POSITION PAPER

ON

CONTINUOUS SHOULDER RUMBLE STRIPS

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Summary

The improper installation of "Rumble Strips" in numerous areas of Nova Scotia highways is causing unsafe conditions for road users including cyclists. Cyclists can be thrown from their bike by the strips or be forced to verge abruptly into the traffic lane.

Although the Nova Scotia Department of Transportation and Infrastructure Renewal has provided general guidance in the form of a standard plan, (File S-2009-042) there are no known policy on the installation of rumble strips except for Notes attached to the standard plan (See attachment)

In addition, it appears that the contractors applying the rumble strips are either unaware of the guidance or are ignoring it. This issue must be addressed at local and district levels.

Discussion

Rumble Strips

Rumble strips are raised or grooved patterns in a road's shoulder designed to alert drivers with noise and vibrations that they are drifting off the roadway. [1]

Rumble strips are placed as a countermeasure for driver error, rather than roadway deficiencies. They are designed primarily to assist distracted, drowsy, or otherwise inattentive drivers who may unintentionally drift over the edge line. Because they are designed to generate vibration through the vehicle, rumble strips impact the comfort and control of bicycles when traversed.

Background

In early 2007, the then Nova Scotia Department of Transportation and Public Works, installed rumble strips along a 100km section of Highway 104 between Amherst and Truro at an approximate cost of $530,000.

According to a spokesman for the Department, that section was chosen because of its wide shoulders and because it has a history of cars leaving the road. [2]

Rumble strips have more recently been introduced to Cape Breton Island's 100 Series highways in the past year or so. Velo Cape Breton is concerned by the negative impacts of rumble strips installed on sections of highways used by cyclists, especially where there is no alternate route available.

In 2009, a "Continuous Shoulder Rumble Strips" standard plan was issued by the now Department of Transportation and Infrastructure Renewal. See Annex A.[3]

The drawing shows length and width dimensions, depth, offset and location of the rumble strips milled on the paved shoulder. The attached notes say that rumble strips will only be used on freeways and major arterials; they will not be installed on bridge structures; they are not to be used when paved shoulders width are less than 1.0 metre.

Safety of Rumble Strips

Rumble strips can be an effective safety measure to prevent run-off-the-road (ROR) crashes, especially on limited-access highways and rural two-lane highways with long straight sections.

ROR crashes are due to inattention, speeding, traction loss, overreaction, crash avoidance, and mechanical failure.[4] Rumble strips only prevent ROR crashes due to inattention or simply put, when drivers do not comply with the law[5]. Research indicates that 47% of ROR's exited the highway to the left; while only a slightly higher percentage (53%) exited the highway to the right.[6]

Rumble strips as a small-scale "engineering" decision has significant policy implications. Rumble strips can be a contentious solution for traffic control as they affect a wide range of road users - not just the targeted automobile drivers. Safe accommodation of all road users should be considered when designing and applying rumble strips. This includes passenger and commercial vehicle drivers, cyclists, pedestrians, and others. Cyclists, in particular, are negatively impacted by rumble strips. Where shoulders are available and clear, cyclists will often choose to use them to avoid conflicts with faster moving vehicles in the travel lane.[7]

Rumble Strips Impacts on Bicycle Safety

One of the problems for cyclists occurs when these rumble strips take up too much of the shoulder such that they cannot be avoided. While rumble strips merely create "noise and vibration" in a motor vehicle, they can cause damage to a bicycle, destabilize the rider and lead to a crash. Poorly designed and poorly placed rumble strips force cyclists to ride out of the shoulder area[8] and into the travel lane presenting an increased risk to both the cyclists and the driver of the motor vehicle. (Figs. 1, 2)

Rumble strips are almost impossible to ride a bicycle on or over – they are at best uncomfortable, even for a very short distance, and at worst can cause cyclist to lose control of their bike and fall, not to mention the possibility of falling into the path of a speeding car. Destabilization is a hazard to even the most experienced of cyclists.

Fig. 1

No matter how wide the shoulder, cyclists must cross rumble strips at times: i.e. in order to prepare for left turns, to avoid shoulder debris and objects, to skirt parked vehicles, to pass vehicles, to dodge vehicles nosing out of driveways.

Riding on rumble strips can damage a bicycle wheel, cause a flat tire, and/or shake lose parts off a bicycle. Consequently, cyclists will avoid riding over them as much as possible.

While rumble strips do not deter car, truck or bus travel, they have a severe impact on bicycling travel, and are ruining popular cycling routes[9].

Rumble Strips on Narrow Shoulders

Travel to the right of shoulder rumble strip is generally most beneficial for the cyclist as long as that area is free of debris and obstacles and the travel path is wide enough to comfortably accommodate the bicycle. TransCanada Highway 105 typically has 2 metre wide paved shoulders. The milling of a rumble strip along the fog line leaves a clear paved shoulder width of 1.45 metres; a lane width considered safe for a bicycle lane. And still there are situations like: vehicles parked on the shoulder, debris on the shoulder, or downhill sections where even with a 1.5 metre clear path, a rumble strip presents a significant hazard particularly if the pavement is wet. The argument that rumble strips help protect cyclists is a moot point if not entirely misleading as inattentive drivers' vehicles generally pass entirely over the rumble strip before recovery (if any).

The main issue for a cyclist is when the rumble strip takes up too much of the shoulder such that it cannot be avoided. For example, in Nova Scotia on long and/or steep climbs, the travel way subdivides to two climbing lanes; this usually leaves a 1 metre wide paved shoulder on the right hand side. Although the 1 metre paved shoulder is below the 1.5 metre width of a standard bike lane, 1 metre is just enough room for cyclists to ride away from the faster moving traffic lane. However, the Nova Scotia Department of Transportation and Infrastructure Renewal *Continuous Shoulder*

Rumble Strips standard plan allows the milling of 400mm long rumble strips at 150mm off the fog line on 1 metre paved shoulders. This occupies 550mm of space or, more than half of the 1 metre shoulder. The 450mm remaining space of paved shoulder is not a width safe for a cyclist to ride on. (Fig. 1) Furthermore, the remaining narrow space is most often broken up or filled with debris and gravel that the draft created by the fast moving traffic deposits on the shoulder.

The rumble strips to alert inattentive drivers therefore creates a safety hazard to cyclists left to ride on too narrow a strip of clear shoulder often forcing them to cross over the rumble strip to merge into the fast moving traffic lane, a hazardous situation which should be avoided.

This dangerous situation is further amplified by the installation of rumble strips on the centre line intended to prevent "lane displacement" or "lane drift" by motor vehicles; however, the safe vehicular use of a bicycle depends on lane displacement, especially on narrow roads. If the overtaking motor vehicle driver does not shift left, over the centerline, the cyclist could be imperiled. The active discouragement of lane displacement at all times and in all locations effectively amounts to a bicycle-use discouragement policy. For example, here in Nova Scotia, it has been observed that drivers of motor vehicles are more and more hesitant to cross the Centerline rumble strips to overtake a cyclist by a minimum of 1-metre separation to respect the law.[10]

Centerline rumble strip is creating a dangerous condition for use as grounds in future tort litigation should a cyclist become injured and the injury be traced to the new rumble strip.

Effectiveness of Rumble Strips

The USA Federal Highway Administration states: "Long sections of relatively straight roadways that make few demands on motorists are the most likely candidates for the installation of shoulder rumble strips." The degree of engagement of a highway affects the accident rate. Implied in this statement is that highways that are twisty and hilly with a variable foreground have low rates of accidents due to inattention, and are therefore not likely candidates for the installation of rumble strips.[11] The installation of rumble strips along highways that are highly engaging like our Nova Scotia highways, with a narrow shoulder, a low accident rate, and relatively low proportion of accidents due to fatigue or inattentive driving have questionable value.

Climate is another factor that affects the success of rumble strips installation. If they are installed in a northern climate, they may be filled or partially filled with a deicing salt and traction sand mixture. They may also be filled with ice. This is a particular concern in regions with freeze-thaw cycles requiring frequent deicing. Furthermore, rumble strips filled with water, snow, slush, and ice may cause or aggravate occasional accidents.[12] And this situation occurs from November to April, almost five months of

the year. For example, there are no rumble strips installed in Vermont for the above reasons.

Rumble strips help create the illusion of separation between drivers and non-motorized roadway traffic, i.e. cyclists, pedestrians but inappropriately placed they will only increase the risk to both cyclists and pedestrians forced into the fast traffic moving lane

Rumble strips may gradually encourage inattentive driving, also known as "distracted driving" – thereby causing motorists to give even less consideration and attention to the task of driving and partially negating any safety benefits in the long term.

Velo Cape Breton Bicycle Association

Velo Cape Breton Bicycle Association is Cape Breton Island's primary bicycle advocacy organization representing bicyclists of all abilities and types. Members of our board have significant cycling experience as well as a strong base of technical knowledge. Moreover we are deeply informed by input from hundreds of bicyclists.

Velo Cape Breton understands and appreciates the potential of rumble strips to protect motorists from run-off-the-road crashes. However we recognize that the benefit to cost ratio provided by rumble strips on given roadways varies significantly according to a number of factors, including road geometry, speed and traffic volume. We support targeted installation of rumble strips on roads that would benefit the most from their use. Rumble strips affect the comfort and control of bicycle riders; consequently, their use is to be limited to highway corridors that experience high levels of run-off-the-road accidents [13]. We believe that the indiscriminate, wholesale installation of rumble strips provides significantly reduced return-on-investment and results in a serious reduction in safety, comfort and mobility for cyclists. (Fig. 2)

Fig. 2

Currently there is no known Departmental policy other than the *Continuous Shoulder Rumble Strips* Standard Plans and Notes attached to it. We urge the Nova Scotia Department of Transportation and Infrastructure Renewal to put a moratorium on milling rumble strips on less than 2 metre wide paved shoulders and to seriously consider the following recommendations in the drafting of a rumble strip policy toward the future installation of rumble strips.

Recommendations

Velo Cape Breton Bicycle Association recommends that:

- **Rumble strips should not be used indiscriminately on roadways that are not limited-access.** Rumble strips should be used where there is a history of run-off-the-road crashes and when the impact to cyclists safety can be minimized.

- **Milling of rumble strips shall not to be used when paved shoulder width is less than 2 metres**. This way, the space used for the rumble strip will leave at least 1.5 metre of unobstructed roadway shoulder (i.e., smooth surface not covered with debris) which is safe and encourages cycling as a mode of transportation.

- **No installation of rumble strips on the descent side with a downgrade in excess of 4%, or in excess of 2% if the decent is longer than 500 feet.** Here cyclists travel at very high speeds and are extremely vulnerable to destabilization. High speeds complicate the process of switching between shoulder and roadway to avoid debris or to allow cars to pass.

- **There also need(s) to be periodic gaps in the rumble strips so cyclists can move safely between shoulder and (the) travel lane** when needed without having to ride across the rumble strip.

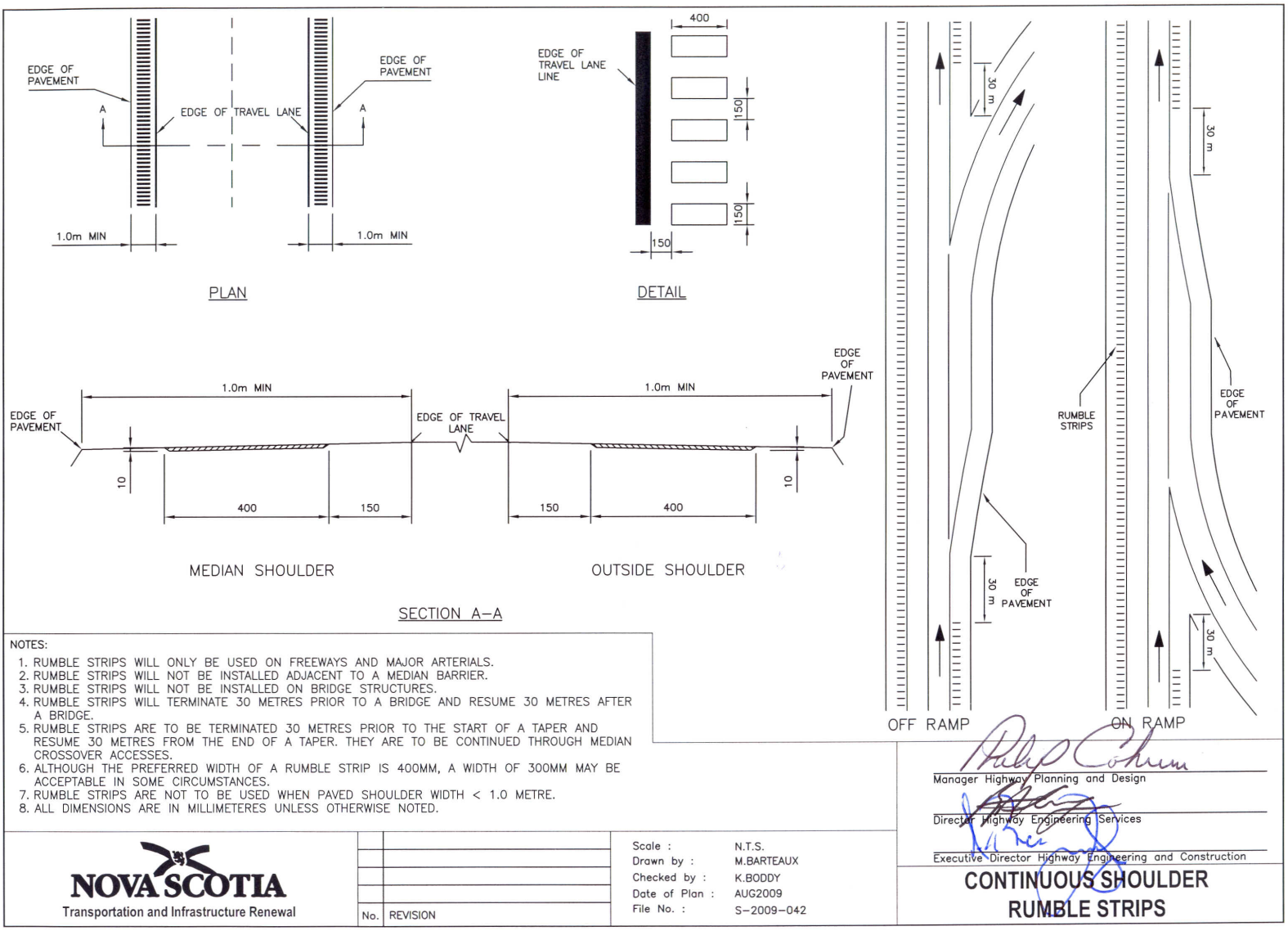
- **Adjusting rumble strips dimensions to be more bicycle friendly**
  Pennsylvania, California, and Colorado have studied bicycle - tolerable rumble strip designs. Their studies come to similar conclusions about the dimensions for such rumble strips.
  - Width: 127 mm; Depth: 10 mm; and Spacing: 280 or 305 mm
  - Of note: Nova Scotia dimensions are Width: 400mm, Depth: 10mm; Spacing: 150mm which is **three times wider**, **same depth** and grooves **half as much closer to each other**.

  When bicyclists need more of the shoulder, or rumble strips are needed along a narrow shoulder, Torbic et al. report that narrower strips can "still generate the desired sound level differences in the passenger compartment."[14]

- **Rumble strips as an effective measure to prevent run-off-the-road crashes, should be placed on the fog line to alert drivers sooner as they leave the travel lane.** Especially in Nova Scotia where our limited road budget does not allow the installation of 2-metre wide paved shoulders everywhere**.** Milling 127mm rumble strips on the fog line - where it is absolutely needed - will only use 27mm of the paved shoulder instead of 550 mm leaving almost a full width clear shoulder.

- Edge line rumble stripes have been shown to be most effective, because the driver is alerted sooner and it provides a slightly larger recovery area after being alerted [15]. Also milling rumble strips on the fog line (rumble stripe) both increases the visibility of the white line and maximizes available shoulder area [16].

- **Formally issue a draft policy for public comment before any new rumbl**e strip policy is adopted. Input from all stakeholders is needed to craft a fair and effective policy.



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