safety and transportation engineering. He is a recognized expert in undertaking in-service safety reviews of transportation facilities and, in the recent past has completed in-service safety studies encompassing over 330 kilometres of roadway and 150 intersections and accesses. The study locations represented a variety of operating conditions from constrained freeway work zones to remote locations on rural highways. In his current position, Russell works with GK’s Accident Reconstruction group to examine causal factors. Russell is an active member of the Institute of Transportation Engineers (ITE). He has been a member of the Traffic Engineering Council Executive Committee for a number of years and is the current Chair of the ITE Transportation Safety Council Executive Committee.