SHIFT Safety Performance Functions and Adjustment Factors

William Staats, MSCE
Research Engineer

Reg Souleyrette, PE, PhD
Program Manager

Eric Green, PE, PhD
Program Manager

and

Riana Tanzen
Research Assistant

Kentucky Transportation Center
College of Engineering
University of Kentucky
Lexington, Kentucky

In Cooperation With
Kentucky Transportation Cabinet
Commonwealth of Kentucky
10/11/18*

**Intersections added to document 3/14/19*

SPFs and Adjustment Factors

Table of Contents

Overall Summary

Roadway Type	Base Conditions
Rural 2 Lane	**Lane Width = 9 ft** **Shoulder Width = 3 ft** **Horizontal Curve = Class A** **Grade = Class A**
Non Rural 2 Lane	**---**
Rural Multilane (Divided)	**Shoulder Width = 10 ft**
Rural Multilane (Undivided)	**Lane Width = 12 ft**
Urban Multilane (Divided)	**Median Width over 20**
Urban Multilane (Undivided)	**Lane Width = 12 ft**
Rural Interstate and Parkways	**---**
Urban Interstate and Parkways	**---**

1. Rural Two-Lane SPF and Adjustment Factors

- **Base Conditions**

Lane Width	9 ft
Shoulder Width	3 ft
Horizontal Curve	Class A
Grade	Class A
Median	No
Intersection	No

$$SPF = L * e^{-4.492} * AADT^{0.844}$$

Theta = 1.532

- **Adjustment Factors**

➢ Lane width AF (Modified from HSM)

Lane Width (ft)	AADT <400	AADT 400-2000	AADT>2000
9 or less (base)	1	1	1
10	0.97	1.02+.000175*(AADT-400)/ 1.05+.000281*(AADT-400) Or 0.622776+(1302.8/(AADT+3336.65))	0.87
11	0.96	1.01+.000025*(AADT-400)/ 1.05+.000281*(AADT-400) Or 0.088968+(3261.86/(AADT+3336.65))	0.7
12 or more	0.95	1/(1.05+.000281*(AADT-400)) Or 3558.72/(AADT+3336.65)	0.67

➢ Shoulder Width AF (http://www.cmfclearinghouse.org/study_detail.cfm?stid=338)

➢

Shoulder Width	AF	Crash Severity
0	1.145	All
1	1.12	All
2	1.03	All
3	1	All
4	0.975	All
5	0.945	All
6	0.93	All
7	0.905	All
8	0.875	All

➢ Horizontal Curvature AF (http://www.cmfclearinghouse.org/study_detail.cfm?stid=481)

$$CMF = 196.4 * R^{-0.65}$$

➢ Grade AF (HSM)

Grade	AF
0-3%	1
3-6%	1.1
>6%	1.16

➢ Median Installation AF (http://www.cmfclearinghouse.org/detail.cfm?facid=24)

0.88

2. Urban Two-Lane SPF and Adjustment Factors

- **Base Conditions**
-

Intersection	No

$$SPF = L * e^{-3.65} * AADT^{0.78}$$

Theta = 1.126

3. Rural Multilane (Divided) SPF and Adjustment Factors

- **Base Conditions**

Length	Greater than 0.1
Shoulder width	10
Intersection	No

$$SPF = L * e^{-5.337} * AADT^{0.768}$$

Theta = 1.951

- Adjustment Factors

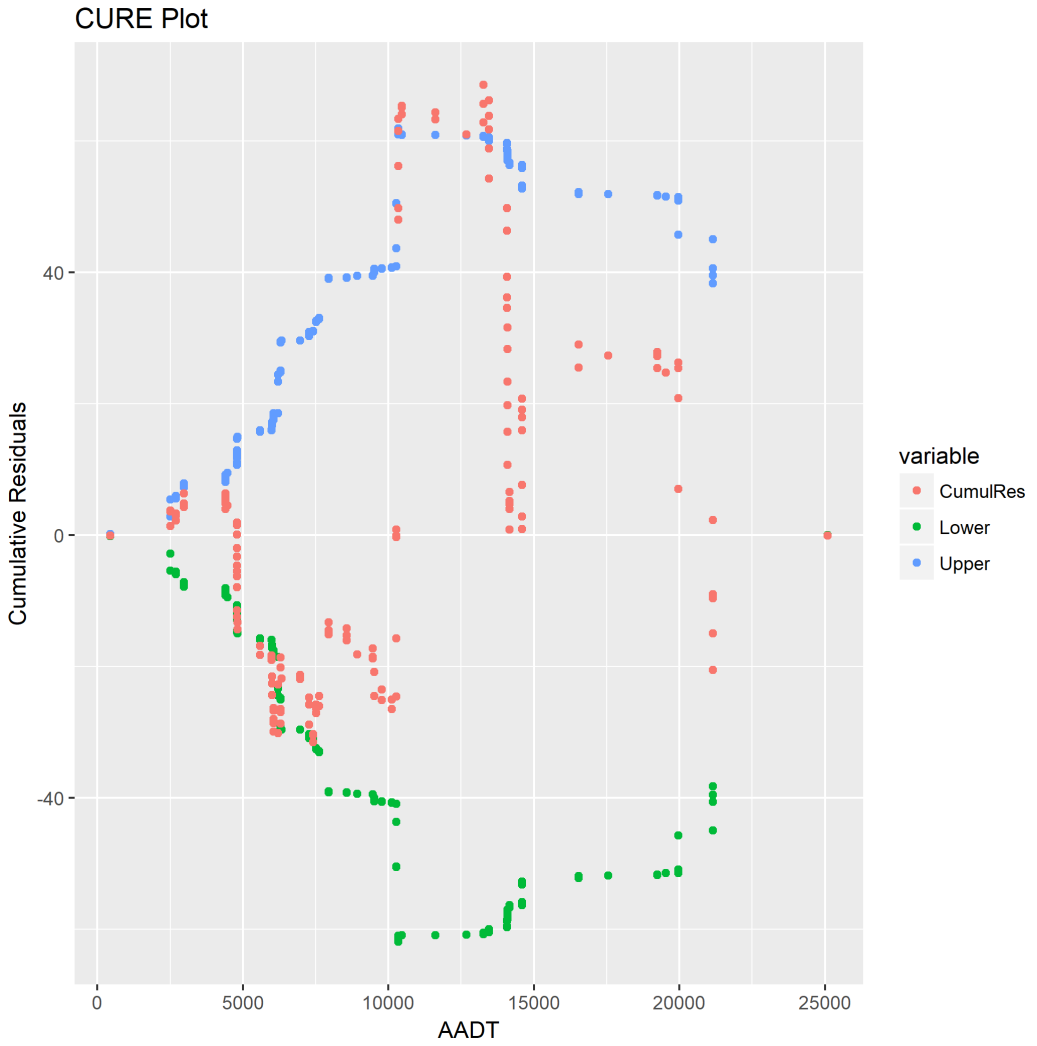
  - **Shoulder Width (Right Shoulder) AF (HSM)**

Avg. Shoulder Width	AF
0	1.18
2	1.13
4	1.09
6	1.04
8 or more	1.00

4. Rural Multilane (Undivided) SPF and Adjustment Factors

Base Conditions

Length	Above 0.1
Lane Width	12
Intersection	No



$$SPF = L * e^{-6.962} * AADT^{1.045}$$

Theta = 0.649

- Adjustment Factors

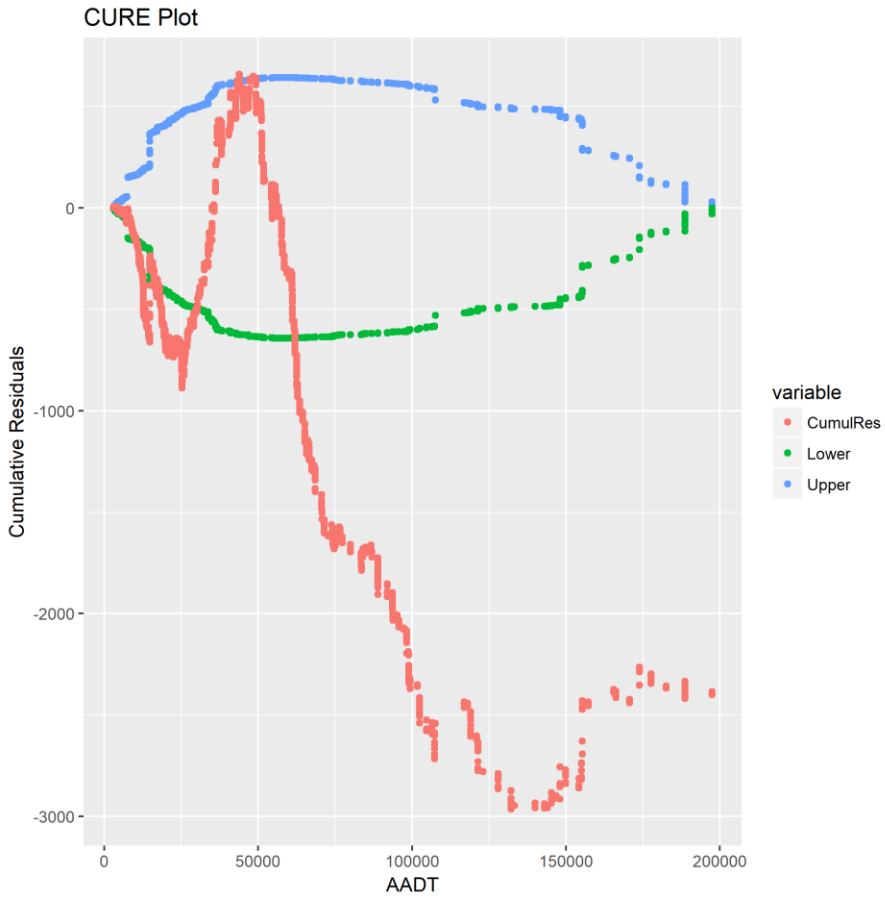
  - **Lane width AF (HSM)**

Lane Width (ft)	AADT <400	AADT 400-2000	AADT>2000
9 or less (base)	1.04	$1.04 + 2.13*10^{-4}$ (AADT-400)	1.38
10	1.02	$1.02+1.31*10^{-4}$ (AADT-400)	1.23
11	1.01	$1.01+1.88*10^{-5}$ (AADT-400)	1.04
12 or more	1.00	1.00	1.00

5. Urban Multilane (Divided) SPF and Adjustment Factors

- **Base Conditions**

Length	Above 0.1
Median Width	Over 20
Intersection	No



$$SPF = L * e^{-4.171} * AADT^{0.761}$$

Theta = 0.814

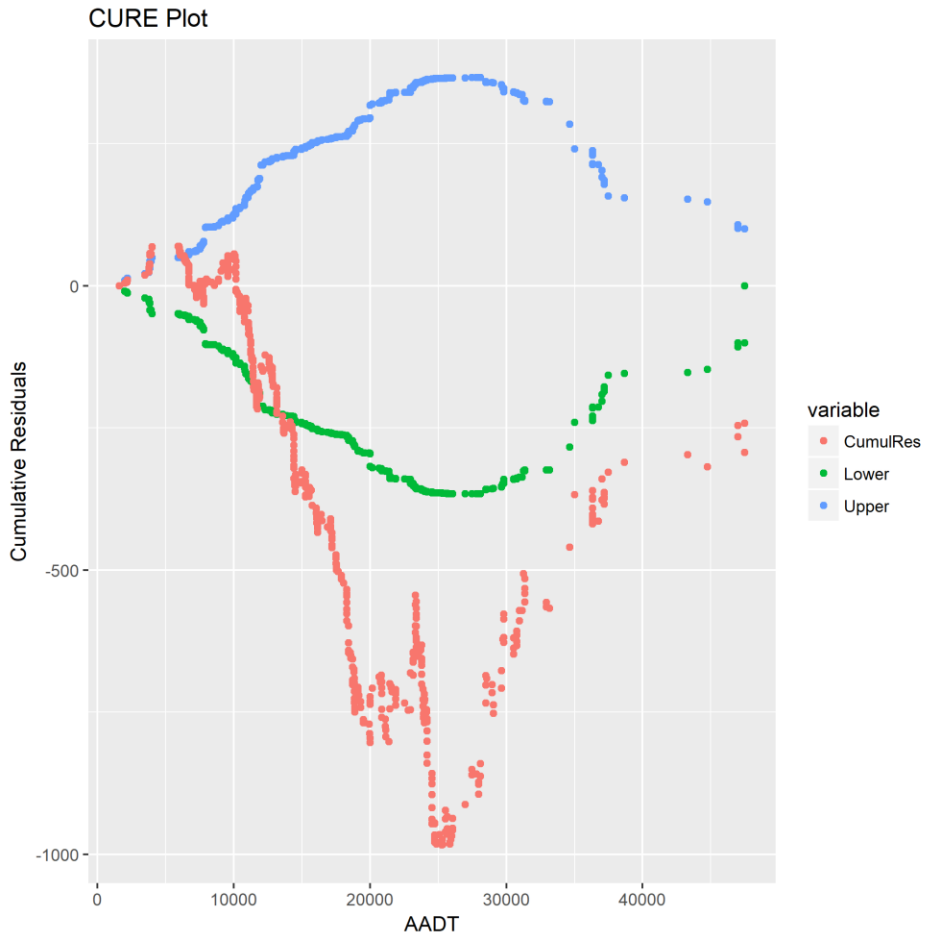
- Adjustment Factors

Median Width	AF
>=20 ft.	1
<20 ft.	1.026

6. Urban Multilane (Undivided) SPF and Adjustment Factors

- Base Conditions

Lane width	12
Intersection	No



$$SPF = L * e^{-6.894} * AADT^{1.15}$$

Theta = 0.882

- Adjustment Factors

Lane Width	9 or less	10	11	12+
AF	1.12	1.07	1.01	1

7. Rural Interstate and Parkway SPF and Adjustment Factors

- Base Conditions

Length	Above 0.1
Intersection	No

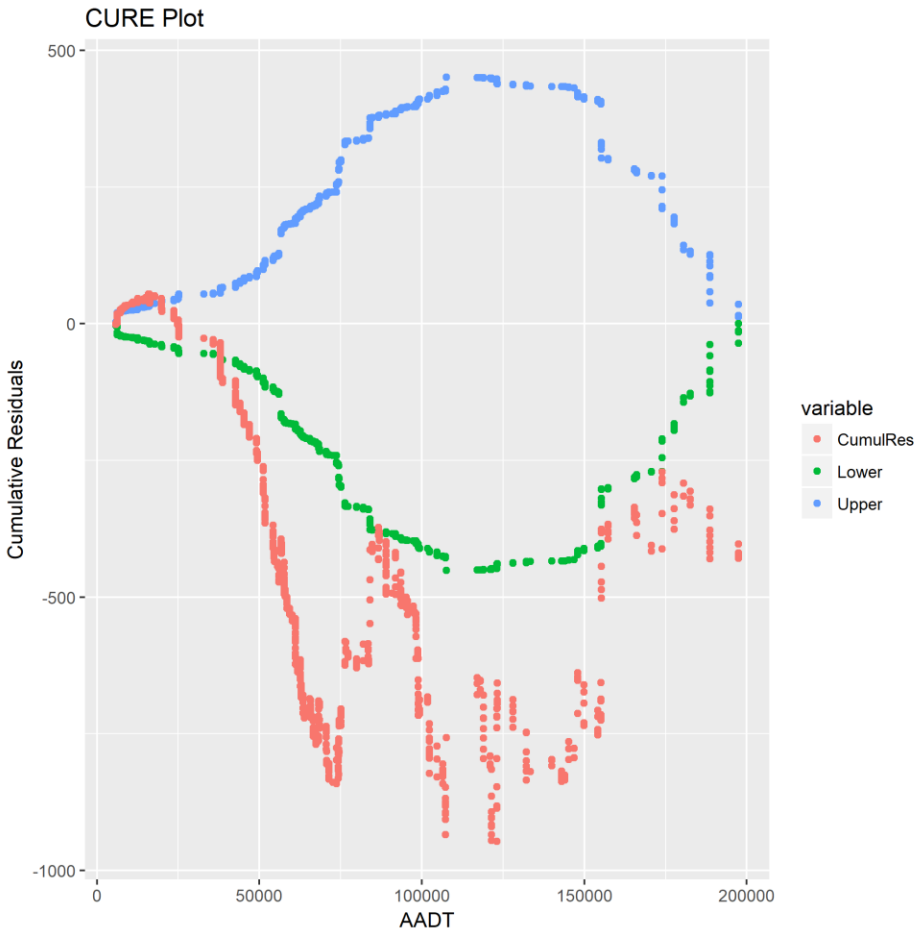
$$SPF = L * e^{-6.358} * AADT^{0.869}$$

Theta = 2.448

8. Urban Interstate and Parkway SPF and Adjustment Factors

- **Base Conditions**

Length	Above 0.1
Intersection	No



$$SPF = L * e^{-10.595} * AADT^{1.305}$$

Theta = 1.642

9. Intersections

	D3rN	D3rP	D3rS	D3rx	D3uN	D3uP	D3uS	D3ux	D4rN	D4rP	D4rS	D4rx
Theta	0.890	0.916	1.437	0.911	0.779	0.805	2.012	0.456	46014.510	1.004	5.458	0.658
Intercept	-2.602	-4.771	-0.319	-3.373	-0.528	-2.513	-3.128	-0.916	-12.647	-8.429	-1.578	-4.063
Alpha1	0.262	0.283	0.093	0.220	0.174	0.464	0.562	0.265	1.074	0.722	0.329	0.321
Alpha2	0.012	0.473	0.294	0.136	0.050	-0.056	0.102	-0.021	0.485	0.429	0.166	0.308

	D4uN	D4uP	D4uS	D4ux	U3rF	U3rN	U3rP	U3rS	U3rx	U3uF	U3uN	U3uP
Theta	1.103	0.940	2.946	0.465	0.485	0.725	0.956	1.900	0.195	1.624	0.808	1.019
Intercept	-1.686	-3.845	-2.976	-3.807	-5.952	-7.802	-9.035	-1.996	-8.785	-2.213	-1.928	-6.768
Alpha1	0.210	0.525	0.583	0.681	0.368	0.661	0.841	0.439	0.664	0.324	0.330	0.886
Alpha2	0.204	0.113	0.090	-0.038	0.478	0.380	0.387	0.012	0.556	0.098	-0.016	-0.007

	U3uS	U3ux	U4rF	U4rN	U4rP	U4rS	U4rx	U4uF	U4uN	U4uP	U4uS	U4ux
Theta	2.409	0.293	2.005	1.461	1.163	2.325	0.429	1.626	1.038	1.139	2.327	0.351
Intercept	-3.041	-2.631	-10.834	-7.539	-8.166	-2.582	-6.684	-1.065	-0.690	-3.562	-2.142	-0.813
Alpha1	0.574	0.230	0.875	0.580	0.729	0.380	0.541	0.271	0.343	0.573	0.497	0.196
Alpha2	0.066	0.127	0.583	0.466	0.465	0.196	0.429	0.105	-0.114	0.034	0.102	-0.011

D, U	divided, undivided
3, 4	3-legs, 4 or more legs
r, u	rural, urban
N, P, F, S	no control, partial stop (at least), full stop, signal
x	no data

$$Crashes = Intercept * AADT_{Major}^{Alpha1} * AADT_{Minor}^{Alpha2}$$