City of Phoenix

Street Transportation Department

May 9, 2019

Ms. Mona Aglan-Swick, P.E.
Transportation Systems Management & Operations, Traffic Safety
Arizona Department of Transportation
1615 W. Jackson ST., MD 065R
Phoenix, AZ 85007-3217

RE: Highway Safety Improvement Program (HSIP) Project Determination and Application
Agency: City of Phoenix
Project Name: Improve Roadway Geometry and Add a Flashing Left-Turn Arrow
Project Location: 1. 19th Av and Bell Rd
2. 51st Av and Union Hills Dr
3. Bell Rd & Cave Creek Rd
4. 51st Av & Broadway Rd
5. 67th Av & Thomas Rd
6. 43rd Av & Grand Av
7. 64th St & McDowell Rd
8. 19th Av & Baseline Rd
9. 32nd St & Greenway Rd
10. 48th St & Baseline
11. 75th Av & Virginia Av
12. 31st Av & Indian School Rd
13. 29th Av & Bell Rd
14. Cave Creek Rd & Rose Garden Ln

Dear Ms. Aglan-Swick:

The city of Phoenix is submitting herewith a project application for Highway Safety Improvement Program (HSIP) funding. This road safety improvement project was identified through the local network crash data screening process and meets all requirements of Title 23. The proposed request is for the modification of left-turn geometry at intersections to correct negative offsets and the installation of flashing left-turn arrows as a spot-improvement project and does not include any non-infrastructure funding request.

Correcting negative left-turn offsets and installing a flashing yellow left-turn arrow will improve drivers' ability to see upcoming traffic when making a left turn. In addition, the yellow flashing arrow signals to drivers that they need to yield before making a left turn. City staff will hire a consultant to complete the design portion of the project. After the design phase, city staff will procure bids for a contractor to build the project. There will be ground disturbing activates to remove the median. It is anticipated that some minor utility relocations will need to happen.

During the most recent five year period ending December 2017, the city of Phoenix experienced 52 total left turn related crashes including 5 fatal and 47 incapacitating/serious

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crashes. With a Crash Reduction Factor (CRF) of 52% obtained from the ADOT 4/5 Star list for all pedestrian crashes, the city of Phoenix could see a 5-year reduction of 5.41 crashes including 0.52 fatal and 4.89 serious injury crashes.

The city of Phoenix has determined that, in accordance with 23 USC 148(a)(4))(A), this project is consistent with the Maricopa Association of Governments' (MAG) and the State's 2014 State Highway Safety Plan (SHSP). It supports MAG's Strategic Traffic Safety Plan (STSP) Goal to Eliminate Death and Severe Injury Related to Intersections. Additionally, the project supports the State's goal to reduce fatalities and the occurrence and severity of serious injuries on all public roadways in Arizona through enhanced roadway infrastructure and operations.
B/C Ratio = 7.2

The city of Phoenix has estimated the total project cost of this project to be $7,040,548. Of that amount request, ADOT determined that $ 5,195,436 is HSIP eligible, with $1,845,111 being Other funds (if appropriate). In accordance with Title 23, the Federal share for safety improvement items is eligible to be funded at 100% Federal share per 23 U.S.C. 120(c) as described in Code of Federal Register 23 CFR Part 924. Therefore, the city of Phoenix does not propose to contribute any match for the above-mentioned project. Furthermore, the city of Phoenix is not requesting reimbursement for staff time for installation. Table 5 summarizes the anticipated cost estimate projected for this project.

The city of Phoenix is aware that, if funded, additional HSIP funds above the attached estimated cost are not available to pay for excess costs and that other funds whether STP, local or other will have to provided or secured by the city of Phoenix to cover the additional costs or the project will have to be withdrawn and resubmitted in the next call-for-projects.

The city of Phoenix agrees to conduct and provide to ADOT TSS on a yearly basis a written before-and-after study utilizing the same crash data included in the countermeasure influence area to determine the effectiveness of the countermeasure on fatal and serious crashes.

The city of Phoenix further understands that Federal funds can only be used once to install or upgrade either a spot or systemic countermeasure and that once installed, the city of Phoenix will maintain the countermeasure at or above the standard to which it was installed.

If you have any questions, please contact Carl Langford at 602-262-4613 or email carl.langford@phoenix.gov.

Respectfully,

Kini L.E. Knudson
Director

Attachments: Application
Vicinity Map
B/C Ratio
Crash Data
List of Locations

Agency:	City of Phoenix	**Title of Project:**	Improve Roadway Geometry and Add a Flahsing Left-Turn Arrow
County:	Maricopa	**COG/MPO:**	MAG
District:	Central	**Date:**	3/29/2019
Contact:		**Phone:**	**E-Mail:**
Carl Langford		602-262-4613	carl.langford@phoenix.gov
Type of Safety Improvement:		**Spot:** ☐ YES ☑ NO	**Systemic:** ☑ YES ☐ NO
Mark all that apply to your project:	☑ Design ☑ Construction ☑ Procurement ☑ Non-Infrastructure		
Anticipated Total Cost Estimate:		**$ 7,040,547.87**	
Anticipated dollar amount of HSIP Funding:		**$5,195,436.33**	
Anticipated Dollar amount of Local Match (5.7%) (5.66%):		**$0.00**	
Anticipated Dollar amount of Other:		**$1,845,111.54**	
Funding Source: ☑ 100% HSIP ☐ 94.3% ☐ 94.34% HSIP		**Cost Estimate Tab:**	5. 100% Contract Install
Administration of Project:	**Agency:** ☑ YES ☐ NO	**ADOT:** ☐ YES ☑ NO	
Name and Title of COG/MPO Representative:		Margaret Herrera	

Basic Project Information

Anticipated Design Year (Construction year cannot be the same):	☑ FY23	
If additional ROW is needed, what FY is purchase anticipated?:	☐ FY23 ☐ FY24	
Anticipated Construction Year:	☑ FY24	
1.	**Have lower cost countermeasures been considered or implemented?** ☐ YES ☑ NO	
1a.	**If "Yes", describe:** **If "No", explain why not:**	A lower cost countermeasure would not sufficiently address the root of the problem.
2.	**Which 23 USC 148 highway safety improvement project category does this project come under?**	
2a.	20. Geometric improvements to a road for safety pruposes that improve safety	
3.	**Describe your safety improvement project in detail: (50 words or less)**	
3a.	The project will rrect nagative offsets and install flashing left-turn arrows. This is Phase 1 of a citywide systemic project. The first countermeasure that will be applied is CMF 6096 - Improve left-turn lane to create a positive offset. The second countermeasure that will be applied is CMF 7595 - Change from 5-section "doghouse" protected/permissive left turn to flashing yellow arrow protected/permissive left turn	
4.	**Describe the location of this safety project:**	

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4a.	1. 19th Av and Bell Rd 2. 51st Av and Union Hills Dr 3. Bell Rd & Cave Creek Rd 4. 51st Av & Broadway Rd 5. 67th Av & Thomas Rd 6. 43rd Av & Grand Av 7. 64th St & McDowell Rd 8. 19th Av & Baseline Rd 9. 32nd St & Greenway Rd 10. 48th St & Baseline 11. 75th Av & Virginia Av 12. 31st Av & Indian School Rd 13. 29th Av & Bell Rd 14. Cave Creek Rd & Rose Garden Ln .
5.	**What crash data screening method was used to identify this project?**
5a.	The city of Phoenix identified all of the intersections in Phoenix that have a left turn lane with a negative offset. Staff divided up the intersections into four phases. Phase 1 was prioritized because the intersections in the north area of the city have had the more fatlities in the most recent crash data.
6.	**What is the safety justification for the proposed project?**
6a.	The intent of this project is to correct negative offsets at intersections to reduce left-turn crashes.By correcting negative offsets and adding a left-turn flashing yellow arrow, the city of Phoenix intends to improve improve visibility for cars making left-turns to prevent future accidents.
7.	**Will there be ground disturbing activities?** ☑ YES ☐ NO
8.	**Is project within applicants permanent ROW?** ☑ YES ☐ NO

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8a.	**If NO please explain:**	
9.	**Will any temporaty right-of-way acquisitions be required?** ☐ YES ☒ NO	
10.	**Will there be any utility relocation needed?** ☐ YES ☑ NO	
10a.	**If YES please explain:**	
11.	**Does Section 4(f) apply to any portion of this project?** ☐ YES ☒ NO	
11a.	**If YES please explain:**	
12.	**Are there any other issues that may impact or delay development or construction of this project?** ☐ YES ☑ NO	
12a.	**If YES please explain:**	
13.	**Is this project in compliance with revised ADA Standards?** ☑ YES ☐ NO	
13a.	**If NO please explain:**	
14.	**Does the project support Arizona's Strategic Highway Safety Plan?** ☑ YES ☐ NO	
15.	**Are there any Studies, RSA's or Other evaluations that support this project?** ☐ YES ☑ NO	
16.	**If the project is a traffic control device requiring a warrant, is a copy attached?** ☐ YES ☐ NO	
17.	**HSIP Roadway Functional Classification:**	Urban Principal Arterial - Other
18.	**For projects on State System:** **BMP:**	**EMP:**
19.	**Average Daily Traffic Volume and Year Collected:**	ADT: 10,000-56,000 Year: 2016
20.	**What is the source of ADT?:**	City of Phoenix Volume map
21.	**What is the posted speed limit?**	45 mph
22.	**Detailed engineer's cost estimate attached:** ☑ YES ☐ NO	

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"Systemic" Safety Project

23.	**Completed B/C Ratio Tabulation Sheet Attached (Required):**	☐ YES ☐ NO
24.	**Most current 5 Years Crash Data from ADOT ALISS database sorted by year & severity (required):**	
25.	**What are the inclusive dates of the crash data?**	
26.	**Have all crashes that will not be influenced by this countermeasure been deleted from the crash list? (pedestrian, pedalcycle, etc. as applicable)**	
27.	**If purchasing equipment or materials, who will install?**	☐ Town/City ☐ County ☐ Tribe ☐ Contractor
28.	**Does the project require proprietary Items (23CFR 635.411)?:**	☐ Yes ☐ No
29.	**Is a list of locations for systemic projects provided on the attached form?**	☐ Yes ☐ No
30.	**How are (will) the proposed locations be prioritized for replacement? (explain below)**	
30a.		
31.	**Are the supporting structures in good condition, meet local standards and have an anticipated service life longer than the countermeasure being installed?**	☐ Yes ☐ No

"Spot" Improvement Projects Only

32.	**Completed B/C Ratio Tabulation Sheet Attached (required):**	☑ YES ☐ NO
33.	**Is the most current 5 Years Crash Data from ADOT ALISS database sorted by year & severity attached and in correct format? (required):**	☑ YES ☐ NO
34.	**What are the inclusive dates of the crash data?**	2013-2017
35.	**Have all crashes that will not be influenced by this countermeasure been deleted from the crash list? (pedestrian, pedalcycle etc. as applicable)**	
36.	**Have any infrastructure changes occurred within the work limits of this project during the years the crash data covers?**	☐ YES ☐ NO
37.	**If YES please explain:**	

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38.	**Project vicinity map is provided:**	☐ YES ☐ NO
39.	**Project work limits map is provided:**	☐ YES ☐ NO

SHSP - All Projects

40.	**Which SHSP Emphasis Area (EA) does this project support?:**	Roadway_Infrastructure_and_Operations	
40a.	**Which EA Strategy does it support?:**	(Intersections) Reduce frequency and severity of intersection crashes through geometric improvements.	
40b.	**Does this project support a second SHSP EA? If so, which EA.:**	Roadway_Infrastructure_and_Operations	
40c.	**Which EA Strategy supports the second EA?**	(Intersections) Reduce frequency and severity of intersection crashes through traffic-control and operational improvements.	
40d.	**Does this project support a third SHSP EA? If so, which EA.:**		
40e.	**Which EA Strategy supports the third EA?**		

41.	**Does this project support one of the nine FHWA proven countermeasures?:**	☐ YES ☑ NO	
41a.	**If so, which countermeasure?:**		
42.	**Does this project support one of the three Arizona Focus Areas?:**	☑ YES ☐ NO	
42a.	**If so, which focus area?:**	**Intersection**	
43.	**Which HSIP Improvement Category does this project support?:**	**Intersection_Geometry**	
43a.	**Which HSIP Improvement Sub-Category does this project support?:**	Auxiliary lanes – modify right-turn lane offset	
44.	**Does your COG/MPO have a Strategic Transportation Safety Plan (STSP)?:**	☑ YES ☐ NO	
44a.	**If "YES", does this project support an Emphasis Area in the COG/MPO STSP?:**	Yes	
44b.	**List the EA:**	Eliminate Death and Severe Injury Related to Intersections	

HIGHWAY SAFETY IMPROVEMENT PROGRAM
APPLICATION - COST ESTIMATE

Agency:	City of Phoenix	Name of Project:		Improve Roadway Geometry and Add a		Non-State Agency Cost Estimate - Countermeasure 100% HSIP Eligible				

HSIP Project Cost Estimate Worksheet

Project Cost Estimate:	Description:	Quantity:	Unit	Unit Cost:	Total Cost	HSIP Eligible:	HSIP: 100.00%	State Match: 0.00%	Other Amt: 0.00%	TOTAL COST
Design (consultant contract)					$ 620,000.00				$ 620,000.00	$ 620,000.00
Procurement (Design)					$ 4,669.00				$ 4,669.00	$ 4,669.00
DCM Design Administration Fee					$ 453,797.22				$ 453,797.22	$ 453,797.22
APS/SRP Deisn Fee					$ 140,000.00				$ 140,000.00	$ 140,000.00
Project Handoff Administration					$ 6,088.38				$ 6,088.38	$ 6,088.38
Environmental:					$ 93,380.00		$ -	$ -	$ 93,380.00	$ 93,380.00
ADOT Admin Costs:					$ 9,338.00			$ -	$ 9,338.00	$ 9,338.00
Design Total					**$ 1,327,272.60**	**$ -**	**$ -**	**$ -**	**$ 1,327,272.60**	**$ 1,327,272.60**
Dual ADA Ramp		56	EA	$ 2,500.00	$ 140,000.00		$ -		$ 140,000.00	$ 140,000.00
Truncated Domes		600	SF	$ 35.00	$ 19,600.00		$ -	$ -	$ 19,600.00	$ 19,600.00
Remove Concrete D/W, S/W, VG, SLAB, ETC.		102,843	SF	$ 2.00	$ 205,685.64	$ 205,685.64	$ 205,685.64			$ 205,685.64
Street Light Reconfiguration		50	EA	$ 50,000.00	$ 2,500,000.00	$ 2,500,000.00	$ 2,500,000.00			$ 2,500,000.00
Construction (infrastructure) Sub-Total					**$ 2,865,285.64**	**$ 2,705,685.64**	**$ 2,705,685.64**	**$ -**	**$ 159,600.00**	**$ 2,865,285.64**
SWPP Allowance (.7%)					$ 18,987.05	$ 17,937.58	$ 17,937.58	$ -	$ 1,049.47	$ 18,987.05
Misc Removal and Other Work (2%)					$ 54,248.71	$ 51,250.22	$ 51,250.22	$ -	$ 2,998.49	$ 54,248.71
Mobilization (2% major)					$ 42,161.79	$ 39,831.38	$ 39,831.38		$ 2,330.41	$ 42,161.79
Traffic Control/Police Officer					$ 133,078.76	$ 125,723.10	$ 125,723.10	$ -	$ 7,355.67	$ 133,078.77
Allowance for extra work					$ 271,243.56	$ 256,251.11	$ 256,251.11	$ -	$ 14,992.45	$ 271,243.56
Contigency (20%)					$ 542,487.13	$ 512,502.23	$ 512,502.23	$ -	$ 29,984.90	$ 542,487.13
DCM Construction Administration Fee					$ 542,487.13	$ 512,502.23	$ 512,502.23	$ -	$ 29,984.90	$ 542,487.13
Procurement - Construction					$ 7,470.40	$ 7,057.49	$ 7,057.49	$ -	$ 412.91	$ 7,470.40
Testing & Materials (1%)					$ 37,816.44	$ 35,726.21	$ 35,726.21	$ -	$ 2,090.23	$ 37,816.44
Utilities Adjustment (5%)					$ 189,082.18	$ 178,631.03	$ 178,631.03	$ -	$ 10,451.14	$ 189,082.17
Utilities Inspection					$ 37,816.44	$ 35,726.21	$ 35,726.21	$ -	$ 2,090.23	$ 37,816.44
Construruction (other) Sub-Total					**$ 1,876,879.58**	**$ 1,773,138.78**	**$ 1,773,138.79**	**$ -**	**$ 103,740.80**	**$ 1,876,879.60**
SUB TOTAL REQUEST					**$ 6,069,437.82**	**$ 4,478,824.42**	**$ 4,478,824.42**	**$ -**	**$ 1,590,613.40**	**$ 6,069,437.82**
Inflation		**1.16**			**1.16**	**1.16**	**1.16**		**1.16**	**1.16**
					$ 7,040,547.87	**$ 5,195,436.33**	**$ 5,195,436.33**	**$ -**	**$ 1,845,111.54**	**$ 7,040,547.87**

Comments:

**Note: To factor in inflation, the total value was multiplied by 1.16. Cost Estimates are based on the city of Phoenix's infrastructure cost estimate spreadsheet.

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44c.	**If your COG/MPO has a STSP and it was Federally Funded and you answered NO in 41a, explain why this project is being submitted over a STSP identified project. (For Local Agencies Only)**	
44d.	**Rational:**	
45.	**Are any temporaty safety countermeasures needed prior to this permanent solution being installed?**	
45a.	**If yes, please explain:**	
46.	**For State Agencies, has the Regional Traffic Engineer been made aware of this potential project and does he/she concur with it?**	☐ YES ☐ NO

Stratigic Transportation Safety Plans Funds (COG/MPO)

47.	**What is the date of your last STSP or update completed?**	
48.	**How many projects that were identified In your last STSP or update were submitted for HSIP funding?**	
49.	**What was the total dollar amount of the projects in question 45?**	
50.	**How many projects that were submitted for HSIP funding were eligible and funded by ADOT?**	
51.	**What was the total dollar amount of the projects in question 47?**	

B/C Ratio

52.	**The calculated B/C Ratio is:**	**7.20**	**CMF ID Number:**	9022.00
			2nd CMF ID No.:	**433.00**
			3rd CMF ID NO.:	

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**0.80**	**52%**	0.42	$550,499	$229,008
				Total Annual Benefits	$229,008

Costs

Total Project Cost	$562,375
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$83,810
Annual Maintenance Cost	$0.00
Total Annual Costs	$83,810

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$229,008	$83,810	2.7

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Negative Offset

	Inputs												Analysis							
					Crash Statistics				Correcting Negative Offset		Install Flashing Yellow Left Turn Arrow Left Turn									
Project ID	Total Project	Project Life (years)	Annual Maintenance Cost*		Left Turn Fatal Crashes	Left Turn Incapacitating Injury Crashes	Number of Years		Fatality CRF	Injury CRF	Fatality CRF	Injury CRF	Fatal Crashes Reduced (Average Annual)	Incapacitating Crashes Reduced (Average Annual)	Annual Benefit	Capital Recovery Factor	Annual Capital Cost	Annual O&M Cost	Total Annual Cost	B/C Ratio
19th Av & Bell Rd	$496,830	10	$0		1	1	5		36%	36%	25%	25%	0.104	0.104	$ 496,830	0.1490	$ 74,042	$ -	$ 74,042	14.1
51st Av & Union Hills Dr	$562,816	10	$0		1	4	5		36%	36%	25%	25%	0.104	0.416	$ 1,218,606	0.1490	$ 83,876	$ -	$ 83,876	14.5
Bell Rd & Cave Creek Rd	$487,619	10	$0		0	4	5		36%	36%	25%	25%	0.000	0.416	$ 229,008	0.1490	$ 72,670	$ -	$ 72,670	3.1
51st Av & Broadway Rd	$457,928	10	$0		1	1	5		36%	36%	25%	25%	0.104	0.104	$ 1,046,850	0.1490	$ 68,245	$ -	$ 68,245	15.3
67th Av & Thomas Rd	$568,922	10	$0		1	5	5		36%	36%	25%	25%	0.104	0.520	$ 1,275,858	0.1490	$ 84,786	$ -	$ 84,786	15.0
43rd Av & Grand Av	$346,748	10	$0		1	1	5		36%	36%	25%	25%	0.104	0.104	$ 1,046,850	0.1490	$ 51,676	$ -	$ 51,676	20.2
64th St & McDowell Rd	$564,354	10	$0		0	5	5		36%	36%	25%	25%	0.000	0.520	$ 286,259	0.1490	$ 84,105	$ -	$ 84,105	3.4
19th Av & Baseline Rd	$575,252	10	$0		0	5	5		36%	36%	25%	25%	0.000	0.520	$ 286,259	0.1490	$ 85,730	$ -	$ 85,730	3.3
32nd St & Greenway Rd	$570,213	10	$0		0	4	5		36%	36%	25%	25%	0.000	0.416	$ 229,008	0.1490	$ 84,979	$ -	$ 84,979	2.6
48th St & Baseline	$562,375	10	$0		0	4	5		36%	36%	25%	25%	0.000	0.416	$ 229,008	0.1490	$ 83,810	$ -	$ 83,810	2.7
75th Av & Virginia Av	$323,682	10	$0		0	3	5		36%	36%	25%	25%	0.000	0.312	$ 171,756	0.1490	$ 48,238	$ -	$ 48,238	3.5
31st Av & Indian School Rd	$545,402	10	$0		0	4	5		36%	36%	25%	25%	0.000	0.416	$ 229,008	0.1490	$ 81,281	$ -	$ 81,281	2.8
29th Av & Bell Rd	$328,936	10	$0		0	3	5		36%	36%	25%	25%	0.000	0.312	$ 171,756	0.1490	$ 49,021	$ -	$ 49,021	3.5
Cave Creek & Rose Garden Lane	$322,774	10	$0		0	3	5		36%	36%	25%	25%	0.000	0.312	$ 171,756	0.1490	$ 48,103	$ -	$ 48,103	3.5

Note: Used the following combined CRF formula for the analysis: CCRF=1-(1-CRF1)*(1-CRF2)*(1-CRF3)
*Creating a positive offset and adding a yellow flashing arrow is not anticipated to add additional maintenance costs

CCRF (Negative Offset, Flashing Yellow Turn Arrow, Flashing Yellow Left Turn Arrow Left Turn) 52%

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.20**	**52%**	0.10	$9,515,371	$989,599
Incapacitating Injury	**0.20**	**52%**	0.10	$550,499	$57,252
				Total Annual Benefits	$1,046,850

Costs

Total Project Cost	$496,830
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$74,042
Annual Maintenance Cost	$0.00
Total Annual Costs	$74,042

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$1,046,850	$74,042	14.1

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.20**	**52%**	0.10	$9,515,371	$989,599
Incapacitating Injury	**0.80**	**52%**	0.42	$550,499	$229,008
				Total Annual Benefits	$1,218,606

Costs

Total Project Cost	$562,816
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$83,876
Annual Maintenance Cost	$0.00
Total Annual Costs	$83,876

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$1,218,606	$83,876	14.5

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**0.80**	**52%**	0.42	$550,499	$229,008
				Total Annual Benefits	$229,008

Costs

Total Project Cost	$487,619
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$72,670
Annual Maintenance Cost	$0.00
Total Annual Costs	$72,670

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$229,008	$72,670	3.1

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.20**	**52%**	0.10	$9,515,371	$989,599
Incapacitating Injury	**0.20**	**52%**	0.10	$550,499	$57,252
				Total Annual Benefits	$1,046,850

Costs

Total Project Cost	$457,928
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$68,245
Annual Maintenance Cost	$0.00
Total Annual Costs	$68,245

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$1,046,850	$68,245	15.3

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.20**	**52%**	0.10	$9,515,371	$989,599
Incapacitating Injury	**1.00**	**52%**	0.52	$550,499	$286,259
				Total Annual Benefits	$1,275,858

Costs

Total Project Cost	$568,922
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$84,786
Annual Maintenance Cost	$0.00
Total Annual Costs	$84,786

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$1,275,858	$84,786	15.0

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.20**	**52%**	0.10	$9,515,371	$989,599
Incapacitating Injury	**0.20**	**52%**	0.10	$550,499	$57,252
				Total Annual Benefits	$1,046,850

Costs

Total Project Cost	$346,748
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$51,676
Annual Maintenance Cost	$0.00
Total Annual Costs	$51,676

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$1,046,850	$51,676	20.2

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**1.00**	**52%**	0.52	$550,499	$286,259
				Total Annual Benefits	$286,259

Costs

Total Project Cost	$564,354
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$84,105
Annual Maintenance Cost	$0.00
Total Annual Costs	$84,105

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$286,259	$84,105	3.4

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**1.00**	**52%**	0.52	$550,499	$286,259
				Total Annual Benefits	$286,259

Costs

Total Project Cost	$575,252
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$85,730
Annual Maintenance Cost	$0.00
Total Annual Costs	$85,730

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$286,259	$85,730	3.3

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**0.80**	**52%**	0.42	$550,499	$229,008
				Total Annual Benefits	$229,008

Costs

Total Project Cost	$570,213
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$84,979
Annual Maintenance Cost	$0.00
Total Annual Costs	$84,979

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$229,008	$84,979	2.6

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**0.60**	**52%**	0.31	$550,499	$171,756
				Total Annual Benefits	$171,756

Costs

Total Project Cost	$323,682
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$48,238
Annual Maintenance Cost	$0.00
Total Annual Costs	$48,238

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$171,756	$48,238	3.5

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**0.80**	**52%**	0.42	$550,499	$229,008
				Total Annual Benefits	$229,008

Costs

Total Project Cost	$545,402
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$81,281
Annual Maintenance Cost	$0.00
Total Annual Costs	$81,281

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$229,008	$81,281	2.8

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**0.60**	**52%**	0.31	$550,499	$171,756
				Total Annual Benefits	$171,756

Costs

Total Project Cost	$328,936
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$49,021
Annual Maintenance Cost	$0.00
Total Annual Costs	$49,021

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$171,756	$49,021	3.5

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	#REF!	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated **CRF*** Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**0.00**	**52%**	0.00	$9,515,371	$0
Incapacitating Injury	**0.60**	**52%**	0.31	$550,499	$171,756
				Total Annual Benefits	$171,756

Costs

Total Project Cost	$322,774
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$48,103
Annual Maintenance Cost	$0.00
Total Annual Costs	$48,103

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$171,756	$48,103	3.5

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

Required for all HSIP Applications

Agency:	City of Phoenix	Title of Project:	

Benefit / Cost Ratio Tabulation

Annual Benefit Tabulation

Severity	Annual Average	Estimated CRF* Reduction	Total Reduction	Unit Cost	Annual Benefit
Fatal	**1.00**	**52%**	0.52	$9,515,371	$4,947,993
Incapacitating Injury	**9.40**	**52%**	4.89	$550,499	$2,690,839
				Total Annual Benefits	$7,638,832

Costs

Total Project Cost	$ 7,040,547.87
Project Life (years)	10
Interest Rate (%)	8%
Capital Recovery Factor	0.1490
Annual Construction Cost	$1,049,249
Annual Maintenance Cost	$0.00
Total Annual Costs	$1,049,249

Benefit / Cost

Annual Benefit	Annual cost	Benefit / Cost Ratio
$7,638,832	$1,049,249	7.2

***REQUIRED: Use 4 and 5 star CMFs from ADOT Lists Only at Tabs 11 - 12 preferred. The CMF's CRF is used in the above calculation**

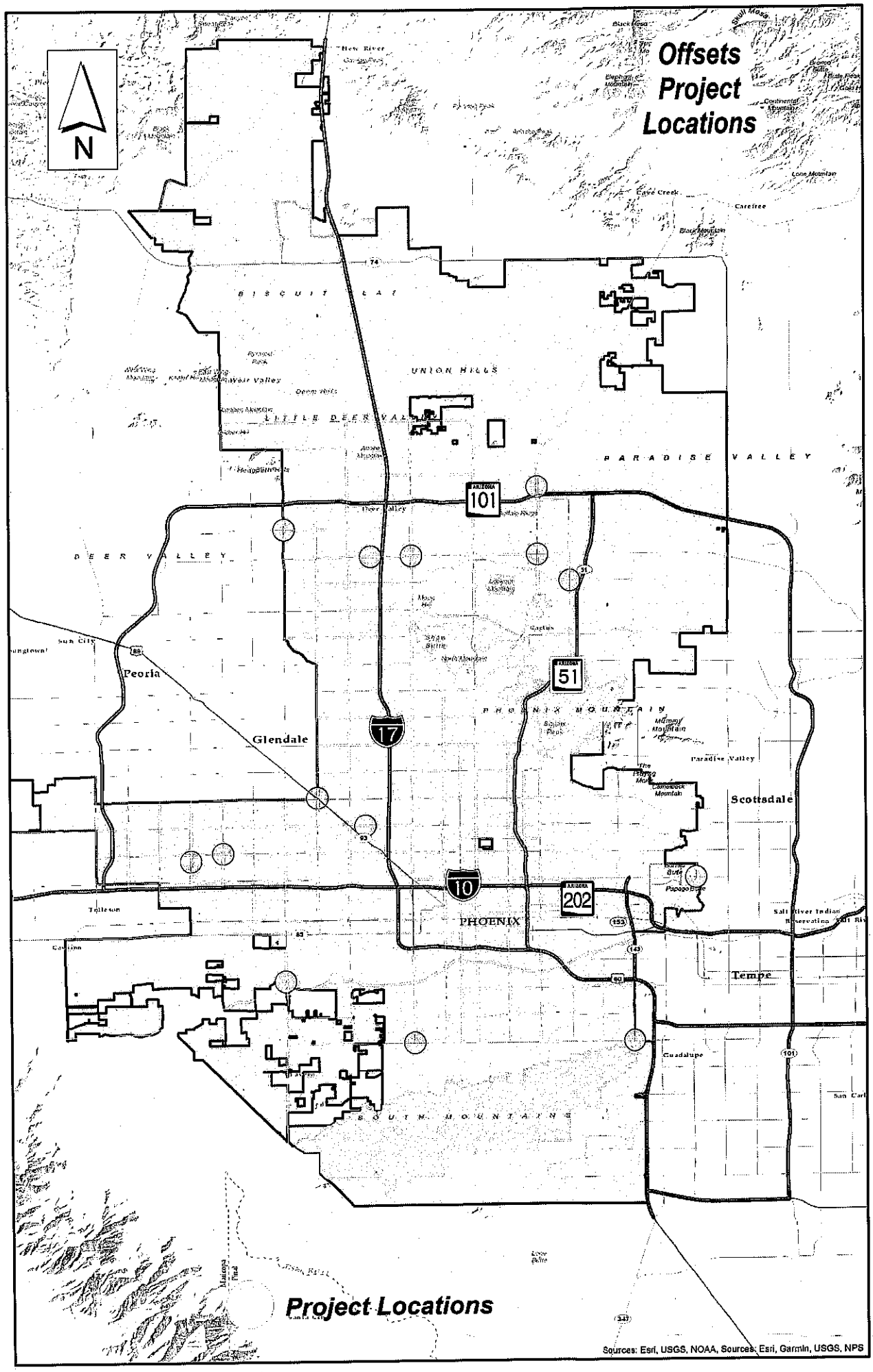
Negative Offset

	Inputs:											Analysis:							
					Crash Statistics			Correcting Negative Offset		Install Flashing Yellow Left Turn Arrow Left Turn									
Project ID	Total Project	Project Life (years)	Annual Maintenance Cost*		Left Turn Fatal Crashes	Left Turn Incapacitating Injury Crashes	Number of Years	Fatality CRF	Injury CRF	Fatality CRF	Injury CRF	Fatal Crashes Reduced (Average Annual)	Incapacitating Crashes Reduced (Average Annual)	Annual Benefit	Capital Recovery Factor	Annual Capital Cost	Annual O&M Cost	Total Annual Cost	B/C Ratio
19th Av & Bell Rd	$496,830	10	$0		1	1	5	36%	36%	25%	25%	0.104	0.104	$ 496,830	0.1490	$ 74,042	$ -	$ 74,042	[redacted]
51st Av & Union Hills Dr	$562,816	10	$0		1	4	5	36%	36%	25%	25%	0.104	0.416	$ 1,218,606	0.1490	$ 83,876	$ -	$ 83,876	[redacted]
Bell Rd & Cave Creek Rd	$487,619	10	$0		0	4	5	36%	36%	25%	25%	0.000	0.416	$ 229,008	0.1490	$ 72,670	$ -	$ 72,670	[redacted]
51st Av & Broadway Rd	$457,928	10	$0		1	1	5	36%	36%	25%	25%	0.104	0.104	$ 1,046,850	0.1490	$ 68,245	$ -	$ 68,245	[redacted]
67th Av & Thomas Rd	$568,922	10	$0		1	5	5	36%	36%	25%	25%	0.104	0.520	$ 1,275,858	0.1490	$ 84,786	$ -	$ 84,786	[redacted]
43rd Av & Grand Av	$346,748	10	$0		1	1	5	36%	36%	25%	25%	0.104	0.104	$ 1,046,850	0.1490	$ 51,676	$ -	$ 51,676	[redacted]
64th St & McDowell Rd	$564,354	10	$0		0	5	5	36%	36%	25%	25%	0.000	0.520	$ 286,259	0.1490	$ 84,105	$ -	$ 84,105	[redacted]
19th Av & Baseline Rd	$575,252	10	$0		0	5	5	36%	36%	25%	25%	0.000	0.520	$ 286,259	0.1490	$ 85,730	$ -	$ 85,730	[redacted]
32nd St & Greenway Rd	$570,213	10	$0		0	4	5	36%	36%	25%	25%	0.000	0.416	$ 229,008	0.1490	$ 84,979	$ -	$ 84,979	[redacted]
48th St & Baseline	$562,375	10	$0		0	4	5	36%	36%	25%	25%	0.000	0.416	$ 229,008	0.1490	$ 83,810	$ -	$ 83,810	[redacted]
75th Av & Virginia Av	$323,682	10	$0		0	3	5	36%	36%	25%	25%	0.000	0.312	$ 171,756	0.1490	$ 48,238	$ -	$ 48,238	[redacted]
31st Av & Indian School Rd	$545,402	10	$0		0	4	5	36%	36%	25%	25%	0.000	0.416	$ 229,008	0.1490	$ 81,281	$ -	$ 81,281	[redacted]
29th Av & Bell Rd	$328,936	10	$0		0	3	5	36%	36%	25%	25%	0.000	0.312	$ 171,756	0.1490	$ 49,021	$ -	$ 49,021	[redacted]
Cave Creek & Rose Garden Lane	$322,774	10	$0		0	3	5	36%	36%	25%	25%	0.000	0.312	$ 171,756	0.1490	$ 48,103	$ -	$ 48,103	[redacted]

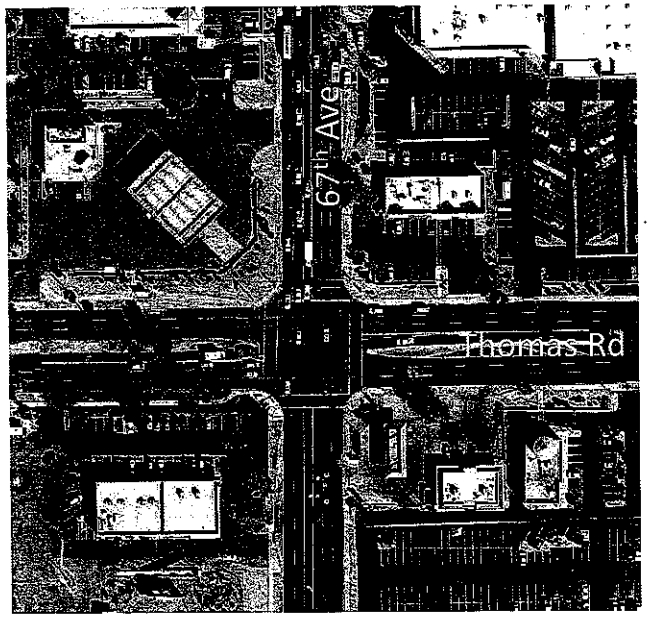
Note: Used the following combined CRF formula for the analysis: CCRF=1-(1-CRF1)*(1-CRF2)*(1-CRF3)
*Creating a positive offset and adding a yellow flashing arrow is not anticipated to add additional maintenance costs

CCRF (Negative Offset, Flashing Yellow Turn Arrow, Flashing Yellow Left Turn Arrow Left Turn) 52%

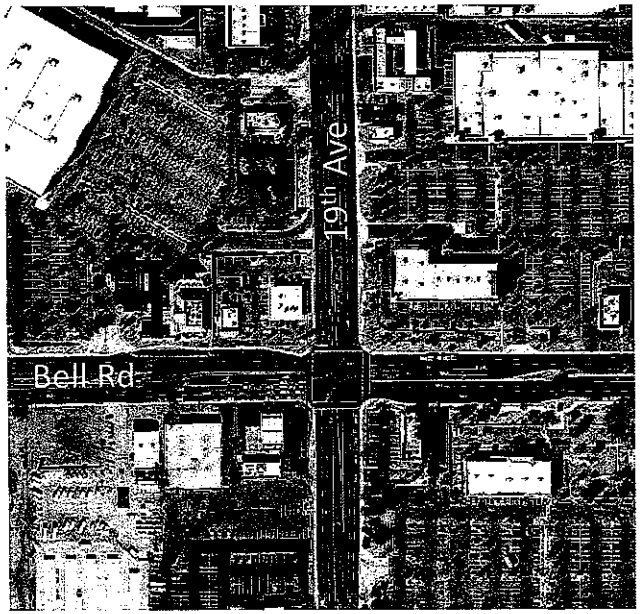
IncidentID	Date	Onroad	Crossroad	Intersection	MC	1stHarm	InjTot	FatTot	Sev	Latitude	Longitude	Type1	Act1	Vio1	Type2	Act2
3249252	3/14/2017	19th Av	Bell Rd	19th Av & Bell Rd	Left Turn	Motor Vehicle	1	1	Fatal	33.640127	-112.099706	Driver	Left Turn	Failed to Yield	Driver	Straight
2763621	10/9/2013	Bell Rd	51st Av	51st Av & Bell Rd	Left Turn	Motor Vehicle	2	1	Fatal	33.639027	-112.169103	Driver	Left Turn	Failed to Yield	Driver	Straight
2932476	12/18/2014	Bell Rd	51st Av	51st Av & Bell Rd	Left Turn	Motor Vehicle	2	1	Fatal	33.639027	-112.169103	Driver	Left Turn	Failed to Yield	Driver	Straight
3345263	12/4/2017	51st Av	Broadway Rd	51st Av & Broadway Rd	Left Turn	Motor Vehicle	2	1	Fatal	33.411503	-112.169169	Driver	Left Turn	Failed to Yield	Driver	Straight
3082051	2/7/2016	67th Av	Thomas Rd	67th Av & Thomas Rd	Left Turn	Motor Vehicle	1	1	Fatal	33.480344	-112.203263	Driver	Straight	Unknown	Driver	Left Turn
2932474	12/13/2014	43rd Av	Grand Av	43rd Av & Grand Av	Left Turn	Motor Vehicle	0	1	Fatal	33.512077	-112.151624	Driver	Left Turn	Failed to Yield	Driver	Straight
3232674	5/30/2017	19th Av	Bell Rd	19th Av & Bell Rd	Left Turn	Motor Vehicle	3	0	Serious	33.640127	-112.099706	Driver	Left Turn	Failed to Yield	Driver	Straight
2796798	1/16/2014	51st Av	Bell Rd	51st Av & Bell Rd	Left Turn	Motor Vehicle	2	0	Serious	33.639027	-112.169103	Driver	Left Turn	Failed to Yield	Driver	Straight
2944860	4/17/2015	Bell Rd	51st Av	51st Av & Bell Rd	Left Turn	Motor Vehicle	2	0	Serious	33.639027	-112.169103	Driver	Left Turn	Failed to Yield	Driver	Straight
3043399	1/29/2016	Bell Rd	51st Av	51st Av & Bell Rd	Left Turn	Motor Vehicle	3	0	Serious	33.639027	-112.169103	Driver	Left Turn	Failed to Yield	Driver	Straight
3121299	8/24/2016	Bell Rd	51st Av	51st Av & Bell Rd	Left Turn	Motor Vehicle	4	0	Serious	33.639027	-112.169103	Driver	Straight	Disregarded Signal	Driver	Left Turn
3147980	10/14/2016	Bell Rd	51st Av	51st Av & Bell Rd	Left Turn	Motor Vehicle	1	0	Serious	33.639025	-112.169103	Driver	Left Turn	Failed to Yield	Driver	Straight
2776353	11/14/2013	Cave Creek Rd	Bell Rd	Bell Rd & Cave Creek Rd	Left Turn	Motor Vehicle	1	0	Serious	33.640526	-112.030855	Driver	Left Turn	Failed to Yield	Driver	Straight
2838316	5/22/2014	Cave Creek Rd	Bell Rd	Bell Rd & Cave Creek Rd	Left Turn	Motor Vehicle	2	0	Serious	33.640526	-112.030855	Driver	Left Turn	Failed to Yield	Driver	Straight
2889750	11/16/2014	Cave Creek Rd	Bell Rd	Bell Rd & Cave Creek Rd	Left Turn	Motor Vehicle	2	0	Serious	33.640526	-112.030855	Driver	Left Turn	Failed to Yield	Driver	Straight
3021524	7/2/2015	Cave Creek Rd	Bell Rd	Bell Rd & Cave Creek Rd	Left Turn	Motor Vehicle	1	0	Serious	33.640526	-112.030855	Driver	Left Turn	Disregarded Signal	Driver	Straight
3287604	10/27/2017	51st Av	Broadway Rd	51st Av & Broadway Rd	Left Turn	Motor Vehicle	1	0	Serious	33.411503	-112.169169	Driver	Left Turn	Failed to Yield	Driver	Straight
2737413	7/9/2013	67th Av	Thomas Rd	67th Av & Thomas Rd	Left Turn	Motor Vehicle	4	0	Serious	33.480344	-112.203263	Driver	Left Turn	Failed to Yield	Driver	Straight
2997479	10/5/2015	67th Av	Thomas Rd	67th Av & Thomas Rd	Left Turn	Motor Vehicle	3	0	Serious	33.480344	-112.203263	Driver	Left Turn	Failed to Yield	Driver	Straight
3078687	4/25/2016	67th Av	Thomas Rd	67th Av & Thomas Rd	Left Turn	Motor Vehicle	1	0	Serious	33.480344	-112.203263	Driver	Left Turn	Failed to Yield	Driver	Straight
3131445	9/22/2016	67th Av	Thomas Rd	67th Av & Thomas Rd	Left Turn	Motor Vehicle	2	0	Serious	33.480342	-112.203266	Driver	Left Turn	Failed to Yield	Driver	Straight
3286365	10/25/2017	67th Av	Thomas Rd	67th Av & Thomas Rd	Left Turn	Motor Vehicle	8	0	Serious	33.480342	-112.203266	Driver	Left Turn	Failed to Yield	Driver	Straight
3015309	11/1/2015	43rd Av	Grand Av	43rd Av & Grand Av	Left Turn	Motor Vehicle	1	0	Serious	33.511592	-112.151518	Driver	Left Turn	Failed to Yield	Driver	Straight
2698695	1/3/2013	Mcdowell Rd	64th St	64th St & Mcdowell Rd	Left Turn	Motor Vehicle	1	0	Serious	33.465875	-111.943638	Driver	Straight	Failed to Keep in Lane	Driver	Left Turn
2812602	12/25/2013	Mcdowell Rd	64th St	64th St & Mcdowell Rd	Left Turn	Motor Vehicle	2	0	Serious	33.465875	-111.943638	Driver	Left Turn	Improper Turn	Driver	Straight
2852345	7/9/2014	Mcdowell Rd	64th St	64th St & Mcdowell Rd	Left Turn	Motor Vehicle	4	0	Serious	33.465875	-111.943638	Driver	Straight	Disregarded Signal	Driver	Left Turn
2892475	11/24/2014	Mcdowell Rd	64th St	64th St & Mcdowell Rd	Left Turn	Motor Vehicle	1	0	Serious	33.465875	-111.943638	Driver	Left Turn	Failed to Yield	Driver	Straight
2904481	10/25/2014	Mcdowell Rd	64th St	64th St & Mcdowell Rd	Left Turn	Motor Vehicle	2	0	Serious	33.465875	-111.943638	Driver	Left Turn	Failed to Yield	Driver	Straight
2777674	9/21/2013	19th Av	Baseline Rd	19th Av & Baseline Rd	Left Turn	Motor Vehicle	2	0	Serious	33.377760	-112.099127	Driver	Left Turn	Improper Turn	Driver	Straight
2795624	10/20/2013	19th Av	Baseline Rd	19th Av & Baseline Rd	Left Turn	Motor Vehicle	3	0	Serious	33.377760	-112.099127	Driver	Left Turn	Failed to Yield	Driver	Straight
3003238	10/20/2015	Baseline Rd	19th Av	19th Av & Baseline Rd	Left Turn	Motor Vehicle	3	0	Serious	33.377760	-112.099127	Driver	Left Turn	Failed to Yield	Driver	Straight
3064080	3/24/2016	Baseline Rd	19th Av	19th Av & Baseline Rd	Left Turn	Motor Vehicle	4	0	Serious	33.377760	-112.099127	Driver	Left Turn	Failed to Yield	Driver	Straight
3275422	9/19/2017	Baseline Rd	19th Av	19th Av & Baseline Rd	Left Turn	Motor Vehicle	2	0	Serious	33.377758	-112.099129	Driver	Left Turn	Failed to Yield	Driver	Straight
2711668	2/21/2013	32nd St	Greenway Rd	32nd St & Greenway Rd	Left Turn	Motor Vehicle	1	0	Serious	33.626327	-112.013352	Driver	Left Turn	Improper Turn	Driver	Stopped
2733075	4/10/2013	Greenway Rd	32nd St	32nd St & Greenway Rd	Left Turn	Motor Vehicle	4	0	Serious	33.626327	-112.013352	Driver	Left Turn	Improper Turn	Driver	Straight
2835860	5/13/2014	32nd St	Greenway Rd	32nd St & Greenway Rd	Left Turn	Motor Vehicle	1	0	Serious	33.626327	-112.013352	Driver	Left Turn	Improper Turn	Driver	Straight
2838773	5/20/2014	32nd St	Greenway Rd	32nd St & Greenway Rd	Left Turn	Motor Vehicle	2	0	Serious	33.626327	-112.013352	Driver	Straight	Unknown	Driver	Left Turn
2729381	6/10/2013	Baseline Rd	48th St	48th St & Baseline Rd	Left Turn	Motor Vehicle	3	0	Serious	33.378181	-111.978404	Driver	Left Turn	Failed to Yield	Driver	Straight
2787112	12/17/2013	48th St	Baseline Rd	48th St & Baseline Rd	Left Turn	Motor Vehicle	1	0	Serious	33.378181	-111.978404	Driver	Left Turn	Failed to Yield	Driver	Straight
2852897	5/11/2014	48th St	Baseline Rd	48th St & Baseline Rd	Left Turn	Motor Vehicle	3	0	Serious	33.378181	-111.978404	Driver	Left Turn	Improper Turn	Driver	Straight
3224168	5/10/2017	48th St	Baseline Rd	48th St & Baseline Rd	Left Turn	Motor Vehicle	2	0	Serious	33.378179	-111.978405	Driver	Straight	Disregarded Signal	Driver	Left Turn
2835664	3/21/2014	75th Av	Virginia Av	75th Av & Virginia Av	Left Turn	Motor Vehicle	7	0	Serious	33.476557	-112.220694	Driver	Left Turn	Improper Turn	Driver	Straight
3103682	6/26/2016	75th Av	Virginia Av	75th Av & Virginia Av	Left Turn	Motor Vehicle	2	0	Serious	33.476557	-112.220695	Driver	Left Turn	Failed to Yield	Driver	Straight
3163520	12/10/2016	75th Av	Virginia Av	75th Av & Virginia Av	Left Turn	Motor Vehicle	1	0	Serious	33.476555	-112.220697	Driver	Left Turn	Failed to Yield	Driver	Straight
2964478	1/29/2015	Indian School Rd	31st Av	31st Av & Indian School Rd	Left Turn	Motor Vehicle	2	0	Serious	33.494947	-112.125621	Driver	Straight	Disregarded Signal	Driver	Left Turn
3149411	10/22/2016	Indian School Rd	31st Av	31st Av & Indian School Rd	Left Turn	Motor Vehicle	3	0	Serious	33.494945	-112.125621	Driver	Straight	Speed Too Fast	Driver	Left Turn
3206680	3/22/2017	Indian School Rd	31st Av	31st Av & Indian School Rd	Left Turn	Motor Vehicle	2	0	Serious	33.494945	-112.125621	Driver	Left Turn	Failed to Yield	Driver	Straight
3231663	5/20/2017	31st Av	Indian School Rd	31st Av & Indian School Rd	Left Turn	Motor Vehicle	3	0	Serious	33.494945	-112.125621	Driver	Left Turn	Improper Turn	Driver	Straight
2789063	12/13/2013	Bell Rd	29th Av	29th Av & Bell Rd	Left Turn	Motor Vehicle	2	0	Serious	33.639802	-112.121406	Driver	Left Turn	Failed to Yield	Driver	Straight
2921551	1/15/2015	Bell Rd	29th Av	29th Av & Bell Rd	Left Turn	Motor Vehicle	2	0	Serious	33.639802	-112.121406	Driver	Left Turn	Failed to Yield	Driver	Straight
3051640	2/12/2016	29th Av	Bell Rd	29th Av & Bell Rd	Left Turn	Motor Vehicle	2	0	Serious	33.639802	-112.121406	Driver	Left Turn	Failed to Yield	Driver	Straight
2726274	5/23/2013	Cave Creek Rd	Rose Garden Ln	Cave Creek Rd & Rose Garden Ln	Left Turn	Motor Vehicle	1	0	Serious	33.676850	-112.031051	Driver	Left Turn	Failed to Yield	Driver	Straight
2733339	3/8/2013	Cave Creek Rd	Rose Garden Ln	Cave Creek Rd & Rose Garden Ln	Left Turn	Motor Vehicle	3	0	Serious	33.676850	-112.031051	Driver	Straight	Disregarded Signal	Driver	Left Turn
2938940	3/25/2015	Cave Creek Rd	Rose Garden Ln	Cave Creek Rd & Rose Garden Ln	Left Turn	Motor Vehicle	3	0	Serious	33.676850	-112.031051	Driver	Left Turn	Failed to Yield	Driver	Straight


Offsets
Project
Locations
N
BISCUIT FLAT
UNION HILLS
LITTLE DEER VALLEY
PARADISE VALLEY
DEER VALLEY
PHOENIX MOUNTAIN
SOUTH MOUNTAINS
Peoria
Glendale
Scottsdale
PHOENIX
Tempe
Guadalupe
Tolleson
Carefree
Cave Creek
Paradise Valley
Salt River Indian Reservation
ARIZONA 101
ARIZONA 51
ARIZONA 202
17
10
Project Locations
Sources: Esri, USGS, NOAA, Sources: Esri, Garmin, USGS, NPS

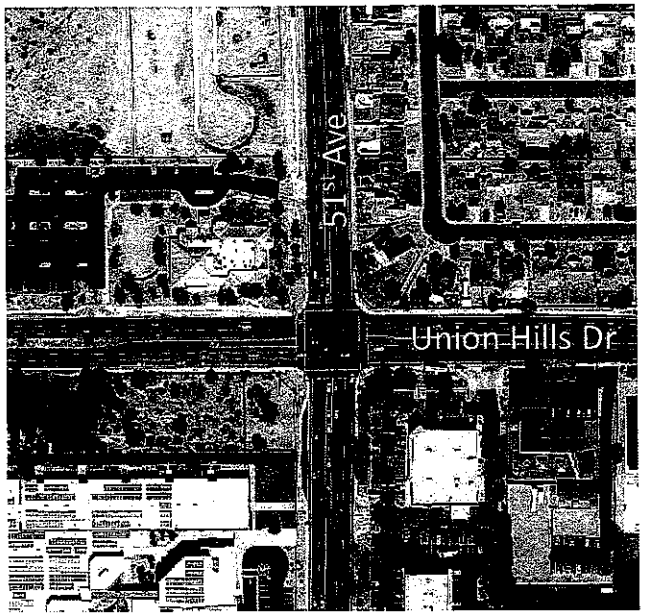
67th Ave & Thomas Rd



19th Ave & Bell Rd

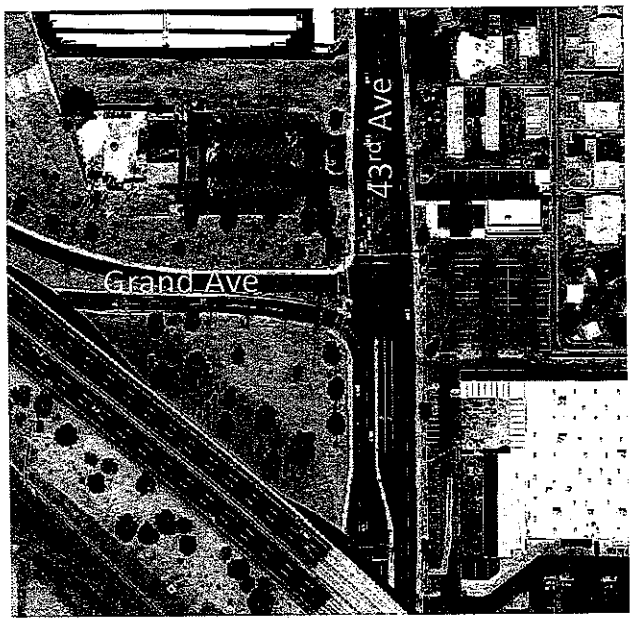


51st Ave & Union Hills Dr



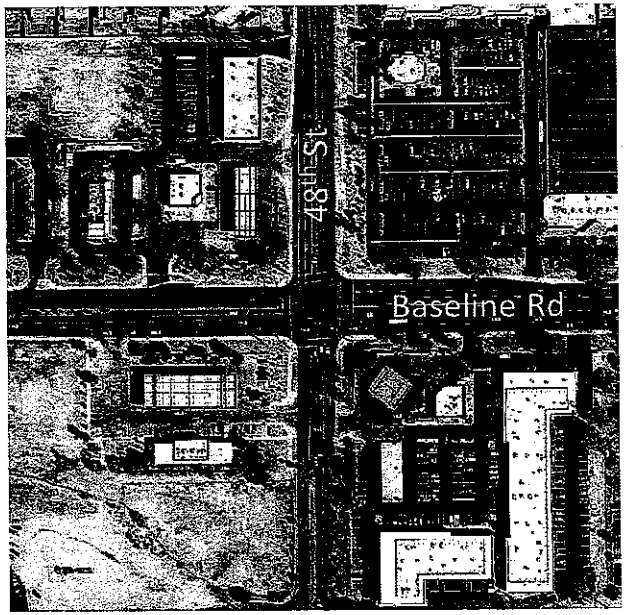
75th Ave & Virginia Ave

43rd Ave & Grand Ave



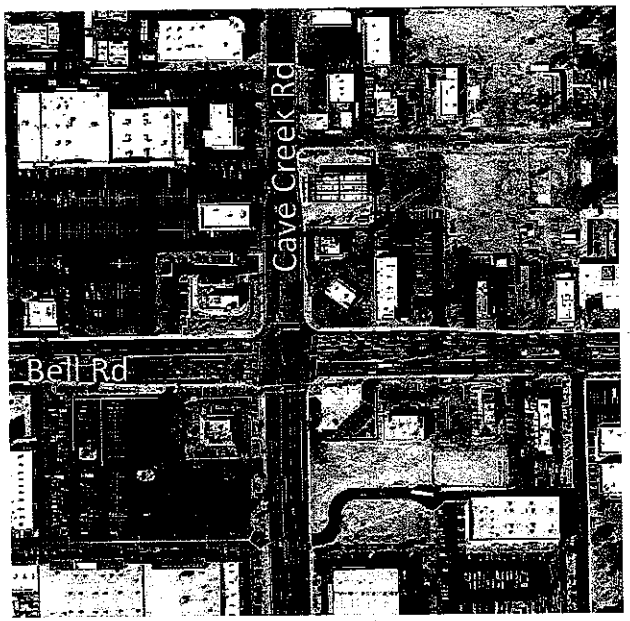
51st Ave & Broadway Rd

48th St & Baseline Rd

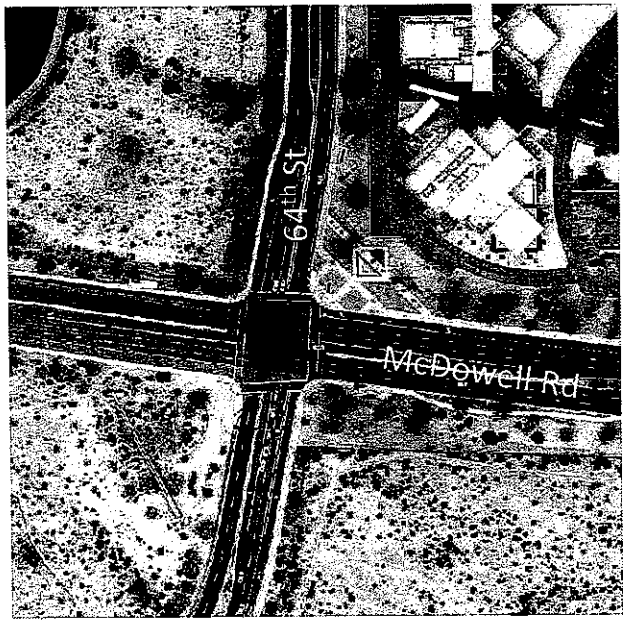


32nd St & Greenway Rd

Bell Rd & Cave Creek Rd

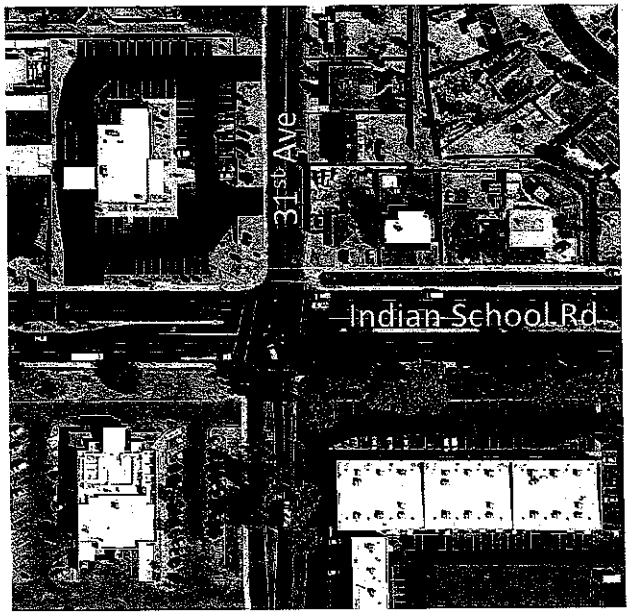


64th St & McDowell Rd



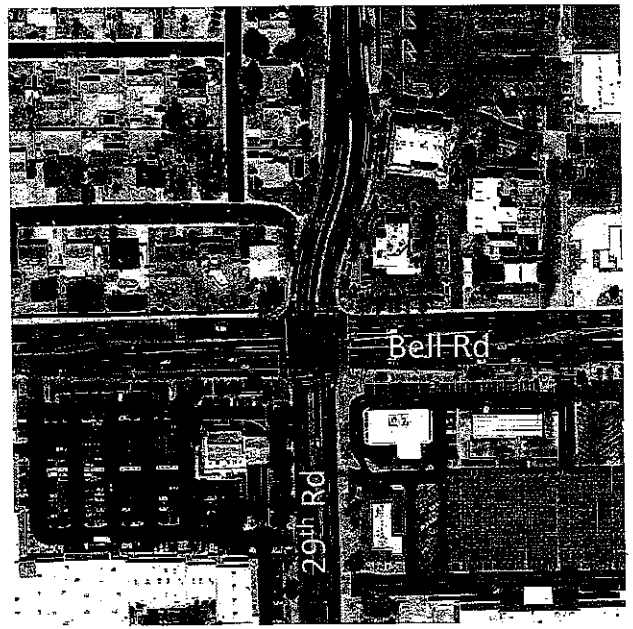
19th St & Baseline Rd

31st Ave & Indian School Rd



Bell Rd & Cave Creek Rd

29th Ave & Bell Rd



CRASH MODIFICATION FACTORS CLEARINGHOUSE

CMF / CRF Details

CMF ID: 6096

Improve left-turn lane offset to create positive offset

Description: Improve left-turn lane offset to make the left-turn lanes with positive offset

Prior Condition: Left-turn lanes with negative offset

Category: Intersection geometry

Study: *Safety Evaluation of Offset Improvements for Left-Turn Lanes*, Persaud et al., 2009

Image: *View the countermeasure image.*

Star Quality Rating: ☆☆☆☆ [View score details]

Crash Modification Factor (CMF)

Value:	0.644
Adjusted Standard Error:	
Unadjusted Standard Error:	0.09

Crash Reduction Factor (CRF)

Value:	35.6 *(This value indicates a **decrease** in crashes)*
Adjusted Standard Error:	
Unadjusted Standard Error:	9

Applicability

Crash Type:	All
Crash Severity:	K (fatal),A (serious injury),B (minor injury),C (possible injury)
Roadway Types:	Not specified
Number of Lanes:	
Road Division Type:	

Speed Limit:	
Area Type:	Not specified
Traffic Volume:	
Average Traffic Volume:	
Time of Day:	All

If countermeasure is intersection-based

Intersection Type:	
Intersection Geometry:	4-leg
Traffic Control:	
Major Road Traffic Volume:	Minimum of 7,150 to Maximum of 29,200 Annual Average Daily Traffic (AADT)
Minor Road Traffic Volume:	Minimum of 2,200 to Maximum of 13,350 Annual Average Daily Traffic (AADT)
Average Major Road Volume :	18,892 Annual Average Daily Traffic (AADT)
Average Minor Road Volume :	6,668 Annual Average Daily Traffic (AADT)

Development Details

Date Range of Data Used:	1983 to 2005
Municipality:	
State:	WI
Country:	
Type of Methodology Used:	Before/after using empirical Bayes or full Bayes
Sample Size (crashes):	305 crashes before, 62 crashes after
Sample Size (sites):	12 sites before, 12 sites after
Sample Size (site-years):	87 site-years before, 33 site-years after

Other Details

Included in Highway Safety Manual?	No
Date Added to Clearinghouse:	Dec-08-2014
Comments:	CMF of shifting the left-turn lane further away from the adjacent through lane and result in a less negative offset or no offset.

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CRASH MODIFICATION FACTORS CLEARINGHOUSE

CMF / CRF Details

CMF ID: 7697

Change from 5-section "doghouse" protected/permissive left turn to flashing yellow arrow protected/permissive left turn

Description: Change from 5-section "doghouse" protected/permissive left turn to FYA protected/permissive left turn

Prior Condition: 5 section doghouse signal

Category: Intersection traffic control

Study: ***Safety Effectiveness of Flashing Yellow Arrow: Evaluation of 222 Signalized Intersections in North Carolina*, Simpson and Troy, 2015**

Star Quality Rating: ☆☆☆☆☆ [View score details]

Crash Modification Factor (CMF)

Value:	0.747
Adjusted Standard Error:	
Unadjusted Standard Error:	0.067

Crash Reduction Factor (CRF)

Value:	25.3 *(This value indicates a **decrease** in crashes)*
Adjusted Standard Error:	
Unadjusted Standard Error:	6.7

Applicability

Crash Type:	Left turn
Crash Severity:	K (fatal),A (serious injury),B (minor injury),C (possible injury)
Roadway Types:	Not specified
Number of Lanes:	
Road Division Type:	

Speed Limit:	20-55
Area Type:	Not specified
Traffic Volume:	
Average Traffic Volume:	
Time of Day:	Not specified

If countermeasure is intersection-based

Intersection Type:	Roadway/roadway (not interchange related)
Intersection Geometry:	3-leg,4-leg
Traffic Control:	Signalized
Major Road Traffic Volume:	Minimum of 3500 to Maximum of 52000 Annual Average Daily Traffic (AADT)
Minor Road Traffic Volume:	Minimum of 300 to Maximum of 26500 Annual Average Daily Traffic (AADT)
Average Major Road Volume :	
Average Minor Road Volume :	

Development Details

Date Range of Data Used:	2003 to 2013
Municipality:	
State:	NC
Country:	
Type of Methodology Used:	Other before/after
Sample Size (crashes):	221 crashes before, 150 crashes after
Sample Size (sites):	156 sites before, 156 sites after

Other Details

Included in Highway Safety Manual?	No
Date Added to Clearinghouse:	Nov-01-2015
Comments:	Target crashes are defined as "left-turn same roadway crashes with the left-turner on an approach treated with FYA and occurring during the time of day when FYA is in operation".

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