

## HIGHWAY SAFETY MANUAL LOCAL CALIBRATION FOR RURAL 2-LANE ROAD SEGMENTS AND INTERSECTIONS

The Maine Strategic Highway Safety Plan gives priority to safety along our rural highways and intersections. Lane departure and speed related crashes total nearly ½ of our annual crashes. A high percentage of these crashes occur on rural 2-lane highways. Between the years 2004 – 2013 over 30% of crashes were lane departures and 18% of crashes were at intersections.

The AASHTO Highway Safety Manual (HSM) is a resource of safety knowledge and tools that can provide improved decision-making based on actual and predicted safety performance. The HSM has predictive models that can be applied to alternative highway designs which allow the agency to make better informed decisions on design and construction of highway facilities. The HSM also encourages and supports the development of local calibration factors. The factors are simply the ratio of actual or observed crashes over the HSM predicted crashes.

The purpose of this study is to develop local calibration factors for rural 2-lane road segments and intersections using the methodology for calibration given in the HSM. Steps consisted of:

1. Select randomly sampled locations for each 2-lane facility type.
2. Gather attributes and recent actual crash data for each facility.
3. Calculate HSM crash predictions for each locations.
4. Calculate calibration factors for each facility type.

The calibrations are completed. The rural roads analysis shows Maine crash data match closely with the HSM predicted crash data. For intersections, it was found that HSM over-predicted the number of crashes by a factor of 2.

2-Lane Rural Facility type	Sample Size	Calibration Factor
Road Segment	47 segments (91 miles)	1.08
3-Leg unsignalized intersection	169	0.54
4-Leg unsignalized intersection	107	0.38
4-Leg signalized intersection	44	0.55

### Implementation:

The Bureau of Planning Transportation Analysis Section is implementing an analysis spreadsheet for the application of the Highway Safety Manual to intersections on 2-lane rural highways. Some of the spreadsheet features include:

1. This spreadsheet is set up for evaluating several alternatives at one intersection. No segment analysis elements are included.
2. Maine-based calibration factors for overall crash rates are included.
3. Maine-based crash type and severity information replaces the default values.
4. Allowance for up to two additional crash modification factors has been included. This feature allows the crash impact analysis of modifications not built into the HSM formulas.
5. A crash cost tab has been added to estimate crash costs (and benefits) of intersection alternatives.



## Case Study:

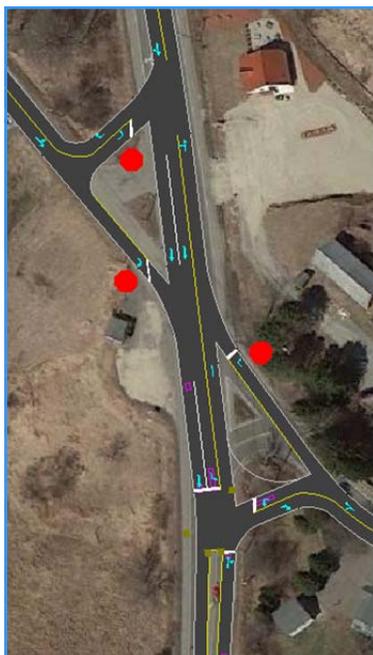
The Transportation Analysis Section recently used the HSM with locally calibrated factors on a rural intersection project in South Berwick at the junction of State Routes 236 (Dow Highway) and 91. Five intersection alternative designs were evaluated and compared to the existing or “no-build” option. For a comparison the HSM was also used without the locally calibrated factors. The table below summarizes the comparison.



Case Study - Existing Intersection

Intersection Alternative	HSM with Local Calibration		HSM without Local Calibration	
	HSM Predicted Crashes per year	Reduction in Annual Costs	HSM Predicted Crashes per year	Reduction in Annual Costs
No-build	2.34 (actual = 3)		6.15 (actual = 3)	
Alt. 1	3.45	\$42,400	6.09	\$104,300
Alt. 2	3.50	\$35,600	6.37	\$95,300
Alt. 3	2.34	\$0	6.15	\$0
Alt. 4	4.47	- \$9200	8.13	\$39,800
Alt. 5	3.23	- \$44,400	8.51	- \$60,700

The result is that crash and crash cost impacts (increases and decreases) are exaggerated. The predicted crashes for the existing configuration are double the observed. With local calibration the difference was approximately 20%. Similarly, the calculated benefits of alternatives were more than doubled. In one case (Alternative 4), the impact was reversed. This shows the importance of determining local calibration factors for the Highway Safety Manual calculations and to the overall project decision-making process.



*Alternative 4, shown here, would signalize the southern intersection while leaving the northern and central intersection stop-controlled. This alternative would eliminate all left-hand turns from the central intersection by directing all left-turning traffic on both routes to the northern and southern intersections. By eliminating left-hand turns from SR 236 at the central intersection, traffic turning right onto either leg of SR 91 would no longer face conflicting traffic coming from the central intersection. This configuration is estimated to cost approximately \$345,000. The HSM analysis with the local calibration factors shows this alternative being not cost effective. However, the HSM without the calibration factors shows it being cost effective. Ultimately, Alternative 1, which added a traffic signal and westbound right-turn lane to the existing intersection, was selected.*