IMPLEMENTING REGIONAL SYSTEMIC SAFETY IMPROVEMENTS

MID-OHIO REGIONAL
MORPC
PLANNING COMMISSION

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CHAPTER 1: INTRODUCTION

OVERVIEW

In partnership with state and local agencies, the Mid-Ohio Regional Planning Commission (MORPC) actively works to address safety concerns on our roadways. As the designated Metropolitan Planning Organization (MPO) for the Columbus Urbanized Area, MORPC uses data supplied by the Ohio Department of Public Safety to create its annual report of the Top 100 Regional High-Crash Intersections. However, crash data alone may not tell the whole story of the safety challenges on Central Ohio roadways, especially on lower-volume and rural roads where the frequency of crashes may not be high enough to warrant a spot on the list. In these cases, a systemic approach can help to mitigate blind spots where a lack of data may paint an incomplete picture.

According to the Federal Highway Administration (FHWA), "a systemic approach takes a broader view and evaluates risk across an entire roadway system. A system-based approach acknowledges crashes alone are not always sufficient to determine what countermeasures to implement, particularly on low volume local and rural roadways where crash densities are lower, and in many urban areas where there are conflicts between vehicles and vulnerable road users (pedestrians, bicyclists, and motorcyclists)."[1]

Rather than addressing particular types of crashes at specific locations, systemic safety improvements (SSI) are implemented following a holistic examination of crash data across a region or throughout a jurisdiction where trends or commonalities have been identified. In 2014, MORPC initiated a region-wide SSI project designed to implement low-cost systemic safety improvements on the locally-maintained roadway system throughout Central Ohio. To support its efforts, MORPC received funding from the Ohio Department of Transportation (ODOT) to apply these improvements in two phases at 207 sites within the MPO and evaluate their effectiveness.

How to Use This Guide

This guide provides details on a pilot project conducted by MORPC in collaboration with ODOT and regional stakeholders, following the step-by-step process of the Systemic Safety Project Selection Tool developed by the FHWA in 2013. By sharing its process and lessons learned, MORPC hopes to provide guidance to other communities and MPOs across the state about the benefits and considerations of a systemic approach to implementing safety countermeasures.

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1 *Federal Highway Administration Office of Safety, "A Systemic Approach to Safety – Using Risk to Drive Action," https://safety.fhwa.dot.gov/systemic (March 2019)*

PILOT PROJECT BACKGROUND

Regional Context

Between 2012 and 2016, a total of 191,301 crashes were reported within MORPC's MPO area. Of the more than 485,000 people involved in these crashes, 519 were fatally injured and 4,363 suffered serious injuries. As the chart in Figure 1 shows, the region experienced a nearly 15% increase in total crashes in 2016 as compared to 2012. Fatalities increased by 17% over the same five-year period.

FIGURE 1. CRASH TRENDS BY YEAR (2012 TO 2016)

YEAR	CRASH STATISTICS				OCCUPANT STATISTICS					SAFETY METRICS		
	Fatal Crashes	Injury Crashes	Property Damage Crashes	Total Crashes	Fatalities	Serious Injuries	Minor Injuries	No Injuries	Total People Involved	Injury Rate	EPDO	Fatalities and Serious Injuries per 100,000 population
2012	97	9,092	27,069	36,258	106	885	12,053	79,972	93,016	25.34%	2.89	68.24
2013	81	8,783	25,583	34,447	90	882	11,694	75,312	87,978	25.73%	2.93	66.30
2014	84	9,341	28,339	37,764	91	803	12,377	82,039	95,310	24.96%	2.75	60.22
2015	96	10,487	30,577	41,160	108	922	14,176	88,974	104,180	25.71%	2.83	68.34
2016	115	10,863	30,694	41,672	124	871	14,642	89,566	105,203	26.34%	2.83	65.30
5-Year Total	**473**	**48,566**	**142,262**	**191,301**	**519**	**4,363**	**64,942**	**415,863**	**485,687**			
Annual Average	**95**	**9,713**	**28,452**	**38,260**	**104**	**873**	**12,988**	**83,173**	**97,137**	**25.6%**	**2.84**	**66**
Pct. Change, 2012-2016	**18.6%**	**19.5%**	**13.4%**	**14.9%**	**17.0%**	**-1.6%**	**21.5%**	**12.0%**	**13.1%**	**3.9%**	**-2.1%**	**-4.3%**

During this time period, the number of non-motorized fatal & serious injuries resulting from a collision with a motor vehicle in Central Ohio was increasing. As a result, the region was not on track to meet transportation safety performance targets established in the 2016-2040 Metropolitan Transportation Plan (MTP). The chart in Figure 2 illustrates these trends. As the region's MPO, MORPC is uniquely positioned to coordinate with local jurisdictions to identify and address safety concerns through the implementation of appropriate countermeasures.

FIGURE 2. TRANSPORTATION SAFETY PERFORMANCE MEASURES

PERFORMANCE MEASURE	2015 BENCHMARK	2020		2040		2017 GRADE
		TARGET	TRACK	TARGET	TRACK	
Number of fatalities	96	-10%	10.2%	-39%	27.2%	✗
Number of serious injuries	890	-10%	-7%	-39%	-32.9%	✗
Number of non-motorized fatal & serious injuries	138	-10%	22.7%	-39%	180.5%	✗
Rate of fatalities per 100 MVMT	0.69	0.63	0.76	0.42	0.86	✗
Rate of serious injuries per 100 MVMT	6.40	5.83	5.95	3.91	4.21	✗

Notes:

The benchmark and targets represent five year rolling averages
Million Vehicle Miles Traveled (MVMT)
"TARGET" = Performance target included in the 2016-2040 MTP
"TRACK" = Progress should current trends continue

✓ On track to meet target
✗ Not on track to meet target

Systemic Safety Improvements

Low-cost safety improvements, also known as countermeasures, are a means of reducing the occurrence of fatal and serious injury crashes on the locally maintained roadway system. The annual Top 100 Regional High-Crash Intersections list is one way in which MORPC evaluates data to determine where countermeasures may be most effective. However, a high percentage of severe crashes occur on rural and locally owned roadways, not consistently in the same location. Due to the low density of these crashes, they may be overlooked by traditional analysis methods. Systemic safety improvements, which address safety concerns in a systematic manner rather than at "hot spot" sites, can mitigate such safety issues. Systemic safety improvements (SSI) address widespread safety concerns at multiple sites before many crashes occur rather than at a specific site after people are severely injured or killed.

One such example is that of curved roadways in rural areas. Instead of implementing chevron signs on curves with a high number of documented crashes, the systemic safety improvement approach would proactively install chevron signs at as many rural roadway curves as possible. The Systemic Safety Project Selection Tool (Tool), released in 2013 by the Federal Highway Administration (FHWA), is a guide to help localities address systemic safety issues on rural and locally owned roads.

The Tool outlines a preventive and proactive process for analyzing crash data and roadway characteristics, and assists with selection of appropriate countermeasures. According to FHWA, the Tool offers a step-by-step process for conducting systemic safety analyses, lays out considerations for selecting between implementing site-specific safety improvements and SSI; and provides a mechanism for measuring the effectiveness of the improvements. The graphic in Figure 3 illustrates this process.

Given the concerning regional trends in safety, MORPC sees value in pursuing systemic safety improvements, implemented at multiple locations across the MPO, with the goal of addressing some of the more common crash types. In 2014, MORPC initiated a region-wide SSI project utilizing the Tool as a guide. MORPC's project coordination, together with centralized project management by ODOT, helped to minimize the time and resources required of local jurisdictions to implement the countermeasures.

FIGURE 3. SYSTEMIC SAFETY PROJECT SELECTION TOOL

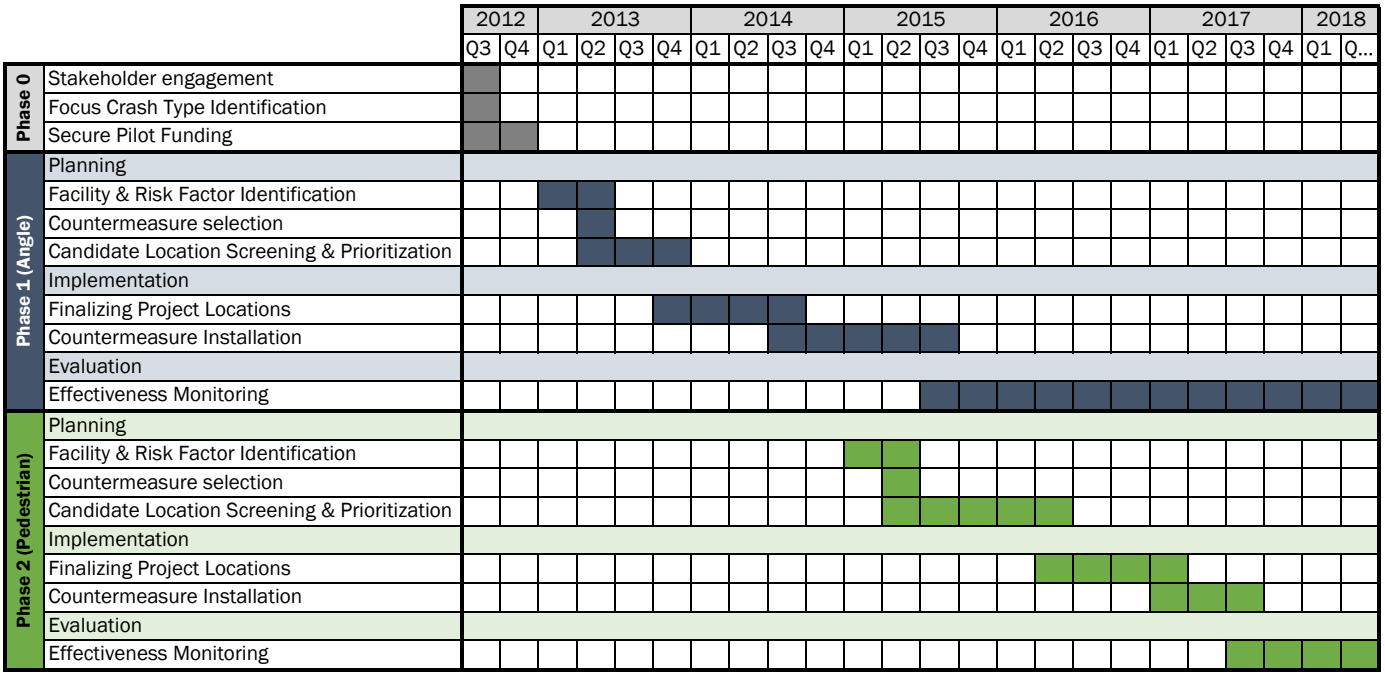
Source: Federal Highway Administration, Systemic Safety Project Selection Tool

Project Scope and Timeline

The Systemic Safety Improvement Pilot Project (project) was designed to implement low-cost systemic safety improvements on the locally-maintained roadway system throughout Central Ohio using the process outlined in the Tool. To support its efforts, MORPC received funds from the Ohio Department of Transportation (ODOT) to apply these improvements in two phases at 207 sites selected jointly by MORPC and participating local jurisdictions.

This project represents the first time an SSI was implemented across several local jurisdictions within Central Ohio. Given the scope and scale of this project and the involvement of multiple jurisdictions, the project was subdivided into two discrete phases to facilitate implementation. Phase I of the project targeted angle crashes in the region through the implementation of LED signal heads, retroreflective back plates on signal heads, and enhanced signage. Phase II addressed pedestrian-involved crashes by improving pedestrian infrastructure through the installation of proven safety countermeasures such as pedestrian countdown timers, high-visibility crosswalk markings, and rectangular rapid flashing beacons. The graphic in Figure 4 shows the project timeline.

FIGURE 4. PROJECT TIMELINE



Notes: Q1: January 1 - March 31, Q2: April 1 - June 30, Q3: July 1 - September 30, Q4: October 1 - December 31

Project Funding

This project was funded by the ODOT Highway Safety Improvement Program (HSIP) and MORPC. ODOT committed $1.8 million in State safety funds requiring a 20% local match. MORPC set aside $200,000 in attributable funds via the Surface Transportation Program (STP) to serve as the match, for a total of $2 million in project funding. Each phase was allocated approximately $1 million for implementation.

CHAPTER 2: THE SYSTEMIC SAFETY PLANNING PROCESS

REGIONAL SSI PILOT PROJECT AND USER GUIDE

STEP 1: IDENTIFY FOCUS CRASH TYPES AND RISK FACTORS

The first step in this pilot project was to determine which crash types to address. Crash types resulting in large numbers of severe injuries and fatalities were determined to be of greatest concern, and MORPC prioritized crash types that were overrepresented in Central Ohio when compared to the state.

The chart in Figure 5 displays crash types the total number of fatal and serious crashes by crash type and roadway ownership. As shown, fixed-object, pedestrian, and angle crashes were the most frequently occurring fatal and serious crash types within Central Ohio from 2012-2016. Given the scope of the project, angle and pedestrian crash types were selected. The maps in Figure 6 and Figure 7 on the following pages illustrate the overall density of all angle and pedestrian crashes within the MPO area during this time period.

FIGURE 5. CRASH SEVERITY BY ROADWAY OWNERSHIP

CRASH TYPE	LOCALLY MAINTAINED		STATE MAINTAINED	
	Fatal and Serious Injury Crashes	% of Total	Fatal and Serious Injury Crashes	% of Total
Angle	603	86.4%	95	13.6%
Fixed Object	602	66.7%	300	33.3%
Pedestrian	453	90.6%	47	9.4%
Rear End	380	62.5%	228	37.5%
Left Turn	302	86.8%	46	13.2%
Sideswipe - Passing	145	56.6%	111	43.4%
Pedalcycles	138	93.2%	10	6.8%
Sideswipe - Meeting	124	79.5%	32	20.5%
Head On	123	80.9%	29	19.1%
Parked Vehicle	100	79.4%	26	20.6%
Overturning	65	58.6%	46	41.4%
Other Non-Collision	51	69.9%	22	30.1%
Unknown	19	86.4%	3	13.6%
Backing	17	94.4%	1	5.6%
Other Object	12	60.0%	8	40.0%
Animal	9	56.3%	7	43.8%
Falling From Or In Vehicle	1	100.0%	0	0.0%
Train	1	100.0%	0	0.0%
Total Crashes	3,145	75.7%	1,011	24.3%

FIGURE 6. ANGLE CRASH DENSITY (2012 TO 2016)

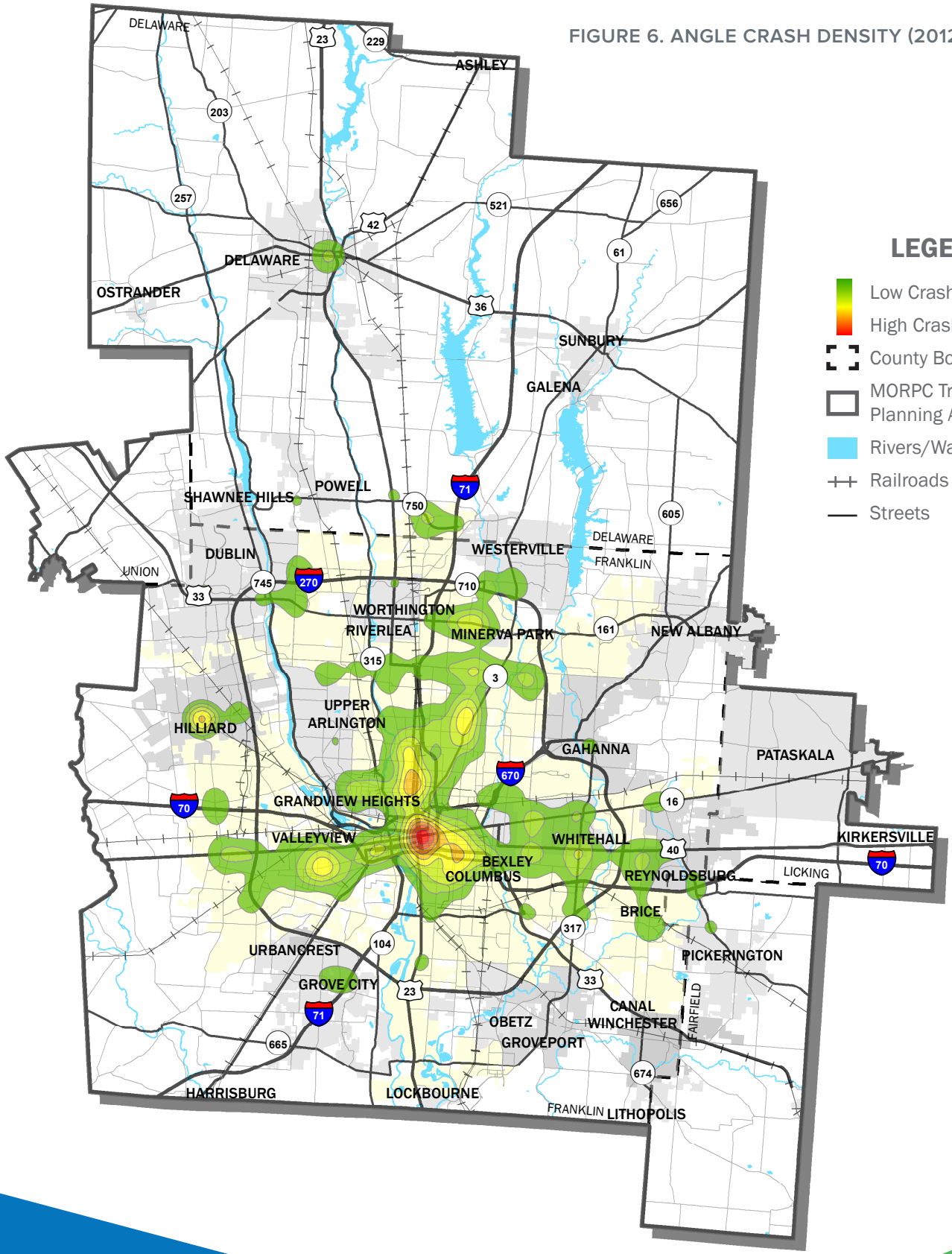
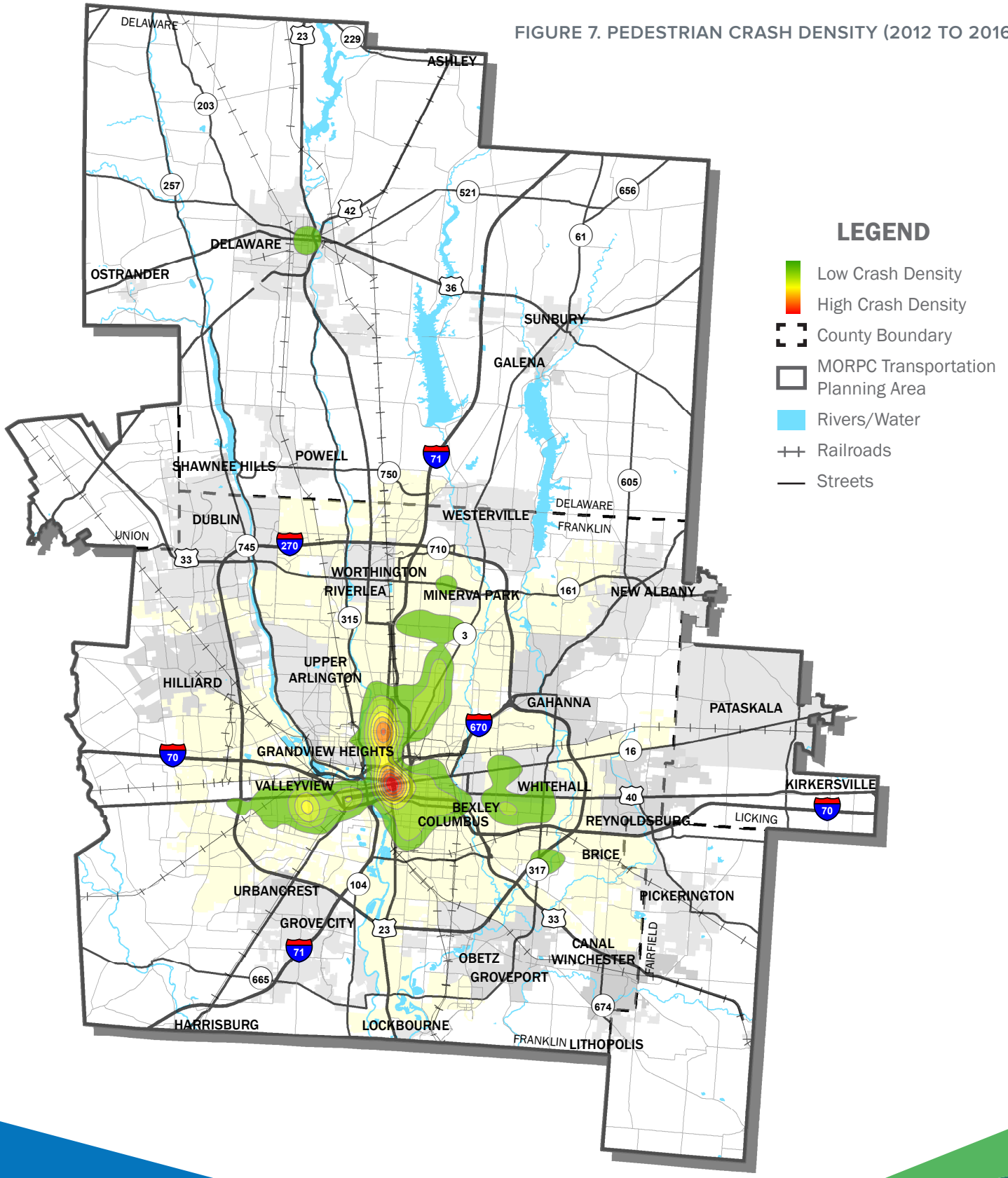


FIGURE 7. PEDESTRIAN CRASH DENSITY (2012 TO 2016)

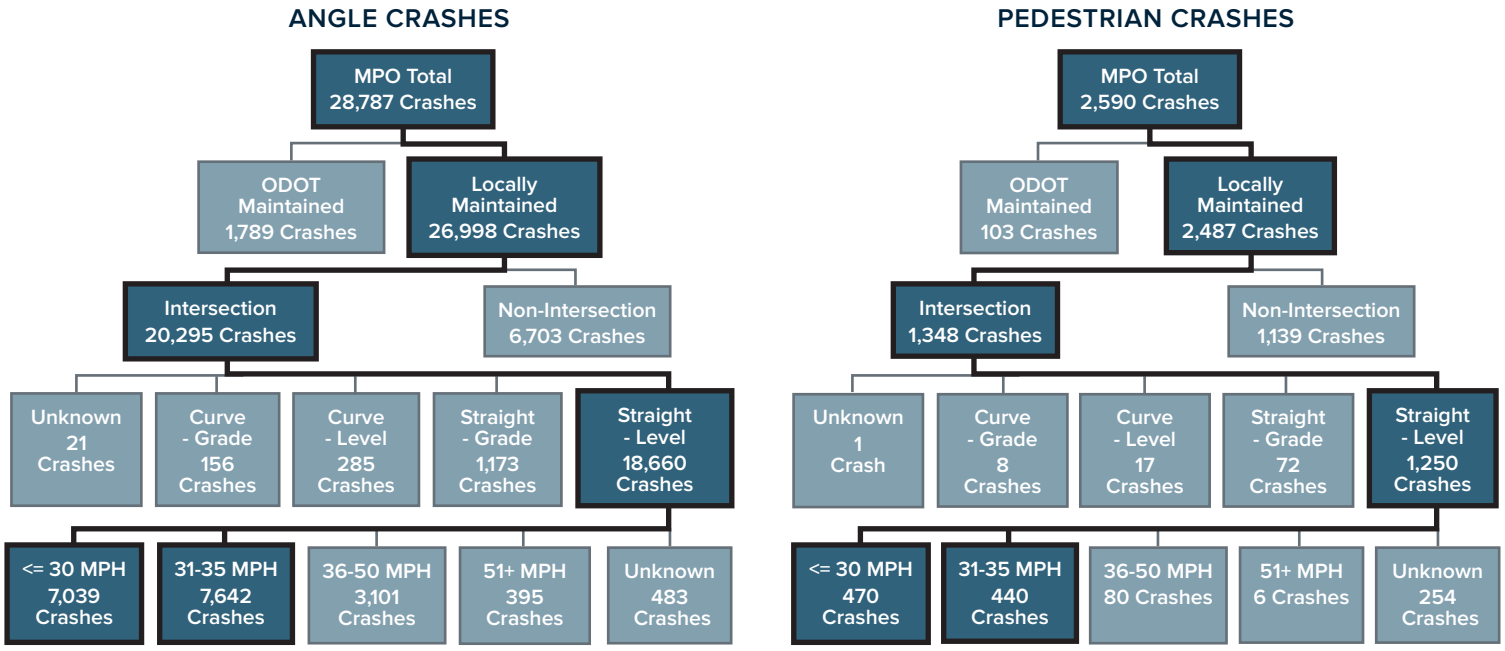


Contributing factors and roadway characteristics were analyzed to better understand the associated risk factors for these crash types and, ultimately, to determine which low-cost countermeasures would be effective in reducing the risk of the selected crash types occurring.

FIGURE 8. PEDESTRIAN CRASH SEVERITY BY CONTRIBUTING FACTOR

CONTRIBUTING FACTOR		CRASH SEVERITY					TOTAL CRASHES
		Fatal	Serious Injury	Minor Injury	No Injury	Possible Injury	
Pedestrian Error	Improper Crossing	26%	29%	15%	14%	11%	16%
	Darting	6%	8%	4%	9%	6%	8%
	Lying And/Or Illegally In Roadway	15%	6%	6%	4%	3%	4%
	Other Pedestrian Factors	25%	19%	15%	16%	15%	16%
	Total (Pedestrian in Error)	72%	61%	40%	43%	35%	45%
Other Unit in Error	Failure To Yield	8%	17%	29%	28%	29%	26%
	Failure To Control	10%	4%	4%	6%	6%	6%
	Operating Vehicle In Negligent Manner	0%	2%	1%	1%	0%	1%
	Other Driver-related Factors	10%	17%	26%	22%	29%	23%
	Total (Driver in Error)	28%	39%	60%	57%	65%	55%
TOTAL CRASHES		3%	17%	7%	49%	23%	100%

FIGURE 9. CRASH TREE DIAGRAMS



STEP 2: SCREEN AND PRIORITIZE CANDIDATE LOCATIONS

Network screening requires time and some technical expertise which may or may not be available in all jurisdictions. To facilitate participation by local jurisdictions, MORPC conducted an initial network screen, identifying intersections where at least one pedestrian or angle crash had occurred within the last five years. The resulting potential candidate locations were reviewed and validated by the respective local maintaining authorities.

The local jurisdictions were also invited to propose additional intersections as well as mid-block crossing locations within the jurisdiction that warranted further consideration. Ultimately, each local maintaining authority held the final decision as to where countermeasures would be implemented within their jurisdiction, with necessary consideration given to project scope and budget.

STEP 3: SELECT COUNTERMEASURES

To select appropriate countermeasures, MORPC, ODOT, and the local jurisdictions considered contributing factors and facilities, ODOT's experience with various countermeasures, and FHWA's Proven Countermeasures list.[1] Countermeasures that were preferred by participating jurisdictions and that could be implemented on the locally-maintained system with minimal complications were prioritized.

By coordinating with the jurisdictions rather than for them, MORPC ascertained important information to guide the project. For example, many participating jurisdictions reported that some potential countermeasures, such as un-signalized angle treatments, could be managed at the local level, without assistance from the MPO. In other cases, distinctly different needs or preferences emerged among more rural communities compared to more urban communities. Countermeasure selection should be aligned with the majority preference of participating jurisdictions in order to achieve the necessary scale.

Phase I countermeasures included LED signal heads and retroreflective backplates, enhanced signage, and LED enhanced stop signs. Phase II countermeasures included pedestrian countdown timers, high-visibility crosswalks, rectangular rapid flashing beacons (RRFBs), and combinations thereof. See Figure 10 for a list of these countermeasures and their associated crash reduction factors, estimated cost, and target facilities.

FIGURE 10. SELECTED COUNTERMEASURES

COUNTERMEASURE		CRASH REDUCTION FACTOR	ESTIMATED COST	TARGET FACILITY
Phase I (Angle)	LED Signal Heads & Reflective Backplates	15% (All Crashes)	$10,000 (per intersection)	Signalized intersections
	Enhanced FHWA Signage	10% (All Crashes)	$1,000 (per intersection)	Unsignalized intersections
	LED Enhanced Stop Signs	41% (Angle Crashes)	$1,500 (per sign)	Unsignalized intersections
PHASE 2 (Pedestrian)	Pedestrian Countdown Timers	70% (Vehicle/Pedestrian)	$6,000 (per intersection)	Signalized intersections
	High-Visibility Crosswalks	40% (Vehicle/Pedestrian)	$3,000 (per crosswalk)	Intersections & Mid-block
	Rectangular Rapid Flashing Beacons	36% (Vehicle/Pedestrian)	$12,000 (per location)	Mid-block crossings

1 *Federal Highway Administration, Making Our Roads Safer One Countermeasure at a Time* https://safety.fhwa.dot.gov/provencountermeasures/fhwasa18029/fhwasa18029.pdf *(March 2019)*

CHAPTER 3: FRAMEWORK FOR BALANCING SAFETY INVESTMENTS

REGIONAL SSI PILOT PROJECT AND USER GUIDE

STEP 5: DECISION SUPPORT FRAMEWORK

To ensure project funds were spent throughout the region, all participating jurisdictions were provided a base or "floor" allocation in each phase (around $50,000 for each phase). Jurisdictions received additional funds based on the extent to which they were impacted by the target crash type. The information in Figure 11 outlines the allocation schema.

FIGURE 11. PHASE ALLOCATION SCHEME

- **Total Phase Allocation:** $900,000 (10% Contingency)
- **Jurisdiction Phase Allocation:** Floor Allocation + Need Allocation
- **Floor Allocation:** Minimum amount individual jurisdiction received for participating
- **Need Allocation:** Allocation based on proportion of target crashes occurring within jurisdiction out of the region's

EXAMPLE:

- **Assume 10 participating jurisdictions**
- **Floor allocation:** $50,000
- **Need Allocation:** $400,000*.10 (Jurisdiction X's proportion)
- **Total Allocation:** $90,000

With locations and plan sets finalized, the project moved into implementation and construction. Countermeasure installation occurred in two phases. Phase I of the project began in late 2014 and continued into 2015. Implementation focused on the installation of countermeasures intended to address angle crashes at 67 locations throughout the region. Phase II implementation was carried out in 2017 to address pedestrian crashes at 120 locations throughout the region. In total, 207 unique countermeasures were installed across 187 locations within 16 Central Ohio jurisdictions.

The project was centrally managed by the ODOT district office and countermeasure installation was completed by an ODOT-managed contractor. The project was structured as a single contract across all participating jurisdictions, each of which signed a Local Public Agency (LPA) agreement with the ODOT district office. The maps in Figure 12 and Figure 13 on the following pages illustrate the final prioritized countermeasures chosen for each location, as well as the participating jurisdictions.

FIGURE 12. PROJECT LOCATIONS BY COUNTERMEASURE

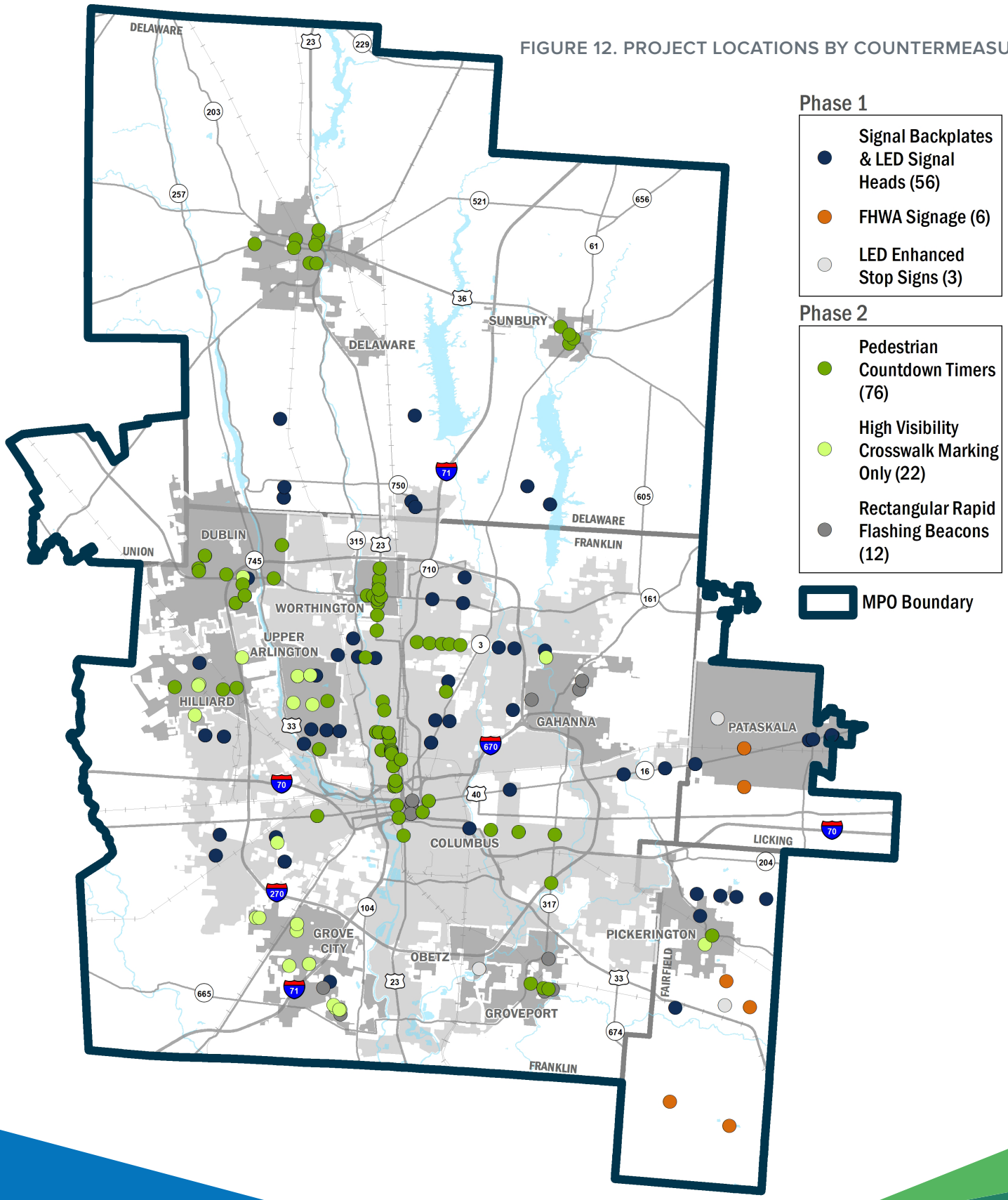
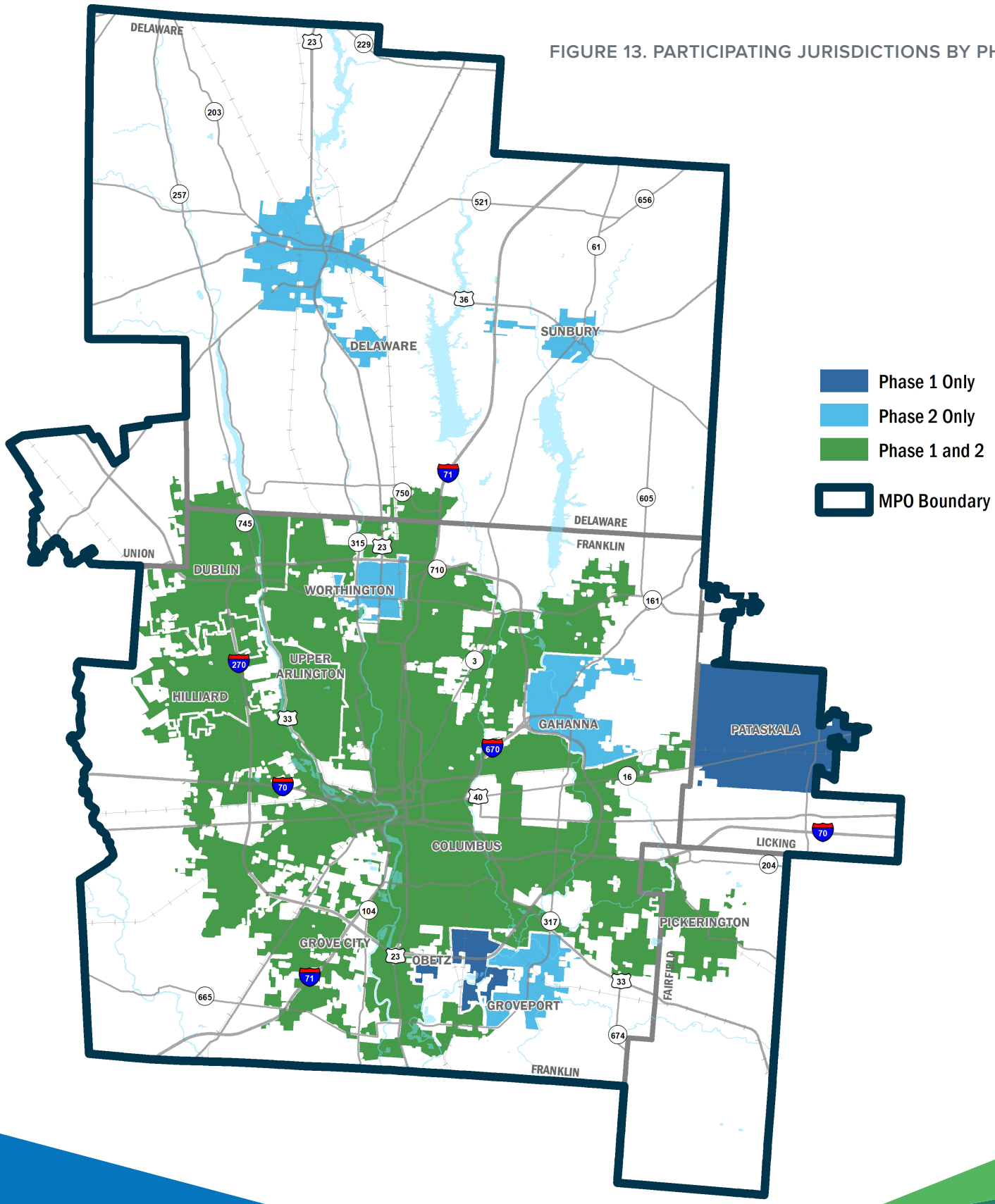


FIGURE 13. PARTICIPATING JURISDICTIONS BY PHASE



COUNTERMEASURE INSTALLATION

The following images are photos of countermeasure installations from select locations.

LED SIGNAL HEADS AND REFLECTIVE BACKPLATES

MORSE RD @ SUNBURY RD

BEFORE

AFTER

ENHANCED SIGNAGE

MINK ST @ REFUGEE RD

HAVENS CORNERS RD @ SUMMIT RD

PEDESTRIAN COUNTDOWN TIMERS AND RECTANGULAR RAPID FLASING BEACONS

PARK ST @ W. GOODALE AVE

BUTTLES AVE @ N. HIGH ST

GAY ST @ 9TH ST

CHAPTER 4: EVALUATION OF A SYSTEMIC SAFETY PROGRAM

REGIONAL SSI PILOT PROJECT AND USER GUIDE

STEP 6: SYSTEMIC SAFETY PERFORMANCE MEASURES

Project evaluation involves observing each countermeasure's effectiveness in reducing the targeted crash types at each implementation location. The following analyses draw from crash data available through the ODOT GIS Crash Analysis Tool (GCAT) through 2017. Crash trends observed at the implementation locations are reported for the periods before and during implementation. Corresponding trends for the MORPC MPO area are included as a benchmark.

Post-implementation data collection began in 2016 for Phase I and 2018 for Phase II. It must be noted there is not yet enough data to determine how effective the countermeasures have been at reducing targeted crashes. A few more years of data will be needed to observe trends over time as drivers and other roadway users adapt to the safety enhancements.

Phase I

Pre-Implementation

The implementation of Phase I of the SSI Pilot occurred throughout 2014 and 2015, focusing on the installation of countermeasures intended to address angle crashes at 67 locations throughout the region. Countermeasures included LED signal heads & retroreflective backplates, enhanced FHWA signage, and LED enhanced stop signs. Pre-implementation crash statistics for the period 2006-2013 are shown in the chart in Figure 14.

FIGURE 14. PHASE I, PRE-IMPLEMENTATION CRASH TRENDS (2006-2013)

ANALYSIS LOCATION	CRASH TYPE	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL 2006-2013	ANNUAL AVERAGE CRASH FREQ.	PERCENT CHANGE
Phase 1 Locations	Angle	266	241	217	191	236	194	189	182	1,716	214.5	-31.6%
	All	1,034	1,055	988	963	1,057	986	902	872	7,857	982.1	-15.7%
MORPC MPO Area	Angle	6,734	6,325	6,000	5,410	5,806	5,632	5,387	5,590	35,981	5,860.5	-17.0%
	All	38,153	38,628	35,979	34,499	36,629	35,913	34,263	33,787	287,851	35,981.4	-11.4%

Note: Shaded orange cells indicate the year with the highest value for each respective row.

A total of 7,857 crashes were observed at the 67 Phase I implementation locations between 2006 and 2013, including 1,716 angle crashes. Implementation locations experienced 872 crashes in 2013, representing a 16% decrease since 2006. Of these crashes, 182 were angle, exhibiting a 32% decrease over 2006. In an observation of all crash types, trends at Phase I implementation locations were on par with regional trends, exhibiting an decrease of 11% between 2006 and 2013. Region-wide angle crash statistics indicated a decrease of 17% between 2006 and 2013.

Implementation Year(s)

Phase I countermeasures were implemented in years 2014 and 2015, during which time Phase I locations experienced 201 and 232 angle crashes, respectively. Angle crashes accounted for 22% of all crashes at the Phase I locations during this time period. The chart in Figure 15 shows the crash data for these two years, indicating an increase in angle crashes, but also in crashes overall at these locations since 2013. These trends were similar to that of crashes throughout the MPO area.

FIGURE 15. PHASE I, IMPLEMENTATION YEAR(S) CRASH TRENDS (2014-2015)

ANALYSIS LOCATION	CRASH TYPE	2014	2015	ANNUAL AVERAGE CRASH FREQ.	PERCENT CHANGE (SINCE 2013)	PERCENT CHANGE (SINCE 2006)
Phase 1 Locations	Angle	201	232	216.5	27.5%	-12.8%
	All	903	1,107	1,005.0	26.9%	7.1%
MORPC MPO Area	Angle	5,890	6,708	6,299.0	20.0%	-0.4%
	All	37,687	41,160	39,423.5	21.8%	7.9%

Post-Implementation

Following Phase 1 countermeasure installation throughout 2014 and 2015, the post-implementation period began in 2016. Two post-implementation years (2016-2017) were evaluated at the time of this report, and will continue to be evaluated as data for future years becomes available. The data for this time period is shown in the chart in Figure 16. Because the post-implementation data is limited at this point, the information highlighted herein represents preliminary results and does not yet establish any clear trends.

FIGURE 16. PHASE I, POST-IMPLEMENTATION YEARS CRASH TRENDS (2016-2017)

ANALYSIS LOCATION	CRASH TYPE	2016	2017	ANNUAL AVERAGE CRASH FREQ.	PERCENT CHANGE (SINCE 2013)	PERCENT CHANGE (SINCE 2006)
Phase 1 Locations	Angle	228	113	170.5	-37.9%	-57.5%
	All	1,060	1,008	1,034	15.6%	-2.5%
MORPC MPO Area	Angle	6,300	4,034	5,167	-27.8%	-40.1%
	All	38,993	40,359	39,676	19.5%	5.78%

In 2016, the first year post-implementation, 228 angle crashes were observed at the Phase I implementation locations, indicating a slight decrease (2%) since 2015. In 2017, there were only 113 angle crashes reported at the Phase I implementation locations. However, it is important to note that a change was made after 2016 to the way angle crash types were identified, potentially classifying some crashes that would previously have been categorized as angle crashes into a new category for right-turn crashes. While this would mean more angle crashes actually occurred at Phase I implementation locations in 2017, only 66 right-turn crashes were reported, which would make the highest potential total for angle crashes at these locations 179. That still represents the lowest number of angle crashes at these locations in 10 years.

Phase II

Pre-Implementation

The implementation of Phase II of the SSI Pilot occurred throughout 2017, focusing on the installation of countermeasures intended to address pedestrian crashes at 120 locations throughout the region. Countermeasures included pedestrian countdown timers, high-visibility crosswalks, and rectangular rapid flashing beacons (RRFBs). Pre-implementation crash statistics for the period 2006-2016 are shown in the charts in Figure 17.

FIGURE 17. PHASE II, PRE-IMPLEMENTATION CRASH TRENDS (2006-2016)

ANALYSIS LOCATION	CRASH TYPE	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Phase 2 Locations	Pedestrian	28	31	27	39	38	36	50	36	23	37	30
	All	992	1,043	955	964	859	880	958	837	853	1,022	895
MORPC MPO Area	Pedestrian	532	439	500	469	535	461	475	473	565	575	513
	All	38,153	38,628	35,979	34,499	36,629	35,913	34,263	33,787	37,687	41,160	38,993

As the charts in Figure 17 show, between 2006 and 2016, the number of pedestrian crashes fluctuated from year to year at Phase II implementation locations, as well as throughout the MPO area. However, while there was an overall decrease (3.6 percent) in pedestrian crashes throughout the MPO area, there was an increase (7.1 percent) in the pedestrian crashes that occurred at the Phase 2 implementation locations. This was also while the number of all types of crashes that occurred at the Phase 2 locations decreased by nearly 10 percent.

ANALYSIS LOCATION	CRASH TYPE	TOTAL 2006-2016	ANNUAL AVERAGE CRASH FREQ.	PERCENT CHANGE
Phase 2 Locations	Pedestrian	375	34.1	7.1%
	All	10,258	932.5	-9.8%
MORPC MPO Area	Pedestrian	5,537	503.4	-3.6%
	All	405,691	36,881.0	2.2%

Implementation Year and Post-Implementation

Phase II countermeasures were implemented in throughout 2017, during which time Phase II locations experienced 33 pedestrian crashes. The chart in Figure 18 shows the crash data for 2017, indicating an increase in pedestrian crashes, but also in crashes overall at these locations since 2016. These trends were similar to that of crashes throughout the MPO area.

FIGURE 18. PHASE II, IMPLEMENTATION YEAR CRASH TRENDS (2017)

ANALYSIS LOCATION	CRASH TYPE	2017	PERCENT CHANGE (SINCE 2016)	PERCENT CHANGE (SINCE 2006)
Phase 2 Locations	Pedestrian	33	10%	17.9%
	All	941	5.1%	-5.1%
MORPC MPO Area	Pedestrian	549	7%	3.2%
	All	40,359	3.5%	5.8%

Following the installation of Phase II countermeasures throughout 2017, the post-implementation period began in 2018. Data for 2018 had not yet been analyzed at the time of this report, but will be evaluated along with future years as that data becomes available.

LESSONS LEARNED/SUMMARY

The findings described in this report indicate a possibility of positive impacts as a result of the implemented SSI project. A closer look at the data shows that some treatments appear to have had a more immediate impact than others, and will be evaluated further as more data becomes available post-implementation. Setting up a framework for evaluation, and specific figures to track as part of that evaluation is a critical step to consider at the outset of the project so an appropriate baseline can be set.

Crash data has illustrated a tendancy to fluctuate over time, and is expected to continue doing so - even at locations where safety countermeasures were implemented. The results of t countermeasure installation may also take time to fully take effect, as drivers and other roadway users become familiar with the enhancements. MORPC will continue to monitor these locations to evaluate the effectiveness of the countermeasures as part of its ongoing commitment to safety planning.

The implementation of region-wide SSIs is a beneficial, but intensive pursuit. Systemic evaluations require time and resources (both staff and financial), as well as good, integrated data. During both phases of this project, MORPC relied on local input to supplement the analysis and risk-based screening. As data improves in the future, this input may become a less intensive part of the process, but will be no less important.

Countermeasure selection depends heavily on the input of local government staff and requires commitment from those entities to continue maintaining the improvements that are installed. Some entities prefer specific improvement types, while others may choose a different countermeasure all together, presenting an added challenge to systemic countermeasure installation.