High Risk Rural Roads Program Guidelines

I Introduction

SAFETEA-LU introduced a new set-aside provision known as the High Risk Rural Roads Program (HRRRP), codified as 23 U.S.C. §148 (f) for reducing the frequency and severity of collisions on rural roads functionally classified as a rural major collector, rural minor collector and rural local roads by correcting or improving hazardous locations or features. The program is a component of the Highway Safety Improvement Program (HSIP). 23 U.S.C. §148 (a)(1) defines a HRRR according to the following definition:

"…any roadway functionally classified as a rural major or minor collector or rural local road--

A. on which the crash rate for fatalities and incapacitating injuries exceeds the statewide average for those functional classes of roadway; or
B. that will likely have increases in traffic volume that are likely to create an crash rate for fatalities and incapacitating injuries that exceeds the statewide average for those functional classes of roadway."

VDOT maintains records on current and historical roadway inventory, traffic volume and crashes. To identify the hazardous HRRR locations, the last three calendar years of crash and inventory data (2005 – 2007) were first analyzed. Fatalities are occupants who died at the scene or within 30days of the crash as a result of injuries sustained in the crash. Incapacitating injury are occupants who suffer visible signs of injury such as bleeding wound or distorted member. VDOT has apportioned the annual allocations of approximately $2 million to each of the nine construction districts based on the proportion of severe crashes in three years. The HRRR funds are 90 percent FHWA and 10 percent local (roadway system), but VDOT has provided the matching state funds. The district and regional staff will propose countermeasures using the HSIP procedures to target the allocations at the worst locations.

The applicant for HRRRP funds is an agency who has responsibility for the use and expenditure of federal funds. For projects located on roadways in cities or towns but not maintained by VDOT, the applicant must be the agency that owns, operates and maintains the facility. If a project involves multiple jurisdictions, the lead agency should provide documents from the other affected agencies.

Project Eligibility

For a project to be eligible for HRRR funds, the roadway location targeted for improvement must have a crash rate for fatalities and incapacitating injuries that exceeds the statewide average for those functional classes of roadways. Construction and operational improvements may include, but are not limited to, the list of twenty-one project categories (http://safety.fhwa.dot.gov/safetealu/memos/memo051906.cfm) identified under 23 U.S.C. § 148 (a)(3)(B) except three categories as **viii** The conduct of a model traffic enforcement activity at a railway-highway crossing, **xiv**. Safety-conscious planning**, xv.** Improvement in the collection and analysis of crash data.

II HRRR Eligible Locations

Virginia's Fatal & Incapacitating Crashes by Roadway Functional Classification

Table 1 shows Virginia's fatal & incapacitating[1] (K+A) injured people distribution by roadway functional classification for last three years (2005 – 2007). Rural roadways carry much less Daily Vehicle Miles of Travel (DVMT) than the urban roadways. However, the roads have 1.4 times higher fatal and incapacitating injuries than urban roads. In addition, about sixty percent of all fatal and incapacitating crashes occurred on rural roadways and over fifty percent of the rural roadways' fatal and incapacitating crashes occur on the rural major or minor collector and rural local roads. Given the random nature of rural crashes and the variable traffic volumes on lower class roadways, VDOT will use K+A injured people density on segments and frequency at intersections to define candidate locations for countermeasures. That is, VDOT has developed a method to identify HRRR locations which have fatal and incapacitating injury density exceeding the statewide average for those functional classes of roadways.

TABLE 1 Virginia's Fatal & Incapacitating (K+A) Injured People by Roadway Functional Classifications (2005 – 2007)

FUNCTIONAL CLASS	LENGTH* (Mile)	DVMT**	FAT + INJ TYPE 'A' PEOPLE FREQUENCY	FAT + INJ TYPE 'A' PEOPLE DENSITY (Mile)	FAT + INJ TYPE 'A' PEOPLE RATE (HMVM)
Rural Interstate	666.5	24,879,574	3373	5.1	12.4
Rural Principal Arterial	1408.1	17,839,011	5092	3.6	26.1
Rural Minor Arterial	3410.9	14,942,109	5839	1.7	35.7
Rural Major Collector	9293.5	15,871,774	8493	0.9	48.9
Rural Minor Collector	2440.2	1,602,940	1181	0.5	67.3
Rural Local	31389.2	8,385,527	5296	0.2	57.7
Urban Interstate	452.5	41,817,177	6871	15.2	15.0
Urban Freeway/Expressway	267.2	9,552,271	720	2.7	6.9
Urban Principal Arterial	1286.3	31,835,810	5203	4.0	14.9
Urban Minor Arterial	2217.3	28,615,700	4311	1.9	13.8
Urban Collector	2340.3	11,708,893	2394	1.0	18.7
Urban Local	6807.8	14,161,299	1461	0.2	9.4
TOTAL/AVERAGE	**61979.8**	**221,212,085**	**50234**	**0.8**	**20.7**

* Based on 2007 Roadway Inventory,
** Based on 2007 Traffic Monitoring System

[1] Virginia follows the KABCO severity scale where K=death, A = visible injury including transported from crash, B = visible but minor injury, C = complain of injury and O = property damage only crash.

Identify Candidate HRRR Roadway Segments and Intersections

Table 2 shows a severe crash summary by VDOT construction district for the three years 2005 to 2007. The eligible HRRR locations, rural major or minor collector and rural local roadway segments, have statewide average K+A injured people densities of 0.30 to 0.06 per mile, for fatal and incapacitating injury crashes. This translates into K+A people rates per 100M VMT of 49.3, 66.3 and 56.6, respectively. So, although the density of minor collectors is about 3 times the locals the severe crash rates are more similar. As such, to find the highest concentration of K+A injured people density, VDOT will focus on the rural collectors.

Should regional or residency staff wish to review HRRR eligible roadways segments in each construction district, the best starting point is the annual high crash rate listings published as the Critical Crash Rate (CCR) Lists[2].. Using the CCR lists, VDOT staffs have the option of finding segments with death plus injury density per mile above the statewide average to focus countermeasure development. The CCR lists do not have the K+A people injured, but they can be sorted on the roadway functional class (codes 4, 5, and 6 are eligible, see Table 3 below) and then on the death plus injuries (all A,B and C severities). With these eligible ranked listing, the police crash reports (FR300) on the segments with the highest total injury densities can be reviewed to determine if above the statewide K+A injury densities in Table 2. For example, in 2006 Richmond District had 13 segments with functional class of rural major collector (= 4) on the CCR list. The K+ABC (all injuries) densities range from 2.6 to 39 per mile. Reviewing the police reports would confirm how many injuries were coded Type "A" severity to determine which segments are HRRR eligible. However, to begin, the HRRR program will focus on high crash rural intersections with collectors that will typically have higher concentrations of severe crashes. The following sections define and rank the eligible intersections.

[2] Annual CCR Lists for each VDOT construction district are posted on the TED Safety Analysis team site in the AnnualCrashReport folder.

Table 2 HRRR Eligible Roadways Fatal & Incapacitating Injured People Summary by VDOT District (2005-2007)

DISTRICT	FUNCTIONAL CLASS	LENGTH* (Mile)	2005 FAT+INJ 'A' PEOPLE DENSITY (Mile)	2005 FAT+INJ'A' PEOPLE RATE	2006 FAT+INJ 'A' PEOPLE DENSITY (Mile)	2006 FAT+INJ'A' PEOPLE RATE	2007 FAT+INJ 'A' PEOPLE DENSITY (Mile)	2007 FAT+INJ'A' PEOPLE RATE	AVG. FAT+INJ 'A' PEOPLE DENSITY (Mile)	AVG. FAT+INJ'A' PEOPLE RATE
BRISTOL	Rur Maj Col	1565.2	0.32	65.19	0.33	61.87	0.30	64.59	0.31	63.88
	Rur Min Col	230.2	0.20	111.34	0.14	75.06	0.17	103.90	0.17	96.77
	Rur Loc	4755.1	0.06	52.70	0.06	51.23	0.05	46.28	0.05	50.07
SALEM	Rur Maj Col	1429.2	0.37	67.90	0.34	61.57	0.29	55.38	0.33	61.62
	Rur Min Col	301.2	0.24	82.55	0.18	63.37	0.28	99.38	0.23	81.77
	Rur Loc	5334.5	0.05	57.98	0.06	76.34	0.06	66.53	0.06	66.95
LYNCHBURG	Rur Maj Col	1269.6	0.21	50.03	0.21	51.18	0.22	50.90	0.21	50.70
	Rur Min Col	379.9	0.11	66.85	0.11	71.62	0.08	53.77	0.10	64.08
	Rur Loc	4466.9	0.05	71.48	0.05	67.74	0.05	67.26	0.05	68.83
RICHMOND	Rur Maj Col	1204.4	0.30	45.03	0.26	36.83	0.27	36.58	0.27	39.48
	Rur Min Col	376.5	0.13	48.52	0.16	59.46	0.19	67.36	0.16	58.45
	Rur Loc	3799.3	0.05	49.19	0.05	44.77	0.06	53.97	0.05	49.31
HAMPTON ROADS	Rur Maj Col	744.8	0.32	61.70	0.25	46.87	0.23	41.28	0.27	49.95
	Rur Min Col	255.2	0.12	55.16	0.11	52.58	0.13	60.90	0.12	56.21
	Rur Loc	2613.2	0.07	57.63	0.06	61.08	0.06	64.23	0.06	60.98
FREDERICKSBURG	Rur Maj Col	926.2	0.34	61.26	0.33	55.11	0.28	45.37	0.32	53.91
	Rur Min Col	203.6	0.17	72.62	0.21	87.97	0.26	110.44	0.21	90.34
	Rur Loc	2860.1	0.07	71.41	0.06	63.65	0.07	65.94	0.07	67.00
CULPEPER	Rur Maj Col	765.4	0.37	46.06	0.31	37.90	0.29	34.64	0.32	39.53
	Rur Min Col	256.9	0.12	45.49	0.19	70.99	0.11	43.37	0.14	53.28
	Rur Loc	3053.1	0.06	44.95	0.05	40.88	0.06	49.19	0.05	45.00
STAUNTON	Rur Maj Col	1220.7	0.39	52.84	0.33	43.32	0.29	37.40	0.33	44.52
	Rur Min Col	400.0	0.20	67.83	0.16	55.16	0.14	48.99	0.17	57.33
	Rur Loc	3817.6	0.07	69.63	0.05	58.89	0.05	56.10	0.06	61.54
NOVA	Rur Maj Col	167.5	0.53	30.87	0.59	31.20	0.57	29.16	0.56	30.41
	Rur Min Col	36.2	0.11	23.85	0.36	76.80	0.11	22.81	0.19	41.16
	Rur Loc	689.1	0.08	36.03	0.08	34.46	0.07	29.92	0.08	33.47
STATEWIDE	**Rur Maj Col**	**9293.0**	**0.33**	**54.85**	**0.30**	**48.42**	**0.28**	**44.60**	**0.30**	**49.29**
	Rur Min Col	**2439.7**	**0.16**	**65.37**	**0.16**	**65.12**	**0.16**	**68.37**	**0.16**	**66.29**
	Rur Loc	**31388.9**	**0.06**	**57.18**	**0.06**	**56.30**	**0.06**	**56.42**	**0.06**	**56.63**

* Based on 2007 Roadway Inventory

Candidate HRRR Intersections

VDOT maintains the Roadway Inventory Subsystem (RDI), RDI is a database of various physical and administrative data such as roadway functional classification, pavement, number of lane, shoulder and median data related to the roadway facilities for all state maintained roadways. Each segment of these facilities is indexed by a unique roadway ID with beginning and ending point of node in the system. Intersections are identified from the nodes which have more than three approaches and classified functions based on the characteristics of approach roadways. Roadway functional classification is the process by which the streets and highways are ranked according to the type of service they provide and grouped into class in the RDI system as shown in Table 3.

As presented above, HRRR candidate intersections must have at least one approach leg under the roadway functional categories (Code 4, 5, and 6). By focusing only on only rural roadway intersections, intersections which have approach legs with urban functional classification A through J are eliminated.

Table 3 Roadway Functional Classification in RDI

Code	Roadway Functional Classification
0	Unknown Functional Class
1	Rural Interstate
2	Rural Other Principle Arterial
3	Rural Minor Arterial
4	**Rural Major Collector**
5	**Rural Minor Collector**
6	**Rural Local**
A	Urban Interstate
B	Urban Freeways and Expressways – Connecting Links of Rural Principle Arterial
C	Urban Freeways and Expressways – Connecting Links of Rural Minor Arterial
D	Urban Freeways and Expressways – Others
E	Urban Other Principle Arterials – Connecting Links of Other Rural Principal Arterial
F	Urban Other Principle Arterials – Connecting Links of Rural Minor Arterial
G	Urban Other Principle Arterials – Other
H	Urban Minor Arterial
I	Urban Collector
J	Urban Local

Based on the 2007 roadway inventory, 42,352 intersections were identified statewide to be possible HRRR candidates on VDOT maintained roads. From those

candidates, intersections which have more than one fatal and incapacitating injury during the last five years (2003 - 2007) are classified. Since the fatal and incapacitating injury are randomly scattered in time and space, more historical crash evidence (five years) were collected and analyzed.

From the inventory and crash data analysis, 5,156 (12.2 %) intersections which have at least one fatal or incapacitating injury during the last five years were identified. Table 4 shows the number of candidate intersections. Less than 0.5 percent of intersections (n = 17) continuously have at least one fatal or incapacitating injuries for the last five years and about two percent of the intersections (n = 87) have four years of fatal or incapacitating injury occurring.

Table 4 HRRR Intersections with Fatal or Incapacitating Injured People (2003 - 2007)

Time of Appearance (Years)	# of Intersections have at least one Fatal or Injury Type 'A' People	Percentage (%)
1	3,959	76.8
2	831	16.1
3	262	5.1
4	87	1.7
5	17	0.3
TOTAL	**5,156**	**100.0**

The candidate intersections were classified by the functional classifications of approach roadways as shown in Table 5. A code was defined as forty series numbers (41-46) for intersections with rural major collector; fifty series numbers (51 – 56) for rural minor collector and sixty series numbers (61 – 66) for rural local roads.

The statewide average density of fatal + injury type 'A' people by each category of intersections are shown in Table 5. The annual average statewide fatal + injury type 'A' people density is 0.45 people (per intersection per year). Eight different categories of average annual densities of fatal + injury type 'A' are greater than statewide average. In particular, the intersections of rural major collectors crossing with rural other principle arterials (HTRIS ID Code = 42) are over two times higher average annual density (= 0.94) than the statewide average. Table 6 provides the average VDOT construction district densities compared to the statewide average.

To prioritize where to conduct roadway safety assessments, a ranked listing of the intersection in each VDOT district have been prepared and are available from HSIP staff. The intersections with more deaths and injuries (K+A) than the statewide average are candidates for HRRR funding and are priorities for further safety study. Intersections

with less than three severe injuries have not been listed. A roadway safety assessment of the intersection should generate cost effective countermeasures, addressing the highest number of targeted crashes, which can be deployed quickly.

However, as mentioned above, district and regional staff have the option of locating roadway sections that have experienced a death plus incapacitating injury density above the statewide average of 0.30 and 0.16 people per mile per year on rural major and minor collectors. Again, the goal to reduce the most injuries from crashes should lead staff to target the highest concentrations in the top 5 percent intersections. The highest concentrations should be at the identified intersections with principal arterials and then with other collectors.

TABLE 5 Fatal + Injury Type 'A' People Summary by HRRR Intersections Category (2003 - 2007)

CODE	DEFINITION OF HRRR INTERSECTION TYPES	# OF INTERSECTIONS	TOTAL NUMBER OF FAT + INJ 'A' PEOPLE IN FIVE YEARS	AVERAGE DENSITY OF FAT + INJ 'A' PEOPLE (INT/YEAR)
41	RURAL MAJOR COLLECTOR + RURAL INTERSTATE	61	134	0.44
42	RURAL MAJOR COLLECTOR + RURAL OTHER PRINCIPLE ARTERIAL	259	1,219	0.94*
43	RURAL MAJOR COLLECTOR + RURAL MINOR ARTERIAL	518	1,649	0.64*
44	RURAL MAJOR COLLECTOR + RURAL MAJOR COLLECTOR	347	936	0.54*
45	RURAL MAJOR COLLECTOR + RURAL MINOR COLLECTOR	154	361	0.47*
46	RURAL MAJOR COLLECTOR + RURAL LOCAL	1,457	2,455	0.34
51	RURAL MINOR COLLECTOR + RURAL INTERSTATE	1	2	0.40
52	RURAL MINOR COLLECTOR + RURAL OTHER PRINCIPLE ARTERIAL	34	141	0.83*
53	RURAL MINOR COLLECTOR + RURAL MINOR ARTERIAL	73	202	0.55*
55	RURAL MINOR COLLECTOR + RURAL MINOR COLLECTOR	14	20	0.29
56	RURAL MINOR COLLECTOR + RURAL LOCAL	200	307	0.31
61	RURAL LOCAL + RURAL INTERSTATE	9	15	0.33
62	RURAL LOCAL + RURAL OTHER PRINCIPLE ARTERIAL	581	1,564	0.54*
63	RURAL LOCAL + RURAL MINOR ARTERIAL	804	1,561	0.39
66	RURAL LOCAL + RURAL LOCAL	644	955	0.30
TOTAL		**5,156**	**11,521**	**0.45**

* Above the statewide average (= 0.45)

Table 6 Fatal + Injury Type 'A' People Summary by VDOT District (2003 - 2007)

DISTRICT	# OF INTERSECTIONS	DISTRIBUTION OF INTERSECTIONS (%)	TOTAL NUMBER OF FAT + INJ 'A' PEOPLE IN FIVE YEARS	AVERAGE DENSITY OF FAT + INJ 'A' PEOPLE (INT/YEAR)
1 BRISTOL	634	12.3	1,230	0.39
2 SALEM	829	16.1	1,751	0.42
3 LYNCHBURG	605	11.7	1,301	0.43
4 RICHMOND	604	11.7	1,316	0.44
5 HAMPTON ROADS	490	9.5	1,215	0.50*
6 FREDERICKSBURG	605	11.7	1,443	0.48*
7 CULPEPER	562	10.9	1,392	0.50*
8 STAUNTON	688	13.3	1,550	0.45*
A NORTHERN VIRGINIA	139	2.7	323	0.46*
TOTAL	**5,156**	**100.0**	**11,521**	**0.45**

* Above the statewide average (= 0.45)

III HRRR Project Development

Conducting and documenting a Roadway Safety Assessment is essentially the process followed by applicants to develop and submit annual HRRR applications for safety improvements. Applications shall follow the requirements and guidelines for the Highway Safety Improvement Program (HSIP). HSIP applications are approved based on the benefit to cost ratio of the proposed countermeasure(s) and the number of severe crashes targeted for reductions.

In VDOT's Six-Year Plan, district (parent) projects were generated with the proportional FHWA funding which is provided each year. Presently, there is about $8 million allocated to the nine district projects. These parent projects are actually Program Items that will not be open to charges. Child HRRR projects at specified locations will be developed and linked to these parent projects. For example, the Richmond District may choose to use their allocations in their parent VDOT Project Code 86684 to improve the SR 7200711 or the intersection of US58 and SR 780 in Mecklenburg County near South Hill. The proposed and approved improvement project would be in a separate child Project set-up, funded out of and linked back to Project 86684. Projects with environmental and right-of-way impacts should be avoided as they will require federal process that will take additional resources and time.

With the crash and proposed countermeasure information compiled for the RSA, submitting the HSIP application information should be straight forward and quick. Applications should be submitted for each intersection and for each segment based improvement. The applications do not need to address all the proposed improvements from the RSA. The process for HSIP staff to approve the development of a location specific project using the proactive funding is as follows:

1. Submit RSA report memo and HSIP application Benefit/Cost spreadsheets with project schedule information to HSIProgram@VirginiaDOT.org
2. HSIP staff review will approve, suggest revisions or deny proposed safety improvement scope and funding allocation within two weeks
3. The regional traffic engineer who proposed the project and the VDOT district PE will be notified that a new project will be developed
4. HSIP staff will forward District PE staff information needed to assign a project manager, generate new (child) project in Six-Year Plan Project Pool, and submit form(s) to Programming division to transfer funds from the parent project
5. VDOT District PE requests Programming Division for TIP/STIP action, preferably an adjustment not an amendment depending on the impacts, and then authorization for each phase of the project.
6. Programming Division will notify HSIP staff, District PE contacts when federal authorization and state authorization has occurred and the project is open to charges.
7. HSIP staff will notify regional traffic engineers when notice to proceed has been given.