Safety and Operational Analysis of 4-lane to 3-lane

Conversions (Road Diets) in Michigan

Final Report

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Road diets, specifically 4-to-3 la were studied to determine the s factors (CMFs), and develop gu desirable to implement such roa guideline that suggests that 4-to daily traffic (ADT) exceeds 10,0 1,000. A CMF of 0.91 (after adj recommended although the fact site-to-site variation among the road diet is contemplated. A stu- implementation strategies are a	afety- and delay-relate idelines that would be ad diets. The results of 0-3 lane conversions re 00 and, more importan justment for backgroun tor is not statistically dif 24 sites studied, and th udy-by-study literature	d impacts useful in the open sult in sig tly, when d citywid ferent fro nis should	s, develop crash i deciding when it rational analysis s gnificant delay wh peak hour volum e trends) for all ci om 1.0. There wa d always be consi	modification might be support a nen average nes exceed rash types is as considerable idered when a		
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EXECUTIVE SUMMARY

Priorities for the design of roadways have shifted over the years—from a primary emphasis of increasing capacity to considering the purpose of streets and roads in the context of specific settings (and often referred to as "context sensitive" design). A technique that has gained popularity in recent years is the so-called "road diet" where traditionally-designed 4lane roads with two lanes in each direction have been converted/reduced to three lanes (often with the addition of bike lanes) with one lane in each direction and a center left-turn-only lane. Such conversions have potential impacts on both travel delay and safety.

The objectives of the study are straightforward and focused on travel delay and safety for typical 4-to-3-lane conversions in Michigan:

- 1. Determine the safety-related impacts of the conversions.
- 2. Determine the delay-related impacts of the conversions.
- 3. Develop a statistically sound crash modification factor for conversions.
- 4. Develop a guideline that addresses/incorporates the results from the above that would be of assistance to MDOT and other agencies in deciding when it might be desirable to implement such "road diets."

While the report includes a literature and state of practice review, anecdotal observations regarding pedestrian and bicyclist use of road diets, and comments regarding the successful implementation of road diets in communities, this summary is focused on the operational and safety aspects of road diet implementation.

From the operational analysis of several Michigan road diet sites-

- The operational analysis of the several sites provide reasonably consistent results and support a guideline that suggests that 4-to3-lane road diet conversions result in significant increases in delay for ADTs over 10,000.
- More importantly, 4-to-3-lane road diet conversions increase delay when peak hour volumes exceed 1,000.

 However, it is clear that "local" conditions (e.g., varying geometry, significant variation in turning movements, and variations in cross-street traffic) can have a significant impact on the viability of any proposed road diet. Thus, while an initial culling of potential road diet sites can be accomplished using the general guidelines above, in all instances a detailed operational analysis of the corridor (including operations at each intersection) for both 4- and 3-lane sections should be undertaken before the road diet conversion is implemented.

From the safety analysis of selected 4-to-3 lane road diets in Michigan-

- There is considerable site-to-site variation in the crash-related results although in almost all instances, there was a reduction in the number of crashes.
- Examination of the background (e.g., citywide, countywide) trends showed that in all cases there was a trend toward lower crash frequencies over time.
- The most appropriate methods for controlling for background trends were a simple control for citywide trends and the consideration of comparison sites.
- Average crash modification factors (CMFs), adjusted for citywide trends, were calculated across all 24 sites. The result was that the overall naïve (unadjusted) CMF was estimated as 0.63, and 0.91 after adjustment. Considering only those crash types expected to be affected by the road diet (not necessarily only reduced), the CMF was 0.90. And, finally, considering only those crash types expected to be reduced by a road diet, the adjusted CMF was 0.59. Use of the latter is problematic since there are typically offsetting changes in crash type frequencies. Only the CMF for the "correctable" crashes was statistically different from 1.0.
- While **the best estimate of a usable CMF is 0.91**, it should be noted that this is not statistically different from 1.0 and is an average across all sites. Perhaps more importantly, there is a great deal of variation from site to site.

- Considering effects of other variables on the overall CMF, it was seen that there was not much change due to controlling for other variables except for adjacent land use residential sites tended to have a lower CMF than mixed-use or commercial sites.
- Changes in crash severity due to road diets were examined and the distributional shift over all sites was estimated (and then compared to statewide changes). The finding was that although there was a slightly more substantial shift to less severe crashes for the road diet sites, it did not seem operationally significant. Moreover, the shift could have easily been due to changes in operating speeds or enforcement rather than the road diets themselves.

Road diets are a useful tool in the traffic engineer's arsenal of making streets and roads a more integral part of the community. As a part of broader plans, they open up "traditional" roads to greater use by pedestrians and, especially, bicyclists. In general, safety benefits can be expected but vary greatly from site to site. When corrected for citywide trends, the results here indicate that only a relatively modest CMF (0.91) is appropriate. This indicates that crash/safety benefits are likely to be considerably less than what is suggested by naïve comparison of before and after crash statistics. Similarly, the results reported here also suggest that operational analyses should always be performed early on in the consideration of a road diet proposal. Moreover, the commonly-quoted threshold ADT of 20,000 for consideration of a road diet should be lower (10,000) and, more importantly, realistic peak-hour analyses (based on actual counts) are much more useful. For the sites evaluated here, the peak-hour threshold volume is estimated as 1,000 vph although this could vary with varying volumes of cross traffic at intersections.

INTRODUCTION AND STATEMENT OF THE PROBLEM

Priorities for the design of roadways have shifted over the years—from a primary emphasis of increasing capacity to considering the purpose of streets and roads in the context of specific settings (and often referred to as "context sensitive" design). Examples of this shift can be seen with the increasing popularity of traffic calming, once the bane of traffic engineers for which the efficient movement of vehicles was the principal criterion, becoming widely accepted and applied. Another technique that has gained popularity in recent years is the socalled "road diet" where traditionally-designed 4-lane roads with two lanes in each direction have been converted/reduced to three lanes (often with the addition of bike lanes) with one lane in each direction and a center left-turn-only lane. Such conversions have potential impacts on both travel delay and safety. In this context, the basic question addressed in this study is "what are the impacts of such conversions in Michigan?" The results of the study will be of use to both MDOT and local road agencies.

OBJECTIVES OF THE STUDY

The original objectives of the study are straightforward and focused on travel delay and safety for typical 4-to-3-lane conversions in Michigan:

- 5. Determine the safety-related impacts of the conversions.
- 6. Determine the delay-related impacts of the conversions.
- 7. Develop a statistically sound crash modification factor for conversions.
- 8. Develop a guideline that addresses/incorporates the results from the above that would be of assistance to MDOT and other agencies in deciding when it might be desirable to implement such "road diets."

BACKGROUND AND SIGNIFICANCE OF WORK

Lane conversions/reductions are popular with many communities as the technique is viewed as a method that puts concerns of the local community, bicyclists, and pedestrians on a par with motorists passing through neighborhoods. The impacts of such conversions can include increased motorist delay, increases and/or decreases in crashes, and better access to

the transportation system for other user groups among others. Like new traffic signals, the impacts often appear to be situation-specific meaning that in some instances traffic crashes can be shown to increase while for others they decrease. The results of the study provide MDOT and other agencies with needed background information so that the outcomes of conversions in specific types of situations will be better understood.

While addressing different issues, work done under previous MDOT contracts on conversions of 2-way streets to 1-way pairs (Lyles et al. 2001) and the effect of new signals (Lyles et al. 1997) both showed that crash and operational changes varied according to the sites being considered. This same phenomenon was noted by Huang and others (2001) in a study of sites in California and Washington specifically for roads where a "road diet" was implemented. Results from several other studies showed that both crash-related and operational measures of effectiveness may vary. In the latter case, for example, if there are significant left-turn volumes on the corridor to be treated, but not particularly high through volumes, operational benefits can be accrued because of the separation of left turns into the center left-turn lane. However, if through volumes are high and the left-turning volume is not, elimination of a through lane can cause operational problems. In previous work done by Taylor for MDOT on road diets (2001), it was found that the crash reduction factor was 27.6% across all volume levels (which, at the time, compared favorably to the 25-30% reduction noted elsewhere). This included a consistent reduction in pedestrian and bicycle-related crashes. Not surprisingly, changes in delay were associated with the volumes on the treated street and the minor/side streets. When volumes were lower (e.g., in residential areas) delay increases were not significant but when major street volumes approach 2,000 vph and minor street volumes approach 200 vph, delay increases and becomes prohibitive.

One of the attractive characteristics of lane conversions is that it is a low-cost alternative—often consisting of only traffic signing and pavement marking changes. If crashes are reduced, benefit-cost ratios are very favorable. Even if there are negative operational impacts, the crash reduction potential may still trump increases in delay. The significant benefit of this project is that it provides MDOT and other agencies of a reliable source of information that can be used in determining whether to propose (or support the proposal of others) lane reduction/road diets.

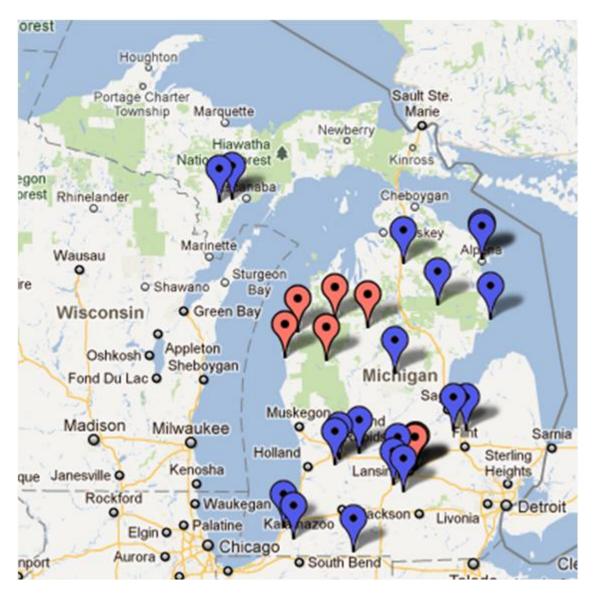
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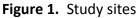
The results of the project are presented in the pages that follow. Syntheses for the several tasks that were completed are presented in the body of the report with more complete results presented in appendices. The following are the sections to the report:

- The literature review includes both traditional technical literature and more informal information from various local studies/presentations on road diets. (See also Appendix A.)
- Results from (qualitative) on-site reviews of several (Michigan) sites focusing on use by pedestrians and bicyclists. (See also Appendix B.)
- An operational analysis of several Michigan sites which focused on determining traffic volume thresholds which indicate when road diets are contraindicated from a delay perspective. (See also Appendix C.)
- A safety-related analysis of 24 sites in Michigan which focused on developing a reliable crash modification factor (CMF) that could be used in determining whether a road diet is appropriate for a given site. (See also Appendix D.)
- Suggestions related to implementation of road diets at new locations were developed based on the experience gained in completing this project and on the experiences elsewhere. (See also Appendix E.)

STUDY SITES

While the mechanism for selecting sites for inclusion in this study is addressed in more detail later in the report, Figure 1 on the next page shows the general location of the 24 sites that were analyzed plus the additional sites (in East Lansing) that were visited to observe pedestrian/bicyclist use.





The figure shows the sites that were used in the safety analysis in blue and, in red, the sites that were used in the safety analysis and visited as part of the review of pedestrian/bicyclist operations. The exception to the latter are the two (red) sites in East Lansing which were only part of the latter (the site markers overlap and are not visible in the figure). Graphical representations of each site are provided in Appendix F.

METHODS

Several different methods of analysis were utilized in this project and are briefly summarized below. Considerably more detail is provided in the appropriate section of the report.

- **Pedestrian and bicyclist operations.** These operations were qualitatively reviewed through on-site visits. Visual observations were made and recorded at several sites and some users were engaged in discussion although no formal survey instrument was used.
- Operational analysis of road-diet sites. Traffic operations of several road-diet sites
 were quantitatively assessed (using existing traffic data) to determine when potential
 level of service/delay issues occur when road diets are implemented. The widely-used
 Synchro software package was used to estimate delay and level of service for the
 selected sites under conditions of increasing traffic volumes. This was done to ascertain
 threshold values for when road diets may be contraindicated (from a delay/level of
 service perspective).
- Safety-related analysis of road diet sites. In the context of determining crashmodification factors (CMFs) for road diet implementation, before-and-after safety analyses were undertaken for several road diet sites. Both naïve and more sophisticated analyses were done including variations of case-control approaches where observed changes in overall and selected crash frequencies were controlled for background variation. Further details of these methods are presented in later sections of the report.
- Acquisition of site information. A straightforward survey instrument (Appendix G) was used to solicit information about tentative sites from MDOT and local agency personnel.

LITERATURE AND STATE-OF-PRACTICE REVIEW

The literature review included both a search of the traditional literature and a review of road-diet-related experiences in the field. The latter was identified from searching electronic media and following leads obtained from mailing lists and traffic professionals (several of whom could generally be perceived as "advocates" of road-diet-type projects). Some 33 different studies were reviewed for this project as well as several overarching reports. Details are provided in a study-by-study format in Appendix A.

Before discussing the literature, a point should be made about the variation in definition of various crash-related factors. Some practitioners/researchers use the term "accident modification factor" (AMF), while others simply refer to reductions in crashes or percent reductions, and still others use the now-standard "crash modification factor" (CMF). In this report, the latter terminology is used. So, in a comparison of before and after crash statistics, a CMF is correctly interpreted as that number which, when multiplied by the frequency of "before" crashes would give you the expected number of "after" crashes. Thus, the following apply:

• A typically-reported crash reduction percentage between before and after conditions (e.g., crashes were reduced by 15%) would be "converted" to a CMF as follows:

CMF = 1 minus the percentage change.

For example, if crashes were reduced by 15%, the CMF = 1 - 0.15 = 0.85. So, for positive improvements (crashes are reduced), the CMF < 1.0.

If crashes increased, the percentage change (as normally reported) would be negative.
 In such a case the CMF > 1.0. For example, if crashes increased by 15%, the CMF is calculated as 1 – (-.15) or 1.15.

The most interesting findings from the literature review can be summarized:

 As a general statement, crash reductions are experienced with most installations and are most typically reported as percentage changes (CMFs would be < 1.0). There is, however, significant variation in the magnitude of the reductions.

- While there appears to be significant "random variation," variation is also introduced because of the great variety in the before/after geometry and operating conditions (e.g., variation in ADT, existing left-turn driveway volumes and adjacent land uses). If the ADT is relatively low and there are few left turns, there is likely to be very little crash reduction; on the other hand, if there are many head-on/left turn crashes, crash reduction is more likely to be substantial. While head-on/left-turn and rear-end/left-turn crashes often are reduced, other crash types such as rear-end/straight in the right lane often increase because of the increased volumes in the right lane (due to the 2-to-1 lane reduction in a given direction).
- Most authors did not report estimates of CMFs per se. The most reliable estimates of CMFs are generally thought to be found on the FHWA-funded website "crash modification factors clearinghouse" maintained by the University of North Carolina Highway Safety Research Center [http://www.cmfclearinghouse.org/]. CMFs posted at this site have been vetted to some degree and a "star rating" is used as a measure of reliability. From that source, road diets are estimated to result in the following CMFs for unspecified roadway types in urban areas: all crash types/all severity levels = 0.63; all crash types/all injury crashes = 1.0; all crash types/property-damage-only (PDOs) = 0.54; angle crashes/all severity levels = 0.63-0.76; and rear-end crashes/all severity levels = 0.59. Based on another study (referenced at the same website), an estimated CMF for all crash types and all severities for minor urban arterials is 0.71.
- Many, if not most, studies were naive in that there was no control for background variation in crash trends. In virtually all areas, the general change in crashes at road diet locations must be somehow adjusted for overall decreases in crashes in the surrounding areas during the study period. Otherwise, too much of the changes in crashes may be attributed to the road diet.
- Travel speed decreases were reported for several studies as a result of road diet implementation. While this would be expected given the more restrictive geometry and

a driver's inability to pass another vehicle, an unknown amount of the reduction could simply be due to lowered speed limits and/or increased enforcement.

 In addition to safety, road diets are also implemented as a part of other system changes such as an overall effort in traffic calming or as part of creating a pedestrian/bicyclistfriendly environment.

ON-SITE REVIEWS OF PEDESTRIAN AND BICYCLIST OPERATIONS

As part of the project, several road-diet sites were visited and operations were observed with primary attention being paid to pedestrian and bicyclist use/operations. The intention of this exercise was not to collect extensive quantitative information but rather to get a qualitative idea about how pedestrians and bicyclists are using road diets and their perceptions of how useful they are.

Since the goal was not necessarily to have a representative sample, the investigated road diet sites (see Figure 1 for general locations) were selected based on having "pedestrian/bicyclist safety" identified as one of the motivations for implementing the road diet project (as per responses to the data collection survey) and close proximity from site to site (so that they could be visited in a short time-frame). Five of the eight sites that were visited were located in the northwestern part of Michigan (Cadillac Transportation Service Center [TSC]) and the others were in the East Lansing area:

- M-37 in Baldwin from the US-10 junction extending approximately 200 ft. south of 9th Street;
- M-55/M-66 in Lake City from W Beeler Road to Union Street (Davis Road);
- M-37/M-115 in Mesick from the M-115/M-37 junction to Clark Street;
- US-31 in Manistee from the M-55 junction extending approximately 300 feet northeast of M-110;
- M-116 in Ludington from US-10 to approximately 500 feet north of Lowell Street;
- Burcham Road in East Lansing from Abbot Road to Timberlane Street;
- Abbot Road in East Lansing from Albert Avenue to Whitehills Drive; and
- M-43 in East Lansing from Michigan Avenue to 200 feet northwest of Audubon Road.

For the five sites located within the Cadillac TSC area, visits were conducted during a major holiday weekend (high use expected) to gain as much insight as possible regarding impressions of operations and safety. For the sites located in East Lansing, visits were done during peak usage hours during the day. The primary focus was to investigate pedestrian/bicyclist use and a secondary focus was to investigate pedestrian/bicyclist-motorist interactions. More detailed observations are provided on a site-by-site basis in Appendix B. The following remarks are based on all of the visits.

- Not surprisingly, a lack of pedestrian and bicyclist infrastructure along a road diet results in low levels of non-motorized use of the corridor. This was most evident at the Manistee site, which, despite listing pedestrian safety as a rationale behind conversion, did not have bike lanes or sidewalks over the length of the site.
- The two most notable characteristics of a well-functioning road diet with significant non-motorized use (besides simply having infrastructure) were the presence of pedestrian-oriented attractions and successful traffic calming:
 - o Placement along corridors with commercial and pedestrian attractions:
 - The Lake City road diet was along a residential corridor of the road, just south of the city's commercial core. Despite having the infrastructure and observations being made during one of the busiest weekends of the year, there was very little pedestrian activity along the road diet, as there were no notable pedestrianoriented attractions present; instead, all of the pedestrian activity took place north of the site, along the commercial strip of town.
 - The road diet in Baldwin ended just before reaching the main commercial district in town, therefore it had no apparent impact on pedestrian traffic.
 - While there was little activity observed during the visits to the Mesick site, it appeared (based on the signage, crosswalk locations, and proximity of a public school) that when school is in session, there is a reason for pedestrians and bicyclists to use the road diet infrastructure.
 - The Ludington site was adjacent to a public beach, which acted as a significant pedestrian generator for the road diet corridor.
 - The Burcham Road and Abbot Road sites in East Lansing both attracted a fair amount of pedestrian and bicyclist use by students from the nearby schools and Michigan State University (all of which were in session).

- Successful traffic calming:
 - Through observation and from conversations with local residents, the main cause of the increase in pedestrian usage of the Ludington site was the perception of "calmed" traffic. While the corridor has largely residential land use, the adjacent public beach had always acted as an attraction of pedestrians and bicyclists. Since the traffic was perceived to be moving more slowly (as a result of the road diet), the road was easier to cross and walk along, encouraging beachgoers to walk or bike there, rather than drive and use the parking lot.
 - Although the site in Baldwin was in a commercial area with pedestrian destinations, the road diet did not appear to be designed so that motorists perceived the need to slow down in the corridor, making it appear unsafe to cross or bike along.
 - At the Mesick site, even though the observed pedestrian traffic was low, the road diet appeared to have successfully calmed traffic—just by walking up and down the corridor, it seemed safe for pedestrian and bicyclist activity.
 - At the Burcham Road site, the local crossing guard remarked that she thought the road diet was unsuccessful at calming traffic, thus rendering the implementation somewhat of a failure.
- In several conversations with residents and in observations (both at various sites) of interactions between motorized and non-motorized traffic, it was apparent that there was an intentional lack of proper usage of the road diets by their users and/or a lack of knowledge of what usage is allowed.
 - Bicyclists were often observed riding on sidewalks rather than using the unmarked bike lanes. Pedestrians were also occasionally observed using bike lanes, even when there was an adjacent sidewalk. There appeared to be a better understanding of the purpose of bike lanes at the sites in East Lansing, where there were appropriate pavement markings.
 - There was a perceived lack of clarity regarding right-of-way at crosswalks along the road diets. Typically, motorists correctly assumed they had the right of way;

residents complained, however, that crossing was difficult when vehicles did not routinely yield to pedestrians (most notably in Ludington) even though the motorists actually had the right of way.

- Motorists occasionally used the two-way left-turn lane (TWLTL) as a waiting (or acceleration) lane in making left turns from a driveway or side-street onto the road diet.
 - On occasions when the TWLTL was used as a waiting/acceleration lane to turn into the far moving lane, motorists in the far lane appeared indecisive, perhaps thinking they were about to be cut off.
 - On a few occasions, motorists were seen making left turns from the right moving lane, rather than moving into the TWLTL and then making the left.

While generally "common sense," the following overarching comments are based on the on-site visits to (qualitatively) assess pedestrian/bicyclist use of road diet sites:

- provisions for pedestrians and bicyclists are most important when there are existing pedestrian/bicyclist generators on the site and/or when the road diet is part of a larger plan for an area;
- if pedestrian/bicyclist provisions are included in the road diet area, they need to be clearly and consistently marked; and
- there appears to be a need for additional information/education regarding appropriate use of the road and pedestrian/bicyclist facilities at road diet sites (by both pedestrians/cyclists *and* motorists), including the use of signs clearly indicating crosswalks and bike lanes at road diet sites.

OPERATIONAL ANALYSIS OF SEVERAL ROAD-DIET SITES

The objective for the operational analysis was to determine if there was a common traffic volume at which the 4-to-3 lane conversion will "fail" from a traffic operations perspective (e.g., level of service [LOS] will drop to D or below). The general rule of thumb is that a road diet should not be implemented when ADT exceeds 20,000 vehicles per day. Since the peak hour is not necessarily always the same fraction of ADT (e.g., in a tourist-oriented area, there may be a more uniform flow over the course of a day), the approach taken for this project was to look at the volume that leads to failure over the course of an hour. Examination of the limits of the traffic volume for which a road diet is appropriate is important since it is a question that typically comes up when road diets are proposed—e.g., will the lane reduction cause congestion; what happens when capacity is reduced?

The conversion of 4-lane to 3-lane sections will impact traffic operations in terms of intersection approach delay. The question is: At what volume does this degradation result in failure of the 3-lane section? To investigate this, a basic operational analysis was conducted using Synchro. The measure of effectiveness (MOE) used to evaluate and compare the operational differences between 4-lane and 3-lane sections for a given traffic volume was approach delay in sec/veh.

Nine signalized intersections from five study sites were used for analysis and are shown in Table 1. The existing data for signal timing, phases and peak hour traffic volumes, along with intersection geometry were obtained and used for the Synchro models.

Site #	County	City	Intersection
1	Alpena	Alpena	US-23 @ 11th Ave
8	Eaton	Charlotte	Lansing Rd @ Hall St/ Island Hwy
			M-99 @ State St
9	Eaton	Eaton Rapids	M-99 @ Knight St
			M-50 @ Canal St/Brook St
11	Genesee	Clic	M-57 @ Mill St
11		Clio	M-57 @ Plaza Dr
13	Company	Montroso	M-57 @ Saginaw St
	Genesee	Montrose	M-57 @ Seymour Rd

Table 1. Sites/intersections used for Synchro analysis

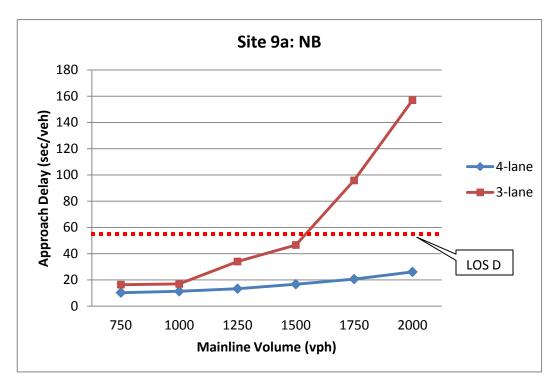
The volumes for AM and PM peak hours were obtained, and the analysis was conducted for the worst case (i.e., the higher overall volume). In all instances, the PM peak hour was highest. The existing turning volume percentages for each approach were determined and held constant throughout the analysis. An analysis of existing conditions was done for each site and results were checked for any major issues such as high delay or queue length values (there was none). Once baseline conditions were established, each intersection was then subjected to increasing increments of mainline (road diet) volume to determine when "failure" would occur. The volume increments were 750, 1000, 1250, 1500, 1750, and 2000 vph.

The following assumptions were made:

- The volume increments were for the mainline road-diet approaches only instead of all four legs to avoid a rapid decline in intersection performance at relatively low volumes. In most instances, the non-road-diet approaches were already 3-lane sections and increasing their volumes by the same level would have made the intersection difficult to operate.
- Since it was desired to check the behavior of a 4-to-3-lane conversion at specific traffic volumes, the volume on those approaches was not increased by a fixed percentage, but rather by the same magnitude on both intersection approaches with the road diet.
- The existing signal phasing was used for the study; however, in some cases where the turning volumes were high (>100 vph) a turning bay or storage lane was provided to avoid interference with the mainline traffic. Without storage lanes, the approach delay exceeded LOS F (>80 sec/veh) at very low mainline volumes which was not realistic.
- The signal timings and splits were optimized for each mainline increment to obtain the minimum intersection delay.
- No parking was allowed on any of the intersection approaches.
- A heavy-vehicle percentage of 2% was used throughout. While in some cases this was a bit different from actual data, 2% was used for a uniform comparison.
- The upper limit of LOS D (55 sec/veh delay) was used as a threshold.

The approach delay vs. mainline volume increments (for each road-diet approach) were plotted for all intersections and visually examined to determine the critical volume associated with "failure." See the figure below for an example and Appendix C for results from all sites.

The graph below (Figure 2) shows the approach delay for both 4- and 3-lane sections (existing conditions [blue line] and road diet [red line]) as the mainline volume is varied from 750 to 2000 vph for a signalized intersection at site 9 (northbound direction). In this instance, the approach delay is less then 20 seconds/vehicle for both types of road when the mainline volume is less than 1000 but performance begins to degrade more rapidly for the 3-lane section for mainline volumes of 1250 and 1500 and very quickly beyond that. Graphs similar to this one are shown in Appendix C for each of the sites analyzed.





The results (for all analyzed sites) indicate that for all cases, the approach delay for a road diet stays similar to the 4-lane section up to a mainline volume of approximately 1000 vph. When the mainline volume is increased from 1250 to 1500 vph, for most cases the approach delay for 3-lane sections increases and approached LOS D. It should be noted that the delay

results for the two different approaches (e.g., NB vs. SB) for a single intersection may be different. For example, for site 9 (Eaton Rapids), the intersection of M-50 (road diet) and Canal Street/Brook Street has very different delay thresholds for the 3-lane sections for the two approaches. This is attributed to heavy left-turn volume for one approach. Notwithstanding such differences, for most cases the trends are similar for both approaches if the turning volume patterns are similar. For all the 4-lane cases, the approach delays are relatively low and typically stay below the 55 sec/veh threshold for volumes up to ~2000 vph. An obvious reason for this "better" performance for 4-lane sections is more capacity; however, another factor could be the use of turning bays at the intersections and corresponding optimized signal timings. If there are no storage or turning lanes, the approach delay would increase significantly for 4-lane sections.

Table 2 shows a summary gleaned from the results of the Synchro analysis (over all six sites). In general, if the mainline volume increased beyond an interpolated value of 1000-1100 vph for these sites (consistent with the other assumption showed above), the conversion from 4-lane to 3-lane sections will typically have a negative impact on the traffic operations in terms of approach delays. Using a K factor of 0.10 for conversion from peak hour to ADT yields an ADT of 10-11,000 veh/day. This is considerably lower than the 20,000 ADT which appears to be a widely used rule of thumb. The results here suggest that an ADT of greater than 10,000 would be a better figure to use as a critical ADT where a road-diet conversion for a particular site requires detailed operational evaluation. For all of the 3-lane study sections, the average mainline volume was 1500 vph (corresponding ADT of 15,000 vpd) at which the approach delay reached the threshold of 55 sec/veh.

A corridor-level operational analysis study using microscopic simulation models (e.g., VISSIM) would provide an even more detailed evaluation of the operational impacts of a proposed road diet. More detained operational analysis can incorporate multiple factors (e.g., varying levels of heavy traffic volumes, turning movements at the intersection).

Site #	County	City	Intersection	Interpolated Mainline Volume at Threshold Delay (≥ 55 sec/veh)				
п				4-lane		3-lane		
1	Alnona	Alpona	115 22 @ 11+b Avo	S	В	SB		
T	Alpena	Alpena	US-23 @ 11th Ave	-		1750		
8	Eaton	Charlotte	Lansing Rd @ Hall Street/	NE	SW	NE	SW	
0	Eaton	Chanotte	Island Highway	-	-	1600	1550	
			M-99 @ State Street	NB	SB	NB	SB	
		Eaton		-	-	1550	1550	
9	O Fatar		M-99 @ Knight Street	NB	SB	NB	SB	
9 Eaton	Rapids	WI-99 @ Killght Street	-	-	1350	1350		
			M-50 @ Canal	SE	NW	SE	NW	
			Street/Brook Street	-	1750	1850	1100	
			M-57 @ Mill Street	EB	WB	EB	WB	
11 Genesee	Clio		-	-	1150	1300		
		M-57 @ Plaza Drive	EB	WB	EB	WB		
			-	-	1300	1800		
12 Conocoo		M-57 @ Saginaw Street	EB	WB	EB	WB		
	Genesee	Montroco	ivi-57 @ Sagillaw Street	-	-	1350	1650	
13	Genesee	Montrose	MET @ Sournour Pood	EB	WB	EB	WB	
			M-57 @ Seymour Road	-	-	1700	1650	

Table 2. Interpolated mainline volumes (vph) when approach delay \geq 55 sec/veh (\geq LOS D)

The important summary points from the operational analysis include the following:

- The operational analysis of the several sites provide reasonably consistent results and support guidelines that suggest that 4-to-3-lane road diet conversions become problematic for ADTs greater than 10,000.
- More importantly, 4-to-3-lane road diet conversions result in increased delay for peak hour volumes between 1,000 and 1,500.
- However, it is clear that "local" conditions (e.g., varying geometry, variation in turning movements, and variations in cross-street traffic) can have a significant impact on the viability of any proposed road diet. Thus, while an initial culling for potential road diet sites can be accomplished using the general guidelines above, in all instances a detailed operational analysis of the corridor (including operations at each intersection) for both

4- and 3-lane sections should be undertaken before the proposed road diet conversion is implemented.

A SAFETY-RELATED ANALYSIS FOR SELECTED 4-TO-3 LANE ROAD DIETS

The overarching purpose of the project was to estimate a crash modification factor (CMF or CMFs) that could be used to estimate crash savings that result from the implementation of 4-to-3-lane road diets in Michigan. From the outset it needs to be clear that road diets can have any of the following results (or combinations of results):

- decreases in crashes since, for example, left-turning vehicles are moved out of a through lane and into the reserved turning lane (the TWLTL) at mid-block non-intersection locations;
- increases in crashes since two lanes of through vehicles are moved into a single through lane (e.g., rear-end crashes in the right-hand lane become more likely simply due to higher volumes in the lane);
- decreases in pedestrian and bicyclist crashes because of the provision of better infrastructure for these users; and
- increases in pedestrian and bicyclist crashes since such users/trips are attracted to the improved infrastructure.

In addition, crash increases or decreases can vary substantially given the prevailing ADTs, road usage patterns, adjacent land uses (e.g., are there pedestrian/bicyclist attractors adjacent to the road diet site), turning volumes (especially mid-block), peak hour characteristics, and type of area (e.g., tourist area, university campus, small town) among others. Finally, background variation in crash frequencies (e.g., all crashes are steadily decreasing in a particular city) must be considered when trying to isolate the effect of a road diet.

The point is that there is likely to be significant variation in existing conditions prior to the implementation of a road diet. Crash savings (if there are any) are, likewise, likely to vary substantially with all of these variables.

In this section, the development of a crash modification factor (CMF) for selected 4-to-3 lane road diet sites in Michigan is documented:

- first, site selection is reviewed;
- next, data collection and reduction (e.g., reclassification of crash types) are discussed;
- then, the data analysis is presented including consideration of various methods for controlling for background trends in crash history; and,
- finally, a general CMF for road diets in Michigan is presented.

SITE SELECTION

Site selection for this project was developed through a general solicitation of sites from various MDOT personnel (e.g., TSC and/or regional traffic engineers) and local agencies. MDOT personnel had developed a tentative contact list which was supplemented with suggestions from others. A survey (see Appendix F) was sent to the list with the purpose of identifying potential sites, locations of the road diets, basic information about the site (e.g., type of road diet such as 4-to-3 lane reductions), the reasons for implementing the road diet, start and end dates for the actual implementation, and other basic data. Some 43 initial sites were eventually identified via the survey. Although it had originally been envisioned that different types of road diets might be included in the study, review (with MDOT) of the set of sites that emerged from the survey led to the conclusion that the study be limited to the "standard" 4-to-3 lane road diet conversions.

Some sites were eliminated because they were too recent to have adequate (three years) "after-implementation" data. Other sites were too old to have crash data that were consistent with data for all other sites. Other reasons for eliminating sites included: length too short, other recent site changes, inconsistent or no ADT data, and on-street parking allowed. For the final analysis, a total of 24 sites were generally used. For some of the analysis (e.g., on-site visits to observe pedestrian/bicyclist operations) some older sites were used while for other parts of the analysis, some of the 24 were not used. The latter is discussed in more detail below. Locations of all of the sites (including some that were only visited) were shown earlier in Figure 1. A copy of the spreadsheet for each of the 24 sites used in the crash analysis is in Appendix D.

DATA COLLECTION AND REDUCTION

Once the sites had been identified and agreed-upon, crash data were retrieved for each site (both for the mainline and cross streets near the intersections) as were ADT and other traffic data (e.g., turning data for some sites for the operational analysis). In addition to the electronic crash records, the "hard copies" of all of the relevant UD-10s were retrieved so that the actual crash diagram and narrative could be examined for each crash. This allowed, for example, for a determination of whether cross-street crashes were correctly assigned to the intersection or the cross street itself (and back from the intersection)—i.e., were these crashes at all associated with the road diet.

In addition, crashes were "reclassified" using a more-detailed assignment so that the effects of the road diets could be more accurately assessed. An example of this "reclassification" is assigning a rear-end/straight crash to the right or left lane during the "before" period. Further, crash categories were classified as whether they were expected to be: 1) "correctable" by a road diet (e.g., a rear-end left-turn crash in the left lane which should be corrected with a road diet since the turning vehicle would be out of the regular travel lane as a result of the road diet); or 2) affected by the road diet (e.g., rear-end crashes in the curb lane might increase). Note that while "correctable" crashes are a benefit, the affected crashes might either increase or decrease. Details of the reclassification scheme can be seen in Appendix G.

During the review of the crash data, some crashes were eliminated from consideration in the subsequent analysis. For example, if the crash didn't have anything to do with the roadway or its geometry, it was eliminated. Examples of such an elimination include a crash where a driverless vehicle rolled out of a driveway and crossed the entire roadway before crashing; and another where a police traffic stop resulted in the admission by the (inebriated) driver that she had been involved in a crash "somewhere" within the preceding hour or so, and the crash was coded to the street where the stop occurred. Other crashes that were eliminated included those with animals, those that occurred during (any) construction, and those that occurred on (or were otherwise attributable to) the side streets.

DATA ANALYSIS

Once all of the data had been prepared and reconciled, the analysis was relatively straightforward except for the control for background trends. The data used for any site is illustrated in the spreadsheet on the next page (site 11). Copies of the spreadsheets for all 24 sites are in Appendix D.

With reference to the information shown on the next page, the top section contains a summary of the basic **site characteristics** for site 11 (e.g., county, city, road name). The next section contains the **descriptive statistics** which include the basic crash frequencies by before and after period (and further broken down by year) as well as all of the crash information for background trends (e.g., crashes for the city and county over the same time period). The third section shows a **naïve before/after crash analysis** (no correction for trends) including a graphical representation of the crash frequency by year for the site. The fourth section shows the **before/after crash analysis with a simple adjustment for various background trends**. The final section (only available for some sites) shows the **before/after crash analysis adjusted for trends of an untreated comparison group**. Each of these sections is discussed in more detail in the following paragraphs.

Site characteristics, in addition to simple identification of the site, are also used for grouping similar types of sites when the CMF is developed—for example, the number of driveways, intersections, and average daily traffic (ADT).

Descriptive statistics include all of the basic crash information for the site. For each site, three-year before and after windows are shown. While, in most, if not all, instances the construction duration was short-lived, the crash data for the entire year during which the construction/implementation of the road diet occurred are eliminated from the analysis. Thus, each year in the before-after window for every site is a full calendar year and all before-after comparisons are based on three full years before and after the construction year. This eliminates any issues with one site being completed in the spring while another is completed in the fall. In addition to the overall crash frequencies, crash data are also broken down by

			Site Charact	aristics					
Site No.		11	Sile Charact				1.46	· · · · · · · · · · · · · · · · · · ·	
Site No. County		11 Genesee		Length (mi) Land Use			1.46 Mixed commerc	ial-residential	
City		Clio		No. of Driveways/Intersections		80/12	lai-residentiai		
Route/Road Name		M-57		Treatment Type				existing curbs with	n new markings
PR/CS No.		1494503/25101							0-
MP 9.400			Nearest Cross S	treet		Washington St.			
EMP		10.856		Nearest Cross S	treet		Liberty St.		
			Descriptive S	statistics					
								After Period	
Year 2002					2	2004	2006	2007	2008
ADT			14628	14614	1	4892	13726	13466	16108
Crash Frequency (Total)	58	_	40	36	45	32			
Crash Rate	6.05	7.47		5.05	4.94	6.29	3.74		
Crash Frequency (Recoded)			42	48	_	31	30	34	24
Crash Frequency (Intersection-rela Crash Frequency (Driveway-related			5 10	8		3 7	5	5	6
Crash Frequency (Affected by Road			40	43		29	28	30	26
Crash Frequency (Corrected by Roa)	16	9		9	2	2	3
Crash Frequency (Background, Cou			14306	14066	1	3285	10458	10701	10180
Crash Frequency (Background, City		,	44	63		46	43	44	43
Crash Frequency (Background, Tru	nklines	-Countywide)	1854	1854	1	1752	1400	1321	1218
Crash Frequency (Background, Tru	nklines		33	39		24	18	30	20
		Crash Analysis N	/lethod: Simple (N	aïve) Before/Aft	er Analy	sis			
Average Crashes per Year (Before)				48.33	70 _	Cr	ash Frequency by	Year (Site)	
Average Crashes per Year (After)				37.67	60				
Percentage Change Average Crashes per Year (Recode	d D-f	rol		-22.07%	50 -		$\boldsymbol{\wedge}$		
Average Crashes per Year (Recode Average Crashes per Year (Recode				40.33 29.33		<u> </u>		A	
Average Crasnes per Year (Recode Percentage Change	a, Arte	1		-27.27%	40	-			Recoded
Average Crashes per Year (Affecter	d, Befo	re)		37.33	30				Affected
Average Crashes per Year (Affecter				28.00	20				Corrected
Percentage Change				-25.00%	10				
Average Crashes per Year (Correct				11.33	_		· · · ·		
Average Crashes per Year (Correct	ed, Aft	er)		2.33	0 +- 2000	2002	2 2004 200	6 2008 201	0
Percentage Change		Constant Augustan Marshard	D-6 (A6 C	-79.41%					-
		Crash Analysis Method:	Before/After Con	nparison with Ba	ckgroun	d Trends			
Background Area Location (County				44657		Creak a			40.22
Average Crashes per Year (County)				41657 31339			es per Year (Site, B		48.33 37.67
Average Crashes per Year (County Percentage Change Overall County		iter)		-24.77%			es per Year (Site, A (Site, Before/Afte		-22.07%
Projected Average Crashes per Yea		Countywide Background (Site	. After)	36.36	rereer			y Year (Backgrour	
Percent Change for Site Adjusted f				2.70%	16000	<u> </u>	clushinequency	y real (backgroun	,
Average Crashes per Year (Citywid	e, Befo	re)		153					Countywide
Average Crashes per Year (Citywid		r)		130	11000	1			,
Percentage Change Overall Citywic				-15.03%	_				
Projected Average Crashes per Yea Percent Change for Site Adjusted f			ter)	41.07	6000	1			Countywide
Average Crashes per Year (Trunklir				5460	1000		_		
Average Crashes per Year (Trunklin				3939		2000 2	002 2004 20	06 2008 2010	n
Percentage Change Overall Trunkli				-27.86%	80		2001 20		-
Projected Average Crashes per Yea	r using	Trunklines-Countywide Backg	round (Site, After)	34.87					-Citywide
Percent Change for Site Adjusted f			b	5.79%	60				
Average Crashes per Year (Trunklir				96	40				Trunklines -
Average Crashes per Year (Trunklin				68	20				Citywide
Percentage Change Overall Trunkli Projected Average Crashes per Yea			nd (Site After)	-29.17% 34.24	0				
Percent Change for Site Adjusted f			(once, Arter)	7.10%	20	000 20	002 2004 200	06 2008 2010	
			lethod: Before/Af		ison Gro	up			
Comparison Site Location (County,	Citv)	Shiawassee, Owosso	,	Route/Road Na		•	M-52		
PR/CS No.	.,	551706							
BMP		16.299		Nearest Cross S			Main St.		
EMP		17.759	Г	Nearest Cross S	treet		Laura Ln.		
Descriptive Statistics				Before Period				After Period	
Year			2002	2003		2004	2006	2007	2008
Crash Frequency (Total)			39	43		34	29	33	33
Crash Modification Factor Compu	tation								
Sample Odds Ratio (year 1-2)				0.86	_		Crash F	requency by Year	(Site vs.
Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratios				1.09			1	Comparison Site)	
Standard Error of the Sample Odds	0.98			70					
95% Confidence Interval of the Sar				0.65		1.30	60		
		shes in before period for treat	ment group]	145.00			50	\mathbf{h}	
N-observed, T, B [total observed no	N-observed,T,A [total observed no. of crashes in after period for treatment group]						40	\rightarrow	^
	N-observed,C,B [total observed no. of crashes in before period for comparison group]							<u>×_ <</u>	\rightarrow
N-observed,T,A [total observed no N-observed,C,B [total observed no			rison groun]	95.00			30		
N-observed,T,A [total observed no N-observed,C,B [total observed no N-observed,C,A [total observed no	. of cra								
N-observed,T,A [total observed no N-observed,C,B [total observed no N-observed,C,A [total observed no N-expected,T,A [expected no. of cr	. of cra			118.75			20		
N-observed,T,A [total observed no N-observed,C,B [total observed no N-observed,C,A [total observed no N-expected,T,A [expected no. of cr treatment]	. of cra						10		
N-observed,T,A [total observed no N-observed,C,B [total observed no N-observed,C,A [total observed no N-expected,T,A [expected no. of cr treatment] Variance of N-expected,T,A	. of cra			367.25				1	
N-observed,T,A [total observed no N-observed,C,B [total observed no N-observed,C,A [total observed no N-expected,T,A [expected no. of cr treatment]	. of cra						10	3 2005 2	007 2009
N-observed,T,A [total observed no N-observed,C,B [total observed no N-observed,C,A [total observed no N-expected,T,A [expected no. of cr treatment] Variance of N-expected,T,A Crash Modification Factor (CMF)	. of cra			367.25 0.93			10		

whether they are intersection- or driveway-related and whether they are correctable or affected. Background data for assessing citywide and countywide trends are also shown. Finally, citywide-trunkline and countywide-trunkline trends are also shown. These can be used to "adjust" the basic before-after comparisons for background trends/variation (addressed below).

The **naïve before/after crash analysis** is a simple comparison of the three-year before and after crash frequencies. (Again, note that percentage reductions [in crashes] are discussed here—the percentage reductions in crashes can be converted to CMFs using the formula where the CMF = 1 - [percent reduction].) A percentage change (based on the before period) is also shown. In addition, similar numbers are shown using recoded crashes and then limiting the crash types to those that are presumed to be affected or correctable by the road diet. A graphical comparison of before and after frequencies is also shown (for total crashes, recoded crashes, affected crashes, and correctable crashes). It should be noted that the results shown for site 11 are fairly typical:

- Considerable year-to-year variation in crash frequencies are noted during both the before and after periods.
- In general, the crash frequencies are lower in the after period than during the before period. If there was no background variation, this would suggest that road diets result in significant crash reductions, regardless of which general group of crashes is examined.
- Crash reductions for "correctable" (by a road diet) crashes are the most substantial—a not-unexpected outcome.

The **before/after crash analysis with a simple adjustment for various background trends** is a consideration of the proposition that some of the observed reduction in crash frequencies is not because of the road diet but rather due to other causes (which may not be known). Background trends are shown for the county in which the road diet is located, for the city, and considering trends in only trunkline crashes for both the county and city. The trunkline trends were added since most of the road diets to be analyzed were on trunklines. Various arguments can be made for which background trend "best" represents the overall environment for the road diet. After considering all of the sites, it was decided that the citywide trend is the most reasonable and realistic to use as the indicator of what else is occurring in the background of the implementation of the various road diets. The county level includes many roads that are quite different (in design and use) from those being "dieted" and, in some instances, may even include other larger urban areas. For this reason, the countywide data are not considered as representative as the citywide data. In addition, for some sites (in smaller cities), the trunkline category may primarily consist of the road diet site. Thus, the following analysis is based on using the "city trend" as indicative of the environment in which the road diet is undertaken. In each instance, the adjusted percentage change is also shown. That is, what is the effect of the road diet after considering (subtracting out) the background trend. Again, what is shown for site 11 is fairly typical of other results (see Appendix D for all sites):

- There is some year-to-year variation in background trends (i.e., the trend lines shown are not flat or monotonically increasing or decreasing).
- Notwithstanding year-to-year variations, the overarching background trends are that crash frequencies are decreasing.
- The simple (naïve) before-after trends associated with road diet implementation need to be adjusted for the general downward trend in crash frequency being experienced in the various cities where road diets were implemented.
- A considerable portion of the reduction in crash frequency that would be attributed to the road diet under a naïve scenario is accounted for by the background trend. For example (considering site 11 as shown), the average number of crashes per year is reduced from 48.3 to 37.7 or ~22% for the road diet site; but citywide crashes decreased from 153 to 130 or ~15%. Thus, much of the reduction on the road diet site is presumably attributable to the background trend—the modified crash reduction due to the road diet is reduced to ~7% (which corresponds to an adjusted CMF of 0.93).

The **before/after crash analysis adjusted for trends of an untreated comparison group** (last section in the example shown) is another attempt at controlling crash reduction for background trends. In the narrative here, the term CMF is used. As noted earlier, a CMF is used to estimate the number of crashes expected at a site following the implementation of a countermeasure or treatment. In addition to the naïve before/after analysis and comparison with background crash trends, the CMFs for each of the 24 project sites were computed. FHWA's 'A Guide to Developing Quality Crash Modification Factors' (Gross et al., 2010) provides several methods to compute crash modification factors and functions including before/after with comparison sites, empirical Bayes, and full-Bayes studies. While these (and other) methods differ primarily in statistical approach to modeling the crash data, a fundamental requirement for most methods is the availability of data for a group of "comparison sites" which are very similar to the "treatment sites" in physical and operational aspects.

To conduct a before/after analysis with a comparison group, comparison sites were identified using various characteristics such as length of road diet, area type (residential, commercial, or mixed), driveway and intersection density, number of lanes in the before period (including similar bike/pedestrian facilities), treatment year, and ADT. Given the practical difficulties in achieving ideal pairs of comparison and treatment sites, this exercise resulted in the identification of 17 potential comparison sites for 9 of the 24 treatment sites (multiple comparison sites were identified for six treatment sites). Crash data for comparison sites in the before period were then extracted to ascertain suitable matches with specific treatment sites.

In order to determine the suitability of the treatment-comparison pairs, sample odds ratios were computed using the crash data in the before period. The mean, standard error, and 95[%] confidence intervals of the sample odds ratios were computed to determine if crash frequencies at the comparison site were statistically similar to the treatment site in the before period. This crash data comparison further reduced the number of suitable comparison sites to five to match with the following treatment sites: 1, 3, 8, 11 (shown above), and 13.

For the five treatment sites for which the sample odds ratios resulted in viable comparison sites, the expected number of crashes that would have occurred in the after period

without treatment (N-expected,T,A) was computed. The CMF was then computed based on the observed number of crashes in the after period for treatment sites (N-observed,T,A) N-expected,T,A, and the variance of N-expected,T,A (Gross et al., 2010). The variance, standard error, and 95% confidence interval of the CMF were also computed.

The CMF for site 11 (see above) was computed to be 0.93 with a 95% confidence interval of 0.60-1.26. Since the confidence interval includes the value of 1.0, it cannot be stated with 95% confidence that the true value of the CMF is not 1.0. In other words, the treatment did not have a statistically significant effect in reducing the crashes at this site. By way of comparison, the naïve before/after analysis shows a decrease of ~22%, and comparison with background crashes shows a range from a **~7% reduction** when adjusted for citywide crashes to an **increase of ~7%** when adjusted for citywide trunk line crashes. A graphical illustration of the crash trends for site 11 and the comparison site is also shown.

For site 1 (see Appendix D), the CMF was computed as 0.98 with a 95% confidence interval of 0.62 and 1.35. Again, since the confidence interval contains the value of 1.0, it cannot be stated with 95% confidence that the true value of the CMF is not 1.0. In other words, the treatment did not have a statistically significant effect in reducing the crashes at this site. While the naïve before/after analysis shows a decrease of 15.6%, the uncertainly of the treatment effect is somewhat evident from the comparison with background crashes where the effect of treatment yields a reduction of 6.11% when adjusted for countywide crashes, and shows an increase of 6.07% when adjusted for citywide crashes.

For site 3 (see Appendix D), the CMF was computed to be 0.83 with a 95% confidence interval of 0.58 and 1.07. The results relative to the confidence interval are the same as above. The naïve before/after analysis shows a decrease of 34.03%, and comparison with background crashes shows a wide range from 20.58% reduction when adjusted for countywide crashes, and a reduction of only 2.34% when adjusted for citywide trunk line crashes.

The CMF for site 8 (see Appendix D) was computed to be 0.97 with a 95% confidence interval of 0.61 and 1.33. Again, these results are similar to those noted above. The CMF for site 13 (see Appendix D) was computed to be 0.80 with a 95% confidence interval of 0.48 and

1.12, so the results are similar. Overall, the CMFs computed using the before/after analysis with comparison groups were not found to be significant for any site.

The outcome of the exercise using comparison sites to adjust the percentage of crash reductions and/or the CMFs was somewhat disheartening. While it seems intuitively clear that there is some reduction in crashes due to road diets, the results of the most-detailed analysis indicated that it was not statistically significant. However, that analysis is highly dependent on the comparison sites that were selected. It was impossible to find sites that were an exact match for the road diets studied, notwithstanding some measure of statistical fit. Roadway segments upstream and downstream from the road diets were considered as were parallel routes; all to no avail. Sites in different locations were considered and those chosen were the "best possible," but far from perfect. The dilemma was whether to go forward with developing recommended CMFs which may not be statistically defensible. The decision was to go forward and, to the extent possible, develop CMFs based on citywide trends in crashes during the before and after periods. The caveat regarding the suitability of comparison groups being noted.

ESTIMATION OF CMFs AND DISCUSSION

As noted, the site-by-site results (as discussed above) for all 24 sites are presented in Appendix D. These results were synthesized to get a general result that could be used by MDOT as a guideline for what might be expected to result from a road diet implementation. Further work was also done to examine trends in crash severity.

The tasks below were completed to develop CMFs; the results are shown in the summary spreadsheets in the appendix. An abbreviated version of that spreadsheet (showing CMFs) is shown on the next page (Table 3). These spreadsheets contain the results from the following tasks:

- Site-by-site calculations were done as described above.
- A summary of selected site characteristics was prepared for each site and included:
 - o site number,

Table 3. Abbreviated summary of CMF-related data

ummary	/synthesis	for crash a	nalysis (CN	/IFs)														
								MF correcti	on factors									
site	~ADT	length (miles)	~avg annual crash	# of drivwys	# of intersecs	type	based on county trend		based on trunkline	based on trunkline city trend	basic CMF	basic CMF corrected by city trend	CMF based on recoded crashes	recoded CMF corrected by city trend	CMF for affected crashes	affected CMF corrected by city trend	CMF for corrected crashes	corrected CMF corrected by city trend
1	13442	0.37	34	19	4	com	0.91	0.78	1.07	0.84	0.84	1.06	n/a	n/a	n/a	n/a	n/a	n/a
2	13261	1.44	41	26	17	com	0.98	0.56	0.88	0.47	0.47	0.91	0.47	0.91	0.39	0.83	0.13	0.56
3	10965	4.33	53	100	35	res	0.87	0.73	0.87	0.68	0.66	0.93	0.62	0.90	0.59	0.86	0.30	0.57
4	11062	0.53	3	16	8	com	0.78	0.63	0.83	0.72	0.36	0.72	0.18	0.55	0.22	0.59	1.00	1.37
8	14328	0.81	39	49	7	com	0.81	0.68	0.79	0.66	0.79	1.11	0.79	1.10	0.81	1.12	0.21	0.53
9	17020	0.43	38	16	8	com	0.81	0.60	0.78	0.54	0.46	0.86	0.45	0.86	0.52	0.92	0.33	0.74
11	14572	1.46	43	80	12	mix	0.75	0.85	0.72	0.71	0.78	0.93	0.73	0.88	0.75	0.90	0.21	0.36
13	9016	1.31	25	97	11	mix	0.84	0.64	0.83	0.51	0.61	0.98	0.56	0.92	0.50	0.86	0.15	0.51
16	12342 7137	0.87 0.96	24	58	8	res	0.84	0.84	0.83	0.90	0.49	0.65	0.31	0.47	0.30	0.46	0.27	0.43
18 20	12639	0.96	5	55 34	6 9	res		0.80	0.71	10.43 0.79	0.80	1.00 0.91	0.77	0.97 1.00	0.83	1.04 1.74	0.17 0.40	0.37
20	7663	0.68	6	34 12	3	res com	0.80	0.69	0.75	0.79	0.60	1.05	0.69 n/a	1.00 n/a	1.43 n/a	1.74 n/a	0.40 n/a	0.71 n/a
22	14652	0.22	20	23	9	com	0.93	0.47	0.77	0.41	0.52	0.93	0.75	0.99	0.86	1,10	0.36	0.60
25	6512	0.79	10	38	4	res	0.72	0.70	0.70	0.72	0.59	0.88	0.75	0.35	0.88	1.16	0.80	1.09
26	10855	0.58	4	39	5	res	0.95	0.87	0.97	0.96	0.35	0.57	0.11	0.24	0.22	0.35	0.00	0.13
29	10747	0.49	7	30	4	res	0.78	0.79	0.86	0.83	0.32	0.53	0.40	0.61	0.24	0.44	0.00	0.21
30	7676	0.38	10	25	8	mix	0.76	0.76	0.80	0.90	0.76	1.00	1.50	1.74	0.69	0.93	0.30	0.54
33	7049	0.69	10	19	6	mix	0.81	0.53	0.87	0.67	0.51	0.98	0.59	1.06	0.67	1.13	0.33	0.80
34	7719	0.46	6	22	2	com	0.79	0.67	0.76	0.29	0.64	0.97	0.56	0.89	0.62	0.95	0.20	0.53
36	4995	0.86	5	42	5	mix	0.76	0.72	0.69	0.00	0.52	0.80	0.43	0.70	0.42	0.69	0.13	0.40
37	14164	0.30	10	4	4	com	0.87	0.88	0.81	0.91	0.49	0.61	0.68	0.80	0.50	0.62	0.33	0.46
39	n/a	0.39	19	14	5	res	0.81	0.69	0.91	0.77	0.48	0.79	0.81	1.13	0.92	1.23	0.24	0.55
40	3510	0.50	6	31	7	com	0.65	0.71	0.62	0.68	1.40	1.69	2.00	2.29	0.60	0.89	0.67	0.96
43	13660	0.62	46	27	11	mix	0.97	0.94	0.91	0.78	0.89	0.95	n/a	n/a	n/a	n/a	n/a	n/a
average	10652	1	20	37	8		0.824	0.721	0.821	1.088	0.630	0.91	0.67	0.95	0.62	0.90	0.31	0.59
td dev	3587.02	0.82	16.09	25.54	6.62		0.080	0.115	0.096	2.002	0.225	0.23	0.42	0.42	0.29	0.31	0.25	0.28
nax	17020	4	53	100	35		0.978	0.936	1.073	10.429	1.400	1.69	2.00	2.29	1.43	1.74	1.00	1.37
nin	3510	0	3	4	2		0.648	0.467	0.616	0.000	0.323	0.53	0.11	0.24	0.22	0.35	0.00	0.13
										n	24	24		21		21		21
										95% conf	0.090	0.092		0.182		0.134		0.122
										μ-95%	0.540	0.817		0.765		0.762		0.469
										μ+95%	0.720	1.001		1.128		1.030		0.712

- o crashes,
- length of road diet,
- approximate average annual crash frequency (over all years—used later to divide sites into high and low accident frequencies), and
- type of site (residential, mixed and commercial—used later to divide sites).
- Percentage changes for the county trends, city trends, and trunklines were calculated for each site (as above) and transferred to the summary spreadsheet—these are used as alternative corrections for considering background variation.
- The percentage reductions (or increases) between the before and after period were calculated for all, recoded, affected, and correctable crashes and transferred to the summary sheet.
- Each of the basic reductions was then "adjusted" using the various corrections for city, county, and other trends (the abbreviated summary below shows only the corrections for city trends; the sheet in Appendix D shows all of the corrections).
- Once the above information was all transferred to the summary sheet, averages (and other statistics) were calculated over all sites with usable data. Confidence intervals for the relevant average CMFs were also calculated.
- All of the percent changes were converted to CMFs (a separate worksheet in the appendix which is shown in abbreviated form below).
- The sites were sorted by relatively high and low "before" crash frequencies (>19 crashes/year vs. 10 or fewer crashes/year), type of adjacent land use (residential, mixed residential and commercial, and commercial), number of driveways (>32 and <32), and number of intersections (8 or less, 9 or more).

The important CMFs in Table 3 are those in bold red. These are: the basic (unadjusted) CMF referred to earlier as the "naïve" CMF and based solely on the overall change in crash frequency between the before and after periods; the basic CMF adjusted for the citywide trend; and the CMFs for recoded crashes, affected crashes, and correctable crashes. Similar CMFs were calculated considering different stratifications of the sites (e.g., by high and low frequencies of before crashes). (Details on these variations are not shown in the abbreviated version of the spreadsheet but are provided in Appendix D.)

The 95% confidence intervals for the mean values of the CMFs are also shown in the following spreadsheet. Note that in every instance (save for the "correctable" crashes) the confidence interval for the trend-corrected CMF contains the value of 1.0—therefore, the average CMFs are not statistically different from zero. This result is actually similar to that obtained from the more detailed analysis involving comparison sites discussed in the last section.

The relevant CMFs are further summarized in Table 4 below. The naïve CMF is 0.63 that is, if all of the reduction in crashes was attributed to the implementation of the road diets the "after" crashes would be 63% of the "before" crashes. However, it was argued above that the naïve CMFs needed to be adjusted for the background citywide trend in crash frequency. In all instances (see detailed results), the citywide trend over the seven-year period (3 years before, 1 year for construction, and 3 years after) studied was toward decreasing crashes. Thus, the "uncorrected CMF" is adjusted for that (average) trend with the result that the basic CMF (shown in bold green in the table) is estimated as 0.91. That is to say that after the adjustment for the background trend, the "after" crashes on road diet sites would be 91% of the "before" crashes (only a 9% reduction after adjustment). Looking at the recoded crashes and only affected crashes, it is seen that the CMF varies by only a few points. For the crashes expected to be "corrected" by a road diet, the CMF is 0.59—that is, for those crashes expected to be reduced by road diets the "after" crashes would be only 59% of the "before" crashes.

The basic CMF is the one that is suggested for general estimates for proposed road diet projects. This is with the strong caveat that there is significant variation among sites. For example, the results in Table 3 show that the (citywide-trend-adjusted) CMFs for the 24 sites studied varied from 0.53 to 1.69 although most sites had CMFs less than 1.0. It should be noted that the site with the highest CMF had a low number of crashes so that a large percentage

		CMFs corrected for city trend				
	un-		CMF for	CMF for	CMF for	
	corrected	basic	recoded	affected	corrected	
type of CMF	CMF	CMF	crashes	crashes	crashes	
average over all sites	0.63	0.91	0.95	0.90	0.59	
potential adjust	ments for dif	ferent chara	cteristics			
high crash	0.65	0.92	0.91	0.92	0.54	
low crash	0.61	0.90	0.98	0.88	0.63	
res	0.55	0.78	0.77	0.91	0.51	
mix	0.68	0.94	1.06	0.90	0.52	
com	0.67	0.99	1.05	0.88	0.72	
low driveway density (<32)	0.63	0.93	1.07	0.87	0.66	
high driveway density (>32)	0.63	0.88	0.81	0.92	0.51	
low number of intersections (8 or less)	0.61	0.90	0.95	0.83	0.61	
high number of intersection (9 or more)	0.67	0.93	0.93	1.05	0.55	

Table 4. Comparison of mean values of CMFs

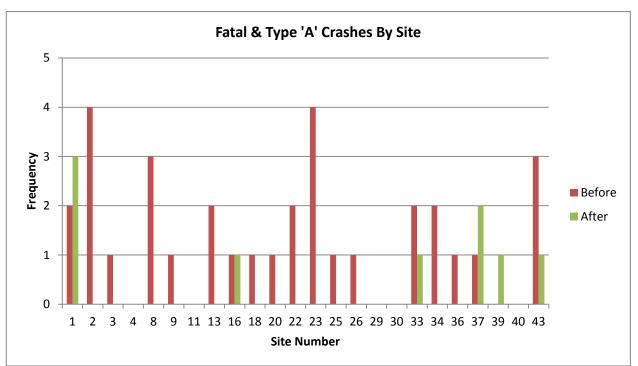
change was relatively easy to achieve. For such reasons, the sites were disaggregated by crash frequency (and other factors) as seen in Table 4—this was to illustrate how the CMF might vary from one grouping to another. For example, the basic (adjusted) CMF is seen to be 0.92 for "high" crash sites and 0.90 for "low" frequency sites. Looking at the "basic CMF" column, it is noted that most of the groupings don't make much difference—with only a couple of points of difference from one grouping to another. The most notable exception is the grouping by type of adjacent land use. The results here suggest that the CMF for "residential" sites might result in more crash savings (CMF = 0.78) than for commercial or mixed-use sites (CMFs = 0.99 and 0.94, respectively). The way the "potential adjustments" should be interpreted is, for example: while the overarching CMF for all sites is expected to be around 0.91, a residential site might result in a lower CMF than would be achieved at a mixed-use or primarily commercial site.

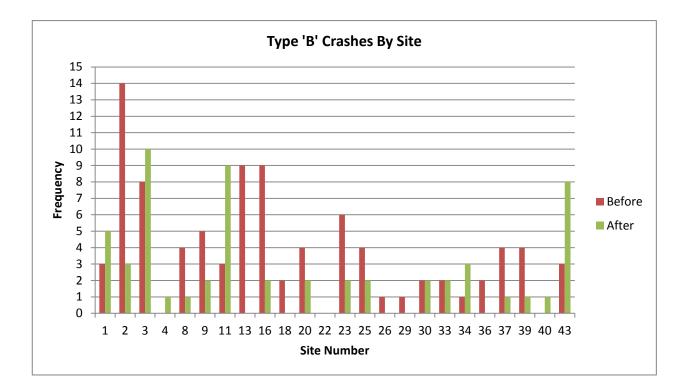
The exception to the above is the collection of those crash types that are expected to be "corrected" by a road diet. The overall CMF is estimated at 0.59 and (as shown in the detailed results) is statistically different from zero. So, while there is more confidence in this result, it should be noted that there are some offsetting changes in the frequencies of other crash types.

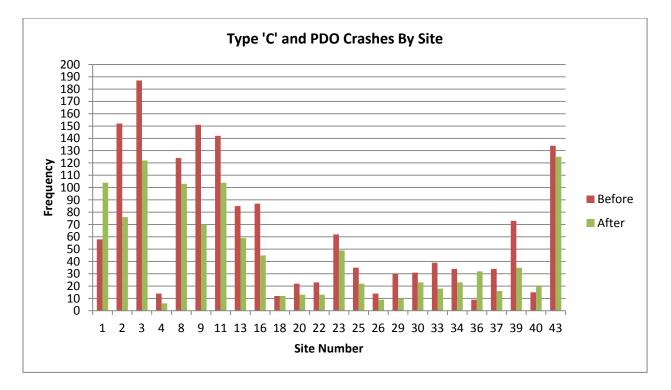
So, used only for selected crash types, this CMF has utility but it is not necessarily good for estimating overall changes.

CRASH SEVERITY

Changes in crash severity might also be expected as a result of the implementation of road diets. Changes in severity must be handled with care as there are many factors in play—e.g., changes in speed limits and/or operating speeds can shift severity distributions regardless of whether road diets are being implemented. The overarching trends in Michigan are that the total number of crashes and all types of severity are decreasing over time (from 1996 through 2010) although not without some year-to-year fluctuation. The three graphs below show the before and after frequency of three severity classifications (fatal + A crashes, B crashes, and C +







PDO crashes) by site. As can be seen, and has been repeatedly noted, there is considerable variation by site although the trend is for an overall reduction (which was noted earlier for all

crashes over all sites). Perhaps the best indication for severity effects is the shift in the distribution of severity for the sites studied. This overall trend (all sites combined) is shown in Table 5.

Table J. Shint in clash sevenity for an sites							
crash type	before	after					
fatal + A	33 (2%)	9 (1%)					
В	91 (5.4%)	57 (4.9%)					
C + PDO	1567 (92.7%)	1109 (94.4%)					

Table 5. Shift in crash severity for all sites

It would appear that there is a slight trend toward less severe crashes on the road diet sites. For rough comparison purposes, an examination of overall statewide trends in severity (using the same severity groupings as for Table 5) is shown below from 2001 to 2010.

Table 0. Shift in statewide clash seventy between 2001 and 2010							
crash type	2001	2004	2007	2010			
fatal + A	2.4%	2.4%	2.3%	2.0%			
В	5.2%	4.8%	4.7%	4.8%			
C + PDO	92.4%	92.8%	93.1%	93.2%			

 Table 6. Shift in statewide crash severity between 2001 and 2010

One issue in comparing the severity shift for the sites is that the actual time periods for the before and after windows varies by site (for example, before-after for site 1 compares 1997-1999 with 2001-2003 while the before-after for site 2 compares 2004-2006 with 2008-2010). That notwithstanding, there are distributional shifts in overall statewide severity over the 10-year period of: a 0.4 percentage point decrease in fatal+A crashes, a 0.4 percentage point decrease in B crashes, and a 0.8 percentage point increase in C+PDO crashes. This compares to a 1 point decrease in fatal+A, a 0.5 point decrease in B, and a 1.7 point increase in C+PDO for the road diet sites. This suggests that the road diet shifts are slightly larger and more positive (from a safety perspective) than overall statewide trends would suggest over the last 10 years or so. Such small differences do not seem operationally significant and could easily be attributable to things like changes in operating speeds, changes in enforcement, or just random variation.

SUMMARY AND DISCUSSION

The development of a crash modification factor (or factors) for road diets in Michigan was the primary objective of this study. In all, 24 separate sites were studied with this goal in mind. Overall changes in crash experience before and after the implementation of the 4-to-3 lane road diets were evaluated and then controlled for background variation. The latter was done through examining citywide and countywide trends (trends on trunklines were also examined) and through consideration of comparison sites (i.e., untreated "control" sites). Changes in crash severity were also examined. The following is a summary of the results of those analyses.

- There is considerable site-to-site variation in the crash-related results although in almost all instances, there was a reduction in the number of crashes.
- Examination of the background (e.g., citywide, countywide) trends showed that in all cases there was a trend toward lower crash frequencies over time. This is a clear indication that before-to-after comparisons of road diet implementations (or any other change to the road system infrastructure) must be evaluated with explicit control for the background trends.
- Several approaches for controlling for background variation were pursued. The most appropriate were deemed to be a simple control for citywide trends and the consideration of comparison sites.
- Good/acceptable comparison sites could be identified for only a few of the 24 sites and none of the eventual comparisons gave statistically significant results—that is, the calculated CMFs for specific sites were not statistically different from 1.0.
- Average CMFs, adjusted for citywide trends, were calculated across all 24 sites. The
 result was that the overall naïve (unadjusted) CMF was estimated as 0.63 and 0.91 after
 adjustment. Considering only those crash types expected to be affected by the road
 diet (not necessarily only reduced), the CMF was 0.90. And, finally, considering only
 those crash types expected to be reduced by a road diet, the adjusted CMF was 0.59.

Use of the latter is problematic since there are typically offsetting changes in crash type frequencies. Only the CMF for the "correctable" crashes was statistically different from 1.0.

- While the best estimate of a usable CMF is 0.91, it should be noted that this is not statistically different from 1.0 and is an average across all sites. Perhaps more importantly, there is a great deal of variation from site to site.
- Considering effects of other variables on the overall CMF, it was seen that there was not much change due to high vs. low overall crash frequency sites, nor was there much difference due to driveway or intersection density. However, sites where the land use adjacent to the road diet was primarily residential tended to have a lower CMF than mixed-use or commercial sites.
- Changes in crash severity due to road diets were also examined. The question was whether the distribution of severity changed—i.e., do crashes tend to be more or less severe after road diets are put in place. Again, it was noted that there was considerable variation from site to site (and often the numbers of crashes, especially the more serious, were quite small). The distributional shift over all sites was estimated and compared to statewide shifts over the general analysis period. The finding was that although there was a slightly more substantial shift to less severe crashes for the road diet sites, it did not seem operationally significant. Moreover, the shift could have easily been due to changes in operating speeds, enforcement, or simply random variation rather than the road diets themselves.

IMPLEMENTATION OF ROAD DIETS

One of the issues with road diets (and, really, any street or road improvement) is how and when to engage the public if the action is being initiated by MDOT or other agency. Road diets in Michigan are typically perceived as a safety improvement although there may also be upkeep and maintenance savings as well. A more-detailed implementation guide is presented in Appendix E but summary comments are presented below.

Historically, traffic engineers (and the public agencies they work for) have been perceived as being primarily concerned with expanding or at least maintaining street and road capacity and enhancing traffic flow. However, over the last decade or so, there has been increasing interest in how streets and roads "fit" into the adjacent environment—conversations about complete streets, traffic calming, green design, accommodating pedestrians and bicyclists, and so forth have become much more common. The road diet concept has gained considerable traction with various agencies, and road diets are often proposed by traffic engineers as being better for non-motorized users and having safety benefits. Ironically, some communities resist proposals for road diets because they can reduce capacity in some situations. Regardless of why a road diet is being proposed (e.g., a single stand-alone project, part of a pedestrian/bicyclist plan, part of a complete streets program), there needs to be engagement of the local community if the project is to be smoothly implemented.

ROAD DIET IMPLEMENTATION

Road diets have been implemented in many states including California, Washington, Iowa, Minnesota, Florida, and, of course, Michigan. For the purpose of developing an implementation guide, studies that present information on the process of implementing a road diet were further reviewed. These studies included advantages and disadvantages of a road diet, motivating factors for conversion, and lessons learned following the project (e.g., Gallagher 2007).

The apprehension regarding (or overt dislike of) road diets stems from the counterintuitiveness of reducing the capacity of the roadway while maintaining an acceptable level of service. To challenge the general thinking, many agencies implementing road diets have experienced success by utilizing techniques that both educate and involve the community.

An implementation guide encompasses all aspects of the project in a beginning-to-end fashion. Continuous community involvement should be maintained through each phase of the road diet conversion. There are three basic phases: pre-construction (phase I), construction (phase II), and post-construction (phase III) with the following objectives for each phase:

- phase I—community education and acceptance for the road diet project;
- phase II (which can be very short if the project is primarily re-striping)—mitigate any negative effects associated with construction and roadway operations; and
- phase III—demonstrate how the road diet fulfilled community objectives while highlighting the benefits of the new corridor.

Success of a road diet project can be measured on several levels, however, when a road diet fulfills the needs of a community while maintaining the necessary function of the corridor, success is generally recognized.

In **phase I**, **community education and acceptance**, it is essential to promote community involvement and a sense of ownership from the outset. Many agencies implementing road diets have involved the public through town hall meetings, workshops, and newspaper postings which detail the road diet project specifically (Gallagher 2007). Others have found success by implementing road diet projects through city master plans or other citywide initiatives such as Complete Streets or a community bicycle plan. For example, Michigan's Genesee County Metropolitan Alliance adopted a "Complete Streets" approach where "Transportation improvements in Genesee County are planned, designed and constructed to encourage walking, bicycling, and transit use while promoting safety for all users" (GCMPC undated). Another example includes the "pedscape plan" adopted in Charlotte, North Carolina (Sak 2007). These techniques provide an accepting atmosphere because residents are more receptive to change and look forward to "reinventing" their community with a broader scope. Additionally, this couples the road diet with other actions which may, for example, have as a goal restoring an out-dated downtown setting. The intent of public meetings during this phase should be to:

- gain an understanding of the needs of a community by generating a list of transportation, economic, and safety objectives;
- develop a broad plan (e.g., a master plan, complete streets program) which considers community objectives and provides a list of projects which fulfill these objectives and provides a context for the road diet;
- provide several alternatives to road diets and explain how different alternatives succeed or fail to meet the goals of corridor and the community;
- demonstrate how a road diet will affect all modes of transportation by providing equal access to motorists, cyclists, and walkers while maintaining safety; and
- perhaps most importantly, provide an unbiased assessment of both the advantages and disadvantages of road diets—overstating the benefits of a road diet sets the project up for failure in the public eye.

With reference to the last point, the operational and safety effects of road diets in Michigan presented earlier in this report provide realistic and relevant information that can be used in "phase I" activities. It is important to not oversell the effects of road diets and to point out the high degree of variance in the safety outcomes that are associated with them.

To maintain community involvement from beginning to end, many engineers/planners involved with road diet projects have utilized public forums such as blogs or social networking sites (e.g., Kazis 2011). This sort of public forum allows citizens to voice concerns, opinions, or support concerning the process of the design and implementation. In turn, this gives the agency an opportunity to answer questions which generally alleviate concerns voiced by community members. Such sites can also provide a central hub for pertinent information regarding street closures, detours, and project progress. Use of the electronic media is much better than relying solely on just one or two "standard" public hearings or meetings in that the new media allow for a dynamic process. During **phase II**, **implementation/construction**, public concern, which can arise during the planning phase, can be heightened when construction begins. The degree of discontent will largely be based on the extent of the project. If a road diet is implemented simply by pavement marking re-striping, negative response will be minimal. If the project requires reconstruction, causing travel/commuting to become difficult, additional measures will be necessary to alleviate any concerns. Regardless of the size of the project, any precautions that will lessen the stress associated with the road diet should be taken. Based on past experiences, the following techniques have been used to maintain a positive attitude throughout the community during the construction phase:

- reduce the impact of constructing the road diet on the community by shortening the construction timeline as possible (Sak 2007);
- provide proper detours to maintain access and mobility through the area;
- if logical/possible, consider public transportation options through the corridor;
- select a design which uses the existing curb line;
- change traffic signal timing before construction to allow motorists to become acquainted with the new cycle lengths (Sak 2007);
- implement the road diet in concert with other projects (e.g., installing new utilities); and
- again, use a blog or website to keep users up-to-date on the progress of the project while relaying important detour and closure information.

An often overlooked part of a road diet project is **phase III**, **project follow-up** to analyze, for example, the post-implementation operational characteristics to understand if the project was successful. This assessment will be important to members of the community who will want to understand if the project met the intended objectives. Similarly, other agencies will be interested if this type of roadway conversion could be successful in their own communities. Success of a road diet should be based on the totality of the project and not just, for example, on motorist delay.

A follow-up evaluation of a road diet plays an important role in the success of the project. By assessing the characteristics of the updated roadway and presenting findings to

community members, a sense of satisfaction and accomplishment can be instilled in the community. Finally, information collected from a converted site can be of use to other agencies considering a similar roadway conversion.

TYPICAL QUESTIONS AND INFORMATION NEEDS REGARDING ROAD DIETS

It is instructive to present a list of typical questions that have come up (Sak 2007) or issues that have been identified (City of Orlando 2002) in various venues regarding road diets. Thinking about these questions/topics in the context of a specific proposal may help frame the content for future presentations.

Some questions (Sak 2007):

- Where does the additional traffic go when the capacity is reduced by half?
- When some communities are widening roadways, why are we narrowing ours?
- How will bus stops be accommodated with a road diet?
- How will emergency response units be affected?
- What if it doesn't work?

Some typical measures of effectiveness (MOEs) that might be developed for a project (City of Orlando 2002):

- increased traffic on neighboring streets
- speeding
- pedestrian and bicyclist volumes
- vehicle (and/or pedestrian/vehicle) crashes
- on-street parking use rates
- resident and merchant pedestrian satisfaction
- parking satisfaction

Actions to address overarching concerns:

 Conduct a thorough analysis of the corridor and make certain a road diet is suitable alternative for the roadway.

- Avoid implementing a road diet without community involvement.
- Develop a plan that not only encompasses the road diet project but the community as a whole such as complete streets or a new bicycle/pedestrian initiative.
- Avoid overstating the benefits of a road diet
- Publish road diet success stories in local newspapers or blogs.
- Use blogs or social networking sites to provide as much information as possible to community members while providing a forum to express any concerns.
- Provide opportunity for additional beautification elements such as stamped concrete, brick accents, planter boxes, curb out-crops, and added landscaping.

SUMMARY AND DISCUSSION

A three-phase process associated with planning, constructing/implementing, and followup on road diet projects was presented. The major points to be emphasized during execution of that process are:

- Road diets should not be "oversold" with respect to expected benefits, especially safety benefits. The estimated CMF (last section) is relatively modest and is an average of many sites—this suggests that "guaranteeing" crash savings of a certain magnitude would misrepresent what will be experienced in any specific situation. Actual benefits could be significantly higher or lower.
- Both the pros and cons associated with road diets need to be presented and thoughtfully discussed with the community.
- Use of social media to discuss (and resolve) road diet proposals can be successful as an adjunct to traditional public hearings and other traditional community-involvement techniques.

SUMMARY AND CONCLUSIONS

The summary and conclusions from this study of selected road diet conversions in Michigan include the following points.

From the literature and state of practice reviews-

- As a general statement, crash reductions are experienced with most installations and are most typically reported as percentage changes (CMFs would be < 1.0). There is, however, significant variation in the magnitude of the reduction.
- While there appears to be significant "natural variation" in crash reduction percentage (and CMFs), variation is also introduced because of the variance in the before/after geometry and operating conditions at road diet sites.
- Most studies did not result in the estimate of CMFs per se. The most reliable estimates of CMFs are generally thought to be found on the FHWA-funded website "crash modification factors clearinghouse" maintained by the University of North Carolina Highway Safety Research Center [http://www.cmfclearinghouse.org/]. From that source, road diets are estimated to result in the following CMFs for unspecified roadway types in urban areas: all crash types/all severity levels = 0.63; all crash types/all injury crashes = 1.0; all crash types/PDOs-only = 0.54; angle crashes/all severity levels = 0.63-0.76; and rear-end crashes/all severity levels = 0.59.
- Many, if not most, studies did not control for background variation in crash trends. In virtually all areas, the general decrease in crashes at road diet locations must be adjusted for overall changes in crashes in the surrounding areas during the study period. Otherwise, too much of the reduction in crashes may be attributed to the road diet.

From the on-site assessment of pedestrian and bicyclist use of road diets-

 Provisions for pedestrian and bicyclist are most important when there are existing pedestrian/bicyclist generators on the site and/or when the road diet is part of a larger plan for an area.

- If pedestrian/bicyclist provisions are included in the road diet area, they need to be clearly and consistently (i.e., always) marked.
- While there appears to be a need for additional information/education regarding appropriate use of the road and pedestrian/bicyclist facilities at road diet sites, supplemental signs indicating crosswalks and bike lanes should be considered for routine inclusion at road diet sites.

From the operational analysis of several Michigan road diet sites-

- The operational analysis of the several sites provide reasonably consistent results and support a guideline that suggests that 4-to3-lane road diet conversions result in significant increases in delay for ADTs over 10,000.
- More importantly, 4-to-3-lane road diet conversions increase delay when peak hour volumes of exceed 1,000.
- However, it is clear that "local" conditions (e.g., varying geometry, significant variation in turning movements, and variations in cross-street traffic) can have a significant impact on the viability of any proposed road diet. Thus, while an initial culling of potential road diet sites can be accomplished using the general guidelines above, in all instances a detailed operational analysis of the corridor (including operations at each intersection) for both 4- and 3-lane sections should be undertaken before the road diet conversion is implemented.

From the safety analysis of selected 4-to-3 lane road diets in Michigan-

- There is considerable site-to-site variation in the crash-related results although in almost all instances, there was a reduction in the number of crashes.
- Examination of the background (e.g., citywide, countywide) trends showed that in all cases there was a trend toward lower crash frequencies over time.
- The most appropriate methods for controlling for background trends were a simple control for citywide trends and the consideration of comparison sites.

- Good/acceptable comparison sites could be identified for only a few of the 24 sites and none of the eventual comparisons gave statistically significant results—that is, the calculated CMFs for specific sites were not statistically different from 1.0.
- Average CMFs, adjusted for citywide trends, were calculated across all 24 sites. The result was that the overall naïve (unadjusted) CMF was estimated as 0.63, and 0.91 after adjustment. Considering only those crash types expected to be affected by the road diet (not necessarily only reduced), the CMF was 0.90. And, finally, considering only those crash types expected to be reduced by a road diet, the adjusted CMF was 0.59. Use of the latter is problematic since there are typically offsetting changes in crash type frequencies. Only the CMF for the "correctable" crashes was statistically different from 1.0.
- While **the best estimate of a usable CMF is 0.91**, it should be noted that this is not statistically different from 1.0 and is an average across all sites. Perhaps more importantly, there is a great deal of variation from site to site.
- Considering effects of other variables on the overall CMF, it was seen that there was not much change due to controlling for other variables except for adjacent land use residential sites tended to have a lower CMF than mixed-use or commercial sites.
- Changes in crash severity due to road diets were examined and the distributional shift over all sites was estimated (and then compared to statewide changes). The finding was that although there was a slightly more substantial shift to less severe crashes for the road diet sites, it did not seem operationally significant. Moreover, the shift could have easily been due to changes in operating speeds or enforcement rather than the road diets themselves.

From the implementation of road diets-

• Road diets should not be "oversold" with respect to expected benefits, especially safety benefits. Actual benefits of a road diet can vary significantly by site.

- Both the pros and cons associated with road diets need to be presented and thoughtfully discussed with the community.
- Use of social media to discuss (and resolve) road diet proposals can be successful as an adjunct to traditional public hearings and other traditional community-involvement techniques.

Road diets are a useful tool in the traffic engineer's arsenal of making streets and roads a more integral part of the community. As a part of broader plans, they open up "traditional" roads to greater use by pedestrians and, especially, bicyclists. In general, safety benefits can be expected but vary greatly from site to site. When corrected for citywide trends, the results here indicate that only a relatively modest CMF (0.91) is appropriate. This indicates that crash/safety benefits are likely to be considerably less than what is suggested by naïve comparison of before and after crash statistics. Similarly, the results reported here also suggest that operational analyses (e.g., using Synchro) should always be performed early on in the consideration of a road diet proposal. Moreover, the commonly-quoted threshold ADT of 20,000 for consideration of a road diet should be lower (10,000) and, more importantly, realistic peak-hour analyses (based on actual counts) are much more useful. For the sites evaluated here, the peak-hour threshold volume is estimated as 1,000 vph although this could vary with varying volumes of cross traffic at intersections.

RECOMMENDATIONS FOR IMPLEMENTATION OF RESEARCH FINDINGS

The recommendations for implementation of the research findings are presented below as "action items" for MDOT and based on the discussion in each section of the report.

- The results of the literature review and the article-by-article review in Appendix A should be made available to MDOT and local-agency engineers and planners who are interested in and/or dealing with road diet projects.
- When pedestrian/bicyclist provisions are included in a road diet, they need to be clearly and consistently (i.e., always) marked.
- MDOT should share the following quantitative, operations-related findings of this research with the FHWA and suggest changes to the appropriate section of the Michigan Operations Manual which is addressed to "4-to-3 Lane Conversions."
 - \circ The ADT threshold for considering such road diets should be changed to ≤10,000.
 - More importantly, detailed operational analysis should be done when ADTs are
 10,000 or more **OR** when peak hour volumes exceed 1,000.
 - Finally, because of the variation in intersection geometry, turning volumes, and signal timing from site to site, detailed operations analysis **always** be done.
- Results of the safety analysis and development of crash modification factors (CMFs) related to 4-to-3 lane road diets should also be shared with the FHWA (as above).
 - When studies of the effects (or effectiveness) of road diets are done, there must always be control for background trends with citywide trends generally being the most appropriate to consider.
 - The overall naïve (unadjusted) estimated CMF is 0.63 and 0.91 after adjusting for citywide trends. Considering only those crash types expected to be affected by the road diet (not necessarily only reduced), the estimated CMF is 0.90. If only those crash types expected to be reduced by a road diet are considered, the adjusted CMF is 0.59. Use of the latter is problematic since there are typically offsetting changes in crash type frequencies. Only the CMF for the "correctable" crashes was statistically different from 1.0.

- Operations- and safety-related results should be incorporated into any presentation material developed by MDOT and local agencies regarding the planning and implementation of road diets.
- Road diets should not be "oversold" with respect to expected benefits, especially safety benefits. Actual benefits of a road diet can vary significantly by site.
- Both the pros and cons associated with road diets need to be presented and thoughtfully discussed with the community.
- Use of social media to discuss (and resolve) road diet proposals can be successful as an adjunct to traditional public hearings and other traditional community-involvement techniques.

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APPENDIX A

DETAILED LITERATURE REVIEW (by project/study)

This literature review is ordered on a study-by-study basis with the important aspects of each study summarized in turn. There are two sections: those studies pertaining to both the safety and operational characteristics of road diets and those pertaining primarily to the operational characteristics. The listing below shows the order of the studies for easy reference if it is desired to review a specific study. All page numbers shown below refer to this appendix.

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SAFETY AND OPERATIONAL CHARACTERISTICS OF ROAD DIETS

The Conversion of Four Lane Undivided Urban Roadways to Three Lane Facilities

June 1999 Thomas M. Welch, P.E. Office of Transportation Safety, Iowa DOT http://contextsensitivesolutions.org/content/reading/conversion-of-fourlane/resources/conversion-of-four-lane/

The intent of this report, prepared for the TRB/ITE Urban Street Symposium 1999, is to present the state of the practice of "road diets". The report illustrates the results of expanding two-lane roadways to 4-lanes in a simple before-and-after analysis. Table 1 explains these implications.

Table 1	: Results	from converting	g a 4-lane i	roadway t	o a 3-lar	ie roadway

Corridor Element	Change
Traffic Volume	Increased 4 percent
Corridor Travel Delay	Increased 4 percent
Mid-block 85 th % Speed	Increased 2.5 mph
Traffic Traveling More than 5 mph Over Speed Limit	Increased from 0.5 percent to 4.2 percent
Accident Rate	Increased 14 percent
Injury Rate	Increased 88 percent
Total Value Loss	Increased 280 percent

The author discusses several "road diet" experiments that have taken place throughout the U.S.

- 17th St. West, Billings, Montana (1979) with ADT of 9,200 10,000 and speed limit of 35 mph had a decrease in accidents from 37 in the 20 months prior to treatment to 14 in the 20 months following treatment.
- US-71 (Flindt Dr.), Storm Lake, Iowa with ADT of 8,500 where a "very positive community reactions" was received.
- Clay Street, Muscatine, Iowa where "an immediate large reduction in accidents" was reported.
- US-12, Helena, Montana with ADT of 18,000 in a commercial area with numerous commercial access points resulted in the "number of accidents decreased, good traffic flow was maintained, and community residents prefer the three-lane facility over the former four-lane roadway".
- 21st ave. East, Duluth, Minnesota with ADT of 17,000 is another example discussed.

Advantages and disadvantages of "road diet" treatments are identified. Advantages include reduced crash rates, reduced speeds, pedestrian safety, traffic calming effects, and improved emergency response time. Reduced crash rates result from the improved sight distance of the design and reduced number of lanes for cross-traffic to navigate. Crash statistics on Minnesota Trunk Highway 49 (Rice St), Minnesota with an ADT of 16,400 are summarized in Table 2. Pedestrian safety is discussed with respect to using the TWLTL as a pedestrian refuge. The inability of aggressive drivers to change lanes several times within a corridor resulted in a decrease in 85th percentile speed where the flow speed is set by the lead drivers.

MTH-49 (Rice Street), Hoyt Avenue to Demont Avenue Ramsey County, MN							
Collision Type	Number of	Collisions	Percent				
	Before	After	Change				
Rear End	68	39	-43				
Sideswipe Passing	16	10	-38				
Left Turn	23	20	-13				
Right Angle	36	31	-14				
Right Turn	2	2	0				
Head On	5	0	-100				
Sideswipe Opposing	2	1	-50				
Off Road Left	1	2	+100				
Off Road Right	4	1	-75				
Other	5	8	+120				
Total	162	117	-28				

Table 2: Comparison of frequency of crash type for before and after road diet treatment

Additional "road diet" examples as well as collision reduction are presented in Table 3 for sites in Seattle, Washington.

Table 3: Comparison of frequency of crash type for before and after road diet treatment

Data on Street Conversions - Seattle, Washington							
ROADWAY SECTION	DATE CHANGE	ADT (BEFORE)	ADT (AFTER)	CHANGE	COLLISION REDUCTION		
Greenwood Ave. N, from N 80 th St. to N 50 th St.	April 1995	11872	12427	4 lanes to 2 lanes plus TWLTL plus bike lanes	24 to 10 58%		
N 45 th Street in Wallingford Area	December 1972	19421	20274	4 lanes to 2 lanes plus TWLTL	45 to 23 49%		
8 th Ave. NW in Ballard Area	January 1994	10549	11858	4 lanes to 2 lanes plus planted median with turn pockets as needed	18 to 7 61%		
Martin Luther King Jr. Way, north of I- 90	January 1994	12336	13161	4 lanes to 2 lanes plus TWLTL plus bike lanes	15 to 6		
Dexter Ave. N, East side of Queen Anne Area	June 1991	13606	14949	4 lanes to 2 lanes plus TWLTL plus bike lanes	19 to 16 59%		
24 th Ave. NW, from NW 85 th St. to NW 65 th St.	October 1995	9727	9754	4 lanes to 2 lanes plus TWLTL	14 to 10 28%		
Madison St., from 7 th Ave. to Broadway	July 1994	16969	18075	4 lanes to 2 lanes plus TWLTL	28 to 28		
W Government Way/Gilman Ave. W, from W Ruffner St. to 31 st . Ave. W	June 1991	12916	14286	4 lanes to 2 lanes plus TWLTL plus bike lanes	6 to 6		
12 th Ave., from Yesler Way to John St.	March 1995	11751	12557	4 lanes to 2 lanes plus TWLTL plus bike lanes	16 to 16		
				Total	185 to 122 34%		

Disadvantages include increased travel delay, increased delay at driveways, and loss of passing opportunities. The author presents corridor LOS analyses as an example, where a section of an lowa roadway is analyzed with 4-Lane and 3-Lane TWLTL cross-sections. Results from this analysis conclude that delay increases, however LOS is maintained when converting from a 4-lane roadway to a 3-lane roadway.

Guidelines for the Conversion of Urban Four-Lane Undivided Roadways to Three-Lane Two-Way Left-Turn Lane Facilities

April 2001 Keith K. Knapp – Iowa State University Center for Transportation Research Education (CTRE) Iowa Department of Transportation http://www.intrans.iastate.edu/reports/4to3lane.pdf

This report presents a comprehensive summary of Road Diets by presenting past research, case studies, and a simulated analysis of four-lane to three-lane conversions. Additionally, the report presents feasibility determination factors to be used when assessing the alternatives to convert a four-lane site as well as providing concluding recommendations.

Past research includes a study on the effectiveness of implementing TWLTLs while converting from four-lanes to three-lanes (Nemeth, 1978). The study concluded that the reduction in through lanes increased delay however access was improved. Further, traffic congestion was increased significantly to a point where drivers used the TWLTL as a passing lane. Walton et al. conducted a study to determine the limiting ADT at which a Road Diet should be implemented. ADT in the range of 5,000 – 12,000 were suggested based on the results of the study. Hummer and Lewis conducted a study to compare the safety of two-lane undivided, three-lane, and four-lane undivided roadways. Results indicated that three-lane roadways had lower crash rates in medium and high-density residential and commercial land use areas.

Case studies included two from Montana, two from Minnesota, five from California, one from Washington, and six from Iowa. Limited data was presented for these case studies, however, the sites with the most complete data are presented in the summary table. Specifically, the sites in Iowa were considered in greater depth, including statistics on level-of-service, vehicle speeds, delay, crashes, and public opinion surveys.

The presented traffic flow simulation is thorough including a simulation software comparison, sensitivity analysis factors (e.g. total entering volume, access point density, and access point left-turn volume), and methods of simulation. The resulting data included before-and-after travel speeds, LOS, and crash frequencies.

Feasibility determination factors were presented with thorough descriptions including:

- Roadway Function and Environment
- Overall Traffic Volume and Level of Service
- Turn Volumes and Patterns
- Frequent-Stop and/or Slow-Moving Vehicles
- Weaving, Speed, and Queues

- Crash Types and Patterns
- Pedestrian and Bike Activity
- Right-of-Way Availability, Cost, and Acquisition Impacts
- General Characteristics: Parallel Roadways, Offset Minor Street Intersections, Parallel Parking, Corner Radii, and At-Grade Railroad Crossings

Final recommendations include:

- Choosing alternatives on a case-by-case basis
- Roadways with bi-directional peak-hour volumes less than 1,500 vph (15,000 ADT) should be considered and less than 1,750 vpd should be considered with caution
- Roadways currently operating as a "defacto" three-lane roadway should be considered

Methods:

- Simple Before and After comparison.
- CORSIM was used to analyze the LOS provided by four-lane undivided and three-lane TWLTL roadways.
- Fixed characteristics of the roadway included:
 - The roadway segment was 1/4-mile long.
 - Through traffic volumes were equally distributed in each direction along the major roadway segment (i.e., there was a 50/50 directional split).
 - Pretimed two-phase signalized intersections exist at each end of the roadway segment.
 - The timing of the two-phase signals was optimized using the SYNCHRO software approach (e.g., delay minimization) and assuming they comprised a two-signal system.
 - No left- or right-turn lanes exist along the four-lane undivided roadway.
 - No right-turn lanes exist along the three-lane roadway.
 - Right- and left-turn volumes each represent 10 percent of the through volume at each signalized intersection.
 - Right-turn volumes entering/exiting the number of access points used in an individual simulation represented 10 percent of the traffic flow.
 - The turn volumes entering/exiting each access point and minor street are equal.
 - There were no through volumes at the four-leg access points (see Figure 3), and the minor street approach volumes at the signalized intersections were assumed to be equal to 40 percent of the major roadway traffic flow at the intersection.
 - A 30 mph travel speed was assumed for both cross sections.
 - Only four-leg intersections occur between the major roadway and the access points and minor streets.
 - All minor street and access point approaches have a single lane.
- Each cross section was simulated with various combinations of total entering volume, access point left-turn volumes, and access point densities.

Evaluation of Lane Reduction "Road Diet" Measures on Crashes and Injuries

2002 H.F. Huang, C.V. Zegeer, J.R. Stewart Viewed in hardcopy print

The intent of this study was to investigate the effects of road diets on crashes and injuries by investigating 23 road diet sites in California and Washington. A four-group study design was utilized by identifying road diet and comparison sites and compiling data for before and after implementation of each road diet. Comparison sites were selected to be similar in terms of roadway functional class, type of development, speed limit, intersection spacing, and access control. For data purposes, a three-month transition period was defined as the month before installation, month of installation, and month following installation. Crashes occurring during this transition period were discarded from the study. Due to limited sample size, several road diet sites were removed from the analysis of determining change in crashes per month. Of the 25 road diet sites, 8 sites were suitable to be incorporated in the analysis.

Following the traditional before and after analysis the following was concluded:

- A 2% 42% reduction in crashes took place.
- Crash type remained the same between road diet and comparison sites.
- Road diets accounted for a reduction in crash severity.

The study presents a literature review of additional road diet examples in California, Iowa, Michigan, Minnesota, Montana, Canada, Pennsylvania, and Washington. This study seems to be a precursor to the previous Huang et al. study.

- Crash variables of interest include date, location (intersection/midblock), crash type, injuries, fatalities, time, number of vehicles, and various conditions.
- A 3-month transition period was considered where no data was used.
- The amount of data for before and after periods varied considerably.
- Intersections at each end of the road diet were considered transition areas and were not considered in the analysis.
- Crashes per month were normalized so as to compare reductions of sites having different lengths.

Urban Minor Arterial Four-Lane Undivided to Three-Lane Conversion Feasibility: An Update July 2003

K. K. Knapp, K. L. Giese, W. Lee

http://docs.google.com/viewer?a=v&q=cache:LiReHQ4b4kgJ:www.urbanstreet.info/2nd_sym_ proceedings/Volume%25202/Knapp.pdf+The+Safety+and+Operational+Effects+of+%22Road+Di et%22+Conversions+in+Minnesota&hl=en&gl=us&pid=bl&srcid=ADGEESg4RotFMBPdrpg8QoV4 G2RdrIk7KEG9I_8tzKlVnyFm7EZ4lJPSQg1dbE0InTr2E4HmZxuYPmkGDQY50_YhG_dogKgtVZjyQq V1jee01iJK-B9Rp-n2N86lurKDWb57Q2swmNT7&sig=AHIEtbRIeQGF3t5WCBSelZ6x-iNG0Yqssw

The intent of this paper is to provide information to the 2nd Urban Street Symposium in Anaheim, California in 2003. The paper summarizes research, guidelines, previous case study results and an analysis using CORSIM software to investigate traffic flow differences of similar four-lane to three-lane conversions.

Case studies mentioned in this paper include sites located in Iowa, Montana, Minnesota, California, and Washington. These road diet locations have been cited in numerous papers that provide information on road diets. Results of each study indicate a reduction in 85^{th} percentile speed and 17% - 62% reduction and crashes. Again, these sites were reinvestigated by Huang et al. with more rigorous statistical techniques where the reduction in crashes was found to be 6% and a negligible change in crash severity and type.

The paper continues by presenting and discussing feasibility determination factors as presented by the Iowa Department of Transportation:

- Roadway function and environment;
- Overall traffic volume and level of service;
- Turning volumes and patterns;
- Frequent-stop and slow-moving vehicles;
- Weaving, speed, and queues;
- Crash type and patterns;
- Pedestrian and bike activity;
- Right-of-way availability, cost, and acquisition impacts; and
- General characteristics; parallel roadways, offset minor street intersections, parallel parking, corner radii, and at-grade railroad crossings.

As part of the Iowa Department of Transportation project, the overall traffic volume and "level of service" feasibility determination factor was further investigate to determine the maximum volume of vehicles that can be serviced before significant operational impacts take place. The analysis compared the average arterial travel speed, arterial LOS, and intersection LOS of similar four-lane undivided and three-lane roadways for peak-hour volumes of 500, 750, 875,

and 1000 vph. The analysis concluded that minimal effects took place up to 750 vph and travel speeds decreased by 1.9 mph at 1,000 vph. The arterial LOS was the same for each cross-section up to 875 vph where a LOS D resulted for the three-lane roadway and a LOS C resulted for the four-lane roadway. The analysis considered variables including total entering traffic volumes, different levels of left-turn traffic, access point densities, heavy vehicles, and bus stops.

Methods:

• CORSIM was used to analyze the sensitivity of delay due to factors including entering traffic volumes, different levels of left-turn traffic, access point densities, percent heavy vehicles, and bus stop activities.

The Effect of Four-Lane to Three-Lane Conversion on the Number of Crashes and Crash Rates in Iowa Roads

June 2005

W. Li and A. Carriquiry

http://www.iowadot.gov/crashanalysis/pdfs/iowa4to3laneconversion_fullbayes_june2005.pdf

The intent of this study is to present findings of a statistical study on road diets and their effectiveness in reducing the number of motor vehicle accidents. The study was conducted on roadways in Iowa and provides an in-depth description of the statistical modeling approaches used to determine the effectiveness of road diets.

The study uses 30 paired sites in Iowa, the same sites that have been the subject of several studies conducted on behalf of the Iowa Department of Transportation. Several data parameters were collected for each site including local population, AADT, and crashes. A Bayesian approach was used to account for regression to the mean and seasonal effects were also considered throughout the analysis. The study provides a great deal of statistical information as far as the approach however lacks any information on site selection and specific characteristics of each site.

The following were concluded through the study:

- The reduction in the expected number of crashes per year and mile was 32.3% for a treated site and 7.1% for a control site.
- The estimated expected reduction in the number of crashes per year, mile, and 100,000,000 AADT were 44.3% and 25.5% respectively for treated and control sites.
- The expected number of monthly crashes per mile tends to be higher during winter months.

- Bayesian method.
- Seasonal effects were accounted for by including smooth trigonometric functions with three different periods representing the four seasons of the year.
- 15 treated and 15 comparison sites were analyzed where local population and traffic volumes were accounted for.
- Independent variables include the four seasons of the year, treatment type (road diet or control), time, and interaction of treatment and time.

Matched Pair Safety Analysis of Four-Lane to Three-Lane Roadway Conversions in Iowa

2006

Thomas B. Stout, P.E.

http://www.ctre.iastate.edu/mtc/papers/2005/stout.pdf

The intent of this paper is to conduct a statistical analysis on crash data compiled for 11 sites in lowa. The research was focused on evaluating the safety impacts of road diets using a Beforeand-After with Yoked Pairs (comparison sites) analysis. The data included five years of traffic crash data for "before" and "after" the implementation of a road diet. Comparison sites were identified by the following characteristics:

- Volume (ADT) within 20% of the study roadway
- City population within 20% of the study roadway's city population (a nearby roadway was used in the Des Moines and Storm Lake studies; in all other cases it was necessary to find sites in other cities)
- Similar "character" (aerial photography was used to assess type of development, number of access points, and physical limitations/topographic features)
- Length within 20% of the study roadway.

The purpose of the study was to determine safety-related impacts of Road Diets including changes in:

- frequency of crashes
- crash rate
- nature/type of crashes
- injury character or severity of the crashes
- involvement of drivers 65 and older, 75 and older, and 25 and younger

Conclusions of the study include a 58% reduction in fatal crashes, 40% reduction in major injury crashes, 67% decrease in minor injury crashes, and 56% decrease in possible injury crashes. Further, a decrease in crash rate per driveway density unit resulted following a road diet conversion.

Successful Road Diet conversions are more likely under the following circumstances:

- There is a history of crashes that are amenable to solution by providing a two-way left-turn lane
- Traffic volume is generally less than about 20,000 ADT
- There is a high density of access points
- There are large turning volumes

The benefits of conversion may include the following:

- A reduction of 21 to 38 percent in the frequency and rate of crashes
- A similar reduction in the number and severity of injury crashes

- Reductions in the involvement of age groups that are traditionally at risk, those 25 and under as well as those 65 and older
- A significant reduction in the number of crash types related to left-turns and stopped traffic.

- Before-and-After Yoked Pair Method
- Driveway density was used to classify the "character" of the roadway (type of development) and to find a relationship to the number of crashes.
- Crash data was collected for a 5-year before and 5-year after period.
- Control sites were selected based on: Volume (ADT) within 20% of the study roadway; city population within 20% of the study roadway's city population; similar "character" (aerial photography was used to assess type of development, number of access points, and physical limitations/topographic features); and length within 20% of the study roadway.

Safety Impacts of "Road Diets" in Iowa

2006

Thomas B. Stout, Michael Pawlovich, Reginald R. Souleyrette, and Alicia Carriquiry <u>http://www.iowadot.gov/crashanalysis/pdfs/ite_draft_4to3laneconversion_papersubmission_2</u> <u>005.pdf</u>

The intent of this paper is to reanalyze data used in a previous study, *Evaluation of Lane Reduction "Road Diet" Measures on Crashes and Injuries* conducted by Huang et al. The previous study used a classical statistical approach and concluded that Road Diets reduced crash frequencies by 6% and had minimal impacts on reducing crash rates. The *Safety Impacts of "Road Diets" in Iowa* study used the same data, however the authors utilized a Before-and-After (B/A) with "yoked-pairs" and the Full Bayes (FB) statistical approaches. The study concluded that a Road Diet could account for 25% reduction in crash frequency per mile and a 19% reduction in crash rate.

This study analyzed the same 15 treatment and 15 control sites in Iowa that were used in the previous study. Information to evaluate the effectiveness of Road Diets was compiled by the Iowa Department of Transportation Office of Traffic and Safety. The sites were mostly located in small urbanized areas with populations ranging from 1,169 to 198,682. The sites experienced annual daily traffic in the range of 2,000 to 17,400 vehicles.

The B/A analysis included data collected for the 5 years previous to treatment and the following 5 years after treatment. Within the examined data, crash frequency, rate, severity, type, driver age, and major cause were all considered. The study determined a 28% reduction in total crash frequency and a 21% reduction in total crash rates when compared to city-wide crashes. Further, major injury crashes were reduced by 11%, minor injury crashes reduced by 30%, and possible injury crashes reduced by 31% compared to city-wide results. Results from the B/A analysis are shown for each site in Table 1.

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CITY	He	ad On Rei	artind An	el eft-fur	sadside Sid	eswite sat	e unt	×/
Blue Grass	25.0	-47.9	-100.0	-50.0	-72.2		-91.7	
Council Bluffs		-89.6	66.7	66.7	-100.0		-100.0	
Des Moines	-58.3	9.8	-84.2	6.4	87.5	150.0	-61.1	
Glenwood	-30.8	-28.8	0.0	-34.7	37.5	300.0	-86.7	
ndianola	-37.5	19.9	-50.9	1.6	42.9		-77.9	
owa Falls	-9.1	-72.2	-64.3	-100.0	-100.0	150.0	-100.0	
Lawton		-100.0	-100.0	-16.7	-58.3		-100.0	
Manchester	150.0	8.7	-75.0	-50.0	87.5	-100.0	-100.0	
Mason City	25.0	-85.3		-16.7	-100.0		-100.0	
Osceola	-31.8	-35.8	13.6	-74.1	-91.7	25.0	-100.0	
Rock Rapids	0.0	-71.4	-100.0	0.0	-90.0		-100.0	
Sioux Center	-89.6	0.7	-81.4	-37.5	-54.2	25.0	-95.5	
Sioux City	-58.3	66.7		-58.3	66.7		-100.0	
Storm Lake	1066.7	128.4	-68.3	-60.0	-69.7		-52.4	
Overall	-41.7	-35.0	-73.5	-40.9	-49.3	100.0	-85.2	

Table 1: Percent change in Type of Crash for Study Segment

The FB analysis included data collected for 23 years (1982-2004) for the 30 site locations. Each site having different treatment dates resulted in a variation of before and after crash data for each site. The study determined a 25.2% reduction in crash frequency per mile and an 18.8% reduction in crash rate.

Final Remarks:

- A 25% reduction in crash frequency per mile and a 19% reduction in crash rate. This differs from the Huang, et al. study which reported a 6% reduction in crash frequency per mile.
- A similar reduction in the number and severity of injury crashes
- Reductions in the involvement of age groups that are traditionally at risk, those 25 and under as well as those 65 and older
- A significant reduction in the number of crashes types related to left-turns and stopped traffic.
- A 34% reduction in the number of injury crashes, as well as a reduction in the severity of the crashes that do occur.

- Classical Before-and-After (B/A) with comparison sites and Full Bayes (FB) methods.
- B/A used 5 years of data before and 5 years after while FB used 23 years total independent of when the road diet was implemented.
- The same comparison sites were selected for the FB and B/A analyses.

- For FB, given the random and rare nature of crash events, a hierarchical Poisson model where the log mean was expressed as a function of time period, seasonal effects, and a random effect corresponding to each site included was fitted to the crash frequencies.
- FB was adopted for estimation of model parameters. In the Bayesian approach, model parameters are treated as random variables and the goal is to estimate the distribution of likely values of the parameters given prior values and data.

Iowa's Experience with Road Diet Measures: Use of Bayesian Approach to Assess Impacts on Crash Frequencies and Crash Rates

February 2007 M.D. Pawlovich, L. Wen, A. Carriquiry, T. Welch http://trb.metapress.com/content/488084n420265182/

The intent of this study was to investigate the safety effects a road diet has on lowa roadways. This study is the analytical document of which many papers and handbooks have been developed from. The sites had volumes ranging from 2,030 to 15,350 and were located in smaller urbanized areas in Iowa. The study employs a Bayesian method to estimate model parameters and draw inferences from the data.

The study uses 15 road diet sites and 15 comparison sites in Iowa. Crash data was available for each site from 1982 to 1994 however due to different intervention dates the available before and after crash data varied. Comparison sites were identified based on traffic volumes, geometry, and local population size each known to have effects on overall safety. It was noted that crash frequency and rate decreased for all treated and non-treated sites during the investigated period however treated sites showed a sharper decline. Following the Full Bayesian analysis it was concluded that road diets in Iowa could account for a 23.2% – 27.8% reduction in crash frequency per mile and a 17.9% – 20% decrease in crash rate.

Factors that have been controlled for include time effects, conversion month, and seasonal effects on crash frequency and traffic volumes.

- Fully Bayesian data analysis.
- 15 treated and 15 comparison sites.
- Seasonality effects were considered.
- A comprehensive summary of statistical details are presented.
- End-of-site treatments are not presented.

Road Diet Handbook - Overview

2007 Jennifer A. Rosales, P.E., Professional Associate http://www.oregonite.org/2007D6/paper_review/D4_201_Rosales_paper.pdf

The intent of this paper is to provide an overview of the published book *Road Diet Handbook: Setting Trends for Livable Streets.* The book presents advantages and disadvantages to road diets with respect to safety effects, operational effects, and livability effects. The handbook is intended to become a guide to local departments of transportation to determine the overall feasibility of a road diet for a given roadway. The paper provides a brief overview of previous studies, case studies, and practice guidelines.

Previous studies are summarized with respect to economic effects and walkability, safety, operations, and road diet examples.

Six case studies are presented including sites in Dunedin, New Zealand; Toronta, Canada; Athens, Georgia; Clear Lake, Iowa; and two in Vancouver, Washington. Supplemental to the common road diet characteristics was a survey that was conducted in the local areas collecting information on:

- Household/business characteristics
- Perceptions on the street's traffic, safety, activities (street life) and friendliness
- Recommended improvements
- Reactions to the road diet
- Comfort and safety for pedestrians, bicyclists, and transit users
- Increased landscaping and beautification opportunities
- Improved quality of life and street character

Results of the surveys were mixed and suggestions for improvement included reducing speeds, prohibiting trucks, reducing traffic, and adding street trees and planters.

Both this paper and the corresponding handbook are summarized by lessons learned and road diet guidelines. Guidelines are presented pertaining to feasibility factors, left-turn treatments, transitions, bicycle facilities, on-street parking, and pedestrians.

Reading *Road Diet Handbook: Setting Trends for Livable Streets* would provide a more thorough understanding of the implications related to road diets.

- Simple Before and After analysis.
- Safety (crashes, speeds, pedestrians) and operations (volumes, delay) were investigated. Implementation:
 - Consider road diet projects when multiple opportunities arise such as a pavement reconstruction project, presence of an adjacent parallel route, or jurisdictional roadway transfer.
 - Consider community requests to evaluate and implement road diet projects. With technical evaluation and community involvement with stakeholder groups, road diet projects are more likely to be successful.
 - A public education campaign that goes along with a road diet project needs to emphasize the notion that this is a safety enhancement project and that it may require trade-offs in capacity and speed.
 - Increase public education regarding the use of the two-way left turn lane.
 - Manage community expectations with clear communication and documentation. Identify project goals, performance measures, expectations and conduct follow-up evaluations.
 - Coordinate road diet projects with concurrent pavement overlay projects, if possible. A road diet striping plan on new pavement results in less driver confusion.
 - Install trees and planters to soften the landscape.

Four-Lane to Three-Lane Conversions: An Update and a Case Study

June 2007

K.K. Knapp and J.A. Rosales

http://docs.google.com/viewer?a=v&q=cache:6GluebHZ9x8J:www.urbanstreet.info/3rd_symp_ proceedings/Four-Lane%2520to%2520Three-

Lane.pdf+The+Safety+and+Operational+Effects+of+%22Road+Diet%22+Conversions+in+Minnes ota&hl=en&gl=us&pid=bl&srcid=ADGEESiWvuhqgofRjX4jCUKTF2nZTpUAh3apmvecoyHhR6FuA b6LkZOcCKkeNiihVqaOO6fsOAjafO_zalYdfTh74HSEsf8HnkLOLJ4XYUFBRyH4jaKu0SZ9VDlgQR3qA Z1WsZsAnXYP&sig=AHIEtbQvD7GgjAdG0TNtgUzupddITewvrA

The intent of this paper was to provide information regarding road diets to the 3rd Urban Street Symposium in Seattle, Washington in June 2007. The paper presents guideline recommendations and some feasibility determination factors for potential road diet projects and concludes with a case study of a road diet candidate in Wisconsin.

The feasibility determination factors were provided by the Iowa Department of Transportation guidelines. The existing and expected status of all of the following factors should be evaluated before determining if a road diet is suitable.

- Match roadway environment with function.
- Road diets have been successful on roadways up to 24,000 ADT however operational impacts may be noticed for a roadway above 20,000 ADT.
- Determine turning volumes and patterns.
- Investigate the frequency of slow moving or large vehicles using the roadway.
- Pedestrian and bicycle activity should be considered.
- Right of Way, costs, and acquisition impacts should be investigated.

Recommendation guidelines set forth by the Iowa Department of Transportation are as follows:

- The feasibility of implementing a road diet should be considered on a case-by-case basis.
- Both existing and expected characteristics of the roadway should be considered.
- Simulation suggests that peak-hour volumes less than 750 vph may experience negligible operational impacts, while caution should be used on roadways ranging from 750 – 875 vph, and above 875 vph indicated a more severe impact to operations.

The paper continues to address the livability benefits presented by Rosales:

- Improved walkability and easier street crossing,
- Increased pedestrian and bicycle use,

- Slower vehicle speeds,
- Users feeling "safer" and more "comfortable" along the roadway,
- Economic growth in adjacent and nearby businesses,
- Increased new home and business improvement projects,
- Redevelopment and renovation work at a quicker pace, and
- Increased front yard activity.

The paper concludes with a case study in which the feasibility factors mentioned were applied on a road diet candidate in Colby, Wisconsin. Because the roadway was only analyzed for feasibility purposes, no before-after data were collected nor analyzed to determine the success of the road diet.

Methods:

• Presented an analysis of the suitability of a road diet candidate using the developed feasibility determination factors.

Comparison of empirical Bayes and full Bayes approaches for before–after road safety evaluations

January 2010 B. Persaud, B. Lana, C. Lyon, and R. Bhim http://www.cmfclearinghouse.org/study_detail.cfm?stid=192

This paper provides additional information on the Empirical Bayes and Full Bayes statistical approaches to determine the effect a road diet has on reducing the number of crashes on a treated roadway. This study is a follow-up to several studies conducted on road diet sites in Iowa by Persaud et al., Pawlovich et al., and Stout. This study uses the identical data presented in these other studies but identifies similarities and differences when using the Full Bayes approach.

The paper provides substantial background to the Full-Bayes approach and utilizes 15 yokedpair sites for analysis. Following analysis it was concluded that the crash reduction rate ranged from 49 – 55%. A crash modification factor (CMF) was determined to be 0.47 for the given data set.

- Full Bayes (FB) and Empirical Bayes (EB) methods.
- Used 15 treatment and 15 comparison sites from Iowa for FB while EB supplemented an additional 296 comparison sites as required.
- EB accounted for temporal effects in weather, demography, crash reporting, vehicle technology, and design standard improvements.
- FB accounted for temporal effects in weather, demography, crash reporting, vehicle technology, and design standard improvements.
- FB was a before-after approach that developed a crash rate model with traffic volume as an independent variable.

Evaluation of Lane Reduction "Road Diet" Measures on Crashes

June 2010

http://www.fhwa.dot.gov/publications/research/safety/10053/index.cfm

The intent of this report was to reanalyze the data used in two previously published reports concerning "road diets" and their effectiveness on reducing the number of crashes on a given roadway. The first study was conducted in six cities in California and two cities in Washington where 30 treatment sites and 51 reference sites were identified. Table 1 presents descriptive statistics of the evaluated sites. Using the empirical Bayes (EB) method on the identical data set, it was determined that following treatment, a 19% decrease in vehicle crashes can be attributed to implementation of a "road diet". The previous study determined only a 6% decrease in vehicle crashes.

	1. Beschiptive statistics	er er al a de a		•
DATABASE/SITE TYPE	CHARACTERISTIC	MEAN	MINIMUM	MAXIMUM
lowa Treatment (15 sites)	Years before	17.53	11.00	21.00
	Years after	4.47	1.00	11.00
	Crashes/mile-year before	23.74	4.91	56.15
	Crashes/mile-year after	12.19	2.27	30.48
	AADT before	7,987	4,854	11,846
	AADT after	9,212	3,718	13,908
	Average length (mi)	1.02	0.24	1.72
	Years	21.8	5	23
lowa Reference (296 sites)	Crashes/mile-year	26.8	0.2	173.7
	AADT	8,621	296	27,530
	Average length (mi)	0.99	0.27	3.38
HSIS Treatment (30 sites)	Years before	4.7	1.8	8.5
	Years after	3.5	0.6	8.8
	Crashes/mile-year before	28.57	0.00	111.10
	Crashes/mile-year after	24.07	0.00	107.62
	AADT before	11,928	5,500	24,000
	AADT after	12,790	6,194	26,376
	Average length (mi)	0.84	0.08	2.54
HSIS Reference (51 sites)	Years	7.82	4.50	12.17
	Crashes/mile-year	42.19	5.96	169.73
	AADT	15,208	1,933	26,100
	Average length (mi)	0.95	0.10	3.31

Table 1: Descriptive statistics of evaluated "road diet" sites

The second study was conducted in Iowa where 11 treatment sites and 24 reference sites were used in the original study and a 25% decrease in vehicle crashes was reported. This study supplemented the 15 reference sites with 281 additional reference sites. The use of the EB method on the updated data set resulted in a 47% decrease in vehicle crashes following implementation of a "road diet". This study also developed crash modification factors (CMF) for the data as presented in Table 2.

Crash Type Studied and Estimated Effects						
State/Site Characteristics	Accident Type	Number of Treated Sites	CMF (Standard Deviation)			
Iowa: Predominately U.S. and State routes within small urban areas (average population of 17,000)	Total crashes	15 (15 mi)	0.53 (0.02)			
California/Washington: Predominately corridors within suburban areas surrounding larger cities (average population of 269.000)	Total crashes	30 (25 mi)	0.81 (0.03)			
All sites	Total crashes	45 (40 mi)	0.71 (0.02)			

Table 2: Results of the EB method reanalysis of Iowa and HSIS data concerning "road diets"

Other findings:

A 4 – 5 mph reduction in the 85^{th} percentile free flow and 30% reduction in vehicles traveling more than 5 mph over the speed limit were found in an Iowa site. The authors speculate this calming affect would be less likely in larger cities.

In the original Iowa study, 15 treatment sites and 30 reference sites were considered while only 11 treatment sites and 24 reference sites were used due to data being omitted due to small sample sizes of crashes, short segments, short data history, and low AADT.

- Empirical Bayes Method
- California and Washington (HSIS) 30 treatment and 51 reference sites matched by functional class, type of development, speed limit, intersection spacing, and access control.
- The lowa database included data from original 15 treatment and 15 reference supplemented by 281 additional reference sites.
- A model was developed with calibration factors accounting for accident reporting practices, demography, and weather for Iowa. However calibration factors could not be utilized in the study concerning "road diets" in California and Washington.
- Sites of longer length were given more weight.

Road Diets – Fixing the Big Road

1999

Dan Burden and Peter Lagerway

http://www.walkable.org/assets/downloads/roaddiets.pdf

The intent of this report is to summarize the state-of-practice of Road Diets as of 1999. The report includes several examples of Road Diets from several states, territories, and countries including: Washington, Pennsylvania, Michigan, Ontario Canada, California, Massachusetts, Maryland, Texas, Ottawa Canada, Colorado, Oregon, and the United Kingdom.

The report presents examples of mobility and access improvement as well as safety improvements. The report also includes examples of Road Diets being placed on roadways with well over 20,000 ADT. For example, Lake Washington BLVD, Kirkland, Washington had 30,000 ADT before conversion with beneficial results.

The paper recommends characteristics of ideal Road Diet candidates including:

- Moderate volumes (8-15,000 ADT)
- Roads with safety issues
- Transit corridors
- Popular or essential bicycle routes/links
- Commercial reinvestment areas
- Economic enterprise zones
- Historic streets
- Scenic roads
- Entertainment districts
- Main streets

Methods:

• Simple Before and After comparison focused on ADT and reason for road diet treatment.

Implementation:

• It is essential to involve the public through highly interactive processes (focus groups, work shops, and interactive designs).

Summary Report: Evaluation of Lane Reduction "Road Diet" Measures and Their Effects on Crashes and Injuries

March 2004

Herman F. Huang, J. Richard Stewart, and Charles V. Zegeer

http://www.planning.kytc.ky.gov/congestion/RoadDiets/Road%20Diet%20Safety%20Study.pdf

The intent of this paper is to summarize a statistical study of road diets and their effectiveness on reducing crash statistics in treated sites. The study includes several sites in California and Washington as these states are involved in the Federal Highway Administration's Safety Information System where quality vehicle and crash data are available. Road Diets were identified by local traffic engineers in 8 cities including: Bellevue, Wa, Seattle, Wa, Mountain View, CA, Oakland, CA, Sacramento, CA, San Francisco, CA, San Leandro, CA, and Sunnyvale, CA. Finally, 12 Road Diets and 25 comparison sites were included in the study.

The comparison sites had an average crash frequency of 41% compared to an average crash frequency of 35.8% for road diet sites indicating road diets reduce the total number of crashes.

Crash rates were determined using 8 Road Diet sites and 14 comparison sites. The ADTs of Road Diet sites ranged from 5,658 – 8,133 in the before period and from 8,300 – 16,482 in the after period. ADTs of comparison sites ranged from 5,480 – 24,183 in the before period and from 7,006 – 26,100 in the after period. Both Road Diet and comparison sites experienced decreased crash rates and had no significant difference between the treated and untreated sites.

Crash severity was nearly the same at Road Diet sites and comparison sites and the statistical analysis determined that Road Diets had no significant affect on crash severity. An analysis by crash type was found to have similar results.

Final Remarks:

- Crash frequencies at road diets in the after period were approximately 6 percent lower than at the corresponding comparison sites.
- Crash rates did not change significantly from the before period to the after period. Although crash rates were lower at road diets than at comparison sites, road diets did not perform better or worse (from the before period to the after period) relative to comparison sites.
- Road diet conversions did not affect crash severity.
- Road diet conversions did not result in a significant change in crash types.
- This report is a summary of Study 11 located in this document.

- Before and After with comparison sites method.
- California and Washington (HSIS) 30 treatment and 51 reference sites matched by functional class, type of development, speed limit, intersection spacing, and access control. Reduced to 12 treatments and 25 comparisons.
- Seasonal variations in crash data were taken into account. Variations in crash reporting techniques were controlled for by selecting comparison sites in the same city as the road diet site.
- Crash Frequencies: A Cochran-Mantel-Haenszel test of overall significance was used to show that the reduction in crashes was statistically significant.
- Crash Rates: Negative binomial regression models were fit to the crash frequencies at each site. The explanatory variables were traffic volume, city, site type (treated or comparison), time period (before or after), and a site type-by-time-period interaction. Segment length was included as a constant factor so the number of crashes on a segment was proportional to its length.
- Statistical analyses were conducted for crash severity and crash type as well.

Evaluation of Lane Reduction "Road Diet" Measures on Crashes and Injuries

May 2005

Herman F. Huang, J. Richard Stewart, and Charles V. Zegeer https://docs.google.com/viewer?a=v&q=cache:teqtEQ0DiiYJ:136.142.82.185/freshman/acade mic/engr0715/Archives/y2008/Team8/research_lanereduc.pdf+&hl=en&gl=us&pid=bl&srcid=A DGEESjdejW91b0eAdMOrvu4y8XpFmP4DbUUUMZTjqyNZDTWpcal_uJeXjMVRf7CFc9IPKyEf2OvFDIIADR6mBOShzTrsWpiV1kkb5yhPr_L_feJRYIdMMmletr_2D1qEGg1b2JGndl&sig=AHIEtbQ zjp4MsCXIspcA84MhOb0sqjNTdw

This paper presents a statistical study on Road Diet sites in California and Washington. Data were collected for before and after periods for both treated sites and comparison sites. A list of 30 Road Diet sites and 50 matching comparison sites were compiled for eight cities. Crash data were compiled, in most cases, for 3 years before and 3 years after treatment for each site including date of crash, crash type, number of injuries, and number of fatalities. A subset of 12 Road Diets and 25 comparison sites was chosen for statistical analysis.

Based on the results of the study the following was concluded:

- Crashes at road diet and comparison sites were not significantly different indicating that the comparison sites are viable.
- Road Diets could be responsible for reducing the number of crashes by 6%.
- Negligible reductions in crash severity and crashes by type were determined between Road Diet and comparison sites.
- Crash rates did not change significantly from before and after a Road Diet was implemented.
- Road diets did not result in a significant change in crash type.

- Yoked-Comparison before-and-after and a negative binomial of crashes per mile using two groups.
- Negative binomial allowed effects of treatment while controlling for ADT, city, and length of study segment.
- Crash data were characterized by date of crash, crash type, number of injuries and number of fatalities.
- A 3-month transition period was considered to separate the "before" and "after" periods.
- 3-years of "before" and 3-years of "after" data were collected.
- Intersections were taken as the transition area of the road diet and were excluded from the study.

 Crash Rates: Negative binomial regression models were fit to the crash frequencies at each site. The explanatory variables were traffic volume, city, site type (treated or comparison), time period (before or after), and a site type-by-time-period interaction. Segment length was included as a constant factor so the number of crashes on a segment was proportional to its length.

Complete Streets Technical Report

Genesee County Metropolitan Planning Commission http://www.co.genesee.mi.us/gcmpc-plan/LRTPWeb/TechReports/CStreets.pdf

The intent of this report is to introduce an innovative approach to urban road design that The Genesee County Metropolitan Alliance has adopted, *Complete Streets*. The Complete Streets vision statement for Genesee County is summarized as, "Transportation improvements in Genesee County are planned, designed and constructed to encourage walking, bicycling, and transit use while promoting safety for all users". The report summarizes the definition of a Complete Street, identifies design elements of a Complete Street, and provides a list of benefits of a Complete Streets program.

Although there are several approaches to complete a street, this report presents an in-depth look at low-cost and simple techniques which includes road diets. The Genesee County Metropolitan Planning Commission (GCMPC) identified candidate road diet roadways in Genesee County to determine the feasibility of converting these roadways from four-lanes to three-lanes. Data was collected for each four-lane roadway including crash data, lane widths, speed limits, surface condition, ADT, number of traffic signals, and land uses. These data were used to develop a rating scale to determine on a case-by-case basis whether the roadway was suitable for a Road Diet. The recommendations of the GCMPC study were shared with local road agencies to develop strategies for implementing Road Diets on ideal candidates. It should be noted that these are all future sites that have not been converted as of the date of this study.

Existing Road Diet sites were also studied to determine the effectiveness of Road Diets on reducing crash frequencies and crash rates. The results are divided into type of crash as well as total non-alcohol/non-deer related crashes. The results are somewhat misleading because the before and after periods are generally different lengths of time. With this in mind, it was determined that Road Diets reduced the total number of crashes by 15% – 47%. Total crashes for these sites are presented in the summary table.

Methods:

• Simple Before and After comparison.

Implementation:

- Complete a sidewalk inventory of Genesee County.
- Include questions about the need for Complete Streets in future transportation surveys.
- Provide local training opportunities about Complete Streets for transportation planners, road agencies and engineers on an annual basis.

- Provide technical assistance to road agencies when needed about implementing Complete Streets in their communities.
- Document and publicize success stories about implementation of Complete Streets.

City of University Place Traffic Safety

http://docs.google.com/viewer?a=v&pid=gmail&attid=0.1&thid=12f35889d6a9b876&mt=appli cation/vnd.ms-

powerpoint&url=http://mail.google.com/mail/?ui%3D2%26ik%3D0c6430dfb7%26view%3Datt% 26th%3D12f35889d6a9b876%26attid%3D0.1%26disp%3Dsafe%26zw&sig=AHIEtbRY_y5dtkLssQFhYiZpWcHgHMC6Q

This presentation provides information on the varying effects that different traffic controlling strategies have on average traveling speeds, traffic crashes, and injuries. Following implementation of a road diet a 37% decrease in traffic accidents occurred and a 54% – 60% decrease in injuries resulted.

Methods:

• Simple before and after comparison of accidents, injuries, and speeds.

Guidelines for 4-Lane to 3-Lane Conversions

September 2001 W.C. Taylor, I.K. Lim, M. Mahmood Viewed in hardcopy print

The intent of this study was to develop guidelines for Michigan Department of Transportation to use in reviewing requests from local communities to convert four-lane urban trunklines to the three-lane configuration. The study also provides a literature review of documents that have investigated the safety and operational impacts of a road diet. Objectives of the literature review were to determine the change in traffic crashes, change in traffic characteristics such as speeds, and characteristics of road segments that affect change in crashes or change in characteristics.

The study provides an operational analysis to investigate the effects of road diets on vehicle delay. The analysis tested various combinations of main street volumes, access volumes, turning volumes, and driveway densities for a given site. Two variables were identified as having impacts on the delay to vehicles entering from the minor street; the headway distribution on the major street and the minor street volume. It was concluded that for the given volume range on Abbott Rd. the headway distribution had little effect on the minor street delay. It was also concluded that from 60 vph to 120 vph the queue time increased by 1 to 2 seconds however 180 vph creates a queue time greater than the gap acceptance time on the major street. The author determined that in this high volume situation, traffic signal warrants would be met and signals would be implemented. Major street delay was also shown to increase due increasing volume and increasing left-turn movements.

A model was produced from the single site analysis to include several different scenarios. Parameters to be used in the model include major street volumes, minor street volume, access point average spacing, and percent of vehicles turning left from the major street. The model encompasses major street volumes from 1000 to 2000 vph for 5 to 10% left turn volumes.

Final conclusions include:

- A 27.6% average reduction in crashes following a road diet treatment
- A decrease from 21 to 5 pedestrian and bicycle involvement crashes and reduction of intersection crashes from 238 to 129.
- Minor street delay increases as major street volume increases however delay is not significant until minor street volumes approach 180 vph.
- The number of injury crashes reduced.

Methods:

• Simple before and after comparison.

- Nine sites were identified for use in analysis.
- Pedestrian and bicycle related crashes were investigated at three of nine sites.
- NETSIM was used to model the relationship between delay, headway distribution, minor street volume, and left-turn volumes.

Edgewater Drive Before & After Re-Striping Results November 2002 City of Orlando – Transportation Planning Bureau <u>http://www.sacog.org/complete-</u> streets/toolkit/files/docs/City%20of%20Orlando_Edgewater%20Drive%20Before%20&%20Afte r%20Re-Striping%20Results.pdf

The intent of this study is to analyze the effectiveness of a four-lane to three-lane conversion in the City of Orlando. The conversion is part of the College Park "Neighborhood Horizon Plan" which identifies 74 neighborhood improvement projects. One of these projects was to transfer jurisdiction of Edgewater Drive from the Florida Department of Transportation to the City of Orlando. This transfer would allow the City of Orlando to improve the section of roadway by adding crosswalks, underground utilities, parking, and bicycle lanes.

The study considers crash and injury data, speed analysis, traffic volumes, parking volumes, pedestrian and cycling volumes, travel times, property values, and community impacts. 3-years of crash data were considered for the "before" period and 4-months of data were considered for the "after" period. Due to the small sample size of "after" data, some conclusions may be inaccurate. It was found that crash rates decreased 34% and injuries decreased 68%. Similarly, a significant decrease in excessive speeds resulted while travel times within the corridor increased in most cases. Further, the annual daily traffic reduced on average by 12% and the utilization of parking increased from 29% to 41% on Edgewater Drive following treatment. It was also noted that the number of pedestrians and cyclists using the corridor increased significantly. Finally, property values were shown to increase at an annual rate of 8% – 10% and 1% - 2% for residential and commercial properties, respectively.

Unlike other studies, this study reported results from a community survey conducted "before" and "after" implementation of the road diet. The community survey and traffic analysis were used to assess whether the list of measures of effectiveness (MOEs) had been met. The list of MOEs and whether they were achieved or not are as follows:

- o Avoid Increasing Traffic On Neighborhood Streets YES
- Reduce Speeding on Edgewater Dr YES
- Increase Bicyclist Volumes YES
- Increase Pedestrian Volumes YES
- Reduce Crashes YES
- Increase On-Street Parking Use Rates YES
- Increase Pedestrian Satisfaction (Residents) YES
- Increase Pedestrian Satisfaction (Merchants) NO

• Increase Parking Satisfaction (Residents) - YES

Methods:

• Simple before and after comparison.

Implementation:

- Advertised public meetings to discuss alternatives.
- Development of measures of effectiveness to assess whether the project met intended goals.

Arterial Street Traffic Calming with Three-Lane Roads 2002 T. A. Sohrweide, B. Buck, and R. Wronski http://www.ite.org/traffic/documents/AB02H5501.pdf

The intent of this report is to discuss the effects of converting two roadways from 4-lanes to 3lanes. The paper focuses on the both operational and safety effects due to road diets by discussing reduction in speed and decreased number of crashes following conversion.

Portland Avenue in Burnsville, Minnesota was a four-lane undivided roadway. The city had been receiving complaints of excessive speeds along the corridor as well as sight obstructions for left-turning vehicles at a major intersection. To resolve the left-turning movement issue at the intersection the City considered widening the roadway and incorporating left-turn lanes at the intersection (\$790,000). The second alternative the City considered was reducing the roadway to three-lanes and a TWLTL (\$250,000). Following implementation of the road diet it was noted that traffic accidents at the major intersection reduced from 4.3 accidents per year to 2.8 accidents per year. Additionally, average speeds and 85th percentile speeds decreased.

North Main St. in River Falls, Wisconsin was being investigated to determine if the warrants were met for a traffic signal. The warrants were met and a traffic signal was to be installed however the City decided to implement additional changes at the same time. Additional issues included the safety of pedestrians and motorists as well as excessive speeding. Engineers to the city constructed a list of advantages and disadvantages for retaining the 4-lane cross-section or implementing the 3-lane cross-section. The city moved forward with the road diet and the following resulted:

- Average and 85th percentile speeds decreased following conversion.
- Minor road intersection delay was either maintained or reduced following conversion.
- Total accidents reduced from 22 to 7 in the year following conversion, however it was not determined whether the new traffic signal or road diet had a significant affect on reduced accidents.
- ADT reduced from 19,200 to 16,240 and it was assumed that traffic was using a highway bypass and not local streets.
- The City conducted a survey to gain insight on public opinion which was generally negative.

Methods:

• Simple before and after comparison of crashes and speeds.

Implementation:

- City handed out 246 surveys following treatment with 87 being returned.
 - How would you say that the reconfiguration has affected stress experienced when entering Main Street?
 - How do you feel the average time it takes to enter Main Street from a side street has changed?
 - Would you say the conversion of Main Street from a four-lane to a three-lane has a positive or negative impact on the ability of side street traffic to enter Main Street?

US-12 Downtown Sturgis Traffic Study: Final Report December 2004 Prepared by URS Viewed in hardcopy print

The intent of this report is to provide recommendations to Michigan Department of Transportation (MDOT) and the City of Sturgis for the reconstruction of US-12 through the City of Sturgis. MDOT proposed reconstructing US-12 as a five-lane cross-section including a two-way left-turn lane (TWLTL) while the City of Sturgis proposed a three-lane cross-section with bike lanes and parallel parking. Because the three-lane and five-lane reconstructions share similar cross-sections, the three-lane can be expanded to five-lanes if this becomes necessary.

URS recommended the three-lane cross-section for reconstruction to provide safety to the downtown. Because the three-lane alternative does not provide adequate level-of-service for the future (year 2026), the roadway is recommended to be monitored and expanded to five-lanes when necessary.

The report continues with a brief crash data analysis and current/future capacity analysis for the different alternatives proposed for the roadway. No substantial information is given for the before and after effects of the reconstruction.

- Analysis and comparison of three alternative geometry designs for existing and future conditions (2026) considering a 2.5% growth rate.
- 2000 Highway Capacity Manual methods to determine peak-hour Levels of Service.

Safety and Operational Characteristics of Two-Way Left-Turn Lanes June 2006 David Noyce, Vijay Talada, Tim J. Gates http://www.lrrb.org/pdf/200625.pdf

The purpose of this report was to evaluate the safety and operational impacts of converting a four-lane undivided roadway to a three-lane roadway with a TWLTL in the State of Minnesota. The report provides a comprehensive list of previous research conducted on road diets and the effectiveness of TWLTLs. Nine road diet sites were identified in Minnesota based on sufficient site information for the before and after periods of the treated site. These data included speed, volume, driveway density, and crash statistics. Nine comparison sites were also identified to account for factors such as changing ADT, seasonal trends, and other natural phenomenon. Comparison sites were chosen based on similar cross-sections, ADT, speed limit, intersection and driveway density, and land use.

Three statistical methods were used to analyze the data including traditional before-after approach, yoked comparison/group comparison, and Empirical Bayes methods. Following each analysis it was concluded that the change in ADT was insignificant for each site. Using the traditional approach it was concluded that the percentage reduction in crashes ranged from 12.9% - 54.1%. Using the group comparison method it was concluded that the percentage reduction in crashes ranged from 39.3% - 71.6% where two sites exhibited increases in crash rates (9.8% and 50.5%). Using the Empirical Bayes method it was concluded that the percentage reduction in crashes ranged from 37.3% - 54.3%.

- Simple before and after, Empirical Bayes, and Yoked-Paired comparison methods.
- Investigated change in number, severity, and types of crashes as well as 85th percentile speed and ADT.
- Volume, speeds, geometric, and access data were collected for nine treatment and nine comparison sites.
- "ADT data were collected for one year prior to and after conversion."
- Five years of before and five years of after crash data were used.
- No specifics on end-of-site treatment.

Safer Streets: The Measured Effectiveness of Hartford's Citywide Traffic Calming Program

2007

F. Clara Fang, Joseph H. Rimiller and Najib O. Habesch http://www.ite.org/traffic/documents/AB07H3401.pdf

The intent of this paper is to investigate and discuss the effects due to implementing a road diet in Hartford, Connecticut. Road diets have become part of Hartford, Connecticut's comprehensive traffic calming master plan and in an effort to study the effects, "before" and "after" data have been collected and analyzed using the Before-and-After method and Empirical Bayesian method.

Five road diets were implemented in Hartford within similar time frames including Wethersfield Ave., Franklin Ave., Maple Ave., Tower Ave., and North Main St. Before and after data were collected including ADT and total crashes. Twelve control sites were also identified and data were collected enabling an Empirical Bayesian analysis to be conducted.

The following conclusions resulted due to implementation of road diets:

- Crashes reduced between 7% and 57% except for one case where the crashes increased. This increase is attributed to the low amount of crashes in the before period.
- Reduction in crashes was attributed to the reduction in speeds up to 6 mph.
- The before-and-after and Empirical Bayesian analysis resulted in similar conclusions indicating that regression to the mean was not present.
- Factors such as crash type and injuries were not analyzed however the authors urge that these statistics be a point of analysis.

Methods:

- Simple before and after comparison and Empirical Bayes method.
- Five treated sites and 12 comparison sites.
- Crashes and speeds were investigated.
- No detailed information on data collection or end treatments.

Implementation:

- Neighborhood Traffic Calming Master Plan.
- Focus sessions with groups including emergency services, senior citizens, transit personnel, merchants, and disabled.
- Workshops where characteristics of their neighborhood were identified and chosen as beneficial to enhance.
- A final plan was developed and presented to the general public and stakeholders for review.

Technical Memorandum: Road Diet Project Review

April 2010 Cynthia Redinger, P.E. – Washtenaw County Road Commission Viewed in hardcopy print

The intent of this technical memorandum is to provide information and data for a road diet site in Washtenaw County. Washtenaw County Road Commission implemented road diets Grove Road and Ford Boulevard. These roadways were four-lane cross-sections with high driveway density, no dedicated left turn lanes, and no bike lanes which contradicted the non-motorized plan for Washtenaw County. This memorandum presents before and after traffic volumes, crash patterns, vehicular speed statistics, and quality of life concerns. The road diet implemented on Grove Road was constructed in two phases (Phase I and Phase II) where Phase I was completed in 2004 and Phase II was completed in 2006.

The before and after analysis of Ford Boulevard resulted in the following conclusions:

- Traffic volumes were not significantly affected following implementation of a road diet
- 85th percentile speed reduced by 6 11 mph.
- The annual number of total crashes was 8.45 for 4-years before treatment and 9 for 2years following treatment indicating that total crashes increased.
- No information on pedestrian/cyclist volumes, however the memorandum indicates that the public opinion was positive.

The before and after analysis of Grove Road resulted in the following conclusions:

- Traffic volumes were not significantly affected although traffic volumes have been decreasing citywide over the past decade.
- The average annual number of total crashes per year for Phase I was 15.5 for the before period and 8.1 for the after period indicating a significant reduction in crashes.
- The average annual number of total crashes per year for Phase II was 16.2 for the before period and 14.9 for the after period indicating a subtle decrease in crashes.

Methods:

• Simple before and after comparison.

Stone Way N Rechannelization: Before and After study

May 2010 City of Seattle – Department of Transportation <u>http://www.seattle.gov/transportation/docs/StoneWaybeforeafterFINAL.pdf</u>

The report focuses on one treated roadway, Stone Way N, in Seattle, Washington. Stone Way N was reduced from 4-lanes to 3-Lanes with a Two-way-left-turn-lane for 1.2. The roadway carries 13,000 ADT along with metro bus routes. The adjacent land is residential and commercial with eight schools, two public libraries, and five parks. The study utilizes a simple before-and-after approach and categorizes "before" as April 5, 2005 – August 6, 2007 and "after" as August 7, 2007 – December 4, 2009.

The study concludes that the 85th percentile speeds decreased following the "road diet" treatment. The number of vehicles traveling over the speed limit by 10 mph or more was reduced by 75% (150 vehicles per day to 25 vehicles per day).

Additionally, the ADT decreased by 6% while bicycle traffic increased by 35%. Peak flow declined between 5% - 13% and off peak flow varied from a 2% increase to a 5% decrease. However, the volume of motor vehicles also decreased citywide between 2006 and 2008. Adjacent roadways averaged larger decreases in ADT and peak hour traffic volumes. Decreases of ADT varied from 12 - 34% while decreases in peak volumes varied from 6 - 49%. However, one roadway had a 2% increase in PM peak hour volumes and another had a 27% increase in AM peak hour volumes.

Most collision types were reduced but the number of collisions involving cyclists remained constant. However, due to the additional number of cyclists the collision rate decreased. The rate of rear end collisions increased, however the majority of these crashes occurred in the transition area from four-lanes to three-lanes.

COLLISIONS BY TYPE						
	2005-07	2007-09	Change			
Right Turn	1	0	-100%			
Pedestrian	5	1	-80%			
Sideswipe	14	6	-57%			
Angle	34	15	-56%			
Left Turn	12	9	-25%			
Parked Car	34	29	-15%			
Head On	1	1	0%			
Pedalcyclist	7	7	0%			
Rear End	17	28	65%			
Total	159	137	-14%			
Injury	52	35	-33%			
Percent Injury	33%	25%				

Table 1: Reduction in collision type for before and after period

OPERATIONAL CHARACTERISTICS OF ROAD DIETS

Two-Way Left-Turn Lanes: State-of-the-Art Overview and Implementation Guide 1978 Z. A. Nemeth Viewed in hardcopy print

The intent of this study was to investigate the effectiveness of installing Two-Way Left-Turn Lanes (TWLTL) on the operational and safety of a roadway. The research included a nationwide expert opinion survey, literature review, and before-and-after field studies.

Ninety questionnaires were mailed and 70 were returned representing 36 states and one city in Canada. The questionnaire contained questions to investigate the effect of the TWLTL on traffic safety, the effect of the TWLTL on traffic flow characteristics, and conditions conducive to the installation of such a median lane. The questionnaire addressed experience (length of time and number of TWLTLs implemented) where most of the respondents had 1 - 10 years experience with 1 - 10 uses. Significant improvement of operations was noticed by 66% of respondents. Public reaction was noted as favorable by 62% of respondents while most of the controversy developed from the lane markings and signage.

The report continues by presenting several warrants that would require installation of a TWLTL as well as design details including number of lanes, lane widths, and treatment at intersections.

One case study that was presented was in fact a road diet example where a four-lane arterial was restriped to three-lanes with a TWLTL. It was noted that the average speed decreased however, due to unfamiliarity of the "new" TWLTL design, there seemed to be erratic (weaving) driving conditions.

The paper concludes with a checklist that should be utilized when determining if a TWLTL would be feasible and effective. Key components of the checklist include existing physical conditions, existing traffic conditions, future development, and accident histories.

Methods:

• Expert opinion survey and simple before-and-after comparison.

Using Roadway Conversions to Integrate Land Use and Transportation– The East Boulevard Experience

April 2007

Joshua E. Saak

http://sdite.org/presentations2007/2A-Saak-Road%20Diet%20Implementation%20in%20NC%20-%20The%20East%20Blvd.%20Experience.pdf

This presentation was prepared for the SDITE annual meeting in Knoxville, TN on April 23, 2007. The presentation presents a road diet that was implemented on East Boulevard in Charlotte, North Carolina.

The presentation provides two population estimates of 651,000 and 1.6 million (metro-area). The 651,000 may be the city population. East Boulevard is classified as an arterial traveling through a neighborhood with 21,400 ADT traveling at "relatively high speeds". The roadway provides access to multiple land uses including parks, commercial, hospital, and residential. The East Boulevard Pedscape Plan, adopted in 2002, was a significant reason that the roadway was converted. The Pedscape Plan established guidelines for streetscape improvements, provided standards for public properties, and made recommendations for public properties. Another significant driver for implementation was public safety concerns.

The road diet consisted of over ½ mile of East Boulevard including three signalized intersections of which two were one-way crossing streets. The conversion included changing signal timing, surface milling, refuge island construction, resurfacing/striping, and landscaping. Following implementation, the ADT of the roadway decreased from 21,400 to 18,400, however, it increased to 22,000 a short time later. The 85th percentile speed was shown to decrease by almost 3 mph and the crash rate reduced 34%.

The presentation concludes with outlining the objectives of the road diet implementation, addressing public concerns, procedure in gaining support and approval from residents, and lessons learned.

Methods:

• Simple before and after comparison of pedestrians, ADT, speed, crash, and injury. Implementation:

• Residents wanted a more comfortable roadway for bike, pedestrians, transit patrons, and motorists.

- Residents wanted to enhance pedestrian activity on sidewalks and to improve pedestrian crossings (safety).
- Residents wanted more sidewalk cafes, outdoor seating, landscaping, and to restore the historic nature of the downtown.
- Worked with residents regarding the proposed project and design details.
- Conducted detailed Synchro analysis to show LOS would not significantly decrease.
- Neighborhood voted unanimously to approve the project.
- Road diets should begin at the neighborhood level and they are counterintuitive so education is key.
- Limiting the construction time reduces complaints.
- Obtain support from city organizations.
- Implement new signal timing before constructing road diet.
- Retain the option to go back to the original condition.

Road Diet Treatment – Ocean City, NJ

February 2007

Daniel Kueper

https://docs.google.com/viewer?a=v&q=cache:AvmAGpBC7UcJ:www.eugeneor.gov/portal/server.pt%3Fopen%3D18%26objID%3D267728%26parentname%3DSearchResult %26parentid%3D1%26mode%3D2%26in_hi_userid%3D2%26cached%3Dtrue+&hl=en&gl=us&pi d=bl&srcid=ADGEEShaT9xhGfEpCMCM6ZTRnTdMOTe-2DwhFjsJgXH-dmO5-YGz3nnLBaG46UBGnyfuN5hKep4ITPSv7VgOHbsYow8X_-nKED4x8on3z1mhgE-N3y9o9hTC6Jg-JiSeeDvQAW0z_Au3&sig=AHIEtbRcy8td09kxcsawuyd_Qmv2KY_Zag

This report presents findings resulting from a Road Diet implemented on West Avenue in Ocean City, NJ. Ocean City is a resort town with an annual population ranging from 15,000 in the winter to 150,000 during the summer. The city received several complaints from pedestrians regarding difficulty crossing the roadway. To resolve these complaints the city decided a road diet was the best alternative. West Avenue is a minor arterial roadway that spans 6 miles. ADT's increase to a maximum of 15,000 in the summer season.

Implementation of the road diet resulted in a reduction in speeds by 1 mph for 50th-percentile speeds (35 mph to 34 mph). Similarly, 85th-percentile speeds were reduced by 1 mph (38 mph to 37 mph). Additionally, the number of motorists traveling 10 mph or more over the speed limit of 30 mph was reduced from 12% to 4%. Motorist delay increased 3 seconds at both intersections however a LOS B was maintained. The number of crashes remained unchanged, however, the average number of crashes occurring each year was relatively low (2 crashes in 2004 and two crashes in 2005).

Methods:

• Simple before and after comparison of speed characteristics

Using Road Diets to Integrate Land Use and Transportation – The East Boulevard Experience 2007 Joshua E. Saak, P.E. Viewed in hardcopy

The intent of this paper was to discuss the process of implementing a road diet on East Boulevard in Charlotte, North Carolina. The paper provides a background of the local area and roadway and discusses reasons for the change in roadway cross-section. The paper continues by presenting characteristics of the collected data as well as the results from analyses using Synchro and VISSIM. A conclusion of the results is provided followed by a brief before-and-after study and finally, a brief list of lessons learned are presented.

The local area surrounding East Boulevard was interested in restoring a multi-modal atmosphere through their Pedestrian Overlay District plan and the need for roadway resurfacing provided the opportunity. In considering a road diet, the City decided to conduct a traffic study to investigate the needs of the community with regard to East Boulevard. The City collected traffic counts, spot speeds, and lane widths to be used in Synchro and VISSIM analyses.

Synchro results indicated that delay and LOS would be negligibly affected. VISSIM results indicated a more prominent change between the four-lane and three-lane alternatives where speeds were shown to decrease, delay was shown to increase 31%, and travel time increased 13% during peak hours.

Although a formal before-and-after study was not conducted, results of continued data collection concluded that ADT decreased from 21,400 to 18,400 and 85^{th} percentile speeds decreased between 1 – 5 mph.

Finally, several lessons were learned through this process including the following insight:

- The project should begin at the neighborhood level
- Road diets seem counterintuitive to citizens
- Implementing new signal timing before construction is beneficial
- The construction period is difficult especially in downtown districts
- Before/after studies are important

Methods:

• Synchro analysis to evaluate possible road diet effects with measures of effectiveness including v/c ratio, level of service, and average control delay per intersection.

- VISSIM analysis to evaluate possible road diet effects with measures of effectiveness including average speed, total travel time, average network speed, and average delay per vehicle.
- Simple before and after comparison.

Implementation:

- East Boulevard Pedestrian Overlay District plan
- Community involvement is essential to the implementation and success of the project.

Multi-objective Optimization of a Road Diet Network Design

March 2011

Keemin Sohn

http://www.sciencedirect.com.proxy1.cl.msu.edu/science?_ob=MImg&_imagekey=B6VG7-52NC4NM-2-

16&_cdi=6031&_user=1111158&_pii=S0965856411000516&_origin=search&_zone=rslt_list_ite m&_coverDate=07%2F31%2F2011&_sk=999549993&wchp=dGLbVtbzSkzV&md5=37e07642a82329aa90796c869393d1e5&ie=/sdarticle.pdf

The intent of this paper is to present a computer algorithm to be used by decision makers to determine the design and implementation of a road diet. The algorithm is comprised of two models: a model where tradeoffs (capacity and delay) between motorists and cyclists took place and a model where tradeoffs between motorists and society took place where variations in mode choice were possible. Use of the algorithm provides a systematic approach to design road diet projects where the primary concern is to provide adequate access for cyclists by cautiously adjusting the capacity and delay of motorists. Although the models have considerable downfalls considering the omission of several key variables, the algorithms nonetheless provide an interesting approach to road diet design.

APPENDIX B

DETAILED ON-SITE REVIEWS OF SELECTED SITES IN MICHIGAN

The intent of this report is to summarize observations made at several road diet sites pertaining to the operational and safety characteristics as they relate to pedestrians and cyclists. Road diet sites were identified by Michigan Department of Transportation and selected by Michigan State University. The investigated road diet sites were selected based on close proximity from site to site as well as having "pedestrian/bicyclist safety" identified as a motivation for implementing the road diet project in the **MSU "road diet" project: project/implementation site data request** form (Road Diet Survey Form). The 8 sites investigated were located in the northwestern part of Michigan and are briefly described as:

- M-37 in Baldwin, MI from the US-10 junction extending approximately 200 ft. south of 9th St.
- M-55/M-66 in Lake City, MI from W Beeler Rd. to Union St. (Davis Rd.)
- M-37/M-115 in Mesick, MI from the M-115/M-37 junction to Clark St.
- US-31 in Manistee, MI from M-55 junction extending approximately 300 ft. northeast of M-110
- M-116 in Ludington, MI from US-10 extending approximately 500 ft. north of Lowell St.
- Burcham Rd. in East Lansing, MI from Abbot Rd. to Timberlane St.
- Abbot Rd. in East Lansing, MI from Albert Ave. to Whitehills Dr.
- M-43 in East Lansing, MI from Michigan Ave. to 200 ft. northwest of Audubon Rd.

For the 5 sites located within the Cadillac TSC area, visits were conducted during a major holiday weekend to gain as much insight as possible regarding operational and safety characteristics. For the sites located in East Lansing, visits were done in anticipation of peak usage hours during the day. Primary focus was to investigate pedestrian/cyclist use and a secondary focus was to investigate pedestrian/cyclist-motorist interactions. Observations will be summarized on a site-by-site basis followed by concluding remarks on the general characteristics of road diet conversions.

SR 22: Baldwin, Michigan, Lake County – M-37

The village of Baldwin, Michigan had a population of 1,208 according to the 2010 Census, with an estimated median household income of \$15,811. As a tourist destination, it draws mainly from camping, hunting, and fishing traffic, as the village is close to several rivers and within the Manistee National Forest. During the visits made to Baldwinno one spoken to mentioned that the pedestrian and bicycle traffic was unusual that day.

According to the Road Diet Survey Form, the primary motivations for implementing a road diet along M-37, which acts as the major arterial road through town, included traffic calming, a reduction of left-turn problems both mid-block and at intersections, and an improvement in overall safety of the corridor, including that of pedestrians and bicyclists. A 5-lane road with two-way left-turn lane (TWLTL) and a parking lane exists within the village commercial district just south of the road diet site. Beginning just south of 9th St., the road diet continues to the north for 0.2 miles ending at the M-37 junction with US-10, after which the road tapers into a 2-lane road. At this point, the speed limit changes from 30 mph in town and along the site, to 40 mph, heading north out of town.

- Visit #1: Friday, July 1 arrival at 12:15 pm
- Visit #2: Saturday, July 2 arrival at 10:15 am

Geometric/Marking Observations:

• Sidewalks are separated from the curb by about 10 feet; they extend the entire length of the road diet and continue south into the village commercial center.



View of sidewalk facing south along M-37

• There is an unsignalized crosswalk located on the north side of the 10th St. intersection.

 There were no observed uses of this crosswalk; nearly all pedestrian crossings were done at midblock locations throughout the site, whenever there was a long enough break in traffic for a safe crossing to be made.



Single pedestrian crosswalk

- There are no signalized intersections on the site, however, the US-10 junction is a stopcontrolled intersection, where NB/SB traffic has a dual flashing yellow beacon, and EB/WB traffic has a dual flashing red beacon.
 - Traffic was heavy enough that it was difficult for EB/WB traffic to find gaps in which to turn onto M-37, especially turning left, resulting in long delays.
 - There are unsignalized crosswalks in every direction at this intersection.



Dual flashing beacon intersection

• There is a snowmobile crossing right at the south edge of the road diet site.



Snowmobile crossing

- There are wide (~7 ft.) unmarked lanes on each shoulder, that are presumably intended to be used as bike lanes.
 - Lanes are wide enough that cars easily drift into them, especially at road curves; they essentially create extra-wide moving lanes that allow cars to travel much faster than the speed limit.
 - There were also occasions witnessed where these lanes were used as right-turn lanes.



View of wide shoulder facing south

Pedestrian/Bicyclist Observations:

- 30 minute count on Visit #1:
 - 13 pedestrians (inc. skateboard, wheelchair, and stroller)
 - o 0 bicyclists

- 15 minute count on Visit #2:
 - 8 pedestrians
 - o 1 bicyclist
- There was very little activity of either pedestrians or bicyclists along the site.
 - No trends in type or purpose of pedestrian were noticeable.
- Most pedestrian crossing occurred mid-block and often required a long wait to find a safe gap in traffic.
- During Visit #1, a wheelchair pedestrian was witnessed experiencing difficulty crossing US-10 at the intersection with M-37; another pedestrian went into the road to direct traffic in order to allow the wheelchair time to cross the road.

Resident Interactions:

- The road diet was constructed in 1998, so no one was able to recall what the road was like prior to construction.
- In a conversation with a local pedestrian during Visit #1, the following comments were made:
 - The M-37/US-10 intersection is very dangerous.
 - Several accidents occur per month.
 - Waits to cross the street can be up to 30 minutes.
 - Speeding is an issue, and cars have to take higher risks to turn into traffic.
- In a conversation with a local pedestrian during Visit #2, the following comments were made:
 - It is easier to cross M-37 along the road diet than either at the US-10 intersection or along the wider section of road south of the site.

Conclusions:

- While there is infrastructure present (sidewalks, crosswalks, bike lanes), very little pedestrian and bicyclist activity occurs along the road diet site. There appears to be much more traffic just south of the site, where the heavier commercial district acts as a pedestrian generator.
- Vehicle traffic through the road diet seems to exceed the speed limit of 30 mph. It gives the road more of a feel of a wide, fast-moving highway than of a pedestrian-friendly road, making crossing difficult and forcing long delays.
- The road diet did not seem to be successful in either calming traffic or in encouraging safe pedestrian and bicycle traffic, even though these were stated reasons behind the construction.

SR 26: Lake City, Michigan, Missaukee County – M-55/M-66

The city of Lake City, Michigan had a population of 836 according to the 2010 Census, with an estimated median household income of \$29,130. It is a popular tourist destination, and is a seasonal home for many more who own or rent cottages around Lake Missaukee. During the two visits made, the town was heavily populated by tourists visiting for a local 4th of July festival. One local business owner said that that weekend was the busiest that the town had experienced and that throughout the rest of the year both traffic and pedestrian volumes were relatively low.

According to the Road Diet Survey Form, the primary motivations for implementing a road diet along M-55/M-66, which is the main arterial road through the city, included traffic calming, a reduction of left-turn problems both mid-block and at intersections, and an improvement in overall safety of the corridor, including that of pedestrians and bicyclists. South of the road diet, M-55/M-66 is a 2-lane road. The road diet begins just south of 1st St. and continues for 0.6 miles until it becomes a 2-lane road with parking lanes on either side, just north of Union St. The speed limit for the majority of the road diet is 35 mph, although it changes to 45 heading south a short distance north of 1st St.

- Visit #1: Friday, July 1 arrival at 2:10 pm
- Visit #2: Saturday, July 2 arrival at 11:55 am

Geometric/Marking Observations:

- There is a sidewalk on the east side of the road, which extends nearly the entire length of the site (there are none between Union St. and Hill St.) and it is not separated from the edge of the road.
 - On the opposite side of the road, pedestrians used the bike lane for walking.



Sidewalk directly adjacent to pavement

- There are no crosswalks along the site.
 - Traffic did not yield to pedestrians, and all crossing was done mid-block and rushed through gaps in traffic.
- There are unmarked bike lanes on both sides of the road diet.
 - There were several instances where cars parked along the road diet in the bike lanes, mostly on the side without the sidewalk.



View of bike lane facing north

- On the west side of the road there were staircases that headed down the slope, towards the boardwalk along the beach.
 - Since there is no sidewalk along this side of the road, there is nowhere for people using these staircases to go once they get to the top, forcing them to either cross mid-block to reach the sidewalk across the street, or to walk in the bike lane.
- There were no signalized intersections along the road diet site.

Vehicular Traffic Observations:

- There was noticeable northbound traffic back-up during both visits, although it was much worse during Visit #2. During that visit, traffic was backed up all the way to the south end of the road diet site.
 - Although this was likely an anomaly because of the 4th of July celebrations in Lake City, it presented an example of the road diet not adequately dealing with the traffic load.
 - Many of the cars in the back-up were carrying kayaks and bicycles, suggesting a high tourist population.
 - To get around heavy traffic, motorcycles were seen using bike lanes as right turn lanes.
- Since the beach extends along the west side of the road diet, there are only turning opportunities to use the TWLTL on one side of the road, and most of those are residential driveways. Thus, the TWLTL was not used very often for turning.
 - There were cars seen using the TWLTL for passing in traffic.
 - Some cars used the TWLTL as a waiting lane to turn left onto M-55/M-66, although that maneuver is not legal.
 - Because of the heavy traffic in the northbound lane, there was occasionally backup in the TWLTL as cars had to wait to find gaps to make the left turn.

Pedestrian/Bicyclist Observations:

- 15 minute count on Visit #1:
 - o 24 pedestrians
 - Almost all of these pedestrians were seen in large groups heading north from either Union St. or the public beach parking lot near the north end of the road diet site.
 - o 4 bicyclists
- 15 minute count on Visit #2:
 - o 7 pedestrians
 - o 1 bicyclist
- There was significantly more pedestrian traffic along the commercial district just north of the road diet, than there was along the more residential area where the road diet was in place.
- There was very little activity of either pedestrians or bicyclists along the site.
- Most pedestrian crossings occurred mid-block and often required a long wait to find a safe gap in traffic.

- Because of the heavy traffic, pedestrian crossing was especially difficult, and there were several occasions witnessed where pedestrians were forced to cross in otherwise unsafe circumstances.
- Although the road diet extends along the beach, most beachgoers park in the public lot near the north end of the road diet and go straight along the boardwalk, avoiding walking along the road.

Resident Interactions:

- In a conversation with a local pedestrian walking her dog during Visit #1, the following comments were made:
 - An increase in pedestrian and bicyclist traffic was noticed when the road diet was implemented, especially with tourists.
 - She liked having the TWLTL to make the left turn into her driveway.
 - She said she felt safer walking along the road since the change.

Conclusions:

- The constant heavy stream of northbound traffic observed in the site visit was out of the ordinary and put an abnormal strain on the road diet site.
- With the single adjacent sidewalk, and the lack of crosswalks, pedestrian traffic does not appear to be encouraged along the main portion of the road diet.
- Pedestrians are forced to make mid-block crossings, through heavy traffic.
- Most pedestrian and bicyclist traffic occurs north of the road diet, along the commercial district of Lake City.

SR 33: Mesick, Michigan, Wexford County – M-37/M-115

The village of Mesick, Michigan has a population of 394 according to the 2010 Census, with an estimated median household income of \$25,313. Although there are nearby fishing and camping areas, even on a holiday weekend over which the two visits were made, there did not appear to be much tourist traffic.

According to the Road Diet Survey Form, the primary motivations for implementing a road diet along M-37/M-115, which is the main arterial road through the city, included traffic calming, a reduction of left-turn problems both mid-block and at intersections, and an improvement in overall safety of the corridor, including that of pedestrians and bicyclists. West of the junction of M-37 and M-115, where the road diet begins, the road tapers into a 2-lane road, as it does on the other end of the 0.7 mile long site, just east of Clark St. The speed limit is 35 mph throughout the site, and it becomes 45 mph as you leave the road diet, heading in either direction.

- Visit #1: Friday, July 1 arrival at 4:15 pm
- Visit #2: Saturday, July 2 arrival at 12:20 pm

Geometric/Marking Observations:

- There are sidewalks that run nearly the entire length (but not further in either direction) of the road diet, on both sides of the road.
 - They are separated from the road/parking lanes, and are well landscaped and look very clean; the road is clearly intended to encourage pedestrian activity.



View of landscaped sidewalk along M-37

• There are crosswalks on both sides of nearly every intersection.

• There are also several signs informing drivers of the location of the crosswalks, as well as advanced signs warning them of upcoming crosswalks.



Crosswalk with warning road sign

• Except for the far western portion of the road diet, in which there does not appear to be as heavy a commercial presence, parking lanes line both sides of the road diet. They appear to be used frequently as most storefronts do not have adjacent parking lots.



View of parking lanes facing west

• There are unmarked bike lanes on both sides of the road diet site.



View of bike lanes facing west

Pedestrian/Bicyclist Observations:

- During Visit #1, after a 10 minute pedestrian count upon arrival witnessed no pedestrian activity, the attempt for a longer formal data collection period was abandoned. Throughout the approximately hour-long site visit there were perhaps a total of 5 pedestrians and 1 bicyclist seen.
- 20 minute count on Visit #2:
 - 3 pedestrians
 - o 1 bicyclist
- There was very little pedestrian activity to note during either visit the only real pedestrian activity witnessed was of people crossing the street (usually mid-block) to go from their parked cars to storefronts and vice versa.
 - At the west end of the road diet are both the Mesick public elementary, and Jr./Sr. high school (The high school is located further south, behind the elementary school, but still appears likely to supply significant pedestrian traffic to the road diet.). It appeared as if the pedestrian infrastructure may have been put in place to handle larger volumes from the schools, when it is in session.
- Although there are crosswalks present throughout the site, most pedestrian crossing witnessed was still done mid-block, especially when it was to get to a car parked in the parking lanes.
 - Crossing, either at the crosswalks, or mid-block, was not very difficult, as the level of vehicle traffic was relatively low, though fairly constant.
 - When there were interactions between crossing pedestrians and vehicles, the vehicles correctly assumed right-of-way.

• The few bicyclists seen along the road diet used the sidewalks rather than the bike lanes.

Resident Interactions:

- In a conversation with a local pedestrian during Visit #2, the following comments were made:
 - Pedestrian crossing was noted as a problem as people cross mid-block.
 - Pedestrians are hesitant to use the TWLTL as a refuge when crossing the street.

Conclusions:

- This seems to be an example of a very well-functioning road diet. Vehicle traffic was relatively calm, and there was never any back-up, and there didn't seem to be any problems regarding pedestrian safety or access.
- The wide lanes, parking lanes, and well-landscaped sidewalks gave the town a very quaint feel that would seem to encourage pedestrian and bicycle activity, however it was not used very much.
 - Presumably, there is heavier traffic from the nearby school when it is in session.

SR 24: Manistee, Michigan, Manistee County – US-31

The city of Manistee, Michigan had a population of 6,226 according to the 2010 Census, with an estimated median household income of \$37,721. Located between Lake Michigan and Manistee Lake, it is a popular camping, boating, and fishing tourist location, and, especially over the 4th of July weekend when the visit was made, there is a lot of extra traffic from seasonal visitors.

According to the Road Diet Survey Form, the primary motivations for implementing a road diet along US-31, which is the main arterial road through the city, included traffic calming, a reduction of left-turn problems both mid-block and at intersections, and an improvement in overall safety of the corridor, including that of pedestrians and bicyclists. Just east of the junction with M-55, the road tapers into a 2-lane road, and just east of Lakeshore Rd. it becomes a 5-lane road with a TWLTL. The road diet goes through a commercial district, and ends before the downtown part of town. The speed limit throughout the site is 40 mph.

• Visit #1: Friday, July 1 – arrival at 6:00 pm

Geometric/Marking Observations:

• There are no sidewalks, bike lanes, or cross walks along the road diet site. It is simply a 3-lane road with a TWLTL and no space between the moving lanes and the curb.



Lack of pedestrian or bicyclist infrastructure

Vehicular Traffic Observations:

• Traffic was constant and heavy along the road diet site and there was congestion throughout.

- Turning left, both onto and off of the road diet site was very difficult because of congestion, and forced cars to take bigger risks. Throughout the hour-long observation, there were several occasions witnessed, where horns were sounded, and squeeling tires were heard as vehicles made aggressive maneuvers.
- In one instance, a car attempting to turn left onto the site found a gap in the near lane, and turned into the TWLTL and used it as a waiting lane to get into the far lane. An oncoming truck, however, though that he was being cut off and slammed on the brakes and sounded his horn.

Pedestrian/Bicyclist Observations:

- There were very few pedestrians or bicyclists seen along the road diet site, which was not surprising given the lack of sidewalks or bike lanes.
 - One bicyclist was seen riding along the grass on the side of the road and sometimes venturing onto the side of the road. When this happened, vehicles had to swerve into the TWLTL to pass him.
- The congestion of vehicles on the road and the fast, aggressive style made walking along the side of the road seem unsafe.

Conclusions:

 It is surprising that pedestrian safety was listed as a rationale for the road diet in Manistee, since there is no infrastructure in place to accommodate pedestrians or bicycles.

SR 25: Ludington, Michigan, Mason County – M-116

The city of Ludington, Michigan had a population of 8,076 according to the 2010 Census, with an estimated median household income of \$33,369. Located along Lake Michigan, it is a very popular tourist location, with a large campground and many hotels in the surrounding area. Both visits were done over the 4th of July weekend, when the city was especially busy with tourists.

According to the Road Diet Survey Form, the primary motivations for implementing a road diet along M-116 included traffic calming, a reduction of left-turn problems both mid-block and at intersections, and an improvement in overall safety of the corridor, including that of pedestrians and bicyclists. The road diet site does not go through the main commercial district of town, but is a 0.8 mile stretch of road that extends along the public beach in Ludington. The road diet begins at US-10, and it ends just north of Lowell St., where it tapers into a 2-lane road. The speed limit is 35 mph on M-116 where the road goes along the beach; north of this portion of the road diet, the speed limit changes to 45 mph.

- Visit #1: Friday, July 1 arrival at 7:35 pm
- Visit #2: Saturday, July 2 arrival at 8:10 am

Geometric/Marking Observations:

 There are sidewalks, separated from the road by about 5 feet, along the entirety of the road diet site, on both sides of the road until just north of the beach, where it ends on one side. These sidewalks join a larger network of sidewalks in the neighborhood east of the site and along the main commercial district in Ludington.



View of sidewalk facing north There are crosswalks at most of the cross streets.



View of crosswalk on M-116

Because there is a public beach parking lot that runs parallel to the road diet, and only
has one entrance, there are no possible left turns from the northbound lane for the
majority of the road diet site. Therefore, the TWLTL is striped with a double solid line on
one side, essentially making it a one way turn lane and a waiting lane for cars making
left turns onto the road.



TWLTL with solid double line on one side

• There are unmarked bike lanes throughout the site on both sides of the road.



View of bike lane facing north

Vehicular Traffic Observations:

- Although the speed limit is 35 mph, traffic seemed to always be traveling at even slower speeds.
 - There are lots of motorcycles that travel along M-116, and they all seem to travel at speeds less than 35 mph as well.
- Except for the driveway into the public beach parking lot, the rest of the driveways were residential along the road diet site, and they were all on the side of the road opposite the beach, meaning that the TWLTL was rarely occupied outside of the turn lane into the beach parking lot.
- The volume of vehicular traffic was obviously much higher during Visit #1 (Friday evening) than during Visit #2 (Saturday morning), but it was never high enough that the road was congested.
- Some cars were seen making left turns out of the outside lane, rather than using the TWLTL.

Pedestrian/Bicyclist Observations:

- 20 minute count on Visit #1 (south end of site):
 - o 17 pedestrians
 - 6 bicyclists
- 15 minute count on Visit #1 (middle of site):
 - 24 pedestrians
 - o 11 bicyclists
- 30 minute count on Visit #2 (middle of site):
 - 46 pedestrians
 - 9 bicyclists

- During both visits, most of the pedestrian traffic seems to be travel across the road and to the beach. People seemed to walk along the beach rather than actually travelling on the sidewalks along the road.
 - Almost all pedestrians crossed at one of the crosswalks, rather than mid-block. The highest frequency of these crossings occurred at the intersection of Haight St. and Pere Marquette St., which, after conversation with a pedestrian, were along the most direct path to the campground.
 - Pedestrians and bicyclists typically crossed M-116 from the neighborhood to the east towards the beach and back. Although some of the bicycle traffic was to and from a skate park at the south end of the site. This usually meant that they travelled on the sidewalks rather than in the bike lanes.
- During Visit #1, most of the pedestrians and bicyclists travelled in groups to and from the beach, and during Visit #2, most of them were morning exercisers (runners, etc.).
- There was much less pedestrian and bicyclist traffic on the section of the site north of the public beach, and on this portion of the site, they were mostly residents travelling north and south along the road to and from the beach, using the sidewalks and bike lanes.
 - Even on the northern part of the site, bicyclists tend to use the sidewalks rather than the bike lanes.
- The vehicular traffic on M-116 was light enough that pedestrians and bicyclists so there was never much delay.

Resident Interactions:

- In a conversation with two local pedestrians during Visit #1, the following comments were made:
 - General perception of the road diet was that it was a very positive change.
 - The change increased pedestrian traffic significantly.
 - Lots of bikes are seen using the bike lanes.
 - Their single complaint was that cars did not yield to pedestrians at crosswalks, and that there is no designation informing drivers that pedestrians have the right-of-way, indicating a lack of education on traffic law, since vehicles legally have the right-of-way in such a situation.
- In a conversation with a pair of bicyclists during Visit #1, the following comments were made:

- They came through the neighborhood to the east, from the campground, and crossed to go to the beach. They followed a bike path network that goes from the campground to the beach.
- They prefer to ride on sidewalks, which they can do in the neighborhood, and do not like riding on "the road" on M-116.
 - They did not seem to be aware of the purpose of the bike lanes, which may not be surprising given that they were tourists and that the bike lanes were unmarked.
- In a conversation with a local pedestrian walking his dog during Visit #2, the following comments were made:
 - General perception of the road diet was very positive and that was the case for everyone he knew locally.
 - The most positive change was that the road diet slowed down vehicles, making it much safer for pedestrians to walk along the road and to cross it to go towards the beach.
 - When it was a 4-lane road, there were lots of vehicles, especially motorcycles, that would race alongside each other down M-116.
 - He never noticed any times when traffic would back up.
 - When the change was first announced, his wife was very skeptical, as were many others, but after experiencing its effects, they were unanimously in favor of it.

Conclusions:

- This seems to be an example of a very successful, well-functioning road diet. Traffic seems to be very calm and safe for pedestrians and bicyclists. It seems that the road diet has encouraged beachgoers to walk or bike to the beach rather than driving and parking in the lot.
- Of the visited sites, this site by far had the most pedestrian activity, although it did not have the most vehicular traffic.

SR 42: East Lansing, Michigan, Ingham County – Burcham Rd.

The city of East Lansing, Michigan had a population of 48,579 according to the 2010 Census, with an estimated median household income of \$27,898. As the location of Michigan State University, it is home to a large student population, who are younger and more active than the average population in non-college cities. There is, to be expected, a higher level of pedestrian and bicycle traffic from this demographic than in other places studied. All visits to the sites in East Lansing were done on weekdays during the school year, in order to witness the impact of student traffic on the road diet sites.

According to the Road Diet Survey Form, the primary motivations for implementing a road diet along Burcham Rd. included traffic calming, a reduction of left-turn problems both mid-block and at intersections, a reduction in traffic volumes, and an improvement in overall safety of the corridor, including that of pedestrians and bicyclists. Along Burcham Rd., in addition to a lot of MSU student housing, are three East Lansing public schools (EL High School, MacDonald Middle School, and Marble Elementary School), as well as a nearby private school, contributing high volumes of pedestrian and bicyclist traffic to the corridor. The road diet begins at the western end of Burcham Rd., at Abbot Rd. – across Abbot Rd., Burcham Rd. becomes a driveway for the East Lansing Community Center. The road diet site is 1.6 miles long, and, at its eastern end, it tapers into a 2-lane road. The speed limit for the entire length is 25 mph.

• Visit: Tuesday, September 13 – arrival at 7:30 am

Geometric/Marking Observations:

There are sidewalks on both sides of the road that run nearly the entire length of the site (on the north side of the road, there is no sidewalk for the easternmost 0.25 mi). They vary in width of separation from the road throughout the road diet, depending on the surrounding land use, and they connect with a larger network of sidewalks within the surrounding residential neighborhoods.

• There are crosswalks throughout the site, especially around the schools, which are, in general, used correctly.



View of crosswalk at Bailey St.

- Traffic, which was consistently heavy, did not always yield to pedestrians and bicyclists waiting to cross the street around the high school. Pedestrians often made aggressive crossing maneuvers, forcing traffic to wait for them to cross.
- Many of the crosswalks included traffic signs indicating their location and purpose.



Pedestrian crossing sign

- Near the middle and elementary schools, there were crossing guards that would stop traffic to allow the safe crossing of students in the crosswalks.
- There was a noticeable lack of crosswalks between school areas, where there are large MSU student apartment complexes. Pedestrians at these destinations crossed midblock at any gap in vehicular traffic.

• There are marked bike lanes on both sides of the road diet site.



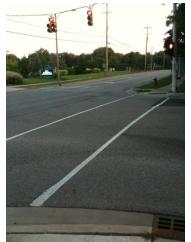
Bike lane marking

• There was a signalized intersection with Abbot Rd. at the western end of the road diet, as well as one with Hagadorn Rd. in the middle of site.



Signalized intersection at Abbot Rd.

• Both signalized intersections also have signalized pedestrian crosswalks.



Signalized crosswalk at Abbot Rd.

• There are no other stop or yield signs along the mainline of the road diet.

Vehicular Traffic Observations:

- Traffic volumes were very high during the visit, as many cars were entering and exiting the schools' parking lots, as well as all of the public school buses. This, at times, made for very congested traffic.
 - Although volumes were high, vehicle delay appeared to be relatively low for turns into the schools. The TWLTL functioned well in allowing traffic to continue steadily, while cars attempting to turn into the schools were able to wait for an appropriate gap.
 - There was significant backup as cars attempted to exit the parking lot and turn onto Burcham Rd. Since vehicles in the TWLTL making turns into the parking lot assumed right-of-way, it was nearly impossible to make a left turn onto Burcham Rd. through the line of waiting cars.
 - Despite the occasional backup, there were never any signs of aggression witnessed, or dangerous driving in regards to vehicle-vehicle interactions.
- Drivers appeared to be well-educated as to the purposes and use of the geometric features of the TWLTL and bike lanes. This is likely at least partially due to the regularity inherent to the types of trips being made on this site (bus drivers, parents dropping of kids, student housing, etc.).

Pedestrian/Bicyclist Observations:

- 15 minute count in front of the high school:
 - o 19 pedestrians

- o 16 bicyclists
- Outside of one or two recreational runners, these pedestrians and bicyclists were exclusively headed towards the high school from various surrounding residential areas.
- 15 minute count on near the elementary school:
 - o 18 pedestrians
 - o 10 bicyclist
 - While many of these pedestrians were students (and their parents), there appeared to be more recreational traffic during this count (runners, recreational bicyclists, walkers with strollers, etc.), but this was likely due to the fact that the count was done about 30 minutes after the first one.
- Most of the pedestrian and bicyclist traffic was associated with the nearby schools, and was therefore most highly concentrated in those areas.
 - Students often travelled in the neighborhoods south of Burcham Rd. and only came to the road diet to cross to the high school, rather than walking along Burcham Rd. for a majority of their trip.
- As there were no crossing guards for traffic at the high school, pedestrians and bicyclists were forced to find safe gaps in traffic on their own. This was often difficult with such heavy vehicular traffic, and there was one incident witnessed where two pedestrians crossed in a short gap and a car had to stop suddenly to avoid a collision.
- Bicyclists often used sidewalks rather than bike lanes, despite the clear markings. Runners often used the bike lanes rather than the sidewalks.
- Several bicyclists were seen using the TWLTL to cross the street and make left turns off of Burcham Rd. Although they were using the bike lanes while travelling along the road diet site, they would enter vehicle traffic in order to make those left turns.

Resident Interactions:

- In a conversation with a crossing guard during a period of low pedestrian traffic, the following comments were made:
 - Pedestrians are not as safe as they were before the implementation of the road diet.
 - There are fewer students who walk to school than there were before the change.
 - Vehicle speeds are still too high, and conditions are not safe for crossing without the control of the crossing guard.
 - There used to be a guard at the crosswalk near Bailey St., where students cross to the high school. There is not anymore, and it is an unsafe location to cross.

• Vehicles do not understand how to use the TWLTL; they often make left turns out of the far lane and hold up other traffic.

Conclusions:

- The road diet appeared to be successful at slowing down vehicular traffic. Despite the comments of the crossing guard, there were never any excessive speeds noticed along the site.
- While the speed of traffic was fairly calm, volumes were high, and there was occasional congestion and delay, especially in traffic turning onto Burcham Rd.
 - Pedestrian crossing was occasionally difficult and forced people to attempt to cross in unsafe gaps.
- A large majority of traffic, vehicular, pedestrian, and bicyclist, was associated with the schools along the corridor.
 - Most vehicular traffic was between Abbot Rd. and Hagadorn Rd., where the schools are located. Traffic along the road diet site east of Hagadorn Rd. was significantly lower than it was west of the intersection.
- Contrary to the observations of the interviewed crossing guard, there appeared to be a reasonable level of understanding as to the proper use of the TWLTL, which contributed to a better flow of traffic throughout the road diet, relative to some of the sites visited in Northern Michigan.

SR 43: East Lansing, Michigan, Ingham County – Abbot Rd.

The city of East Lansing, Michigan had a population of 48,579 according to the 2010 Census, with an estimated median household income of \$27,898. As the location of Michigan State University, it is home to a large student population, who are younger and more active than the average population in non-college cities. There is, to be expected, a higher level of pedestrian and bicycle traffic from this demographic than in other places studied. All visits to the sites in East Lansing were done on weekdays during the school year, in order to witness the impact of student traffic on the road diets.

According to the Road Diet Survey Form, the primary motivations for implementing a road diet along Abbot Rd. included traffic calming, a reduction of left-turn problems both mid-block and at intersections, and an improvement in overall safety of the corridor, including that of pedestrians and bicyclists. There is a mixture of residential (MSU student housing) and commercial/institutional (including the East Lansing Library and Post Office) land uses along this section of Abbot Rd. The road diet begins Albert Ave. and continues north for 0.6 mi. to Whitehills Dr., where the road tapers into a 5-lane road with aTWLTL. The speed limit for the entire length of the site is 25 mph.

• Visit: Tuesday, September 13 – arrival at 7:30 am

Geometric/Marking Observations:

- There are sidewalks on both sides of the road that run the entire length of the road diet and are separated from the road by approximately 5 ft. They connect with a larger network of sidewalks within the surrounding residential neighborhoods.
- There are crosswalks throughout the road diet, located at nearly every intersection, signalized or otherwise.
- There are bike lanes on both sides of the road diet, with simple arrow markings indicating proper direction, although the bicycle symbol is not present in the lanes.
- There is a signalized intersection with Albert Ave. at the southern end of the road diet, as well as with Burcham Rd. and Library Ln. in the middle of site.
 - All three signalized intersections also have signalized pedestrian crosswalks.
 - There are no other stop or yield signs along the mainline of the road diet.

Vehicular Traffic Observations:

• Traffic volumes were high throughout the visit, and many of the vehicles were associated with the public high school located nearby on Burcham Rd.

- There was significant delay (a queue of nearly 20 cars) at both the intersections of Library Ln. and Burcham Rd.
 - This queuing stopped at about 7:50, however, presumably, with the end of the high school arrival and drop-off period.
- Vehicles regularly used the TWLTL as a merging lane to make left turns onto Abbot Rd. from the side streets and driveways.

Pedestrian/Bicyclist Observations:

- 15 minute count at Library Ln:
 - o 4 pedestrians
 - o 33 bicyclists
 - There were significantly more bicyclists than pedestrians along this portion of the site. Many of these bicyclists turned onto Burcham Rd. and headed toward the high school.
- 15 minute count at Albert Ave:
 - 27 pedestrians
 - o 37 bicyclist
 - The majority of these pedestrians and bicyclists were college students, rather than high school students, headed south towards the MSU campus.
- There was a mixture of college (MSU) and high school (ELHS) students travelling along this site during this morning period of study.
- Bicyclists used both the bike lanes (sometimes using the wrong one according to direction), and the sidewalks.
 - A general trend was noticed that bicyclists headed towards the high school tended to ride on the sidewalks, while college students rode in the bike lanes.
- Pedestrians typically crossed appropriately at the crosswalks, while bicyclists would cross mid-block, whenever there was a safe gap.

Conclusions:

- The road diet appears to be successful at making pedestrian and bicycle travel reasonably safe for both the local high school traffic and MSU student traffic.
- This time period was one of high vehicular traffic volumes perhaps temporarily above the capacity of the road diet causing significant backup at the signalized intersections.

Grand River Ave: East Lansing, Michigan, Ingham County – M-43

The city of East Lansing, Michigan had a population of 48,579 according to the 2010 Census, with an estimated median household income of \$27,898. As the location of Michigan State University, it is home to a large student population, who are younger and more active than the average population in non-college cities. There is, to be expected, a higher level of pedestrian and bicycle traffic from this demographic than in other places studied. All visits to the sites in East Lansing were done on weekdays during the school year, in order to witness the impact of student traffic on the road diets.

While this corridor was not a site included in this study, it was selected as a viable candidate for a site visit due to its status as a recent, local road diet that is located in a heavy pedestrian area. The road diet begins at Michigan Ave. and continues northwest for 0.9 mi until it tapers into a 2-lane road near Audubon Rd. There is some commercial land use at the east end of the road diet, but the majority is residential. The speed limit is 25 mph throughout the site.

• Visit: Thursday, September 15 – arrival at 12:45 pm

Geometric/Marking Observations:

- There are sidewalks on both sides of the road that run the entire length of the road diet and are separated from the road by approximately 5 ft. They connect with a larger network of sidewalks within the surrounding residential neighborhoods.
- There are crosswalks throughout the road diet, located at nearly every intersection, signalized or otherwise.
 - There are several signs located along the site indicating the location of crosswalks and presence of pedestrians.
- There are unmarked bike lanes on both sides of the road diet site.
- There are signalized intersections at Hillcrest Ave., Harrison Ave., and Kensington Rd.
 - All three signalized intersections also have signalized pedestrian crosswalks.
 - There are no other stop or yield signs along the mainline of the road diet site.

Vehicular Traffic Observations:

• There was delay at the intersection with Harrison Ave. that led to a queue of about 15 vehicles.

Pedestrian/Bicyclist Observations:

• 15 minute count at Harrison Ave:

- o 7 pedestrians
- 3 bicyclists
- 15 minute count at Hillcrest Ave:
 - 13 pedestrians
 - 8 bicyclist
- The majority of all pedestrian and bicyclist traffic along this corridor was made up of college students.
- Bicyclists tended to use the sidewalks rather than ride in the designated bike lanes.
 - When they did ride in the bike lanes, they managed to safely remain in view of drivers at all times, leading to a minimization of bicyclist/vehicle conflict at intersections.

Conclusions:

- The bike lanes appeared to be successful in making bicyclist/vehicle interactions safer, when bicyclists actually used them.
 - There appeared to be either a lack of education regarding the use of the bike lanes (they were unmarked, unlike others in East Lansing), or a lack of comfort about using them among riders.

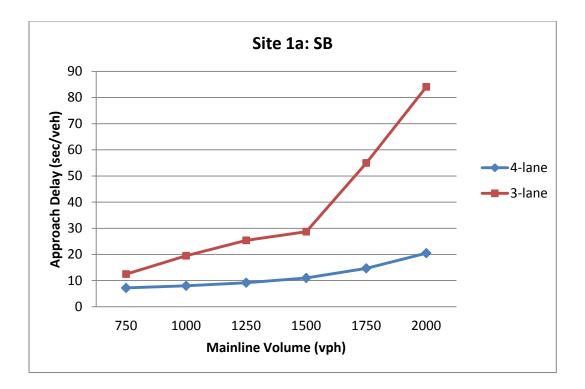
Overall Summary/Conclusions

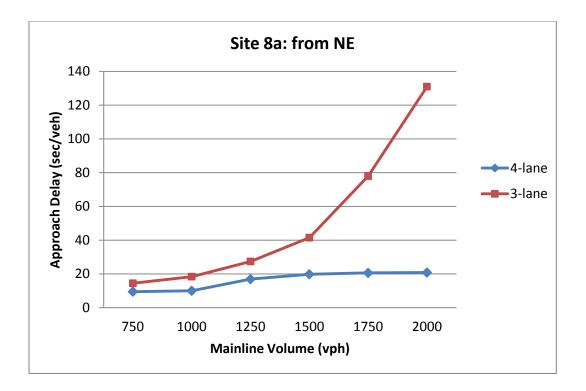
- Unsurprisingly, a lack of pedestrian and bicyclist infrastructure along a road diet site resulted in a very low amount of non-motorized use of the corridor.
- The two most notable characteristics of a well-functioning road diet with significant non-motorized use (besides simply having infrastructure) were:
 - Placement along corridors with commercial and pedestrian attractions:
 - The site in Lake City was located along a residential corridor of the road, just south of the city's commercial core. Despite having the infrastructure, and observations being made during the busiest weekend of the year, there was very little pedestrian activity along the site, as there was no pedestrian oriented attraction at this site; instead, all of the pedestrian activity took place north of the site, along the commercial strip of town.
 - The road diet in Baldwin ended just before reaching the main commercial district in town, therefore it had no impact on the majority of pedestrian traffic in Baldwin.
 - While there was little activity observed during the visits to Mesick, it could be inferred, based on the signage, crosswalk locations, and location of the public school, that when school is in session, there is a reason for pedestrians and bicyclists to use the infrastructure present along the road diet.
 - The site in Ludington was located along the public beach, which acted as a significant pedestrian generator for the corridor. The Burcham Rd. and Abbot Rd. sites in East Lansing both attracted lots of pedestrian and bicycle use from students from the nearby schools and Michigan State University.
 - Successful traffic calming:
 - Based on observations and conversations with local residents, the main cause of the increase in pedestrian usage along the Ludington site, appeared to be the calming of traffic. While the area is largely residential in land use, the adjacent public beach had always acted as an attraction for pedestrians and bicyclists, and now that traffic was slower, the road was easier to cross and walk along, encouraging beachgoers to walk or bike there, rather than drive and use the parking lot.
 - Although the site in Baldwin was in a relatively commercial area, with pedestrian destinations, the road diet was designed such that traffic still sped through the corridor, making it appear unsafe to cross or bike along.

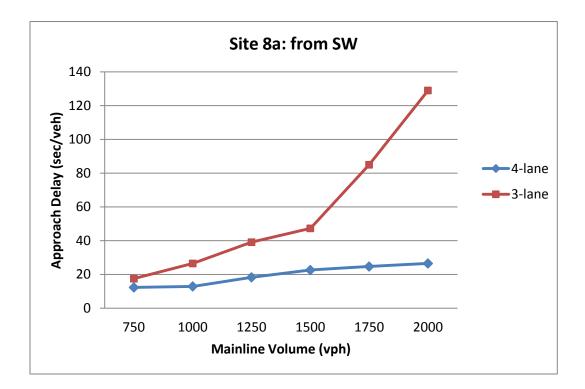
- Along the Mesick site, even though the observed pedestrian traffic was low, the road diet had successfully calmed traffic, and, simply by walking up and down the corridor, you could feel that it was safe for pedestrian and bicyclist activity.
- In several conversations with residents and in observations of interactions between motorized and non-motorized vehicles, it could be seen that, at some locations, there was a lack of proper education regarding the use of different aspects of the road diet projects.
 - Bikers were often seen riding on sidewalks rather than using the bike lanes, which were never designated as such. Pedestrians were also occasionally observed using bike lanes, even when there was an adjacent sidewalk. There appeared to be a better understanding of the purpose of bike lanes at the sites in East Lansing, where there were bicycle markings on the pavement.
 - There seemed to be a lack of clarity regarding right-of-way at crosswalks along the road diet sites. Typically, vehicles correctly assumed it; residents complained, however, that crossing was difficult when vehicles did not yield to pedestrians – most notably in Ludington.
 - Vehicles occasionally used the TWLTL as a waiting lane in making left turns onto the road diet; others did not, although it was unclear whether that was because they were aware that it was an illegal maneuver or because they just felt uncomfortable doing so.
 - On those occasions that the TWLTL was used as a waiting lane to turn into the far moving lane, drivers in the far lane were uneasy, and thought that they were being cut off.

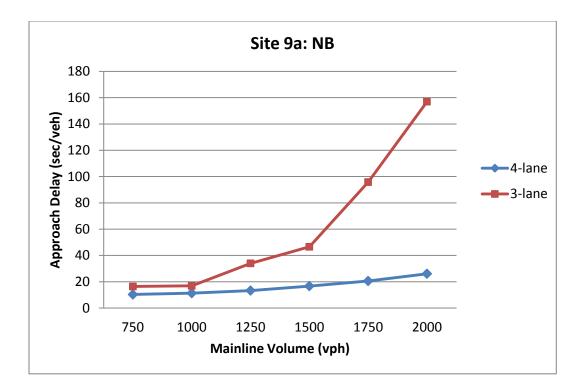
APPENDIX C

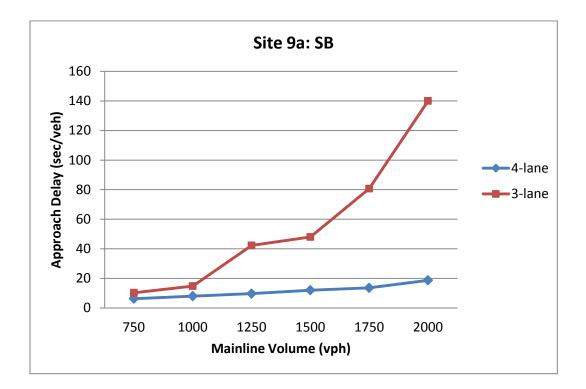
OPERATIONAL ANALYSIS—ADDITIONAL RESULTS

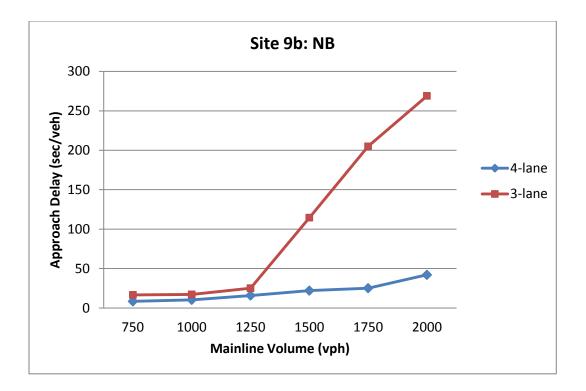


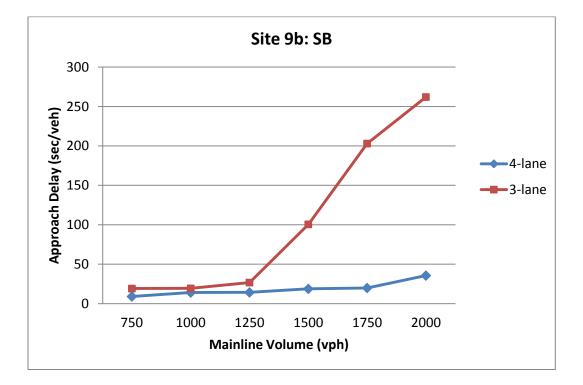


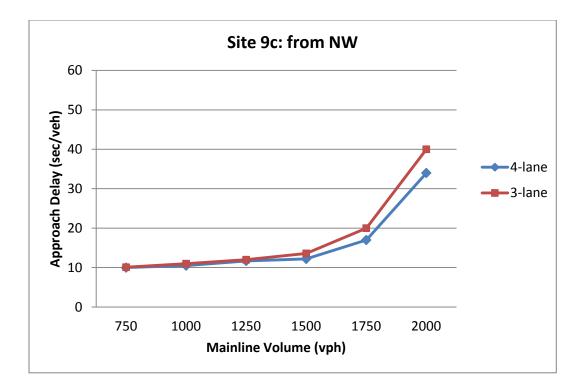


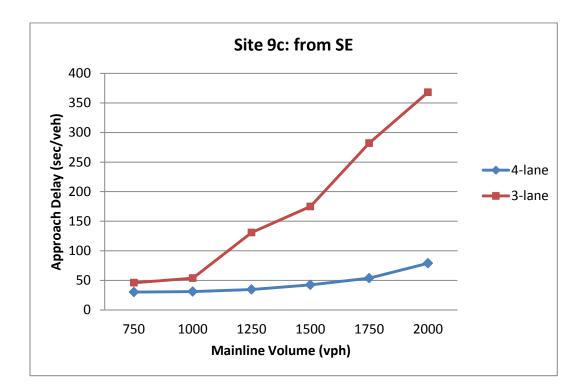


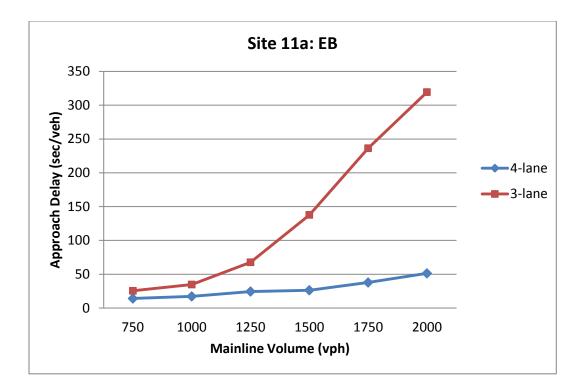


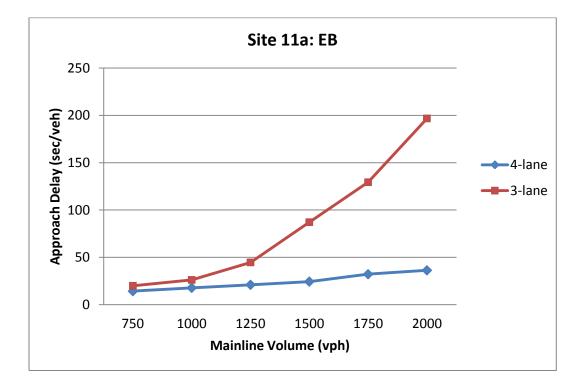


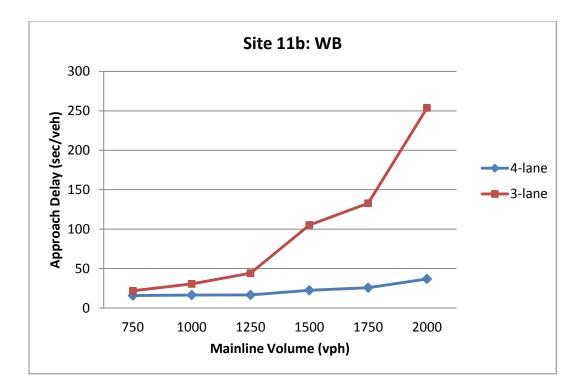


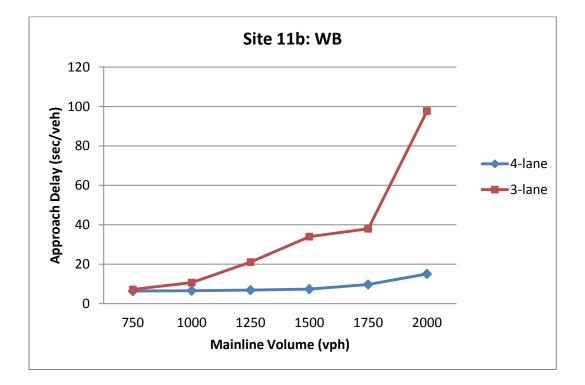


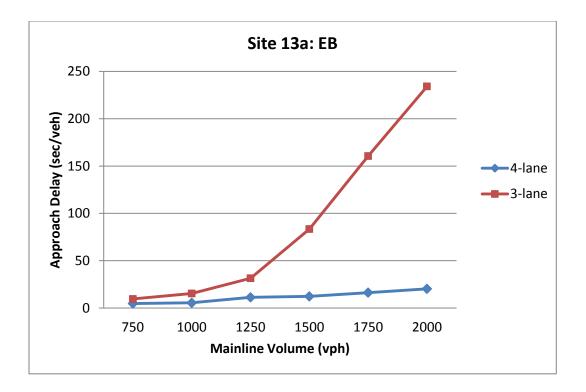


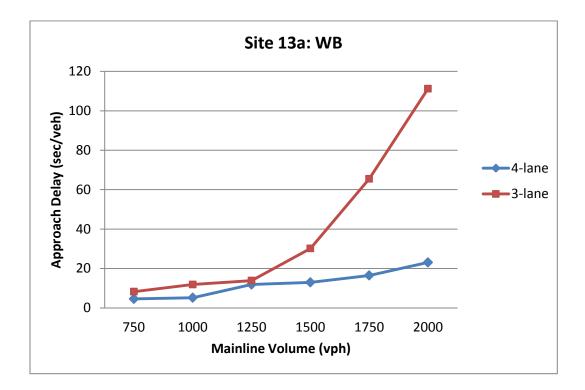


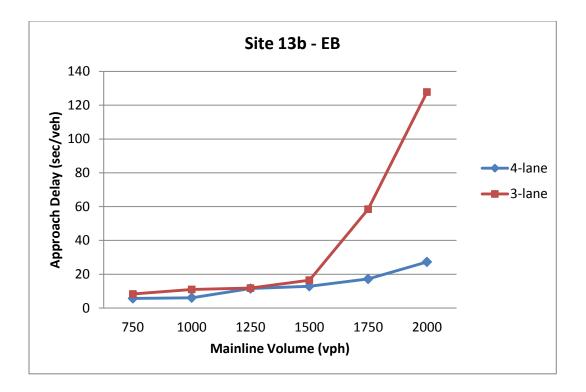


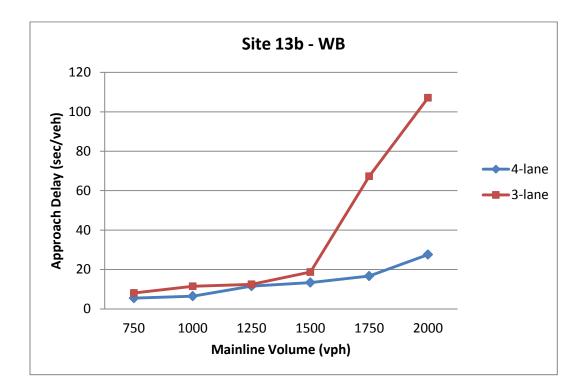












APPENDIX D

SAFETY ANALYSIS—DETAILED SITE-BY-SITE INFORMATION

Summary/synthesis for crash analysis (CMFs)

							0	MF correcti	ion factors									
site	~ADT	length (miles)	~avg annual crash	# of drivwys	# of intersecs	type	based on county trend	based on dity trend	based on trunkline county trend	based on trunkline city trend	basic CMF	basic CMF corrected by city trend	CMF based on recoded crashes	recoded CMF corrected by city trend	CMF for affected crashes	affected CMF corrected by city trend	CMF for corrected crashes	corrected CMF corrected by city trend
1	13442	0.37	34	19	4	com	0.91	0.78	1.07	0.84	0.84	1.06	n/a	n/a	n/a	n/a	n/a	n/a
2	13261	1.44	41	26	17	com	0.98	0.56	0.88	0.47	0.47	0.91	0.47	0.91	0.39	0.83	0.13	0.56
3	10965	4.33	53	100	35	res	0.87	0.73	0.87	0.68	0.66	0.93	0.62	0.90	0.59	0.86	0.30	0.57
4	11062	0.53	3	16	8	com	0.78	0.63	0.83	0.72	0.36	0.72	0.18	0.55	0.22	0.59	1.00	1.37
8	14328	0.81	39	49	7	com	0.81	0.68	0.79	0.66	0.79	1.11	0.79	1.10	0.81	1.12	0.21	0.53
9	17020	0.43	38	16	8	com	0.81	0.60	0.78	0.54	0.46	0.86	0.45	0.86	0.52	0.92	0.33	0.74
11	14572	1.46	43	80	12	mix	0.75	0.85	0.72	0.71	0.78	0.93	0.73	0.88	0.75	0.90	0.21	0.36
13	9016	1.31	25	97	11	mix	0.84	0.64	0.83	0.51	0.61	0.98	0.56	0.92	0.50	0.86	0.15	0.51
16	12342	0.87	24	58	8	res	0.84	0.84	0.83	0.90	0.49	0.65	0.31	0.47	0.30	0.46	0.27	0.43
18	7137	0.96	5	55	6	res	0.76	0.80	0.71	10.43	0.80	1.00	0.77	0.97	0.83	1.04	0.17	0.37
20	12639	0.68	7	34	9	res	0.80	0.69	0.75	0.79	0.60	0.91	0.69	1.00	1.43	1.74	0.40	0.71
22	7663	0.22	6	12	3	com	0.93	0.47	0.77	0.41	0.52	1.05	n/a	n/a	n/a	n/a	n/a	n/a
23	14652	0.50	20	23	9	com	0.72	0.76	0.78	0.93	0.69	0.93	0.75	0.99	0.86	1.10	0.36	0.60
25	6512	0.79	10	38	4	res	0.81	0.71	0.89	0.72	0.59	0.88	0.58	0.87	0.88	1.16	0.80	1.09
26	10855	0.58	4	39	5	res	0.95	0.87	0.97	0.96	0.44	0.57	0.11	0.24	0.22	0.35	0.00	0.13
29	10747	0.49	7	30	4	res	0.78	0.79	0.86	0.83	0.32	0.53	0.40	0.61	0.24	0.44	0.00	0.21
30	7676	0.38	10	25	8	mix	0.76	0.76	0.80	0.90	0.76	1.00	1.50	1.74	0.69	0.93	0.30	0.54
33	7049	0.69	10	19	6	mix	0.81	0.53	0.87	0.67	0.51	0.98	0.59	1.06	0.67	1.13	0.33	0.80
34	7719	0.46	6	22	2	com	0.79	0.67	0.76	0.29	0.64	0.97	0.56	0.89	0.62	0.95	0.20	0.53
36	4995	0.86	5	42	5	mix	0.76	0.72	0.69	0.00	0.52	0.80	0.43	0.70	0.42	0.69	0.13	0.40
37	14164	0.30	10	4	4	com	0.87	0.88	0.81	0.91	0.49	0.61	0.68	0.80	0.50	0.62	0.33	0.46
39	n/a	0.39	19	14	5	res	0.81	0.69	0.91	0.77	0.48	0.79	0.81	1.13	0.92	1.23	0.24	0.55
40	3510	0.50	6	31	7	com	0.65	0.71	0.62	0.68	1.40	1.69	2.00	2.29	0.60	0.89	0.67	0.96
43	13660	0.62	46	27	11	mix	0.97	0.94	0.91	0.78	0.89	0.95	n/a	n/a	n/a	n/a	n/a	n/a
average	10652	1	20	37	8		0.824	0.721	0.821	1.088	0.630	0.91	0.67	0.95	0.62	0.90	0.31	0.59
std dev	3587.02	0.82	16.09	25.54	6.62		0.080	0.115	0.096	2.002	0.225	0.23	0.42	0.42	0.29	0.31	0.25	0.28
max	17020	4	53	100	35		0.978	0.936	1.073	10.429	1.400	1.69	2.00	2.29	1.43	1.74	1.00	1.37
min	3510	0	3	4	2		0.648	0.467	0.616	0.000	0.323	0.53	0.11	0.24	0.22	0.35	0.00	0.13
										n	24	24		21		21		21
										95% conf	0.090	0.092		0.182		0.134		0.122
										μ-95%	0.540	0.817		0.765		0.762		0.469
										µ195%	0.720	1.001		1.128		1.030		0.712

Summary/synthesis for crash analysis (CMFs)--split by "high" and "low" crash frequencies

						0	MF correcti	ion factors			corrected (ded crashes		ted crashes		crashes w/c
site	~ADT	length (miles)	~avg annual crash		type	based on county trend	based on city trend	based on trunkline county trend	city trend	basic CMF	besic CMF corrected by city trend	CMF based on recoded crashes	recoded CMF corrected by city trend	CMF for affected crashes	affected CMF corrected by city trend	CMF for corrected crashes	corrected CMF corrected by city trend
3	10965	4.33	53		res	0.87	0.73	0.87	0.68	0.66	0.93	0.62	0.90	0.59	0.86	0.30	0.57
43	13660	0.62	46		mix	0.97	0.94	0.91	0.78	0.89	0.95	n/a	n/a	n/a	n/a	n/a	n/a
11	14572	1.45	43		mix	0.75	0.85	0.72	0.71	0.78	0.93	0.73	0.88	0.75	0.90	0.21	0.36
2	13261	1.44	41		com	0.98	0.56	0.88	0.47	0.47	0.91	0.47	0.91	0.39	0.83	0.13	0.56
8	14328	0.81	39		com	0.81	0.68	0.79	0.66	0.79	1.11	0.79	1.10	0.81	1.12	0.21	0.53
9	17020	0.43	38		com	0.81	0.60	0.78	0.54	0.46	0.86	0.45	0.86	0.52	0.92	0.33	0.74
1	13442	0.37	34		com	0.91	0.78	1.07	0.84	0.84	1.06	n/a	n/a	n/a	n/a	n/a	n/a
13	9016	1.31	25		mix	0.84	0.64	0.83	0.51	0.61	0.98	0.56	0.92	0.50	0.86	0.15	0.51
16	12342	0.87	24		res	0.84	0.84	0.83	0.90	0.49	0.65	0.31	0.47	0.30	0.46	0.27	0.43
23	14652	0.50	20		com	0.72	0.76	0.78	0.93	0.69	0.93	0.75	0.99	0.86	1.10	0.36	0.60
39	n/a	0.39	19		res	0.81	0.69	0.91	0.77	0.48	0.79	0.81	1.13	0.92	1.23	0.24	0.55
				summary	avg	0.85	0.73	0.85	0.71	0.65	0.92	0.61	0.91	0.63	0.92	0.24	0.54
				statistics	std dev	0.08	0.11	0.09	0.15	0.16	0.12	0.17	0.19	0.22	0.22	0.08	0.11
				for "high"	max	0.98	0.94	1.07	0.93	0.89	1.11	0.81	1.13	0.92	1.23	0.36	0.74
				crash	min	0.72	0.56	0.72	0.47	0.46	0.65	0.31	0.47	0.30	0.46	0.13	0.36
33	7049	0.69	10		mix	0.81	0.53	0.87	0.67	0.51	0.98	0.59	1.06	0.67	1.13	0.33	0.80
25	6512	0.79	10		res	0.81	0.71	0.89	0.72	0.59	0.88	0.58	0.87	0.88	1.16	0.80	1.09
30	7676	0.38	10		mix	0.76	0.76	0.80	0.90	0.76	1.00	1.50	1.74	0.69	0.93	0.30	0.54
37	14164	0.30	10		com	0.87	0.88	0.81	0.91	0.49	0.61	0.68	0.80	0.50	0.62	0.33	0.46
29	10747	0.49	7		res	0.78	0.79	0.86	0.83	0.32	0.53	0.40	0.61	0.24	0.44	0.00	0.21
20	12639	0.68	7		res	0.80	0.69	0.75	0.79	0.60	0.91	0.69	1.00	1.43	1.74	0.40	0.71
22	7663	0.22	6		com	0.93	0.47	0.77	0.41	0.52	1.05	n/a	n/a	n/a	n/a	n/a	n/a
34	7719	0.46	6		com	0.79	0.67	0.76	0.29	0.64	0.97	0.56	0.89	0.62	0.95	0.20	0.53
40	3510	0.50	6		com	0.65	0.71	0.62	0.68	1.40	1.69	2.00	2.29	0.60	0.89	0.67	0.96
36	4995	0.86	5		mix	0.76	0.72	0.69	0.00	0.52	0.80	0.43	0.70	0.42	0.69	0.13	0.40
18	7137	0.96	5		res	0.76	0.80	0.71	10.43	0.80	1.00	0.77	0.97	0.83	1.04	0.17	0.37
26	10855	0.58	4		res	0.95	0.87	0.97	0.96	0.44	0.57	0.11	0.24	0.22	0.35	0.00	0.13
4	11062	0.53	3		com	0.78	0.63	0.83	0.72	0.36	0.72	0.18	0.55	0.22	0.59	1.00	1.37
				summary	avg	0.81	0.71	0.79	1.41	0.61	0.90	0.71	0.98	0.61	0.88	0.36	0.63
				statistics	std dev	0.08	0.12	0.09	2.72	0.27	0.30	0.54	0.55	0.34	0.38	0.31	0.37
				for "low"	max	0.95	0.88	0.97	10.43	1.40	1.69	2.00	2.29	1.43	1.74	1.00	1.37
				crash	min	0.65	0.47	0.62	0.00	0.32	0.53	0.11	0.24	0.22	0.35	0.00	0.13

Summary/synthesis for crash analysis (CMFs)--split by res, com, and mix

						0	MF correcti	ion factors			corrected (ded crashes		ted crashes		trashes w/c
site	~ADT	length (miles)	~avg annual crash		type	based on county trend	based on dity trend	based on trunkline county trend	based on trunkline city trend	basic CMF	besic CMF corrected by city trend	CMF based on recoded crashes	recoded CMF corrected by city trend	CMF for affected crashes	affected CMF corrected by city trend	CMF for corrected crashes	corrected CMF corrected by city trend
3	10965	4.33	53		res	0.87	0.73	0.87	0.68	0.66	0.93	0.62	0.90	0.59	0.86	0.30	0.57
16	12342	0.87	24		res	0.84	0.84	0.83	0.90	0.49	0.65	0.31	0.47	0.30	0.46	0.27	0.43
18	7137	0.96	5		res	0.76	0.80	0.71	10.43	0.80	1.00	0.77	0.97	0.83	1.04	0.17	0.37
20	12639	0.68	7		res	0.80	0.69	0.75	0.79	0.60	0.91	0.69	1.00	1.43	1.74	0.40	0.71
25	6512	0.79	10		res	0.81	0.71	0.89	0.72	0.59	0.88	0.58	0.87	0.88	1.16	0.80	1.09
26	10855	0.58	4		res	0.95	0.87	0.97	0.96	0.44	0.57	0.11	0.24	0.22	0.35	0.00	0.13
29	10747	0.49	7		res	0.78	0.79	0.86	0.83	0.32	0.53	0.40	0.61	0.24	0.44	0.00	0.21
39	n/a	0.39	19		res	0.81	0.69	0.91	0.77	0.48	0.79	0.81	1.13	0.92	1.23	0.24	0.55
						0.83	0.76	0.85	2.01	0.55	0.78	0.54	0.77	0.67	0.91	0.27	0.51
				summary	avg std dev	0.06	0.76	0.05	3.40	0.55	0.78	0.34	0.30	0.67	0.91	0.2/	0.30
				for "res"	max	0.95	0.07	0.06	10.43	0.80	1.00	0.24	113	1.43	1.74	0.20	1.09
				sites	min	0.35	0.69	0.71	0.68	0.32	0.53	0.11	0.24	0.22	0.35	0.00	0.13
				31043		0.70	0.00	0.72	0.00	0.22	0.33	0.11	0.24	0.22	0.20	0.00	
11	14572	1.46	43		mix	0.75	0.85	0.72	0.71	0.78	0.93	0.73	0.88	0.75	0.90	0.21	0.36
13	9016	1.31	25		mix	0.84	0.64	0.83	0.51	0.61	0.98	0.56	0.92	0.50	0.86	0.15	0.51
30	7676	0.38	10		mix	0.76	0.76	0.80	0.90	0.76	1.00	1.50	1.74	0.69	0.93	0.30	0.54
33	7049	0.69	10		mix	0.81	0.53	0.87	0.67	0.51	0.98	0.59	1.06	0.67	1.13	0.33	0.80
36	4995	0.86	3		mix	0.76	0.72	0.69	0.00	0.52	0.80	0.43	0.70	0.42	0.69	0.13	0.40
43	13660	0.62	46		mix	0.97	0.94	0.91	0.78	0.89	0.95	n/a	n/a	n/a	n/a	n/a	n/a
				summary	ave	0.82	0.74	0.80	0.59	0.68	0.94	0.76	1.06	0.60	0.90	0.22	0.52
				statistics	std dev	0.08	0.14	0.09	0.32	0.15	0.07	0.43	0.40	0.14	0.16	0.09	0.17
				for "mix"	max	0.97	0.94	0.91	0.90	0.89	1.00	1.50	1.74	0.75	1.13	0.33	0.80
				sites	min	0.75	0.53	0.69	0.00	0.51	0.80	0.43	0.70	0.42	0.69	0.13	0.36
1	13442	0.37	34		com	0.91	0.78	1.07	0.84	0.84	1.06	n/a	n/a	n/a	n/a	n/a	n/a
2	13261	1.44	41		com	0.98	0.56	0.88	0.47	0.47	0.91	0.47	0.91	0.39	0.83	0.13	0.56
4	11062	0.53	3		com	0.78	0.63	0.83	0.72	0.36	0.72	0.18	0.55	0.22	0.59	1.00	1.37
8	14328	0.81	39		com	0.81	0.68	0.79	0.66	0.79	1.11	0.79	1.10	0.81	1.12	0.21	0.53
9	17020	0.43	38		com	0.81	0.60	0.78	0.54	0.46	0.86	0.45	0.86	0.52	0.92	0.33	0.74
22	7663	0.22	6		com	0.93	0.47	0.77	0.41	0.52	1.05	n/a	n/a	n/a	n/a	n/a	n/a
23	14652	0.50	20		com	0.72	0.76	0.78	0.93	0.69	0.93	0.75	0.99	0.86	1.10	0.36	0.60
34	7719	0.46	6		com	0.79	0.67	0.76	0.29	0.64	0.97	0.56	0.89	0.62	0.95	0.20	0.53
37	14164	0.30	10		com	0.87	0.88	0.81	0.91	0.49	0.61	0.68	0.80	0.50	0.62	0.33	0.46
40	3510	0.50	6		com	0.65	0.71	0.62	0.68	1.40	1.69	2.00	2.29	0.60	0.89	0.67	0.96
						0.83	0.67	0.81	0.65	0.67	0.00	0.74	1.05	0.56	0.00	0.40	0.72
				summary	avg std dev	0.85	0.67	0.81	0.65	0.67	0.99	0.74	1.05	0.56	0.88	0.40	0.72
				statistics for "com"	sto dev max	0.10	0.12	1.07	0.22	1.40	1.69	2.00	2.29	0.21	1.12	1.00	1.37
				for "com"	min	0.65	0.88	0.62	0.35	0.36	0.61	0.18	0.55	0.22	0.59	0.13	0.46
				31065	min	0.65	0.47	0.02	0.25	0.30	0.01	0.10	0.55	0.22	0.35	0.15	0.40

Summary/synthesis for crash analysis (CMFs)--split by number of driveways (<32 and >32 driveways)

							0	MF correcti	ion factors			corrected (ded crashes		ted crashes		crashes w/c
site	~ADT	length (miles)	~avg annual crash	≠of drivwys	# of intersecs	type	based on county trend	based on dity trend	based on trunkline county trend	based on trunkline city trend	basic CMF	basic CMF corrected by city trend	CMF based on recoded crashes	recoded CMF corrected by city trend	CMF for affected crashes	affected CMF corrected by city trend	CMF for corrected crashes	corrected CMF corrected by city trend
37	14164	0.30	10	4	4	com	0.87	0.88	0.81	0.91	0.49	0.61	0.68	0.80	0.50	0.62	0.33	0.46
22	7663	0.22	6	12	3	com	0.93	0.47	0.77	0.41	0.52	1.05	n/a	n/a	n/a	n/a	n/a	n/a
39	n/a	0.39	19	14	5	res	0.81	0.69	0.91	0.77	0.48	0.79	0.81	1.13	0.92	1.23	0.24	0.55
4	11062	0.53	3	16	8	com	0.78	0.63	0.83	0.72	0.36	0.72	0.18	0.55	0.22	0.59	1.00	1.37
9	17020	0.43	38	16	8	com	0.81	0.60	0.78	0.54	0.46	0.86	0.45	0.86	0.52	0.92	0.33	0.74
1	13442	0.37	34	19	4	com	0.91	0.78	1.07	0.84	0.84	1.06	n/a	n/a	n/a	n/a	n/a	n/a
33	7049	0.69	10	19	6	mix	0.81	0.53	0.87	0.67	0.51	0.98	0.59	1.06	0.67	1.13	0.33	0.80
34	7719	0.46	6	22	2	com	0.79	0.67	0.76	0.29	0.64	0.97	0.56	0.89	0.62	0.95	0.20	0.53
23	14652	0.50	20	23	9	com	0.72	0.76	0.78	0.93	0.69	0.93	0.75	0.99	0.86	1.10	0.36	0.60
30	7676	0.38	10	25	8	mix	0.76	0.76	0.80	0.90	0.76	1.00	1.50	1.74	0.69	0.93	0.30	0.54
2	13261	1.44	41	26	17	com	0.98	0.56	0.88	0.47	0.47	0.91	0.47	0.91	0.39	0.83	0.13	0.56
43	13660	0.62	46	27	11	mix	0.97	0.94	0.91	0.78	0.89	0.95	n/a	n/a	n/a	n/a	n/a	n/a
29	10747	0.49	7	30	4	res	0.78	0.79	0.86	0.83	0.32	0.53	0.40	0.61	0.24	0.44	0.00	0.21
40	3510	0.50	6	31	7	com	0.65	0.71	0.62	0.68	1.40	1.69	2.00	2.29	0.60	0.89	0.67	0.96
					summary	avg	0.83	0.70	0.83	0.70	0.63	0.93	0.76	1.07	0.56	0.87	0.35	0.66
					statistics	std dev	0.09	0.13	0.10	0.20	0.28	0.27	0.53	0.51	0.22	0.24	0.27	0.30
					for	max	0.98	0.94	1.07	0.93	1.40	1.69	2.00	2.29	0.92	0.44	1.00	1.37
					"dways<3	min	0.65	0.47	0.62	0.29	0.52	0.53	0.18	0.55	0.22	0.44	0.00	0.21
20	12639	0.68	7	34	9	res	0.80	0.69	0.75	0.79	0.60	0.91	0.69	1.00	1.43	1.74	0.40	0.71
20	6512	0.66	10	38	4	res	0.80	0.69	0.75	0.79	0.50	0.91	0.55	0.87	0.88	1.16	0.40	1.09
25	10855	0.75	4	39	3	res	0.95	0.87	0.85	0.96	0.35	0.55	0.11	0.8/	0.88	0.35	0.00	0.13
36	4995	0.36		42	5	mix	0.35	0.87	0.69	0.96	0.52	0.37	0.43	0.24	0.42	0.69	0.13	0.40
8	14328	0.81	39	49	7	com	0.81	0.68	0.05	0.66	0.79	111	0.45	1.10	0.81	1.12	0.21	0.53
18	7137	0.96	3	35	6	res	0.76	0.80	0.71	10.43	0.80	1.00	0.77	0.97	0.83	1.04	0.17	0.37
16	12342	0.87	24	58	8	res	0.84	0.84	0.83	0.90	0.49	0.65	0.31	0.47	0.30	0.46	0.27	0.43
11	14572	1.46	43	80	12	mix	0.75	0.85	0.72	0.71	0.78	0.93	0.73	0.88	0.75	0.90	0.21	0.36
13	9016	1.31	25	97	11	mix	0.84	0.64	0.83	0.51	0.61	0.98	0.56	0.92	0.50	0.86	0.15	0.51
3	10965	4.33	53	100	35	res	0.87	0.73	0.87	0.68	0.66	0.93	0.62	0.90	0.59	0.86	0.30	0.57
					summary	avg	0.820	0.753	0.805	1.636	0.629	0.876	0.559	0.806	0.672	0.919	0.263	0.510
					statistics	std dev	0.058	0.080	0.088	3.101	0.129	0.163	0.217	0.263	0.351	0.391	0.217	0.254
					for	max	0.948	0.870	0.967	10.429	0.800	1.108	0.788	1.104	1.429	1.739	0.800	1.085
					"dways>3	min	0.752	0.636	0.691	0.000	0.438	0.568	0.111	0.242	0.222	0.353	0.000	0.130

Summary/synthesis for crash analysis (CMFs)--split by number of intersections

							0	MF correcti	ion factors			corrected (ded crashes		ted crashes		trashes w/c
site	~ADT	length (miles)	~avg annual crash	# of drivwys	# of intersecs	type	based on county trend	based on dity trend	based on trunkline county trend	based on trunkline city trend	basic CMF	basic CMF corrected by city trend	CMF based on recoded crashes	recoded CMF corrected by city trend	CMF for affected crashes	affected CMF corrected by city trend	CMF for corrected crashes	corrected CMF corrected by city trend
34	7719	0.46	6	22	2	com	0.79	0.67	0.76	0.29	0.64	0.97	0.56	0.89	0.62	0.95	0.20	0.53
22	7663	0.22	6	12	3	com	0.93	0.47	0.77	0.41	0.52	1.05	n/a	n/a	n/a	n/a	n/a	n/a
1	13442	0.37	34	19	4	com	0.91	0.78	1.07	0.84	0.84	1.06	n/a	n/a	n/a	n/a	n/a	n/a
25	6512	0.79	10	38	4	res	0.81	0.71	0.89	0.72	0.59	0.88	0.58	0.87	0.88	1.16	0.80	1.09
29	10747	0.49	7	30	4	res	0.78	0.79	0.86	0.83	0.32	0.53	0.40	0.61	0.24	0.44	0.00	0.21
37	14164	0.30	10	4	4	com	0.87	0.88	0.81	0.91	0.49	0.61	0.68	0.80	0.50	0.62	0.33	0.46
26	10855	0.58	4	39	5	res	0.95	0.87	0.97	0.96	0.44	0.57	0.11	0.24	0.22	0.35	0.00	0.13
36	4995	0.86	5	42	5	mix	0.76	0.72	0.69	0.00	0.52	0.80	0.43	0.70	0.42	0.69	0.13	0.40
39	n/a	0.39	19	14	5	res	0.81	0.69	0.91	0.77	0.48	0.79	0.81	1.13	0.92	1.23	0.24	0.55
18	7137	0.96	5	55	6	res	0.76	0.80	0.71	10.43	0.80	1.00	0.77	0.97	0.83	1.04	0.17	0.37
33	7049	0.69	10	19	6	mix	0.81	0.53	0.87	0.67	0.51	0.98	0.59	1.06	0.67	1.13	0.33	0.80
8	14328	0.81	39	49	7	com	0.81	0.68	0.79	0.66	0.79	1.11	0.79	1.10	0.81	1.12	0.21	0.53
40	3510	0.50	6	31	7	com	0.65	0.71	0.62	0.68	1.40	1.69	2.00	2.29	0.60	0.89	0.67	0.96
4	11062	0.53	3	16	8	com	0.78	0.63	0.83	0.72	0.36	0.72	0.18	0.55	0.22	0.59	1.00	1.37
9	17020	0.43	38	16	8	com	0.81	0.60	0.78	0.54	0.46	0.86	0.45	0.86	0.52	0.92	0.33	0.74
16	12342	0.87	24	58	8	res	0.84	0.84	0.83	0.90	0.49	0.65	0.31	0.47	0.30	0.46	0.27	0.43
30	7676	0.38	10	25	8	mix	0.76	0.76	0.80	0.90	0.76	1.00	1.50	1.74	0.69	0.93	0.30	0.54
					summary	avg	0.815	0.714	0.821	1.249	0.613	0.898	0.679	0.952	0.561	0.835	0.332	0.606
					statistics	std dev	0.072	0.113	0.107	2.379	0.255	0.274	0.492	0.507	0.242	0.288	0.282	0.332
					for	max	0.948	0.877	1.073	10.429	1.400	1.691	2.000	2.291	0.917	1.229	1.000	1.365
					"intersect	min	0.648	0.467	0.616	0.000	0.323	0.529	0.111	0.242	0.222	0.353	0.000	0.130
20	12639	0.68	7	34	9	res	0.80	0.69	0.75	0.79	0.60	0.91	0.69	1.00	1.43	1.74	0.40	0.71
23	14652	0.50	20	23	9	com	0.72	0.76	0.78	0.93	0.69	0.93	0.75	0.99	0.86	1.10	0.36	0.60
13	9016	1.31	25	97	11	mix	0.84	0.64	0.83	0.51	0.61	0.98	0.56	0.92	0.50	0.86	0.15	0.51
43	13660	0.62	46	27	11	mix	0.97	0.94	0.91	0.78	0.89	0.95	n/a	n/a	n/a	n/a	n/a	n/a
11	14572	1.46	43	80	12	mix	0.75	0.85	0.72	0.71	0.78	0.93	0.73	0.88	0.75	0.90	0.21	0.36
2	13261	1.44	41	26	17	com	0.98	0.56	0.88	0.47	0.47	0.91	0.47	0.91	0.39	0.83	0.13	0.56
3	10965	4.33	53	100	35	res	0.87	0.73	0.87	0.68	0.66	0.93	0.62	0.90	0.59	0.86	0.30	0.57
•					summary	avg	0.847	0.737	0.821	0.696	0.672	0.935	0.636	0.932	0.752	1.048	0.257	0.553
					statistics	std dev	0.100	0.126	0.071	0.160	0.135	0.024	0.109	0.052	0.372	0.352	0.113	0.116
					for	max	0.978	0.936	0.913	0.929	0.890	0.977	0.750	1.003	1.429	1.739	0.400	0.710
					"intersect	min	0.722	0.563	0.721	0.474	0.470	0.908	0.468	0.878	0.390	0.827	0.125	0.356

Summary/synthesis for crash analysis (CMFs)--split by type of treatment

							0	MF correcti	on factors			corrected (ded crashes		ted crashes		trashes w/c
site	~ADT	length (miles)	~avg annual crash	# of drivwys	# of intersecs	type	based on county trend	based on city trend	based on trunkline county trend	based on trunkline city trend	basic CMF	basic CMF corrected by city trend	CMF based on recoded crashes	recoded CMF corrected by city trend	CMF for affected crashes	affected CMF corrected by city trend	CMF for corrected crashes	corrected CMF corrected by city trend
1	13442	0.37	34	19	4	com	0.91	0.78	1.07	0.84	0.84	1.06	n/a	n/a	n/a	n/a	n/a	n/a
8	14328	0.81	39	49	7	com	0.81	0.68	0.79	0.66	0.79	1.11	0.79	1.10	0.81	1.12	0.21	0.53
40	3510	0.50	6	31	7	com	0.65	0.71	0.62	0.68	1.40	1.69	2.00	2.29	0.60	0.89	0.67	0.96
2	13261	1.44	41	26	17	com	0.98	0.56	0.88	0.47	0.47	0.91	0.47	0.91	0.39	0.83	0.13	0.56
3	10965	4.33	53	100	35	res	0.87	0.73	0.87	0.68	0.66	0.93	0.62	0.90	0.59	0.86	0.30	0.57
4	11062	0.53	3	16	8	com	0.78	0.63	0.83	0.72	0.36	0.72	0.18	0.55	0.22	0.59	1.00	1.37
9	17020	0.43	38	16	8	com	0.81	0.60	0.78	0.54	0.46	0.86	0.45	0.86	0.52	0.92	0.33	0.74
11	14572	1.46	43	80	12	mix	0.75	0.85	0.72	0.71	0.78	0.93	0.73	0.88	0.75	0.90	0.21	0.36
13	9016	1.31	25	97	11	mix	0.84	0.64	0.83	0.51	0.61	0.98	0.56	0.92	0.50	0.86	0.15	0.51
16	12342	0.87	24	58	8	res	0.84	0.84	0.83	0.90	0.49	0.65	0.31	0.47	0.30	0.46	0.27	0.43
18	7137	0.96	5	55	6	res	0.76	0.80	0.71	10.43	0.80	1.00	0.77	0.97	0.83	1.04	0.17	0.37
20	12639	0.68	7	34	9	res	0.80	0.69	0.75	0.79	0.60	0.91	0.69	1.00	1.43	1.74	0.40	0.71
22	7663	0.22	6	12	3	com	0.93	0.47	0.77	0.41	0.52	1.05	n/a	n/a	n/a	n/a	n/a	n/a
23	14652	0.50	20	23	9	com	0.72	0.76	0.78	0.93	0.69	0.93	0.75	0.99	0.86	1.10	0.36	0.60
25	6512	0.79	10	38	4	res	0.81	0.71	0.89	0.72	0.59	0.88	0.58	0.87	0.88	1.16	0.80	1.09
29	10747	0.49	7	30	4	res	0.78	0.79	0.86	0.83	0.32	0.53	0.40	0.61	0.24	0.44	0.00	0.21
36	4995	0.86	5	42	5	mix	0.76	0.72	0.69	0.00	0.52	0.80	0.43	0.70	0.42	0.69	0.13	0.40
37	14164	0.30	10	4	4	com	0.87	0.88	0.81	0.91	0.49	0.61	0.68	0.80	0.50	0.62	0.33	0.46
26	10855	0.58	4	39	5	res	0.95	0.87	0.97	0.96	0.44	0.57	0.11	0.24	0.22	0.35	0.00	0.13
33	7049	0.69	10	19	6	mix	0.81	0.53	0.87	0.67	0.51	0.98	0.59	1.06	0.67	1.13	0.33	0.80
39	n/a	0.39	19	14	5	res	0.81	0.69	0.91	0.77	0.48	0.79	0.81	1.13	0.92	1.23	0.24	0.55
43	13660	0.62	46	27	11	mix	0.97	0.94	0.91	0.78	0.89	0.95	n/a	n/a	n/a	n/a	n/a	n/a
30	7676	0.38	10	25	8	mix	0.76	0.76	0.80	0.90	0.76	1.00	1.50	1.74	0.69	0.93	0.30	0.54
34	7719	0.46	6	22	2	com	0.79	0.67	0.76	0.29	0.64	0.97	0.56	0.89	0.62	0.95	0.20	0.53
									-									<u> </u>
average	10652	1	20	37	8		0.824	0.721	0.821	1.088	0.630	0.91	0.67	0.95	0.62	0.90	0.31	0.59
std dev	3587.02	0.82	16.09	25.54	6.62		0.080	0.115	0.096	2.002	0.225	0.23	0.42	0.42	0.29	0.31	0.25	0.28
max	17020	4	53	100	35		0.978	0.936	1.073	10.429	1.400	1.69	2.00	2.29	1.43	1.74	1.00	1.37
min	3510	0	3	4	2		0.648	0.467	0.616	0.000	0.323	0.53	0.11	0.24	0.22	0.35	0.00	0.13

- H-		Site Charac			0.37		
Site No. County	1 Alpena		Length (ml) Land Use		Commercial		
City	Alpena		No. of Driveways,	Intersections	19/4		
Route/Road Name	US-23		Treatment Type		Reconstruction w	thin existing curbs	w signal timings
PR/CS No.	1024202/4032						
BMP	0.971		Nearest Cross Str		11th Ave.		
DMP	1.338		Nearest Cross Str	eff.	14th Ave.		
		Descriptive					
			Before Period			After Period	
Year		1997	2998	1999	2001	2002	2003
ADT Crash Frequency (Total)		14008	12347	12644	14327	13009	13655
Crash Rate		19.72	26.60	16.53	10.94	20.75	18.04
Crash Frequency (Recoded)					36	26	25
Crash Frequency (Intersection-related)					4	2	5
Crash Frequency (Driveway-related)			o data prior to 200	1	0	4	1
Crash Frequency (Affected by Road Diet) Crash Frequency (Corrected by Road Diet)					15	27	24
Crash Frequency (Corrected by Road User) Crash Frequency (Background, Countywide)		895	851	889	730	856	799
Crash Frequency (Background, Citywide)		442	379	448	308	356	330
Crash Frequency (Background, Trunklines-Cou	ntywide)	116	111	131	115	137	132
Crash Frequency (Background, Trunklines-Ob	wide)	43	м	56	37	43	32
	Crash Analysi	a Method: Simple		tter Analysis			
Average Crashes per Year (Before)			36.33	so O	ash Frequency by Ye	ar (Site)	
Average Crashes per Year (After)			30.67		A		
Percentage Change Average Crashes per Year (Recoded, Before)			-15.60%	┥╸	1	r	4.841
Average Crashes per Year (Recoded, After)			22.33		~	1 ~	
Percentage Change			n/a			Im	-B-Recoded
Average Crashes per Year (Affected, Before)			n/a	20			
Average Crashes per Year (Affected, After)			22.00	10			-e-Corrected
Percentage Change Average Crashes per Year (Corrected, Before)			n/a n/a				
Average Crashes per Year (Corrected, After)			2.00	0		<u> </u>	
Percentage Change			n/a	1996 1997 1	1998 1999 2000 20	05 2002 2008 200	*
	Crash Analysis Meth	od: Before/After C	omparison with I	Beckground Tren	da		
Background Area Location (County, City)							
Average Crashes per Year (Countywide, Befor	-)		2635		per Year (Site, Befor		36.33
Average Crashes per Year (Countywide, After			2385		per Year (Site, After	1	30.67
Percentage Change Overall Countywide	stands Backsoned (The Affect		-9.49%	Percent Change	(Site, Before/After)		-15.60%
Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw			12,89	•	rash Frequency by Te	ar (Background)	
Average Crathes per Year (Citywide, Before)			1269				
Average Crashes per Year (Citywide, After)			994	3050			Countywide
Descentane Change Overall Chaudde			11			A	
Percentage Change Overall Citywide			-21.67%	1 1			
Projected Average Crashes per Year using Ch			28.46				
Projected Average Crashes per Year using City Percent Change for Site Adjusted for Citywide	Background		28.46 6.07%	550	1998 2000	2002 2004	
Projected Average Crashes per Year using City Percent Change for Site Adjusted for Citywide Average Crashes per Year (Trunklines-County	Background wide, Before)		28.46	550 1996 500	1998 2000	2002 2004	
Projected Average Crashes per Year using City Percent Change for Site Adjusted for Citywide	Background wide, Before) wide, After)		28.46 6.07% 358	1995	, , , ,	2002 2004	-a-Citywide
Projected Average Crashes per Yaar using CB Percent Change for SNe Adjusted for Chyvide Average Crashes per Year (Trus kines-County Average Crashes per Year (Trus kines-County Percentage Change Overall Truskine-County Pojected Average Crashes per Year using Tru	Background wide, Before) wide, After) elde nklines-Countywide Background (5	ite, After)	28.46 6.07% 358 384 7.20% 38.97	500 400	2002 8000	2002 2004	
Projected Average Cranhes per Year using City Percent Change for She Adjusted for Citywidd Average Crashes per Year (Trunkline-County Average Crashes per Year (Trunkline-County Percentage Change Overall Trunkline-County Projected Average Crashes per Year using Tru Percent Change for She Adjusted for Trunklin	Background wide, Before) wide, Afber) elde nilmer-Countywide Background (5 er-Countywide Background	ite, After)	28.46 6.07% 358 384 7.26% 38.97 -32.86%	2996 500 400 200	2000	2002 2004	-e-Citywide -d-Trunklines- Countywide
Projectal Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywles Average Crashes per Year (Trunklow-Courty Percentage Crashes per Year (Trunklow-Courty Projectad Average Crashes per Year using Tru Percent for Change Overall Trunklow-Courty Percent Change for Site Adjusted for Trunklow Average Crashes per Year (Trunklow-Chyvid	Background wide, Before) wide, After) elde nklines-Countywide Background (5 m-Countywide Background m-Countywide Background	ita, Attar)	28.46 6.07% 358 384 7.26% 38.97 -22.80% 133	1995 500 400 200 200		2002 2004	-4-Trunklines- Countywide
Projected Average Crathes per Year using City Percent Change for Site Adjusted for Citywidd Average Crathes per Year (Tranklow-Courty Percentage Change Overall Tranklow-Courty Projected Average Crathes per Year using Tranklow Percentage Change for Site Adjusted for Tranklow Average Crathes per Year (Tranklow-Citywid Average Crathes per Year (Tranklow-Citywid	Background wide, Retore) wide, After) wide nkilnee-Countywide Background (5 es-Countywide Background es, After) e, After)	ite, After)	28.46 6.07% 358 384 7.20% 38.97 -22.80% 113 112	2996 500 400 200	2000	2002 2004	Trunklines-
Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywleid Average Crashes per Year (Trushilow-Courty Percentage Crashes per Year (Trushilow-Courty Percentage Crashes per Year using Tru Percent Change for Site Adjusted for Trushile Average Crashes per Year (Trushilow-Chywid Average Crashes per Year (Trushilow-Chywid Percentage Crashes per Year (Trushilow-Chywid Percentage Crashes per Year (Trushilow-Chywid Percentage Change Overall Trushilow-Chywid	Background wide, Beforel wide, Atter) elde nklines-Countywide Background (S e. Countywide Background e, Atter) nklines-Chywide Background (Ste,		28.46 6.07% 358 384 7.26% 38.97 -22.80% 133	1996 500 400 200 200 200 0			-d-Trunklines- Countywide -s-Trunklines-
Projected Average Cranhes per Year using City Percent Change for She Adjusted for Citywide Average Crashes per Year (Trunkline-County Percentage Crashes per Year (Trunkline-County Projected Average Crashes per Year using Tru Percent Change for She Adjusted for Trunklin Average Crashes per Year (Trunkline-Chyvid Average Crashes per Year (Trunkline-Chyvid Average Change Overall Truskline-Chyvid	Background wide, Betorel wide wide Re-Countywide Background (S Re-Countywide Background (Ste R, Sefore) R, After) Rillines-Chywide Background (Ste Re-Chywide Background (Ste	After)	28.46 6.07% 358 384 7.20% 38.97 -22.80% 133 112 -15.79% 30.60 0.19%	1996 500 400 200	1998 2000 		-d-Trunklines- Countywide -s-Trunklines-
Projected Average Crathes per Year using CB Percent Change for Site Adjusted for CBywlds Average Crathes per Year (Inskilow-County Percentage Change per Year (Inskilow-County Percentage Change Crathes per Year using Tru Percent Change for Site Adjusted for Truskile Average Crathes per Year (Truskilew-Chywld Percentage Change Overall Truskilew-Chywld Percentage Change Overall Truskilew-Chywld Percentage Change Overall Truskilew-Chywld Percent Change for Site Adjusted for Truskile	Background Nice, Before wice, After) wice nkilmes-Countywide Background (5 n, Sefore) n, After) nkilmes-Chywide Background Stackground Crash Analysi		28.46 6.07% 358 384 7.20% 38.97 -22.80% 133 112 -15.79% 30.60 0.19%	1996 500 400 200	2566 2000		-d-Trunklines- Countywide -s-Trunklines-
Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywlide Average Crashes per Year (Trunklines-Courty Percentage Crashes per Year (Trunklines-Courty Percentage Crashes per Year using Tru Percent Change for Site Adjusted for Trunkline Average Crashes per Year (Trunklines-Chywid Average Crashes per Year (Trunklines-Chywid Percentage Change Overall Trunkline-Chywid Percentage Change Orabis per Year using Tru Percent Change for Site Adjusted for Trunkline Comparison Site Location (Courty, Chy)	Background vide, Before vide, After) vide hillnes-Countyvide Background (5 e, Before) e, After) e hillnes-Chywide Background (5te, s-Chyvide Background Creab Analysi Clakland, Royal Clak	After)	28.46 6.07% 358 384 7.20% 38.97 -22.80% 133 112 -15.79% 30.60 0.19%	1996 500 400 200 200 200 200 200 200 200 200 2			-d-Trunklines- Countywide -s-Trunklines-
Projected Average Crathes per Year using CB Percent Change for Site Adjusted for CBywldd Average Crathes per Year (Trunkline-County Percentage Chankes per Year (Inskline-County Projected Average Crathes per Year using Trunklin Average Crathes per Year (Trunkline-CBywld Average Crathes per Year (Trunkline-CBywld Percentage Chankes per Year (Trunkline-CBywld Percentage Chankes per Year (Trunkline-CBywld Percentage Chankes per Year (Trunkline-CBywld Percent Change for Site Adjusted for Trunklin Comparison Site Location (County, Chy) PI(CS No.	Background wide, Before) wide Milese-Countywide Background (S es-Countywide Background (S es-Countywide Background es-Chywide Background Cashand, Royal Oak 4400088	After)	28.46 6.07% 358 384 7.26% 3.97 -22.80% 133 112 -15.79% 30.60 0.19% After with Compt Route/Road Nam	500 400 200 300 500 500 500 500 500 500 500 500 5	13958 2000 11 Mile Rd.		-d-Trunklines- Countywide -s-Trunklines-
Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywlide Average Crashes per Year (Trunklines-Courty Percentage Crashes per Year (Trunklines-Courty Percentage Crashes per Year using Tru Percent Change for Site Adjusted for Trunkline Average Crashes per Year (Trunklines-Chywid Average Crashes per Year (Trunklines-Chywid Percentage Change Overall Trunkline-Chywid Percentage Change Orabis per Year using Tru Percent Change for Site Adjusted for Trunkline Comparison Site Location (Courty, Chy)	Background vide, Before vide, After) vide hillnes-Countyvide Background (5 e, Before) e, After) e hillnes-Chywide Background (5te, s-Chyvide Background Creab Analysi Clakland, Royal Clak	After)	28.46 6.07% 358 384 7.26% 30.97 -22.86% 133 112 -15.79% 30.60 0.19% After with Compared	5996 500 400 200 300 300 300 300 300 300 300 40 300 30	2566 2000		-d-Trunklines- Countywide -s-Trunklines-
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Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywles Average Crashes per Year (Trunkline-Courty Percentage Crashes per Year (Trunkline-Courty Percentage Crashes per Year using Tru Percent Change for Site Adjusted for Trunkline- Average Crashes per Year (Trunkline-Chywle Average Crashes per Year (Trunkline-Chywle Average Crashes per Year (Trunkline-Chywle Percentage Change Overall Trunkline-Chywle Percentage Change Crashes per Year using Tru Percent Change for Site Adjusted for Trunklin- Comparison Site Location (County, Chy) PM/C No.	Background side, Beforel wide, After) wide nkines-Countywide Background (5 e-Countywide Background e, Before) e, After) e, After) e, After) e, After) e, After, e, Chywide Background Crash Analysi Oskiand, Royal Osk 4400058 7,740	After)	28.46 6.07% 358 384 7.20% 38.97 -22.80% 38.97 -22.80% 30.97 30.00 0.19% 8.000 0.19% 8.000 Roote/Rood Nam Nearest Cross Str Nearest Cross Str Nearest Cross Str	5996 500 400 200 300 300 300 300 300 300 300 40 300 30	11 Mile Rd. Knowim St.		-d-Trunklines- Countywide -s-Trunklines-
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Projected Average Crathes per Year using CB Percent Change for Site Adjusted for CBywldd Average Crathes per Year (Trunkline-Courty Percentage Chankes per Year (Trunkline-Courty Percentage Chankes per Year (Trunkline-Courty Percentage Chankes per Year (Trunkline-Chywld Average Crathes per Year (Trunkline-Chywld Percentage Chankes per Year (Trunkline-Chywld Percent Change for Site Adjusted for Trunklin Comparison Site Location (Courty, Chy) PhylC3 No. BMP DMP Dearrights Statistics Year Crash Frequency (Total) Crash Medification Factor Comoutation Sample Odds Ratio (year 1-2)	Background side, Beforel wide, After) wide nkines-Countywide Background (5 e-Countywide Background e, Before) e, After) e, After) e, After) e, After) e, After, e, Chywide Background Crash Analysi Oskiand, Royal Osk 4400058 7,740	After) a Method: Before/ 1997	28.46 6.07% 358 384 7.26% 3.97 -22.80% 133 112 -15.79% 0.060 0.19% Route/Road Nam Nearest Cross Str Nearest Cross Str Nearest Cross Str Sefore Period 1998 53 1.15	1996 500 400 200200 20020	13968 2000 13 Mile Rd. Knowles St. Campbell Rd. 2001 20 Crash R	After Period 2002 2004	-d-Trunklines- Countywide -e-Trunklines- Chywide 2003 30
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Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywlde Average Crashes per Year (Trunkline-County Percentage Crashes per Year (Trunkline-County Projected Average Crashes per Year using Tru Percentage Crashes per Year (Trunkline-Chywld Average Crashes per Year (Trunkline-Chywld Percentage Crashes per Year using Tru Percent Change for Site Adjusted for Trunkline Comparison Site Location (County, Chy) Physics No. BMP DMP Description Statistics Year Crash Frequency (Total) Crash Mediffication Factor Consultation Sample Odds Tatio (year 1-2) Sample Odds Tatio (year 1-3) Mean d Sample Odds Tatios S9% Confidence Interal of the Sample Odds N-Osterved, T,8 (total observed no. of crashes N-Osterved, T,8 (total observed no. of crashes	Background side, Before wide, After wide, After wide background (5 e.Countywide Background (5 e.Countywide Background e.Chywide Background Castand, Royal Oak 4400088 7.740 8.550 tatio (11, UL) in before period for treatment ground in the period for treatment ground tatio (11, UL)	After) 1 Method: Before/ 1997 27 27	28.46 6.07% 358 384 7.26% 38.97 -22.80% 38.97 -22.80% 30.60 0.19% 8.0.0% Roots/Toad Nam Nearest Cross Str Nearest Cross Str Nearest Cross Str Before Period 1998 53 1.15 1.07 1.11 0.06 1.00 109.00 92.00	1996 500 400 300 300 0 0 0 0 0 0 0 0 0 0 0 0 0	11 Mile Rd. Knowled Rd. 2001 200	After Period 2002 2004	-d-Trunklines- Countywide -e-Trunklines- Chywide 2003 30
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Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywldd Average Crashes per Year (Trunklines-Courty Percentage Crashes per Year (Trunkline-Courty Percentage Change Overall Trunkline-Chywld Average Crashes per Year (Trunkline-Chywld Average Crashes per Year (Trunkline-Chywld Projected Average Crashes per Year using Tru Paccent Change for Site Adjusted for Trunklin Projected Average Crashes per Year using Tru Paccent Change for Site Adjusted for Trunklin Comparison Site Location (County, Chy) Ph/CS No. BMP Daardigthe Statistics Year Crash Frequency (Total) Crash Modification Factor Comoutation Sampie Odds Ratio (year 1-2) Sampie Odds Ratio (year 1-2) Mean of Sampie Odds Ratios Sander Odds Ratio Sear-2-3) Mean of Sampie Odds Ratios Sander Odds Ratio (sear-2-3) Mean of Sampie Odds Ratios Sander Odds Ratio (year 2-3) Mean of Sampie Odds Ratios	Background Wide, Before) wide, After) wide In Allow-Countywide Background (S m-Countywide Background millow-Chyvide Background Cashand, Royal Oak 4400088 7.740 8.550 Satio (Li, UL) In Sefore period for treatment gro in after period for treatment gro in after period for comparison gro	After) is Method: Before/ 1997 37 27 27 29 27 27 27 27 27 27 27 27 27 27 27 27 27	28.46 6.07% 358 384 7.26% 38.97 -22.80% 133 112 -15.79% 30.60 0.19% 0.19% 0.19% After with Compa Route,Road Nam Nearest Cross Str Before Period 1998 53 1.15 1.07 1.11 0.06 1.00 109.00 92.00 128.00	1996 500 400 300 300 0 0 0 0 0 0 0 0 0 0 0 0 0	11 Mile Rd. Xnowies St. Campbell Rd. 2001 39 Crash Fr. 60 40 40 20 20 20 20 20 20 20 20 20 2	After Period 2002 2004	-d-Trunklines- Countryelde -e-Trunklines- Chyelde 2003 30
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1		Site Charac	teristics				
Site No.	2		Length (mi)		1.44		
County	Berrien		Land Use		Commercial		
City	Berrien Springs		No. of Driveways	Intersections	26/17		
Route/Road Name	M-139		Treatment Type		Receiving within a	disting curbs with re	w markings
	3111292/11052						
	0.580		Nearest Cross Stre	set.	Madison St.		
EMP	2.019		Nearest Cross Stre		Sumet Dr.		
		Descriptive	Statistics				
			Before Period			After Period	
Year		2004	2005	2006	2008	2009	2010
ADT		13967	13704	14489	12705	12793	11926
Crash Frequency (Total)		61	57	50	33	23	23
Crash Rate		8,38	7.87	6.57	4.95	1.42	3.67
Crash Frequency (Recoded)		57	48	36	26	22	18
Grash Frequency (Intersection-related)		22		ĩ			
			-	-	4	-	+
Crash Frequency (Driveway-related) Crash Frequency (Affected by Road Diet)		14	13 40	29	26	0	2
Crash Frequency (Affected by Road Diet) Crash Frequency (Corrected by Road Diet)		35	40	29	26	1	3
		4702	4202	3541	4776	9927	3474
Crash Frequency (Background, Countywide)							
Crash Frequency (Background, Citywide)		1219	52	57 987	34	33	41
Grash Frequency (Background, Trunklines-Cour				98.7	1145	915	859
Crash Frequency (Background, Trunklines-City)		56 Method: Simple	39	40	20	15	24
Average Crashes per Year (Before)	Crash Analysis	s Method: Simple	(Nelve) Before/At 56.00				
Average Crathet per Year (Serore) Average Crathet per Year (After)			26.33	70 Cra	th Frequency by Yes	ar (Site)	
Percentage Change			-52.98%	a			
				80	and the second se		
Average Crashes per Year (Recoded, Before)			47.00	×			Total
Average Crashes per Year (Recoded, After)			22.00	40			Recoded
Percentage Change			-53.19%	- 20	\sim	<u> </u>	Affected
Average Crashes per Year (Affected, Before)			39.33			the second second	-t-Corrected
Average Crashes per Year (Affected, After)			15.33	20	~		-P-Lorrected
Percentage Change			-61.02%	30		\rightarrow	
Average Crashes per Year (Corrected, Before)			26.67			\checkmark	
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After)			26.67 3.33	0	- 05 2006 2007 20		
Average Crashes per Year (Corrected, Before)			26.67 3.33 -87.50%	0 2008 2004 20		08 2009 2010 20	11
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change	Crash Analysis Meth	od: Before/After C	26.67 3.33 -87.50%	0 2008 2004 20		08 2009 2010 20	11
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change Background Area Location (County, Oty)		od: Before/After (26.67 3.33 -87.50% Comparison with I	0 2003 2004 20 Beckground Trend	•		11
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, Afber) Percentage Change Background Area Location (County, Chy) Average Crashes per Year (County-Vide, Before		od: Before/After (26.67 3.33 -87.50%	0 2008 2004 20 Beckground Trend	s er Year (Site, Before	•	-
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change Background Area Location (County, Oty)		od: Before/After (26.67 3.33 -87.50% Comparison with I 12445	0 2008 2004 20 Beckground Trend Average Crathes p Average Crathes p	s ver Year (Site, Defor ver Year (Site, After)	•	56.00
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Before) Average Crashes per Year (Countyvide, After))	od: Before/After C	26.67 3.33 -87.50% Comparison with I 12445 12177	0 2008 2004 20 Beckground Trend Average Crathes p Average Crathes p Percent Change (S	er Year (Site, Before er Year (Site, After) ite, Before/After)	•)	56.00 26.33
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change Background Area Location (County, City) Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide) tywide Background (Ste, After)	od: Before/After 0	26.67 3.33 -67.50% Comparison with I 12445 12177 -2.15% 54.79	0 2008 2004 20 Beckground Trend Average Crathes p Average Crathes p Percent Change (S	s ver Year (Site, Defor ver Year (Site, After)	•)	56.00 26.33
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countywide, After) Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Court Percent Change for Site Adjusted for Countywide) tywide Background (Ste, After)	od: Before/After C	26.67 1.33 -87.50% Comparison with I 12445 12177 -2.15% 54.79 -50.82%	0 2003 2004 20 Background Trend Average Crashes p Average Crashes p Percent Change (2) 6000 Cras	er Year (Site, Before er Year (Site, After) ite, Before/After)	•)	56.00 26.33 -52.90%
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Before) Average Crashes per Year (Countyvide, After) Percentage Onage Versil Countyvide, March Projected Average Crashes per Year using Court Percent Change for Sta Adjusted for Countyvide, Berney Crashes per Year (Chyvide, Sefore)) tywide Background (Ste, After)	od: Before/After (26.67 3.33 -67.50% Comparison with I 12445 12177 -2.15% 54.79 -50.82% 192	0 2008 2004 20 Beckground Trend Average Crathes p Average Crathes p Percent Change (S	er Year (Site, Before er Year (Site, After) ite, Before/After)	•)	56.00 26.33
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide, After) Percent Change for Site Adjusted for Countywid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, After)) tywide Background (Ste, After)	od: Before/After C	26.67 3.33 47.50% Comparison with I 12445 12177 -2.15% 54.79 -50.02% 192 100	0 2009 2004 20 Background Trend Average Crather p Percent Change (5 6000 Crat	er Year (Site, Before er Year (Site, After) ite, Before/After)	•)	56.00 26.33 -52.99%
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Crashes per Year (Countyvide, Before) Average Crashes per Year (Countyvide, Before) Average Crashes per Year (Countyvide, After) Percentage County Vide, Countyvide Projected Average Crashes per Year utiling County Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before)) tywide Background (Ste, After) de Background	od: Before/After C	26.67 3.33 -67.50% Comparison with I 12445 12177 -2.15% 54.79 -50.82% 192	0 2003 2004 20 Background Trend Average Crashes p Average Crashes p Percent Change (2) 6000 Cras	er Year (Site, Before er Year (Site, After) ite, Before/After)	•)	56.00 26.33 -52.90%
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Crashes per Year (County, Chy) Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, After) Percentage Crashes per Year (Countyvide, After) Percent Change for Site Adjusted for Countyvide Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, After) Percentage Crashes per Year (Chyvide, After) Percentage Crashes per Year (Chyvide, After)) tywide Baciground (Ste, After) de Baciground vide Baciground (Ste, After)	od: Before/After C	26.67 3.33 -47.50% Comparison with I 12445 12177 -2.15% 54.79 -50.82% 192 108 -43.75%	0 2009 2004 20 Background Trend Average Crather p Percent Change (5 6000 Crat	er Year (Site, Before er Year (Site, After) ite, Before/After)	•)	56.00 26.33 -52.99%
Average Crashes per Year (Corrected, Before) Average Crashes per Year (Corrected, After) Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countywide, After) Percentage Change Orabie per Year Ling Countywide Projected Average Crashes per Year Ling Countywide Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percent Change for She Adjusted for Countywide Projected Average Crashes per Year (Chyvide, Before) Percent Change for She Adjusted for Chyvide Projected Average Crashes per Year Ling Chyvide Percent Change for She Adjusted for Chyvide) tywide Background (Ste, After) de Background vide Background (Ste, After) ackground	od: Before/After (26.67 3.33 -47.50% Comparison with 1 12445 12177 -2.15% 54.79 -50.82% 192 100 -43.75% 31.50 -4.25%	Average Crather p Percent Change Crather p Average Crather p Average Crather p 2000 Crat	ar Year (Site, Befor ar Year (Site, After) ite, Before/After) ite Response by Yea	4) ** (Background) **	56.00 26.33 -52.90%
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	-	Site Charac			4.33		
Site No. County	3 Decries		Length (ml) Land Use		6.33 Residential		
City	St. Joseph		No. of Driveways/	Interactions	100/35		
Route/Road Name	1-9401.		Treatment Type			sisting curbs with ne	w markings
PR/CS No.	1360705/13012						
BMP	1.150		Nearest Cross Stre		Edgewood Path		
DMP	5.414		Nearest Cross Stre	HR.	Hatch St.		
		Descriptive					
			Before Period			After Period	
Year		2002	2003	2004	2006	2007	2008
ADT		12062	12961	12091	9794	9765	9118
Crash Frequency (Total) Crash Rate		69 1.62	59	63 1,29	40	36	50 1.47
Crash Frequency (Recoded)		46	40	44	256	20	15
Crash Frequency (Intersection-related)		15	17	13	6	6	3
Crash Frequency (Driveway-related)		4	5	9	5	2	4
Crash Frequency (Affected by Road Diet)		39	40	40	24	17	29
Crash Frequency (Corrected by Road Diet)		16	18	36	6	4	5
Crash Frequency (Background, Countywide) Crash Frequency (Background, Citywide)		5069	4715	4702 287	237	4220	4776 232
Crash Frequency (Background, Trunklines-Cos	ntywide)	1315	1123	1219	987	1041	1145
Crash Frequency (Background, Trunklines-City		207	172	148	130	106	122
		a Method: Simple	(Naive) Before/Af	ter Analysis			
Average Crathes per Year (Before)			63.67	-	sh Frequency by Ye	er (Site)	
Average Crashes per Year (After)			42.00	70			
Percentage Change			-34.03%		-		
Average Crathes per Year (Recoded, Before) Average Crathes per Year (Recoded, After)			43.33	50			
Percentage Change			-37.69%	- <u>-</u>			Recoded
Average Crashes per Year (Affected, Before)			39.67			1	-l-Affected
Average Crashes per Year (Affected, After)			23.33				-e-Corrected
Percentage Change			-41.10%				
Average Crashes per Year (Corrected, Before)			16.67				
Average Crashes per Year (Corrected, After)			5.00		08 2004 2005 20	06 2007 2008 200	•
Percentage Change	Crash Analysis Meth	ad. Balans (Albert		and second Taxad			
	Crisin Analysis meta	iod: beloney Americ	comparation with a	actground trend	•		
Background Area Location (County, City) Average Crashes per Year (Countywide, Befor	-1		14486	Average Crashes r	er Year (Site, Befor	-1	61.67
Average Crashes per Year (Countywide, After			12537	Average Crashes p	er Year (Site, After)		42.00
Percentage Change Overall Countywide			-13.45%	Percent Change (3	ite, Before/After)		-34.03%
Projected Average Crashes per Year using Col			55.10	6500 Crad	h Frequency by Yea	r (Background)	
Percent Change for Site Adjusted for Countyy	ide Background		-20.58%				
Average Crashes per Year (Citywide, Before) Average Crashes per Year (Citywide, After)			962	4500	Same and		- Countywide
			-27.44%				- Taurkings
Average Crathes per Year (Citywide, After) Percentage Change Overall Citywide Projected Average Crathes per Year using City	wide Background (Site, After)			2500	· · ·		Trunklines- Countywide
Percentage Change Overall Citywide Projected Average Crashes per Year using City Percent Change for Site Adjusted for Citywide	Background		-27.44% 46.19 -6.59%				
Percentage Change Overall Citywide Projected Average Crathes per Year using City Percent Change for Site Adjusted for Citywide Average Crathes per Year (Trunklines-County	Background wide, Before)		-27.44% 46.19 -6.59% 3657	500			
Percentage Change Overall CEywide Projected Average Crashes per Year using CB Percent Change for Site Adjusted for CEyvide Average Crashes per Year (Trunkline-County Average Crashes per Year (Trunkline-County	Background wide, Before) wide, After)		-27.44% 46.19 -6.59% 3657 3173				
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Percent Large Forward Citywide Projected Average Crashes per Year using Chy Percent Change for She Adjusted for Citywide Average Crashes per Year (Trunklow-County Percentage Change Overall Trunklow-County Projected Average Crashes per Year using Tru Percent Change for She Adjusted for Trunklow Average Crashes per Year (Trunklow-Chywid Average Crashes per Year (Trunklow Chywid Average Chywid Chywid Average Chywid Aver	Illeckground wide, Defore) wide, After) wide, After) wide miclour Countywide Background (s miclourywide Background micloure Background Creath Analysi Ottawa, Holland 722105 2205	After) a Method: Sefore/	-27.44% 46.19 46.59% 3657 3173 -11.23% 55.24 -20.60% -23.46% 43.49 -2.34% After with Compa Route/Road New Nearest Cross Stru Before Period	500 2000 200 400	2 2004 2004 2004 2004 2004 2006 Ottawn Beach Rd. 160th Ave.	2008 2010 After Period	Countywide
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Percent Lange for Site Adjunted for Clayvide Projected Average Crashes per Year using Ch Percent Change for Site Adjunted for Clayvide Average Crashes per Year (Trunklow-County Percent Lange for Site Adjunted for Trunklow Percent Change for Site Adjunted for Trunklow Average Crashes per Year (Trunklow-County Percent Change for Site Adjunted for Trunklow Average Crashes per Year (Trunklow-Clayvid Percent Change for Site Adjunted for Trunklow Projected Average Crashes per Year (Trunklow-Clayvid Percent Change for Site Adjunted for Trunklow Comparison Site Location (County, City) Ph/ District Average Crashes per Year (Trunklow Comparison Site Location (County, City) Ph/ District Average Crashes per Year (Trunklow County) Ph/ District Average County, City) Ph/ District Average County, City)	Illeckground wide, Defore) wide, After) wide, After) wide miclour Countywide Background (s miclourywide Background micloure Background Creath Analysi Ottawa, Holland 722105 2205	After) a Method: Sefore/	-27.44% 46.19 46.59% 3657 3173 -11.23% 55.24 -20.60% -23.46% 43.49 -2.34% After with Compa Route/Road New Nearest Cross Stru Before Period	500 2000 200 400	2 2004 2004 2004 2004 2004 2006 Ottawn Beach Rd. 160th Ave. River Ave.	2008 2010 After Period	Countywide
Percentuge Charge Oversil Cityetés Projected Average Crabes per Year using Ch Percent Charge for She Adjusted for Cityetés Average Crabes per Year (Trunkline-County Percentuge Crabes per Year Uninkline-County Percentuge Crabes per Year Uninkline-County Percent Charge for She Adjusted for Trunklin Average Crabes per Year (Trunkline-Chyvid Percentuge Crabes per Year Uninkline-Chyvid Percentuge Crabes per Year Uninkline-Chyvid Percentuge Crabes per Year Uninkline-Chyvid Percentuge Crabes per Year Uninkline-Chyvid Percentuge Crabes per Year Uninkline-Chyvid Percent Charge for She Adjusted for Trunkline Comparison She Location (County, Chy) PMP Description She Location (County, Chy) PMP Description She Incation Cash Percentuge (Total) Crash Medification Factor Consultation	Illeckground wide, Defore) wide, After) wide, After) wide miclour Countywide Background (s miclourywide Background micloure Background Creath Analysi Ottawa, Holland 722105 2205	After) a Method: Before/ 2002	-27.44% 46.19 46.59% 3657 3173 -11.23% 55.24 -20.80% -31.69% 43.49 -2.34% After with Compa Route/Road New Nearest Cross Str Nearest Cross Str	500 2000 200 400 200 200 200 200 200 200 200 400 200 200 200 400 200 200 200 400 200	2 2004 2000 2 2004 2000 2 2004 2006 2 2004 2006 2 2004 2006 2 2006 25 2 2006 25		Countywide s-Citywide b-Trunklines- Citywide 2008 60
Percentuge Charge Develoi Citywide Projected Average Crashes per Year using Ch Percent Charge for She Adjusted for Citywide Average Crashes per Year (Trunkline-County Percentage Charge Overall Trunkline-County Projected Average Crashes per Year (Trunkline- Average Crashes per Year (Trunkline- Average Crashes per Year (Trunkline- Average Crashes per Year (Trunkline- Average Crashes per Year (Trunkline- Comparison Ste Location (County, Chy) Projected Average Crashes per Year (Trunkline- Comparison Ste Location (County, Chy) Phylos No. BMP DMP Descripter Statistics Year Crash Frequency (Total) Crash Modifies Into Factor Computation Sample Odds Ratio Syster 1-2)	Illeckground wide, Defore) wide, After) wide, After) wide miclour Countywide Background (s miclourywide Background micloure Background Creath Analysi Ottawa, Holland 722105 2205	After) a Method: Before/ 2002	-27.44% 46.19 46.59% 3657 3173 -11.22% 527 360 -31.69% 43.49 -2.34% After with Compa Rostaffood Nam Nearest Cross Str. Nearest	500 2000 200 400 200 200 200 200 200 200 200 400 200 200 200 400 200 200 200 400 200	2 2004 200 2 2004 200 2 2004 2006 1 2006 2006 1 2006 2006 1 2006 2006 2 2006 2 2006 2 2006 2 2 2004 2006 2 2 2004 2006 2 2 2004 2006 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 2008 2010 /Dorgian Ave. After Period 2007 51 squency by Year (28)	Countywide s-Citywide b-Trunklines- Citywide 2008 60
Percentuge Charge Foreist Citywide Projected Average Crashes per Year using Ch Percent Charge for Site Adjusted for Citywide Average Crashes per Year (Trunkline-County Percentuge Charge Foreist Trunkline-County Percent Charge for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-County Percent Charge for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Citywid Percent Charge for Site Adjusted for Trunklin County Foreist Charge Crashes (County, City) Percent Charge for Site Adjusted for Trunklin Comparison Site Location (County, City) PR/CS No. BMP Description Site Site Site (County, City) PR/CS No. Crash Frequency (Total) Crash Medification Factor Computation Sampio Codis Ratio (year 1-2) Sampio Codis Ratio (year 1-2)	Inscignand wide, Defore) wide, After) wide Informe-Countywide Background (S m-Countywide Background m, After) m, After) m, After) m, After) m, After) m, After) m, After) m, After) Marken, Sandar Crash Analysi Ottawa, Holland 722105 2,265	After) a Method: Before/ 2002	-27.44% 46.19 46.59% 3657 3173 -11.23% 55.24 -20.80% -31.69% 43.49 -2.34% After with Compa Route/Road New Nearest Cross Str Nearest Cross Str	500 2000 200 400 200 200 200 200 200 200 200 400 200 200 200 400 200 200 200 400 200	2 2004 200 2 2004 200 2 2004 2006 1 2006 2006 1 2006 2006 1 2006 2006 2 2006 2 2006 2 2006 2 2 2004 2006 2 2 2004 2006 2 2 2004 2006 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		Countywide Citywide Trunklines Citywide 2008 60
Percent Change For Site Adjusted for Clayvide Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Clayvide Average Crashes per Year (Trunklow-County Percent Change for Site Adjusted for Trunklow Percent Change for Site Adjusted for Trunklow Average Crashes per Year (Trunklow-County Projected Average Crashes per Year (Trunklow-Clayvid Average Crashes per Year (Trunklow-Clayvid Percent Change for Site Adjusted for Trunklow Projected Average Crashes per Year (Trunklow-Clayvid Percent Change for Site Adjusted for Trunklow Projected Average Crashes per Year (Trunklow-Clayvid Percent Change for Site Adjusted for Trunklow Comparison Site Location (County, City) Ph/OS No. BMP Parcent Change for Site Adjusted for Trunklow Comparison Site Location (County, City) Ph/OS No. BMP Comparison Site Location (County, City) Ph/OS No. BMP Cash Frequency (Total) Crash Frequency (Total) Crash Site (Site) (year 1-2) Sample Odds Itatio (year 2-3) Mean of Sample Odds Ratios	Illackground wide, Before) wide Inform-Countywide Background (5 m-Countywide Background e, Before) e, Refore) e, Refore) e, Refore) e Nolline-Chywlde Background (Stawa, Hollind 732105 2,265 2,688	After) a Method: Before/ 2002	-27.44% 46.15 46.59% 3657 3173 -11.23% 55.24 -20.10% 527 360 -31.69% 43.49 -2.34% After with Compa Route/Road Namy Nearest Cross Str Nearest Cross Str Neare	500 2000 200 400 200 2000 200 200	2 2004 2000 2 2004 2000 2 2004 2006 2 2004 2006 2 2006 2006 2 55 Crash Fig.	2008 2010 2008 2010 /Dorgian Ave. After Period 2007 51 squency by Year (28)	Countywide Citywide Trunklines Citywide 2008 60
Percentuge Charge Forward Citywide Projected Average Transes per Year using City Percent Charge for Site Adjunted for Citywide Average Crashes per Year (Tranklow-County Percentuge Charge Oversill Tranklow-County Percent Charge for Site Adjunted for Tranklow Average Crashes per Year (Tranklow-County Percent Charge for Site Adjunted for Tranklow Average Crashes per Year (Tranklow-Citywid Average Crashes per Year (Tranklow-Citywid Percent Charge for Site Adjunted for Tranklow Citymparkon Site Location (County, City) PA/CI No. BMP DMP DMP Crash Mod Riston Factor Consultation Sample Odds Tatio (year 1-2) Sample Odds Tatio (year 2-3) Mean of Sample Odds Tatio Sample Odds Tatios Sith Conflored Interion	Illackground wids, Affan) wids, Affan) wids, Affan) wids, Affan) scheme-Catywids Background (Ste, s, Affan) s, Affan) skilnes-Citywide Background (Ste, s, Affan) Crash Analysi Citawa, Holland 722105 2.265 5.688	After) n Method: Before/ 2002 67	-77.44% 46.19 -6.59% 3857 3173 -11.22% 527 360 -11.09% 43.49 -2.34% After with Compa Roots/Road Nam Nearest Cross Str Nearest Cross Str Ne	500 2000 200 400 200 200 200 200 200 200 200 400 200 200 200 400 200 200 200 400 200	2 2004 2004 2 2004 2004 2 2004 2006 1 2004 2006 1 2004 2006 1 2006 255 2006 255 2006 255 1 2006 255 1 2006 255 1 2006 255 1 2006 2006 2 2004 2004 2 2004 2 2004 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 //Douglas Ave. After Period 2007 51 squency by Year (28) Comparison Site)	Countywide Citywide Trunklines Citywide 2008 60
Percent Change For Site Adjusted for Chywlai Projected Average Crashes per Year using Chy Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Chywlai Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywlai Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywlai Percent Change for Site Adjusted for Trunklin Percent Change for Site Adjusted for Trunklin Projected Average Crashes per Year (Trunkline- Chywlai Percent Change for Site Adjusted for Trunklin Comparison Site Location (County, Chy) Ph/CS No. MP DMP Description Site Location (County, Chy) War Crash Frequency (Total) Crash Modification Location Sample Odds Earls Oyeer 1-2) Sample Odds Earls Oyeer 1-2) Sample Odds Earls Odds Fatios 20% Confidence Interval of the Sample Odds Profee Odds Fatio	Inscignand wide, Before) wide hiltem-Countywide Background (3 e-Countywide Background (stre, s, After) e, Before) e, After) e, Before) e, Before) e, Before) e, Before) e, Before) e, Before) e, Before Background Crash Analysi Ottawa, Holland 732105 2.265 5.688 batto (14, UL) in before period for treatment gro	After) is Method: Before/ 2002 67	77.44% 46.19 6.5% 3657 3173 13.23% 527 360 31.69% 43.49 2.34% After with Compa Route/Road Namy Nearest Cross Str Nearest Cross S	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2005 1 2005 2005 2006 255 Crash Fre 2006 55	2008 2010 2008 2010 /Dorgian Ave. After Period 2007 51 squency by Year (28)	Countywide Citywide Trunklines Citywide 2008 60
Percentuge Charge Downil Citywide Projected Average Tombae per Year using Cit Projected Average Tombae per Year (Insultone-County Average Crashes per Year (Insultone-County PercentUsange Crashes per Year (Insultone-County Percentuge Charge Oversill Trunkline-County Percentuge Crashes per Year (Insultone-County Percentuge Crashes per Year (Insultone-Chyvid Percentuge Crashes per Year (Insultone-Chyvid Percentuge Crashes per Year (Insultone-Chyvid Percentuge Crashes per Year (Insultone-Chyvid Percentuge Crashes per Year (Insultone-Chyvid Percent Charge for Site Adjusted for Trunkline- Chyvid Percent Charge for Site Adjusted for Trunkline Comparison Site Location (County, Chy) PR/CS No. BMP DMP Cash Medifies Idea Factor Consultation Sampio Odds Ratio (year 1-2) Sampio Odds Ratio (year 2-3) Mean of Sampie Odds Ratios Sandard Intro of the Sampie Odds Ratios	Inskiprund wide, Netron wide, After) wide, After) wide nither-Countywide Background (S e-Countywide Background (Site, e.After) e-Rither-E-Sywide Background (Site, e-Citywide Background Crash Analysi Ottawa, Holland 722105 2-265 5-688 batto (Li, UL) In before period for treatment gro	After) is Method: Before/ 2002 67 sopj pj	-27.44% 46.19 46.59 3657 3173 -11.23% 55.24 -20.10% 52.7 360 -31.69% 43.49 -2.34% Rotty/Road Nam Nearest Cross Str Nearest Cross Str Nearest Cross Str Nearest Cross Str Before Period 2003 25 1.27 0.84 1.05 1.05 1.27 1.27 1.05 1.05 1.05 1.05 1.05 1.05 1.05 1.05	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2005 2 2004 2005 2 2004 2005 2 2005 2005 2 2005 2 2006 2005 2 2 2004 2 2 2004 2005 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 //Douglas Ave. After Period 2007 51 squency by Year (28) Comparison Site)	Countywide Citywide Tranklines Citywide 2008 60
Percent Charge Foreial Citywide Projected Average Crashes per Year using Ch Projected Average Crashes per Year (Trustilene-County Percent Charge for She Adjusted for Citywide Average Crashes per Year (Trustilene-County Projected Average Crashes per Year (Trustilene-County Percent Charge for She Adjusted for Trustilen Average Crashes per Year (Trustilene-County Percent Charge for She Adjusted for Trustilen Average Crashes per Year (Trustilene-Chywid Percent Charge for She Adjusted for Trustilen Projected Average Crashes per Year (Trustilene Projected Average Crashes per Year (Trustilene Comparison Site Location (County, Chy) Ph/CS No. BMP DMP DMP DMP DMP Campides Statistics Year Crash Modification Factor Comountation Stampio Odds Tatis (year 1-2) Sampie Odds Tatis (year 2-3) Mean of Sampie Odds Tatis (Sampie Odd Tatiss 25% Confidence Interval of the Sampie Odds N-Observed, TA) Isotal observed no. of crashes N-Observed, TA) Isotal observed no. of crashes N-Observed, TA) Isotal observed no. of crashes	Inskiprund vida, After) vida, After) vida, After) vida nilites-Countywide Background (Site, s, After) s, After) s, After) s, After) s, After) s, After) s, After) s, After) s, After) S, After) Crash Analysi Ottawa, Holland T22105 5.588 Site (JL, UL) In before period for treatment grou in after period for treatment grou	After) is Method: Before/ 2002 67 ×spi pi ropj	77.44% 46.19 6.5% 3657 3173 13.23% 527 360 31.69% 43.49 2.34% After with Compa Route/Road Namy Nearest Cross Str Nearest Cross S	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2006 2 2004 2006 2 2006 25 2 2006 2006 25 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 //Douglas Ave. After Period 2007 51 squency by Year (28) Comparison Site)	Countyvide Cityvide Tranklines- Cityvide 2008 60
Percent Change For Site Adjusted for Chywla Projected Average Crashes per Year using Chy Percent Change for Site Adjusted for Chywla Average Crashes per Year (Trunkline-County Percentage Change Noreall Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywla Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywla Percent Change for Site Adjusted for Trunklin Percent Change for Site Adjusted for Trunklin Projected Average Crashes per Year (Trunkline- Comparison Site Location (County, Chy) Phylos No. MP DMP DMP DMP DMP Crash Frequency (Total) Crash Frequency (Total) Crash Frequency (Total) Crash Modific Ratio (year 1-2) Sample Odds Tatio (year 2-3) Mean of Sample Odds Ratios Six Add Earlo (year 2-3) Mean of Sample Odds Ratios Six Contience Interval of the Sample Odds N-observed, J. Itotal observed no. of crashes N-observed, J. Itotal observed no. of crashes	Inskiprund wide, Before) wide, Before) wide hillow-Countywide Background (S e-Countywide Background e, After) e, Before) e, Before) e, Before) e, Before e, Chywlde Background Crash Analysi Ottawa, Holland 732105 2.265 5.688 batto (Li, UL) in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2002 67 sopj el rospj sopj	-77.44% 46.19 46.19 3657 3173 -11.23% 527 360 -31.69% 43.49 -2.34% After with Compa Route/Road Namy Nearest Cross Str Nearest Cross Str Ne	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2006 2 2005 2005 2 2006 2005 2 2006 2005 2 2006 2005 2 2 2004 2006 2 2 2004 2006 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 //Douglas Ave. After Period 2007 51 squency by Year (28) Comparison Site)	Countywide Citywide Tranklines Citywide 2008 60
Percent Change Forsile Citywide Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Citywide Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Percent Change Forsile Percent Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywid Percent Change for Site Adjusted for Trunklin Projected Average Crashes per Year (Trunkline- Comparison Site Location (County, Chy) Phylos No. BMP DMP DMP DMP DMP DMP DMP Campie Code Satisfics Year Crash Frequency (Total) Crash Modific Istic (year 2-3) Mean of Sample Odds Ratios Six Addarreed, TA (Istal observed no. of crashes N-observed, TA (Istal observed no.	Inskiprund wide, Before) wide, Before) wide hillow-Countywide Background (S e-Countywide Background e, After) e, Before) e, Before) e, Before) e, Before e, Chywlde Background Crash Analysi Ottawa, Holland 732105 2.265 5.688 batto (Li, UL) in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2002 67 sopj el rospj sopj	-27.44% 46.19 46.59% 3657 3173 -11.23% 55.24 -20.10% 527 360 -31.69% 43.49 -2.34% After with Compa Route/Road Namy Nearest Cross Str Nearest Cross Str Neare	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2006 2 2004 2006 2 2004 2006 2 2 2004 2006 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 //Douglas Ave. After Period 2007 51 squency by Year (28) Comparison Site)	Countywide Citywide Tranklines Citywide 2008 60
Percent Change For Site Adjunted for Chywlide Projected Average Crashes per Year using Chy Percent Change for Site Adjunted for Chywlide Average Crashes per Year (Tranklow-County Percent Change for Site Adjunted for Chywlide Percent Change for Site Adjunted for Tranklow Average Crashes per Year (Tranklow-County Percent Change for Site Adjunted for Tranklow Average Crashes per Year (Tranklow-Chywli Average Crashes per Year (Tranklow-Chywli Average Crashes per Year (Tranklow-Chywli Percent Change for Site Adjunted for Tranklow Percent Change for Site Adjunted for Tranklow Percent Change for Site Adjunted for Tranklow Comparison Site Location (County, Chy) PH/CS No. BMP Change Code Site Site (County) Caraphed Site Site (County) Sample Odds Tatio (year 1-2) Sample Odds Tatio (year 2-3) Mean of Sample Odds Tatio Sample Odds Tatio (year 2-3) Mean of Sample Odds Tatio Sample Odds Ratios Site Coldineous Internol Odds Ratios N-Observed, Z.B (total observed no. of crashes N-Observed, Z.B (total observed no.	Inskiprund wide, Before) wide, Before) wide hillow-Countywide Background (S e-Countywide Background e, After) e, Before) e, Before) e, Before) e, Before e, Chywlde Background Crash Analysi Ottawa, Holland 732105 2.265 5.688 batto (Li, UL) in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2002 67 sopj el rospj sopj	77.44% 46.19 6.5% 3657 3173 11.27% 527 20.80% 41.69% 41.69% 	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2006 2 2004 2006 2 2004 2006 2 2004 2006 2 2004 2006 2 2004 2006 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 //Douglas Ave. After Period 2007 51 squency by Year (28) Comparison Site)	Countywide Citywide Tranklines Citywide 2008 60
Percent Change For Site Adjusted for Chywlia Projected Average Crashes per Year using Chy Percent Change for Site Adjusted for Chywlia Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywli Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywli Percent Change for Site Adjusted for Trunklin Percent Change for Site Adjusted for Trunklin Projected Average Crashes per Year (Trunkline- Comparison Site Location (County, Chy) Phylos No. MP DMP DMP DMP DMP DMP Cample Odds Earlis (year 1-2) Sample Odds Earlis	Inskiprund wide, Before) wide, Before) wide hillow-Countywide Background (S e-Countywide Background e, After) e, Before) e, Before) e, Before) e, Before e, Chywlde Background Crash Analysi Ottawa, Holland 732105 2.265 5.688 batto (Li, UL) in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2002 67 sopj el rospj sopj	77.44% 46.19 6.5% 3657 3173 11.23% 527 360 31.69% 43.49 2.34% After with Compa Route,/Road Namy Nearest Cross Str Nearest Cross	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2006 2 2004 2006 2 2004 2006 2 2 2004 2006 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 After Period 2007 511 aquency by Year (201 Origination Site)	Countywide Citywide Tranklines Citywide 2008 60
Percent Change For Site Adjunted for Citywide Projected Average Transme per Year using City Percent Change for Site Adjunted for Citywidd Average Crashes per Year (Tranklow-County Percent Change for Site Adjunted for Citywidd Percentage Change oversill Tranklow-County Percentage Change oversill Tranklow-County Percentage Change for Site Adjunted for Tranklow Average Crashes per Year (Tranklow-Citywidd Percentage Change Oversill Tranklow-Citywidd Percentage Change For Site Adjunted for Tranklow Camper Cost Internation (County, City) PR/CS No. BMP DMP Campion Site Location (County, City) PR/CS No. Sampio Odds Ratio (year 1-2) Sampio Odds Ratio (year 2-3) Mean of Sample Odds Ratios Sanapio Odds Ratios (year 3-3) Mean of Sample Odds Ratios Sanapio Odds Ratio (year 3-3) Mean of Sample Odds Ratios Sanapio Odds Ratio (year 3-3) Mean of Sample Odds Ratios Nobarved, Z, I Intal Inberved no. of crashes N-obarved, Z, I Intal Inberved no. of crashes Nobarved, Z, Intal Inberved no. of crashes Nobarved, Z, Intal Inberved no. of crashes Nobarved, Z, Intal Inberved no. of	Inscignand wide, Before) wide, Before) wide hillow-Countywide Background (S e-Countywide Background e, After) e, Before) e, Refore) e, Before) e, Before) e, Before e, Chywlde Background Crash Analysi Ottawa, Holland 732105 2.265 5.688 before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2002 67 sopj el rospj sopj	-77.44% 46.19 -4.59% 3657 3173 -11.22% 3657 3173 -11.22% 360 -31.09% 43.49 -20.80% 43.49 -3.34% 43.49 -3.34% After with Compa Roots/Road Name Nearest Cross Stri 1.27 0.84 1.05 0.31 0.45 191.00 126.00 120.00 150.07 361.25 0.43 0.02	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2006 2 2004 2006 2 2005 2006 2 2006 2005 2 2006 2005 2 2 2006 2006 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 2008 2010 //Douglas Ave. Attar Period 2007 51 squares by Year (28) Comparison Site)	Countywide
Percent Change For Site Adjusted for Chywlia Projected Average Crashes per Year using Chy Percent Change for Site Adjusted for Chywlia Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-County Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywli Percent Change for Site Adjusted for Trunklin Average Crashes per Year (Trunkline-Chywli Percent Change for Site Adjusted for Trunklin Percent Change for Site Adjusted for Trunklin Projected Average Crashes per Year (Trunkline- Comparison Site Location (County, Chy) Phylos No. MP DMP DMP DMP DMP DMP Cample Odds Earlis (year 1-2) Sample Odds Earlis	Inscignand wide, Before) wide, Before) wide hillow-Countywide Background (S e-Countywide Background e, After) e, Before) e, Refore) e, Before) e, Before) e, Before e, Chywlde Background Crash Analysi Ottawa, Holland 732105 2.265 5.688 before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2002 67 sopj el rospj sopj	77.44% 46.19 6.5% 3657 3173 11.23% 527 360 31.69% 43.49 2.34% After with Compa Route,/Road Namy Nearest Cross Str Nearest Cross	500 2000 200 400 200 2000 200 200	2 2004 2004 2 2004 2004 2 2004 2006 2 2004 2006 2 2005 255 2 2006 255 2 2006 255 2 2006 255 2 2006 255 2 2006 2006 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2008 2010 2008 2010 //Douglas Ave. Attar Period 2007 51 squares by Year (28) Comparison Site)	Countywide Citywide Trunklines

		Site Charac	charistics				
Site No. 4			Longth (mil)		0.53		
County	lare		Land Use		Commercial		
	lare		No. of Driveways/	Intersections	16/8		
	4-115		Treatment Type		Receiving within e	disting curbs with re	w markings
PR/CS No. 1/	041702/18022					•	
	6.443		Nearest Cross Stre	et.	Maple Rd./ Plones	er Picary.	
EMP	6.969		Nearest Cross Stre	ant.	Ann Arbor Trail/ 4	th St.	
-		Descriptive	Statistics				
			Before Period			After Period	
Year		2001	2002	2005	2005	2006	2007
ADT		8549	11954	11942	12863	12515	8550
Crash Frequency (Total)		6	5	3	2	2	1
Crash Rate		3.66	2.18	1.11	0.01	0.00	0.61
Crash Frequency (Recoded)		5	5	1	1	1	0
Crash Frequency (Intersection-related)		ő	ő	ō		-	ő
Crash Frequency (Driveway-related)		1	3	ő	i i	š	ő
Crash Frequency (University-related) Crash Frequency (Affected by Road Diet)		;	3	1		1	1
Crash Prequency (Americad by Road Diet) Crash Prequency (Corrected by Road Diet)		ò	1			:	
Crash Frequency (Corrected by Road Diet) Crash Frequency (Background, Countywide)		909	1017	996	847	729	712
Crash Frequency (Background, Countywide) Crash Frequency (Background, Citywide)		109	105	101	847	729	712
		239	266	267	216	219	204
Crash Frequency (Background, Trunklines-County					216		
Crash Frequency (Background, Trunklines-Citywi		65 Method: Simple	71 (Naive) Before/Af	73	20	45	47
Average Crashes per Year (Before)	Creat Analysia	method: simple	4.67			and the second sec	
Average Crashes per Year (After)			1.67	30 CA	sh Frequency by Yes	ar (size)	
Percentage Change			-64.29%				
			1.67	*			
Average Crashes per Year (Recoded, Before)			0.67				Total
Average Crashes per Year (Recoded, After)				· ·			Recoded
Percentage Change Average Crashes per Year (Affected, Before)			-01.02%				Affected
Average Crathet per Year (Affected, After)			0.67		1		-0-Corrected
Percentage Change			-77.78%	2			-Series5
Average Crashes per Year (Corrected, Before)			0.33			-	-m-SeriesS
			0.35	0	<u> </u>	\sim	Series7
Average Crashes per Year (Corrected, After)			0.00%	2000 2001 20	02 2003 2004 20	05 2006 2007 20	ca-n-Series8
Percentage Change	Coash Annhain Mathe						
			Companison with I	lackenound Trend			
Background Area Location (County, Oty)		d: Betore/After (Comparison with E	Beckground Trend	5		
Background Area Location (County, City) Average Crather per Year (Countywide, Before)		d: Setore/Alter (Comparison with E				4.67
Average Crashes per Year (Countywide, Before)		d: Before/Anar (Average Crashes	per Year (Site, Before		4.67
Average Crashes per Year (Countywide, Before) Average Crashes per Year (Countywide, After)		d: Setors/Alter (2922	Average Crathes Average Crathes	per Year (Site, Befory per Year (Site, After)		
Average Crashes per Year (Countywide, Before) Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide		d: Setore/After (2922 2200	Average Crashes Average Crashes Percent Change (per Year (Site, Befory per Year (Site, After) Site, Before/After)		1.67
Average Crashes per Year (Countywide, Before) Average Crashes per Year (Countywide, Afber) Percentage Change Overall Countywide Projected Average Crashes per Year using County	ywide Background (Site, After)	d: Betore/Alter (2922 2288 -21.70% 3.65	Average Crashes Average Crashes Percent Change (per Year (Site, Befory per Year (Site, After)		1.67
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Average Crashes per Year (Countywide, Before) Average Crashes per Year (Countywide, Atter) Percentage Countywide Projected Average Crashes per Year using County Percent Change for Site Adjusted for Countywide Average Crashes per Year (Daywide, Before)	ywide Background (Site, After)	d: Betone/Alter (2922 2268 -21.70% 3.65 -42.59% 315	Average Crashes Average Crashes Percent Change (per Year (Site, Befory per Year (Site, After) Site, Before/After)		167 -54.29%
Average Crashes per Year (Countyvide, Sefore) Average Crashes per Year (Countyvide, Arber) Percentage Countywide Projected Average Crashes per Year using County Percent Change for Sta Adjusted for Countyvide Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Arber)	ywide Background (Site, After)	d: Setore/After o	2922 2268 -21.70% 3.65 -42.59%	Average Crathes Average Crathes Percent Change (1200 Cr 1000	per Year (Site, Befory per Year (Site, After) Site, Before/After)		1.67
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Average Crashes per Year (Countyvide, Befon) Average Crashes per Year (Countyvide, Mhar) Percentage Carage Overall Countyvide Projected Average Crashes per Year using Courth Percent Change for State Adjusted for Countyvide Average Crashes per Year (Chyvide, Petero) Average Crashes per Year (Chyvide, Petero) Percent Change Overall Chyvide Projected Average Crashes per Year using Chyvid Percent Change for State Adjusted for Chyvide Is	ywide Background (Ste, After) • Background de Background (Ste, After) ckground	d: Setore/After (2922 2288 -21.70% 3.65 -42.59% 315 200 -36.51% 2.96 -27.78%	Average Crathes Average Crathes Percent Change () 1000 Cri 1000 Cri 1000 Cri	per Year (Sta, Defon per Year (Sta, After) ita, Befora/After) uh Prequency by Ye	ar (Background) '	1.67 -64.29%
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Site Characteristics Site No. B Lang Use 0.81 County Daton Land Use Commercial City Charlotts No. of Driveway/Interactions 40/7 Bouta/Noad Kame I-608L Treatment Type 40/7 RC(S) No. 56000(2)2012 No. of Driveway/Interactions 40/7 PMP 0.380 No. of Driveway/Interactions 40/7 DMP 0.380 Nearest Cross Street Pleasent 2 Cast Descriptive Statistics Nearest Cross Street Butternut Dr. Teac 2001 2002 2003 2005 2007 ADT Crash Frequency (Total) 15135 14763 15933 13176 Crash Frequency (Intersection-related) 44 25 34 27 25 Crash Frequency (Intersection-related) 21 11 8 2 4 Crash Frequency (Intersection-related) 206 203 205 2332 2647 Crash Frequency (Intersection-related) 26 13 14 2 3 Crash Frequency (Intersection-related) 26 13 14 2 5 Crash Frequency (Intersection-related) 26 13 </th <th></th>	
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Crash Frequency (Background, Countywide) 3042 3268 2905 2332 2647 Crash Frequency (Background, Tranklinee-Countywide) 319 366 333 229 228 Crash Frequency (Background, Tranklinee-Countywide) 1159 1311 1001 936 992 Crash Frequency (Background, Tranklinee-Countywide) 205 227 206 138 142 Crash Frequency (Background, Tranklinee-Chywide) 205 227 206 138 142 Arerage Crashes per Year (Before) 43.33 401 Crash Frequency (Mark Panalysis 500	6
Crash Frequency (Background, Trunklinee-Countywide) 1159 1311 1001 936 992 Crash Frequency (Background, Trunklinee-Countywide) 205 237 206 138 142 Crash Analysis Average Crashe per Year (Before) Astronge Crashe per Year (Before) Astronge Crashe per Year (Mar) 34.33 Astronge Crashe per Year (Mar) 34.33 Astronge Crashe per Year (Mar)	2506
Crash Frequency (Background, Trunklines-Chywide) 205 237 206 138 142 Average Crashe per Year (Before) Crash Analysis Method: Simple (Nelve) Before/After Analysis 60 Grash Frequency by Year (Site)	253
Crash Analysis Method: Simpia (Naive) Before/After Analysis Average Crashes per Year (Before) 43.33 Average Crashes per Year (After) 34.33 Percentage Crashes per Year (After) 34.33	890
Average Crashes per Year (Before) 43.33 60 Grash Frequency by Year (Ste) 43.33 60 Grash Frequency by Year (Ste) 43.33 70 Frequency by Year (Ste) 43.33 70 70 70 70 70 70 70 70 70 70 70 70 70	147
Average Crashes per Year (Atter) 34.33 Percentage Change -20.77% 50	
Percentage Change -20.77% 50	-
	-
Average Craches per rear (Necoded, Berore) 37/67	
Average Crathes per Year (Recoded, After) 29.67	
Percentage Change -2124K at	
Average Crashes per Year (Affected, Before) 34.67	-d-Affected
Average Crashes per Year (Affected, After) 25.00	-0-Corrected
Percentage Change -19.22% to	-
Average Crashes per Year (Corrected, Before) 20.33 0	-
	030
Crash Analysis Method: Before/After Comparison with Background Trends	
Tackground Area Location (County, City)	
Average Crashes per Year (Countywice, Before) 9215 Average Crashes per Year (Site, Before)	43,33
Average Crashes per Year (Countywide, After) 7485 Average Crashes per Year (Ste, After)	34.33
Percentage Change Oversil Countywide -18.77% Percent Change (Site, Before/After)	-20.77%
Projected Average Crashes per Year using Countywide Background (She, After) 15.20 200 Crash Prequency by Year (Background)	
Percent Charge for Site Adjusted for Countywide Background -2.00%	
Average Craches per Year (Citywide, Before) 1038 A000 Average Craches per Year (Citywide, After) 710	
	Countywide
Percentage Change Overall Citywide	
Percent Change for Site Adjusted for Citywide Background 10.80% 2000	
Average Crashes per Year (Trunklines-Countywide, Before) 1571 2000 2002 2004 2006 2008 20	0
Average Crathes per Year (Trunklines-Countywide, After) 2818 1500	
Percentage Change Overall Trunkline-Countywide -21.09%	Chywlde
Projected Average Crashes per Year using Trunklines-Countywide Background (Site, After) 34.20 3000	
Percent Change for Site Adjusted for Trunkibes-Countywide Background 0.12% Average Crashes per Year (Trunkibes-Chywide, Before) 648	Countywide
Augurean Crathan per Yang Thunking (Thunking Albert)	
Percentage Change Overall Trunking-Chywles	Citywide
Projected Average Crashes per Year using Trunklines-Citywide Background (Site, After) 28.55 0	
Percent Change for Site Adjusted for Trunklines-Citywide Background 13.34%	9
Crash Analysis Method: Before/After with Comparison Group	
Comparison Site Location (County, City) Oakland, Royal Oak Route/Road Name 11 Mile Rd.	
P8/CS No. 4400088	
IMP 7.740 Nearest Cross Street Knowles St. IMP 8.550 Nearest Cross Street Campbell Rd.	
Descriptive Statistics Before Period After Period	
Year 2001 2002 2003 2006 2007 Crash Frequency (Total) 39 38 30 30 25	2008
	30
Crash Modification Factor Consolution Sample Odds Batto (vest 1-2) 1.06 and Sample Odds Batto (vest 1-2)	
Crain Hegency by Tear	ite va.
Comparison sites	
Standard Error of the Sample Odds Ratios 0.19	
95% Confidence Interval of the Sample Odds Ratio (LI, UL) 0.55 1.30 50	
N-observed, T, B (total observed no. of crashes in before period for treatment group) 130.00	
N-observed T.A Itotal observed no. of crashes in after period for treatment group) 103.00	\sim
	<u> </u>
N-observed,C,B (total observed no. of creshes in before period for comparison group) 107.00 a0	•
N-observed, C,B (total observed no. of crashes in before period for comparison group) 107.00 a0 N-observed, C,A (total observed no. of crashes in after period for comparison group) 85.00 30	
N-observed, C.B. [total observed no. of crashes in before period for comparison group] 107.00 a0 N-observed, C.B. [total observed no. of crashes in after period for comparison group] 85.00 a0 N-opsected, T.A. [sepacied no. of crashes that would have occurred in after period w/out treatment] 103.27	
N-observed, C.B (total observed no. of crashes in before period for comparison group) 107.00 a0 N-observed, C.A (total observed no. of crashes in after period for comparison group) 85.00 20 N-sepected, T.A (supected no. of crashes that would have occurred in after period w/out treatment) 103.27 10	
N-observed, C.B. [total observed no. of crashes in before period for comparison group] 107.00 40 N-observed, C.A. [total observed no. of crashes in after period for comparison group] 85.00 30 N-sepacted, T.A. [sepacted no. of crashes that would have occurred in after period w/out treatment] 103.27 10 Variance of N-sepacted, T.A. 307.18	6 2008
N-observed, C.B. [total observed no. of crashes in before period for comparison group] 107.00 40 N-observed, C.A. [total observed no. of crashes in after period for comparison group] 85.00 30 N-sepacted, T.A. [sepacted no. of crashes that would have occurred in after period w/out treatment] 103.27 10 Variance of N-sepacted, T.A. 307.18	_
N-observed,C,B (total observed no. of crashes in before period for comparison group) 107.00 a0 N-observed,C,A (total observed no. of crashes in after period for comparison group) 85.00 20 N-expected,T,A (sepected no. of crashes that would have occurred in after period w/out treatment) 103.27 10 Variance of N-expected,T,A 0.7.18 0 Variance of CMF 0.23 2000 2002 2004 20	son Site

		Site Charac	teristics				
Ste No.	0		Length (mil)		0.43		
	Eaton		Land Use		Commercial		
County	Laton Eaton Rapida				16/8		
City Route/Road Name	Laton Rapids M-50/M-99		No. of Driveways	Intersections			
Route/Road Name PR/CS No.		565810/23051	Treatment Type		Repoving within ex	ditting curbs with r	ww markings
PR/CS No.	568804/23091				King St.		
	6.151	9,850	Nearest Cross Str				
EMP	6.571	9.860	Nearest Cross Str	940	Main St.		
		Descriptive					
			Before Period			After Period	
Year		2002	2005	2004	2006	2007	2006
ADT		16883	18372	18262	17382	15977	15242
Crash Frequency (Total)		78	46	32	27	19	26
Crash Rate		29.44	15.95	11.16	9.90	7.50	10.87
Crash Frequency (Recoded)		66	39	23	21	14	23
Crash Frequency (Intersection-related)		13	5	0	2	2	6
Crash Frequency (Driveway-related)		7	6	3	2	4	1
Crash Frequency (Affected by Road Diet)		53	29	20	19	14	20
Crash Frequency (Corrected by Road Diet)		21		30	4	4	5
Crash Frequency (Background, Countywide)		3268	2905	3082	2332	2647	2506
Grash Frequency (Background, Citywide)		176	131	128	306	81.	73
Grash Frequency (Background, Trunklines-Cou	ntywide)	1511	1101	1217	936	992	890
Grash Frequency (Background, Trunklines-City		127	92	87	72	40	45
		is Method: Simple	(Naive) Before/Al	fter Analysis			
Average Crashes per Year (Before)			52.00	100 - Cras	h Frequency by Yes	ar (Site)	_
Average Crashes per Year (After)			24.00				
Percentage Change			-53.05%	80			_
Average Crashes per Year (Recoded, Before)			42.67				Total
Average Crashes per Year (Recoded, After)			19.33	@ \\			- Recoded
Percentage Change			-54.69%	- AN			
Average Crashes per Year (Affected, Before)			34.00	40	<u> </u>		Affected
Average Crashes per Year (Affected, After)			17.67		<u></u>		-é-Corrected
Percentage Change			-48.04%	20	<u></u>		_
Average Crashes per Year (Corrected, Before)			13.00				
Average Crashes per Year (Corrected, After)							-
			4.33	0			
			4.33		68 2004 2005 20	06 2007 2008 2	009
Percentage Change	Crash Analysis Meth	od: Before/After (-66.67%	2001 2002 20		06 2007 2008 2	009
	Crash Analysis Meth	od: Before/After (-66.67%	2001 2002 20		06 2007 2008 2	
Percentage Change		od: Before/After (-66.67%	2001 2002 20 Beckground Trends	1		52.00
Percentage Change Background Area Location (County, Oty)	0	od: Sefore/After (-66.67% Comparison with I	2001 2002 20 Background Trends Average Crathes p		4	
Percentage Change Background Area Location (County, City) Average Crashes per Year (Countywide, Before	0	od: Before/After (-66.67% Comparison with I 9255	2001 2002 20 Background Trends Average Crathes p	er Year (Site, Before er Year (Site, After)	4	52.00
Percentage Change Background Area Location (County, City) Average Crashes per Year (Countywide, Befor Average Crashes per Year (Countywide, Ather)	0	nod: Before/After (-66.67% Comparison with I 9255 7485	2001 2002 20 Beckground Trends Average Crather p Average Crather p Percent Change (5	er Year (Site, Before er Year (Site, After) ta, Before/After)	0	52.00 24.00
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (CountyWids, Befor Average Crashes per Year (CountyWids, Befor Percentage Change Overall CountyWids	e) ntywide Background (Site, After)	nod: Before/After (-66.67% Comparison with I 9255 7485 -19.12%	2001 2002 20 Beckground Trends Average Crather p Average Crather p Percent Change (5	er Year (Site, Before er Year (Site, After)	0	52.00 24.00
Percentage Dunge Background Area Location (County, Chy) Average Crathes per Year (Countyvida, Befor Average Crathes per Year (Countyvida, After) Percentage Dunge Orathe per Year using Cou	e) ntywide Background (Site, After)	nod: Before/After (-66.67% Comparison with 1 9255 7485 -19.12% 42.06	2001 2002 20 Beckground Trends Average Crather p Average Crather p Percent Change (5	er Year (Site, Before er Year (Site, After) ta, Before/After)	0	52.00 24.00
Percentage Change Background Area Location (County, City) Average Crashes per Year (Countywids, Befon Average Crashes per Year (Countywids Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw	e) ntywide Background (Site, After)	od: Before/After (-66.67% Comparison with 1 9255 7485 -19.12% 42.06 -34.72%	2001 2002 20 Beckground Trends Average Crather p Average Crather p Percent Change (5 2000 Cr	er Year (Site, Before er Year (Site, After) ta, Before/After)	0	52.00 24.00 -53.85%
Percentage Change Background Anes Location (County, Chy) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, After) Percentage Change Crathes per Year using Cou Percent Change for Site Adjusted for Countyv Average Crathes per Year (Chyvide, After) Average Crathes per Year (Chyvide, After)	e) ntywide Background (Site, After)	od: Before/After (-66.67% Comparison with 1 9255 7485 -19.12% 42.06 -34.72% 425	2001 2002 20 Background Trends Average Crasher p Percent Change (5 3800 0 2800 9	er Year (Site, Before er Year (Site, After) ta, Before/After)	0	52.00 24.00 -53.85%
Percentage Change Background Area Location (County, Chy) Average Crather per Year (Countyvide, Befor Average Crather per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crather per Year uning Cou Percent Change for Site Adjusted for Countyvide, Nerrage Crather per Year (Chyvide, Before)	n) ntywide Background (Site, After) Ide Background	od: Before/After (-66.57% Comparison with I 9255 7485 -19.12% 42.06 -34.72% 425 260	2001 2002 20 Beckground Trends Average Crather p Average Crather p Percent Change (5 2000 Cr	er Year (Site, Before er Year (Site, After) ta, Before/After)	0	52.00 24.00 -53.85%
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Befon Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year uning Cou Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before)	n) ntywide Background (Ste, After) ide Background wide Background (Ste, After)	od: Before/Alter (-66.67% Comparison with 1 9255 7485 -19.12% 42.06 -34.72% 425 280 -40.23%	2003 2002 20 Background Trends Average Crashes p Percent Change (5 3800 Gr 2800 9 3800	er Year (Site, Before er Year (Site, After) ta, Before/After)	0	52.00 24.00 -53.85%
Percentage Dunge Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, After) Percentage Crathes per Year using Cou Percent Change for Site Adjusted for Countyv Average Crathes per Year (Chyvide, After) Average Crathes per Year (Chyvide, After) Percentage Crathes per Year (Chyvide, After) Percent Change for Site Adjusted for Chyvide	n) ntywide Background (Ste, After) ide Background Mide Background (Ste, After) Background	nod: Before/After (-66.67% Comparison with I 9255 7465 -19.12% 42.06 -34.72% 435 260 -40.23% 31.06	2003 2002 28 Background Trends Average Crather p Average Crather p Percent Change (2 3800 0 1800 0 800 0	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.05% -e-Countywide -countywide
Percentage Change Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crathes per Year uting Cou Percentage Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Percentage Change Overall Chyvide Projected Average Crathes per Year uting Chy Percent	n) ntywide Background (Ste, After) ide Background Wide Background (Ste, After) Background vide, Before)	od: Sefore/After (-46.67% Comparison with 1 9255 7485 -19.12% 42.06 42.05 425 260 -40.23% 31.08 -13.62%	2003 2002 20 Background Trends Average Crather p Average Crather p Percent Change Cr 2800 9 2800 9 2800 9 2000 2002	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.05% -e-Countywide -countywide
Percentage Dunge Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, Arber) Percentage Orange Ovenil Countyvide, Percent Projected Average Crathes per Year using Cou Percent Change for Site Adjusted for Countyvide, Average Crathes per Year (Chyvide, After) Percentage Crathes per Year using Chyvide Percent Change for Site Adjusted for Chyvide Average Crathes per Year (Trunkine-Countyvide) Average Crathes per Year (Trunkine-Countyvide)	n) ntywide Background (Ste, After) ide Background Wide Background (Ste, After) Background ide, After)	od: Before/After (-66.67% Comparison with 1 9255 7485 -39.12% 42.06 -34.72% 42.00 -40.23% 31.09 -13.62% 3231	2003 2002 28 Background Trends Average Crather p Average Crather p Percent Change (2 3800 0 1800 0 800 0	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.05% -e-Countywide -countywide
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Befor Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year utiling Cou Percent Change for Sta Adjusted for Countyvide Average Crashes per Year (Chyvide, Befors) Average Crashes per Year (Chyvide Average Crashes per Year (Chyvide Average Crashes per Year (Trusiline-Countyy Average Crashes per Year (Trusiline-Countyy Average Crashes per Year (Trusiline-Countyy Average Crashes per Year (Trusiline-Countyy	n) ntywide Background (Ste, After) ide Background Wide Background (Ste, After) Background Vide, After) ide		-66.67% Comparison with 1 9255 7485 -19.12% 42.06 -34.72% 42.06 -34.72% 31.06 -10.62% 31.08 -13.62% 3629 2018 -22.35%	2001 2002 20 Background Trends Average Crasher p	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.85% -e-Countywide -ountywide
Percentage Dunge Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, Refor Percentage Onape Overlike Countyvide Projected Average Crathes per Year using Cou Percent Change for Site Adjusted for Countyvide Average Crathes per Year (Chyvide, Beford) Average Crathes per Year (Chyvide, Beford) Percentage Crathes per Year (Chyvide, Beford) Percentage Change Overall Chyvide Average Crathes per Year (Chyvide, Marc) Percentage Change Press Average Crathes per Year (Initialine-Countyv Average Crathes per Year (Initialine-Countyv Percentage Change Crathe per Year using Thur Projected Average Crathes per Year using Thur	n) ritywide Background (Ste, After) ide Background Wide Background (Ste, After) Background Vide, Sterne) vide, After) ride Mihae-Countywide Background (St		-46.67% Comparison with 1 9255 7485 -39.12% 42.06 -40.72% -40.72% -40.72% -30.27% -31.08 -31.62% -33.52% 40.33	2003 2002 20 Background Trends Average Crather p Average Crather p Percent Change Cr 2800 9 2800 9 2800 9 2000 2002	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.05%
Percentage Change Inclusional Area Location (County, Chy) Average Crashes per Year (Countyvide, Refor Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide, Percentage Change Overall Countyvide, Percentage Crashes per Year (Chyvide, Merre) Percentage Crashes per Year (Chyvide, After) Percentage Crashes per Year (Trusiline-Countyv Average Crashes per Year (Trusiline-Countyv Percentage Crashes per Year (Trusiline-Countyv) Percentage Crashes per Year (Trusiline-Countyv) Per	n) ntywide Background (Ste, After) ide Background Background (Ste, After) Background Wde, Before) vide, After) vide e.Countywide Background (Ste e.Countywide Background (Ste		-46.67% Comparison with 1 9255 7485 -33.12% 42.06 43.72% 435 260 -40.23% 31.00 -13.62% 9338 -23.35%	2001 2002 20 Background Trends Average Crasher p	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.85% Truskilve- Countywide Truskilve- Countywide
Percentage Change Background Area Location (County, City) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crathes per Year uting Cou Percentage Change per Year (Cityvide, Before) Average Crathes per Year (Cityvide, Sefore) Percentage Change Overall Oryvide Projected Average Crathes per Year uting City Percentage Change Overall Oryvide Percentage Change Overall Oryvide Percentage Change Overall Oryvide Percentage Change Overall Oryvide Percentage Change Overall Oryvide Average Crathes per Year uting City Percentage Orabes per Year uting Tru Percentage Orabes per Year Uting Hear Orabes Developed Percentage Orabes per Year Uting Hear Orabes Developed Percentage Orabes per Year Orabes Developed Percentage Orabes Develope	n) ntywide Background (Ste, After) Ide Background (Ste, After) Background vide, Stefore) vide, Stefore) vide, Stefore) vide, Stefore) Stefore) Stefore) Stefore) Stefore) Stefore)		-46.67% Comparison with 1 9255 7485 -39.12% 42.05 42.05 42.05 43.72% 43.5 20 -40.22% 31.08 -40.22% 31.08 -40.22% 31.08 -40.23% 31.62% 30.55% 30.65%	2003 2002 20 Background Trends Average Crather p Parcent Change (2 3800 Cr 3800 Cr 380 Cr 3800 Cr 380 Cr 3800	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.05% -e-Countywide -e-Trunklines- Countywide -e-Trunklines-
Percentage Dunge Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, Refor Percentage Onage Overall Countyvide Projected Average Crathes per Year using Cou Percent Change for Site Adjusted for Countyvide Average Crathes per Year (Chyvide, After) Percentage Crathes per Year (Chyvide, After) Percentage Crathes per Year (Chyvide, After) Percentage Change Overall Chyvide Average Crathes per Year (Chyvide, After) Percentage Change Per Year using Chy Average Crathes per Year (Trusitione-Countyv Percentage Change Per Year (Trusitione-Countyv Percentage Change Per Year using Tru- Percent Change for Site Adjusted for Truwkins Average Crathes per Year (Trusitione-Chyvide Average Crathes per Year (Trusitione-Chyvide	n) ntywide Background (Ste, After) ide Background Wide Background Sternen Wide, After) ide Mines-Countywide Background (St m-Countywide Background Staffree) , After)		-46.67% Comparison with 1 9255 7485 -39.12% 42.06 -34.72% 42.06 -34.72% 42.05 -30.23% 31.08 -13.62% 2018 -22.35% 40.03 -31.90% 306 106	2001 2002 20 Background Trends Average Crather p Parcent Charge 2 3800 1800 200 1800 200 200 150 5	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.85% Truskilve- Countywide Truskilve- Countywide
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Befor Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year utiling Cou- Percent Change for Tak Adjusted for Countyw Average Crashes per Year (Chywlde, Befors) Average Crashes per Year (Chywlde Average Crashes per Year (Chywlde Average Crashes per Year (Tunkilme-Countyy Average Crashes per Year (Tunkilme-Countyy Average Crashes per Year (Tunkilme-Countyy Average Crashes per Year (Tunkilme-Countyy Projected Average Crashes per Year (Tunkilme-Countyy Projected Average Crashes per Year (Tunkilme-Chywld Average Crashes per Year (Tunkilme-Chywld Average Crashes per Year (Tunkilme-Chywld Average Crashes per Year (Tunkilme-Chywld Average Crashes per Year (Tunkilme-Chywld	ntywide Background (Ste, After) ide Background Background (Ste, After) Background vide, Before) vide, After) ide wilnes-Countywide Background (St e-Countywide Background s, Before) s, After)	te, After)	-46.67% Comparison with 1 9255 7485 -33.12% 42.06 432 -40.23% 31.08 -40.23% 31.08 -31.02% 3429 2818 -22.35% 40.38 -31.90% 306 -45.73%	2003 2002 20 Background Trends Average Crather p Parcent Change (2 3800 Cr 3800 Cr 380 Cr 3800 Cr 380 Cr 3800	i er Year (Ste, Belore er Year (Ste, Atter) te, Before/Atter) uh Frequency by Tr	4) Aar (Background)	52.00 24.00 -53.85% -e-Countywide -e-Trunklines- Countywide -e-Trunklines-
Percentage Change Background Area Location (County, Chy) Nerage Crashes per Year (Countyvide, Befor Nerage Crashes per Year (Countyvide, Refor Projected Average Crashes per Year using Cou Percentage Change Overall Countyvide, Beford Nerage Crashes per Year (Chywide, After) Percentage Change Per Year (Chywide, After) Percentage Change Per Year (Chywide, After) Percentage Change Der Year (Chywide, After) Percentage Change Der Year (Chywide, Marcy) Nerage Crashes per Year (Chywide, Marcy) Nerage Crashes per Year (Chywide, Marcy) Nerage Crashes per Year (Churidine-Chywide Nerage Crashes per Year (Churidine-Chywide Nerage Crashes per Year (Churidine-Chywide Nerage Crashes per Year (Churidine-Chywide Nerage Crashes per Year (Churidine-Chywide) Nerage Crashes per Year (Churidine-Chywide)	n) rtywide Background (Ste, After) ide Background Wide Background (Ste, After) Background wide, Sterne) wide, Sterne) withes-Countywide Background (Ste, , After) withinse-Chywide Background (Ste, , Minse-Chywide Background (Ste,	te, After)	-46.67% Comparison with 1 9255 7485 -39.12% 42.06 -34.72% 42.06 -34.72% 42.05 -30.23% 31.08 -13.62% 2018 -22.35% 40.03 -31.90% 306 106	2003 2002 20 Background Trends Average Crather p Parcent Charge (2 3800 Cr 3800 Cr 380	ar Year (Ste, Belor er Year (Ste, After) te, Belore/After) uh Frequency by To 2004 2005	4)	52.00 24.00 -53.85% Trunklines- Countywide Trunklines- Chywide Trunklines- Chywide

		a b b c a					
		Site Charac	-		1.46		
Site No. County	11		Length (ml) Land Use		1.46 Mixed commercial	Logislantial	
Chy	Clip		No. of Driveways/	Internections	80/12		
Route/Road Name	M-57		Treatment Type			disting curbs with ne	e markings
PR/CS No.	1494503/25101						-
BMP	9.400		Nearest Cross Stre		Washington St.		
DMP	10.856		Nearest Cross Stre	**	Liberty St.		
		Descriptive					
			Before Period			After Period	
Year ADT		2002	2003	2004	2006	2007	2008
Crash Frequency (Total)		47	58	40	13725	45	32
Crash Rate		6.05	7.47	5.05	4.94	6.29	3.74
Crash Frequency (Recoded)		42	45	31	30	34	24
Crash Frequency (Intersection-related)		5		3	5	5	6
Crash Frequency (Driveway-related) Crash Frequency (Affected by Road Diet)		10 40	40	7 29	2	30	0
Crash Frequency (Corrected by Road Diet)		16		9	2	2	3
Crash Frequency (Background, Countywide)		14306	14066	13285	10458	10701	10180
Crash Frequency (Background, Chywide)		44	63	45	43	44	43
Crash Frequency (Background, Trunklines-Con	ntywide)	1854	1854	1752	1400	1321	1218
Crash Frequency (Background, Trunklines-Ch	Crash Analysi	a Method: Simple (30	20
Average Crashes per Year (Before)	come company		48.33		sh Frequency by Yes	ar (Site)	
Average Crashes per Year (After)			37.67		and a second of the		
Percentage Change			-22.07%	- /			
Average Crashes per Year (Recoded, Before) Average Crashes per Year (Recoded, After)			40.33	*			Total
Average Crashes per Year (Recoded, After) Percentage Change			-27.27%	40			- Recoded
Average Crathes per Year (Affected, Before)			37.33	*			-d-Affected
Average Crashes per Year (Affected, After)			28.00	20			-q-Corrected
Percentage Change			-25.00%	10	_		
Average Crathes per Year (Corrected, Before) Average Crathes per Year (Corrected, After)			11.33		1		
Percentage Change			-79.41%	2001 2002 20	08 2004 2005 20	06 2007 2008 200	•
	Crash Analysis Meth	od: Before/After C		eckground Trend			
Background Area Location (County, City)							
Average Crashes per Year (Countywide, Befor	•)		41657	Average Crashes p	er Year (Site, Befor	*)	48.33
Average Crashes per Year (Countywide, After			31339		ver Year (Site, After)		37.67
Percentage Change Overall Countywide Projected Average Crathes per Year using Cou	minute Declaration (City After)		-24.77%	Percent Change (5			-22.07%
Percent Change for Site Adjusted for County			2.70%	16000	rash Frequency by 1	eer (secutround)	
Average Crashes per Year (Citywide, Before)			153	1 •	the second		
Average Crashes per Year (Citywide, After)			130	11000		-	
Percentage Change Overall Citywide Projected Average Crashes per Year using City	and the second state states		-15.03%	6000			Trunkines-
Percent Change for Site Adjusted for Citywide			-7.04%				Countywide
Average Crashes per Year (Trunklines-County	wide, Before)		5460	1000	****		
Average Crashes per Year (Trunklines-County	wide, After)		3939	2001 2002	2003 2004 2005 20	06 2007 2008 2009	
Percentage Change Overall Trunkline-County			-27.86%	80			
Projected Average Crashes per Year using Tru Percent Change for Site Adjusted for Trunkin		ite, After)	34,87	60	A		-e-Citywide
Average Crashes per Year (Trunklines-Citywid			96	40			-e-Touldines-
Average Crashes per Year (Trunklines-Otywid	e, After)		68	20	\sim	\sim	Citywide
Second and Changes (Second Second Sec							
Percentage Change Overall Trunkline-Citywid			-29.17%				
Projected Average Crashes per Year using Tru	nkines-Citywide Background (Site,	After)	34.24	3000 300	2 2004 200	6 2008 2030	
	nkines-Citywide Dackground (Site, es-Citywide Background		34.24 7.30%	2000 200	2 2004 200	6 2008 2030	
Projected Average Crashes per Year using Tru	nkines-Citywide Dackground (Site, es-Citywide Background	After) a Method: Before/	34.24 7.30%	2000 200 rison Group	2 2004 200 M-52	6 2008 2030	
Projected Average Crashes per Year using Tru Percent Change for Site Adjusted for Trunklin Comparison Site Location (County, City) PR/CS No.	nklines-Chywide Background (Ste, es-Chywide Background Crash Analyst Shlawassee, Owosso 551706		34.24 7.10% After with Compa Route/Road Name	2000 200 rison Group	M-52	6 2008 2030	
Projected Average Crashes per Year using Tru Percent Change for Site Adjusted for Trunklin Comparison Site Location (County, City) PR/CS No. BMP	nklines-Chywide Background (She, es-Chywide Background Crash Analysi Shlawassee, Oworso 551706 16.299		34.24 7.10% After with Compa Route/Road Name Nearest Cross Stre	2000 200 rison Group	M-52 Mah St.	6 2008 2020	
Projected Average Crashes per Year using Tru Percent Change for Site Adjusted for Trunkille Comparison Site Location (County, City) PR/CS No. BMP DMP	nklines-Chywide Background (Ste, es-Chywide Background Crash Analyst Shlawassee, Owosso 551706		34.24 7.10% After with Compa Route/Road Name Nearest Cross Stre Nearest Cross Stre	2000 200 rison Group	M-52		
Projected Average Crashes per Year using Tru Percent Change for Site Adjusted for Trunklin Comparison Site Location (County, City) PR/CS No. BMP	nklines-Chywide Background (She, es-Chywide Background Crash Analysi Shlawassee, Oworso 551706 16.299	a Method: Sefore/	34,34 7.10% After with Compa Route/Road Name Nearest Cross Stre Nearest Cross Stre Defore Period	2006 200 rison Group eet eet	M-52 Main St. Laura La.	After Period	
Projected Average Crashes per Year using Tru Percent Change for She Adjusted for Trunkin Comparison Site Location (County, City) PR/CS No. BMP EMP Baserishtes Statistics Year	nklines-Chywide Background (She, es-Chywide Background Crash Analysi Shlawassee, Oworso 551706 16.299		34.24 7.10% After with Compa Route/Road Name Nearest Cross Stre Nearest Cross Stre	2000 200 rison Group	M-52 Mah St.		2008
Projected Average Crashes per Year using Tru Percent Change for She Adjusted for Trunkile Comparison Site Location (County, City) PR/CS No. BMP DMP DMP Description Statistics Year Crash Frequency (Total)	nklines-Chywide Background (She, es-Chywide Background Crash Analysi Shlawassee, Oworso 551706 16.299	a Method: Before/	34.34 7.10% After with Compa Route/Road Name Nearest Cross Stre Defore Period 2003	2000 300 rison Group set set 2004	M-52 Main St. Laura La. 2006	After Period 2007	
Projected Average Crashes per Year using Tru Percent Change for She Adjusted for Trunkin Comparison Site Location (County, City) PR/CS No. BMP EMP Baserishtes Statistics Year	nklines-Chywide Background (She, es-Chywide Background Crash Analysi Shlawassee, Oworso 551706 16.299	a Method: Before/	34.34 7.10% After with Compa Route/Road Name Nearest Cross Stre Defore Period 2003	2000 300 rison Group set set 2004	M-52 Maib St. Laura La. 2006 29	After Period 2007 33	33
Projected Average Crashes per Year using Tro Percent Change for She Adjusted for Trunkin Comparison Site Location (County, City) RV/CS No. BMP DMP Description Statistics Year Crash Frequency (Total) Crash Modification Factor Computation Sample Odds Tablo (year 1-2) Sample Odds Tablo (year 1-2)	nklines-Chywide Background (She, es-Chywide Background Crash Analysi Shlawassee, Oworso 551706 16.299	a Method: Before/	34.24 7.10% After with Compa Route/Road Name Nearest Cross Stre Nearest Cross Stre Nearest Cross Stre Defore Period 2003 43 0.86 1.09	2000 300 rison Group set set 2004	M-52 Maib St. Laura La. 2006 29	After Period 2007	33
Projected Average Crahem per Year using Tru Percent Change for Site Adjusted for Trunkin Comparison Site Location (County, City) PR/CS No. BMP DMP DMP DMP DMP Cash Modifiesting Sample Odds Table (year 1-2) Sample Odds Table (year 2-3) Mean of Sample Odds Table Sites	nklines-Chywide Background (She, es-Chywide Background Crash Analysi Shlawassee, Oworso 551706 16.299	a Method: Before/	34.24 7.30% RouteyRoad Name Nearest Cross Stro Nearest Cross Stro Nearest Cross Stro Defore Period 2003 43 0.86 1.09 0.96	2000 300 rison Group set set 2004	M-52 Maib St. Laura La. 2006 29	After Period 2007 33	33
Projected Average Crashes per Year using Tro Percent Change for She Adjusted for Trunkin Comparison Site Location (County, City) PR/CS No. BMP DMP Description Statistics Year Crash Frequency (Total) Crash Modification Factor Consulation Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratios	hline-Chyelde Background (Ste, e-Chyelde Background Create Analysi Salawassee, Owoto 351705 12,299 17,759	a Method: Before/	34.24 7.10% After with Compa Route/Road Name Nearest Cross Stre Nearest Cross Stre Nearest Cross Stre Defore Period 2003 43 0.86 1.09	2000 300 rison Group set set 2004	M-52 Main St. Laura (n. 2006 29 Crash Fin	After Period 2007 33	33
Projected Average Crathen per Year using Tru Percent Change for Site Adjusted for Trunkin Comparison Site Location (County, City) PII/US No. BMP DMP DMP Bascristites Statistics Year Crash Forequency (Total) Crash Modification Factor Consortation Sample Odds Tatio (year 2-3) Mean of Sample Odds Tatio (year 2-3) Mean of Sample Odds Tatio Sample Odds Tatios Stangle Odds Tatio (year 2-3)	hilme-Citywide Background (Site, -Citywide Background Crash Analysi Salawasae, Dwosso S31706 12,299 17,759	a Method: Before/ 2002 39	34.24 After with Compa Route/Road Name Nearest Cross Stre Nearest Cross Stre Before Period 2003 43 0.86 1.09 0.58 0.17	2000 200 rtson Group eet eet 2004 34	M-52 Main St. Laura Ln. 2006 29 Crash Fin	After Period 2007 33	33
Projected Average Crashes per Year using Tru Percent Change for She Adjusted for Trunkin Comparison Site Location (County, City) PR/CS No. BMP DMP Description Statistics Year Crash Frequency (Total) Crash Modification Factor Consulation Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratios	hilhes-Chywlde Background (Ste, s-Chywlee Background Crash Analysi 251706 15239 17.759 16239 17.759	a Method: Before/ 2002 39	34.24 7.30% RouteyRoad Name RouteyRoad Name Nearest Cross Stri Nearest Cross Stri Before Period 2003 43 0.86 1.09 0.96 0.17 0.65	2000 200 rtson Group eet eet 2004 34	M-52 Main 52 Laura Ln. 2006 29 Crash Fin 60	After Period 2007 33	33
Projected Average Crantes per Year using Tru Percent Change for Site Adjusted for Trunklin Comparison Site Location (County, City) PR/CS No. BMP EMP EMP Cash Modifies Statistics Year Crash Frequency (Total) Campie Odds Ratio (year 1-2) Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratios Standard Emor of the Sample Odd Ratios Standard Emor of the Sample Odd Ratios PS/C confidence Internal of the Sample Odds N-Observed, TA) (total observed no. of crashes N-Observed, TA) (total observed no. of crashes	hiltner-Chywlad Background (Ste, n-Chywlad Background Crash Analysi Shinemase, Owosto 251705 10,299 17,759 In Jily period for treatment gro In sitro period for treatment gro In sitro period for treatment gro	a Method: Before/ 2002 39 Pl pl pnpp]	34.34 7.306 After with Comps Route/Road Name Nearest Cross Stre Nearest Cross Stre Neares	2000 200 rtson Group eet eet 2004 34	M-52 Main Sz. Laura La. 2006 29 Crash Pin 50 40	After Period 2007 33	33
Projected Average Crambes per Year using Tro Percent Change for Sile Adjusted for Trunkin Comparison Site Location (County, City) PN/CS No. BMP DAP Descriptive Statistics Year Crash Frequency (Total) Crash Modiffication Factor Consciption Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 1-2)	hiltner-Chywlad Background (Ste, n-Chywlad Background Crash Analysi Shinemase, Owosto 251705 10,299 17,759 In Jily period for treatment gro In sitro period for treatment gro In sitro period for treatment gro	a Method: Before/ 2002 39 Pl pl pnpp]	34.34 34.34 After with Compa Route/Road Name Nearest Cross Stre Nearest Cross Stre Neares	2000 200 rtson Group eet eet 2004 34	M-52 Main Sz. Laura Ln. 2006 29 Crash Fin 60 50 50 60 60 60 60 60 60 60 70 60 60 70 70 70 70 70 70 70 70 70 70 70 70 70	After Period 2007 33	33
Projected Average Crantes per Year using Tru Percent Change for Site Adjusted for Trunklin Comparison Site Location (County, City) PR/CS No. BMP EMP EMP Cash Modifies Statistics Year Crash Frequency (Total) Campie Odds Ratio (year 1-2) Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratios Standard Emor of the Sample Odd Ratios Standard Emor of the Sample Odd Ratios PS/C confidence Internal of the Sample Odds N-Observed, TA) (total observed no. of crashes N-Observed, TA) (total observed no. of crashes	hiltner-Chywlde Background (Ste, s-Chywle Background Crash Anelysi 201006 201006 102390 17.759 Intel (I., U.) In befroe period for treatment grou In after period for treatment grou In after period for treatment grou In after period for comperions In after period for comperions grou	a Method: Before/ 2002 39 el el upj	34.34 7.306 After with Comps Route/Road Name Nearest Cross Stre Nearest Cross Stre Neares	2000 200 rtson Group eet eet 2004 34	M-52 Main Sz. Laura La. 2006 29 Crash Pin 50 40	After Period 2007 33	33
Projected Average Cranhes per Year using Tru Percert Change for She Adjusted for Trunkin Comparison Site Location (County, City) PI/CS No. BMP EMP EMP Cash Modification (Source Consultation Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratio Station Standard Entro of the Sample Odds Ratios Standard Entro of the Sample Odds Ratios Scandard Entro of the Sample Odds Ratios N-Observed, TA (total observed no. of crashes N-Observed, TA (total observed no. of crashes	hiltner-Chywlde Background (Ste, s-Chywle Background Crash Anelysi 201006 201006 102390 17.759 Intel (I., U.) In befroe period for treatment grou In after period for treatment grou In after period for treatment grou In after period for comperions In after period for comperions grou	a Method: Before/ 2002 39 el el upj	34.24 7.10% After with Compa Route/Road Name Nearest Cross Stre Nearest Cross Stre Nearest Cross Stre Nearest Cross Stre 2003 43 0.86 1.09 0.86 0.17 0.65 0.17 0.65 145.00 113.00 95.00 118.75	2000 200 rtson Group eet eet 2004 34	M-52 Main Sz. Laura Ln. 2006 29 Crash Fin 60 50 50 60 60 60 60 60 60 60 70 60 60 70 70 70 70 70 70 70 70 70 70 70 70 70	After Period 2007 33	33
Projected Average Cranhes per Year using Tru Percert Change for She Adjusted for Trunkin Comparison Site Location (County, City) PR/CS No. BMP EMP EMP Cash Modifies Statistica Year Crash Med Statistica Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratio Standard Entro of the Sample Odd Ratios 25% Confidence Interval of the Sample Odds N-Observed, TA (total observed no. of crashes N-Observed, TA (total observed no. of crashes	hiltner-Chywlde Background (Ste, s-Chywle Background Crash Anelysi 201006 201006 102390 17.759 Intel (I., U.) In befroe period for treatment grou In after period for treatment grou In after period for treatment grou In after period for comperions In after period for comperions grou	a Method: Before/ 2002 39 el el upj	34.24 7.305 After with Comps Routy/Road Name Nearest Cross Stry Nearest Cross Stry Nearest Cross Stry Nearest Cross Stry Nearest Cross Stry 2003 43 0.86 1.09 0.86 0.95 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.4	2000 200 rtson Group eet eet 2004 34	M-52 Main Sz. Laura La. 2006 29 Crash Fin 40 40 40 40 40 40 40 40 40 40 40 40 40	After Period 2007 33 squancy by Year (Sh Comparison Sha)	
Projected Average Crahem per Year using Tro Percent Change for Sile Adjusted for Trunklin Comparison Site Location (County, City) PN/CS No. BMP DMP DMP DMP Cash Modiffer Son Exchange County, City) Part Cash Modiffer Son Factor Consultation Count Modiffer Son Factor Consultation Count Modiffer Son Factor Consultation Sample Odds Ratio (year 1-2) Sample Odds Ratio	hiltner-Chywlde Background (Ste, s-Chywle Background Crash Anelysi 201006 201006 102390 17.759 Intel (I., U.) In befroe period for treatment grou In after period for treatment grou In after period for treatment grou In after period for comperions In after period for comperions grou	a Method: Before/ 2002 39 el el upj	34.34 After with Compa Route/Road Name Nearest Cross Stre Nearest Cros	2000 200 rtson Group eet eet 2004 34	M-52 Main St. Laura La. 2006 23 Crash Fm Crash St. 2007 20 20 20 20 2001 2001	After Period 2007 23 squency by Tear (2b)	23
Projected Average Cranhes per Year using Tru Percert Change for She Adjusted for Trunkin Comparison Site Location (County, City) PR/CS No. BMP EMP EMP Cash Modifies Statistica Year Crash Med Statistica Sample Odds Ratio (year 1-2) Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratio Standard Entro of the Sample Odd Ratios 25% Confidence Interval of the Sample Odds N-Observed, TA (total observed no. of crashes N-Observed, TA (total observed no. of crashes	hiltner-Chywlde Background (Ste, s-Chywle Background Crash Anelysi 201006 201006 102390 17.759 Intel (I., U.) In befroe period for treatment grou In after period for treatment grou In after period for treatment grou In after period for comperions In after period for comperions grou	a Method: Before/ 2002 39 el el upj	34.24 7.305 After with Comps Routy/Road Name Nearest Cross Stry Nearest Cross Stry Nearest Cross Stry Nearest Cross Stry Nearest Cross Stry 2003 43 0.86 1.09 0.86 0.95 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.4	2000 200 rtson Group eet eet 2004 34	M-52 Main Sz. Laura Ln. 2006 29 Crash Fin 40 40 40 40 40 40 40 40 40 40 40 40 40	After Period 2007 23 squency by Tear (2b)	33

		Site Charac					
Site No. County	13 Genesee		Length (ml) Land Use		1.31		
Chy	Montrose		No. of Driveways/	internet lines	Mised commercial 97/11		
Route/Road Name	M-57		Treatment Type	THE PLANE		ditting curbs with ne	w markings
PR/CS No.	1494503/25101						
DMP	1313		Nearest Cross Stre	wet.	Robinhood Dr.		
DMP	2.625		Nearest Cross Stre	wt.	Seymour Rd.		
		Descriptive	Statistics				
			Before Period			After Period	
Year		2000	2001	2002	2004	2005	2006
ADT		9201	9312	8529	8306	8255	10494
Crash Frequency (Total)		25	32	36	17	24	16
Crash Rate		5.67	7.18	8.81	4.27	6.07	3.18
Crash Frequency (Recoded)			21	21	30	16	9
Crash Frequency (Intersection-related) Crash Frequency (Driveway-related)		no data prior to	6	6	2	4	4
Crash Frequency (Affected by Road Diet)		2001	19	25		14	10
Crash Frequency (Corrected by Road Diet)			13	18	1	4	2
Crash Frequency (Background, Countywide)		15053	14181	14306	13285	12842	10458
Crash Frequency (Background, Citywide)		21	34	33	38	21	17
Crash Frequency (Background, Trunklines-Co	untywide)	1919	1900	1854	1752	151.0	1400
Crash Frequency (Background, Trunklines-Ob		12	22	23	6	12	11
	Crash Analysi	a Method: Simple					
Average Crathes per Year (Before)			31.00	60 Cra	sh Frequency by Yes	ar (Site)	
Average Crashes per Year (After)			19.00	50			
Percentage Change Average Crathes per Year (Recoded, Before)			-38.71%				
Average Crathes per Year (Recoded, Serore) Average Crathes per Year (Recoded, After)			11.67				
Percentage Change			-44.44%	×			Recoded
Average Crashes per Year (Affected, Before)			22.00	C 🖌	<u></u>	*	
Average Crashes per Year (Affected, After)			11.00	20	1		-e-Corrected
Percentage Change			-50.00%	10 1	P*	\sim	
Average Crathes per Year (Corrected, Before)			15.50				
Average Crathes per Year (Corrected, After)			2.33		01 2002 2008 20	04 2005 2006 200	17
Percentage Change			-84.95%				
	Crash Analysis Meth	iod: Before/After C	omparison with B	eckground Trend	1		
Reckground Area Location (County, City)							
Average Crashes per Year (Countywide, Befor Average Crashes per Year (Countywide, After			43540		ver Year (Site, Before ver Year (Site, After)		31.00
Percentage Change Overall Countywide	,		-15.97%	Percent Change (5			-38.71%
Projected Average Crashes per Year using Cos	antywide Background (Site, After)		26.05	1 0	ash Frequency by Ye	and the descent of the	
Percent Change for Site Adjusted for Countyw			-22.74%	38000		er (sectrone)	
the second s			88	1	*****		
Average crathes per Tear (Citywide, Before)							
Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, After)			56	11000			
Average Crashes per Year (Citywide, After) Percentage Change Overall Citywide			56 -36.30%				-d-Trunklines-
Average Crashes per Year (Citywide, After) Percentage Change Overall Citywide Projected Average Crashes per Year using City			56 -36.30% 19.73	scoo			-d-Trunklines- Countywide
Average Crashes per Year (Chywide, After) Percentage Change Overall Chywide Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywide	Background		56 -36.36% 19.73 -2.35%	scoo			-d-Trunklines-
Average Crashes per Year (Chywlde, After) Percentage Change Overall Chywlde Projected Average Crashes per Year using Ch Percent Change for She Adjusted for Chywlde Average Crashes per Year (Trunkines-County	Background wide, Before)		56 -36.30% 19.73 -2.35% 5673	scoo			-d-Trunklines-
Average Crashes per Year (Chyvide, After) Percentage Change Overall Chyvide Projecied Average Crashes per Year using Ch Percent Change for Sile Adjusted for Chyvide Average Crashes per Year (Trunkline-Courty Average Crashes per Year (Trunkline-Courty	Background wide, Before) wide, After)		56 -36.36% 19.73 -2.35%	scoo		64 3005 3006 3007	-d-Trunklines-
Average Crashes per Year (Citywide, Aber) Percentage Change Owenil Citywide Projekted Average Crashes per Year using Cit Percent Change for Site Adjusted for Citywidd Average Crashes per Year (Trunkines-County Average Crashes per Year (Trunkines-County Average Crashes per Year (Trunkines-County	Background wide, Before) wide, After) wide	ita, Aftar)	56 -36.36% 19.73 -2.35% 5673 4735	4000			-d-Trunklines- Countyvide
Average Crabes per Year (Chywlde, After) Percentage Change Downil Chywlde Projectaf Average Crabes per Year using Ch Percent Change for Site Adjusted for Chywlei Average Crabes per Year (Traditions-Courty Percentage Crabes per Year (Traditions-Courty Percentage Crabes per Year using Tra Percentage Crabes per Year using Tra Percentage for Site Adjusted for Tradition	Background wide, Before) wide, After) wide nikines-Countywide Background (S e-Countywide Background	its, After)	56 -36.30% 19.73 -2.15% 5673 4735 -36.53%	6000 1000 1999 2000 1 20 60			-d-Trunklines-
Average Crashes per Year (Chywlde, After) Percentage Change Overall Chywlde Projected Average Crashes per Year using Ch Parceet Change for She Adjusted for Chywldd Average Crashes per Year (Trashlow-Courty Percentage Crashes per Year (Trashlow-Courty Projected Average Crashes per Year using Tru Percent Change for She Adjusted for Trushlow Average Crashes per Year (Trushlow-Courty Percent Change for She Adjusted for Trushlow	Background wide, Before) wide, After) alde nklinee-Countywide Background (S ee-Countywide Background e, Betore)	ita, After)	56 -36.30% 19.73 -2.15% 5673 4735 -36.53% 25.87 -22.18% 57	4000			-d-Trunklines- Countywide
Average Crashes per Year (Chywlde, After) Percentage Change Overall Chywlde Projected Average Crashes per Year using Ch Percent Change for She Adjusted for Chywlde Average Crashes per Year (Truskines-County Percentage Crashes per Year (Truskines-County Percentage Crashes per Year (Truskines-County Percent Change for She Adjusted for Truskin Average Crashes per Year (Truskines-Chywld Average Crashes per Year (Truskines-Chywld	• Background wide, Betore) wide, After) wide nkilnee-Countywide Background (5 es-Countywide Background is, Getore) is, After)	its, After)	56 -36.36% 19.73 -2.15% 5673 4735 -36.53% 25.87 -22.18% 57 29	6000 1000 1999 2000 1 20 60			-d-Trunklines- Countyvide
Average Crabes per Year (Chyvide, After) Percentage Change Overall Chyvide Projected Average Crabes per Year using Ch Parcert Change for She Adjusted for Chyvide Average Crabes per Year (Tranklow-Courty Percentage Crabes per Year (Tranklow-Courty Projected Average Crabes per Year using Tra Percent of Change Overall Trunklow-Chyvid Average Crabes per Year (Tranklow-Chyvid Average Crabes per Year (Tranklow-Chyvid Average Crabes per Year (Tranklow-Chyvid Average Crabes per Year (Tranklow-Chyvid Average Crabes per Year (Tranklow-Chyvid	• Background wide, Before wide nkilner-Countywide Background (5 e-Countywide Background is, Before) e. After) e		56 -36.30% 19.73 -2.25% 5673 4725 -36.53% 25.87 -22.18% 57 29 -49.12%	6000 1000 1999 2000 1 20 60			-d-Trunklines- Countywide
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Average Crashes per Year (Chywlde, After) Percentage Change Dowall Chywlde Projected Average Crashes per Year using Ch Percent of Change for Site Adjusted for Chywlde Average Crashes per Year (Trashilone-Courty Percentage Change Overall Trushilone-Courty Projected Average Crashes per Year using Tru Percentage Change Overall Trushilone-Chywld Average Crashes per Year (Trushilone-Chywld Percentage Change Overall Trushilone-Chywld Percentage Change Overall Trushilone-Chywld Percent Change for Site Adjusted for Trushilon Chym Percent Change for Site Adjusted for Trushilon Chym Dataria Site Location (Courty, Chy) PH/C3 No. DMP Dataria Site Location (Courty, Chy) PH/C3 No. Sample Odds Tatio (year 1-2) Sample Odds Tatio (year 1-2) Sample Odds Tatio (year 1-3) Mean of Sample Odds Tatios S7% Contience Internal of the Sample Odds N-Obarred, CJ (total Obarved no. of crashe N-Obarred, CJ (total Obarved no. of crashe N-Obarred, CJ (total Obarved no. of crashe N-Obarred, CJ, (total Obarved no. of crashe	Background wide, Defrei) wide, Rhere) wide, Rhere) wide, After) wide inter-Countywide Background (S e-Countywide Background (Ste, s, After) e hilter-Chywide Background (Ste, s-Chywide Background (Ste, s-Chywide Background Crash Anelysi Ingham, Lansing 333005(3308) 0.597 2.057 Ratio (LL, UL) in before period for treatment grou in after period for treatment grou in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2000 25 xspj ei rotpj xspj	36 -36.30% 39.73 -3.35% 4735 -36.55% 25.87 -21.35% 37 -22.37% -23.28% -49.12% 35.77 30.41% After with Comparation Route/Food Name Nearest Cross Stre Nearest Cross Stre Status 1.14 0.87 1.00 0.19 0.62 51,00 57,00 108.000 69.75	6000	001 2002 2008 20 2002 2008 2002 2005 Crand River Ave. Andrea Dr. Coolings St. 2004 40 50 50 40 50	After Period 2005 2005 2006 2008	-d-Trunkline- Countrelde -e-Chyelde -e-Trunkline- Chyelde 2006 30
Average Crashes per Year (Chyvide, After) Percentage Change Deveal (Chyvide Projected Average Crashes per Year using Ch Parcent Change for Site Adjusted for Chyvide Average Crashes per Year (Trunklow-Courty Percentage Crashes per Year (Trunklow-Courty Projected Average Crashes per Year using Tru Percent Change for Site Adjusted for Trunklow Percent Change for Site Adjusted for Trunklow Projected Average Crashes per Year using Tru Percent Change for Site Adjusted for Trunklow Projected Average Crashes per Year using Tru Percent Change for Site Adjusted for Trunklow Phylics No. Dampie Odds Ratio (year 2-3) Mean of Sample Odds Ratios Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratios Sample Odds Ratio (year 2-3) Mean of Sample Odds Ratios Son Conference Linespice Odds Ratios No-Oberred CJ, a Intal observed no. of crashes No-Oberred CJ, a Intal observed no. of crashes	Background wide, Defrei) wide, Rhere) wide, Rhere) wide, After) wide inter-Countywide Background (S e-Countywide Background (Ste, s, After) e hilter-Chywide Background (Ste, s-Chywide Background (Ste, s-Chywide Background Crash Anelysi Ingham, Lansing 333005(3308) 0.597 2.057 Ratio (LL, UL) in before period for treatment grou in after period for treatment grou in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2000 25 xspj ei rotpj xspj	56 -36.30% 18.73 -3.35% 4735 -45.53% 25.87 -22.18% 57 29 -49.12% 13.77 10.41% After with Compe Route/Road Name Nearest Cross Stry Nearest Cross Stry Nearest Cross Stry Defroe Period 2001 54 1.14 0.19 0.62 93.00 1.14.00 0.57 13.14	6000	001 2002 2003 20 2002 2004 2002 2004 Crand River Ave. Andres Dr. Coolidge St. 2004 40 40 40 40 40 40 40 40 40 40 40 40	After Period 2005 2005 2006 2008	-d-Trunkline- Countrelde -e-Chyelde -e-Trunkline- Chyelde 2006 30
Average Crashes per Year (Chywlde, After) Percentage Crashes per Year (Chywlde Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywlde Average Crashes per Year (Truskines-Courty Percentage Crashes per Year (Truskines-Courty Percent Change for Site Adjusted for Truskine Average Crashes per Year (Truskines-Chywld Average Crashes per Year (Truskines-Chywld Percent Change for Site Adjusted for Truskine Average Crashes per Year (Truskines-Chywld Percent Change for Site Adjusted for Truskine Percent Change for Site Adjusted for Truskine Percent Change for Site Adjusted for Truskine Percent Change for Site Adjusted for Truskine Comparison Site Location (Courty, Chy) PR/CS No. DMP Description Site Location (Courty, Chy) PR/CS No. Cash Frequency (Total) Crash Modification Factor Consultation Sondord Torro of the Sample Odds N-observed, TJ, Iotal observed no. of crashes N-observed, TJ, Iotal observed no. of crashes	Background wide, Defrei) wide, Rhere) wide, Rhere) wide, After) wide inter-Countywide Background (S e-Countywide Background (Ste, s, After) e hilter-Chywide Background (Ste, s-Chywide Background (Ste, s-Chywide Background Crash Anelysi Ingham, Lansing 333005(3308) 0.597 2.057 Ratio (LL, UL) in before period for treatment grou in after period for treatment grou in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2000 25 xspj ei rotpj xspj	36 -36.30% 39.73 -3.35% -36.55% 35.87 -32.13% -35.87 -32.13% -33.28 -49.12% 35.77 20.41% After with Compa Route/Road Name Nearest Cross Stri Before Period 2001 54 1.14 0.87 1.00 0.19 0.62 93.00 54.00 108.00 68.75 131.14 0.80	6000	001 2002 2008 20 2002 2008 2002 2005 Crand River Ave. Andrea Dr. Coolings St. 2004 40 50 50 40 50	After Period 2005 2008 2005 2008 2005 2008 2005 2008 34 comparison State	-d-Trankline- Countyelds -e-Chywla -Trankline- Chywla 2006 30
Average Crabes per Year (Chyvide, After) Percentage Change Densil Chyvide Projected Average Crabes per Year using Ch Parcent Change for Site Adjusted for Chyvide Average Crabes per Year (Truskine-County Percentage Change Oversil Truskine) Projected Average Crabes per Year using Tru Percent Change for Site Adjusted for Truskin Average Crabes per Year (Truskine-Chyvid Percent Change Oversil Truskine-Chyvid Projected Average Crabes per Year using Tru Percent Change for Site Adjusted for Truskin Average Crabes per Year (Truskine-Chyvid Projected Average Crabes per Year using Tru Percent Change for Site Adjusted for Truskin Percent Change for Site Adjusted for Truskin Comparison Site Location (County, Chy) PMP Description (Chy) PMP Description (Chy) PMP	Background wide, Defrei) wide, Rhere) wide, Rhere) wide, After) wide inter-Countywide Background (S e-Countywide Background (Ste, s, After) e hilter-Chywide Background (Ste, s-Chywide Background (Ste, s-Chywide Background Crash Anelysi Ingham, Lansing 333005(3308) 0.597 2.057 Ratio (LL, UL) in before period for treatment grou in after period for treatment grou in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2000 25 xspj ei rotpj xspj	36 -36.30% 18.77 -3.25% 4735 -36.55% 25.87 -22.18% 57 29 -49.12% 15.77 10.41% After with Compar Route/Food Ham Nearest Cross Stru Nearest Cross St	6000	001 2002 2008 20 2002 2008 Crand River Ave. Andrea Dr. Coolinge St. 2004 40 50 50 50 50 50 50 50 50 50 50 50 50 50	After Period 2005 2008 2000 2006 2008 2005 2008 2005 2008 2005 2008 2005 2008 2005 2008 2005 2008	-d-Truckline- Countrelds
Average Crashes per Year (Chywlde, After) Percentage Change Dowall Chywlde Projected Average Crashes per Year using Ch Percent Change for Site Adjusted for Chywlde Average Crashes per Year (Truskines-Courty Percentage Crashes per Year (Truskines-Courty Percent Change for Site Adjusted for Truskine Average Crashes per Year (Truskines-Chywld Average Crashes per Year (Truskines-Chywld Percent Change for Site Adjusted for Truskine Average Crashes per Year (Truskines-Chywld Percent Change for Site Adjusted for Truskine Average Crashes per Year (Truskines-Chywld Percent Change for Site Adjusted for Truskine Percent Change for Site Adjusted for Truskine Comparison Site Location (Courty, Chy) PR/CS No. DMP Dearches Siteliatios Year Crash Frequency (Total) Crash Modification Factor Consultation Social Confidence Interval of the Sample Odds N-observed, TJ, Iotal Observad no. of crashes N-observed, TJ, Iotal Observad no. of crashes	Background wide, Defrei) wide, Rhere) wide, Rhere) wide, After) wide inter-Countywide Background (S e-Countywide Background (Ste, s, After) e hilter-Chywide Background (Ste, s-Chywide Background (Ste, s-Chywide Background Crash Anelysi Ingham, Lansing 333005(3308) 0.597 2.057 Ratio (LL, UL) in before period for treatment grou in after period for treatment grou in before period for treatment grou in after period for comparison gro	After) is Method: Before/ 2000 25 xspj ei rotpj xspj	36 -36.30% 39.73 -3.35% -36.55% 35.87 -32.13% -35.87 -32.13% -33.28 -49.12% 35.77 20.41% After with Compa Route/Road Name Nearest Cross Stri Before Period 2001 54 1.14 0.87 1.00 0.19 0.62 93.00 54.00 108.00 68.75 131.14 0.80	6000	2001 2002 2003 20 2002 2004 2002 2004 Crand River Ares. Andrea Dr. Coolidge St. 2004 40 50 50 50 50 50 50 50 50 50 50 50 50 50	After Period 2005 2008 2000 2006 2008 2005 2008 2005 2008 2005 2008 2005 2008 2005 2008 2005 2008	-d-Truckline- Countrelds

		Site Chare	cteristics				
Site No.	16		Length (mi)		0.87		
County	Kent		Land Use		Residential		
Oby	Grand Rapids		No. of Driveways/	Intersections	58/8		
Route/Road Name	soch se.		Treatment Type		Receiving within ex	dating curbs with ne	w markings
PR/CS No.	409510						
IMP	0.307		Nearest Cross Stre	-	Ovision St.		
EMP	1,100		Nearest Cross Stre		Leisure Dr.		
		Descriptive					
		Descriptive	Before Period			After Period	
Year		2004	2005	2006	2008	2009	2010
ADT		17115	*/*	10683	n/a	11291	10077
Crash Frequency (Total)			30		15	21	11
Crash Rate		6.05	n/=	9.52	n/a	5.04	3.43
Crash Frequency (Recoded)		21	15	15	6	6	4
Crash Frequency (Intersection-related)		10		6	5	3	1
Crash Frequency (Driveway-related)		5	2	2	1	0	0
Crash Frequency (Affected by Road Diet)		15	11	34	6	4	2
Crash Frequency (Corrected by Road Diet)			9	9	2	4	1
Crash Frequency (Background, Countywide)		21991	19311	16437	17718	15651	15265
Crash Frequency (Background, Citywide)		9023	7359	6418	6731	6161	6257
Crash Frequency (Background, Trunklines-Cou		4597	3816	3419	3285	3190	3346
Grash Frequency (Background, Trunklines-City)		1406	1045	290	933	1000	1179
	Crash Analysi	s Method: Simple	(Naive) Before/Af	ter Anelysis			
Average Crashes per Year (Before)			32.00	60 Cra	ch Frequency by Yes	ar (Site)	
Average Crashes per Year (After)			15.67				
Percentage Change			-51.04%	50			
Average Crashes per Year (Recoded, Before)			17.00				Total
Average Crashes per Year (Recoded, After)			5.33	-			Recoded
Percentage Change			-68.63%	30			
Average Crashes per Year (Affected, Before)			13.33	20			-I-Affected
Average Crashes per Year (Affected, After)			4.00	~		\sim	Corrected
Percentage Change			-70.00%	30		· · · · ·	
Average Crashes per Year (Corrected, Before)			0.67				
Average Crashes per Year (Corrected, After)			2.33	0	05 2006 2007 20		
Percentage Change			-73.00%			01 209 200 20	11
	Crash Analysis Meth	od: Before/After	Comparison with I	leckground Trends	1		
Background Area Location (County, City) Average Crashes per Year (Countywide, Before			57739		er Year (Site, Before		32.00
Average Crashes per Year (Countywide, Serore Average Crashes per Year (Countywide, After)	0		40634		er Year (Site, Defore er Year (Site, After)		15.67
Percentage Change Overall Countywide, Arter)			-15.77%	Percent Change (5			-51.04%
Projected Average Crather per Year using Court	the state in the state of the state of		-15.77%	25000			
Percent Change for Site Adjusted for Countywi			-35.27%		Crash Frequency by	y Tear (Background	
Percent Unange for Site Adjusted for Countywi	oe sacaround		-35-27%	20000			
			19149	20000	×		
Average Grashes per Year (Citywide, Before)						·	- Countywide
Average Crashes per Year (Citywide, Before) Average Crashes per Year (Citywide, After)							
Average Crashes per Year (Citywide, Before) Average Crashes per Year (Citywide, After) Percentage Change Overall Citywide	the Bachemund (Cha All-1)		-16.01%	15000 -			
Average Crashes per Year (Otywide, Before) Average Crashes per Year (Otywide, After) Percentage Change Overall Otywide Projected Average Crashes per Year using Oty			-16.01% 26.88				
Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywide Projected Average Crashes per Year using Chy Percent Change for Site Adjusted for Chywide	Background		-16.01% 26.88 -35.03%	30000		· · · · · · · · · · · · · · · · · · ·	
Average Crashes per Year (Drywide, Before) Average Crashes per Year (Drywide, After) Percentage Change Owenil Chywide Projected Average Crashes per Year using Chy Percent Change for Site Adjusted for Chywide Average Crashes per Year (Trunkiner-Country	Background ride, Before)		-16.01% 26.88 -35.03% 11832	10000	м 2006 200	e 2010 2011	1
Average Crathes perYear (Dtywide, Sefbre) Average Crathes perYear (Dtywide, After) Percentage Compa Overall Orywide Projected Average Crathes perYear using Oty Percent Change for Site Adjusted for Chywide Average Crathes perYear (Trunkines-Courtye Average Crathes perYear (Trunkines-Courtye	Background Ade, Before) Ade, After)		-16.01% 26.08 -35.03% 11032 9821	10000 2002 200 10000	н 2006 200	e 2010 2011	-a- Otyaida
Average Crathes per Year (Chywlos, Before) Average Crathes per Year (Chywlos, After) Percentage Change Overall Chywlos Percent Change for Site Adjusted for Chywlos Percent Change for Site Adjusted for Chywlos Average Crathes per Year (Trutkine-Countys Average Crathes per Year (Trutkine-Countys Percentage Crathes per Year (Trutkine-Countys	Background ride, Bafore) ride, After) fide		-16.01% 26.88 -35.03% 11832 9821 -17.00%	10000	H 2006 200	e 2010 2011	
Average Crathes per Year (Dhywlde, Before) Average Crathes per Year (Dhywlde, After) Percentage Oxampe Ovenil Orpolde Projected Average Crathes per Year uting Ohy Percent Change for She Adjusted for Chywlde Average Crathes per Year (Trunkline-Courtyw Percentage Change Ovenil Trunkline-Courtyw Percentage Change Ovenil Trunkline-Courtyw	Background Ade, Before) Ade, After) Ade kilnes-Countywide Background (Sh	te, After)	-16.01% 26.88 -35.03% 11832 9821 -17.00% 26.56	10000 2002 200 10000	H 2006 200	e 2010 2011	-e- Otyaide
Average Crathes per Year (Chywlos, Before) Average Crathes per Year (Chywlos, After) Percentage Change Ovenall Chywlos Percent Change for Sta Adjunct for Chywlos Percent Change for Sta Adjunct for Chywlos Average Crathes per Year (Trunkline-Countys Average Crathes per Year (Trunkline-Countys Percentage Change Ovenall Trunkline- Percentage Change Ovenall Trunkline- Percent Change for Sta Adjunct for Trunkline	Background vide, Before) (de, After) (de kilnee-Countywide Background (St e-Countywide Background	ta, Aftar)	-16.01% 26.08 -35.03% 11052 9021 -17.00% 26.56 -34.05%	2000 - 2002 200 2002 200 2000	н 2006 200	e 2010 2011	
Average Crathes per Year (Chyvids, Breire) Average Crathes per Year (Chyvids, After) Fercentage Crathes per Year (Chyvids Projected Average Crathes per Year utiling Chy Persent Change for Site Adjusted for Chyvids Average Crathes per Year (Trusitione-Country Persentage Crathes per Year (Trusitione-Country Persentage Crathes per Year (Trusitione-Country Persentage Change Oversiti Trusitione-Country Persentage Change Oversiti Trusitione-Country Persentage Change Oversiti Trusitione-Country Persentage Change for Site Adjusted for Trunkline- Average Crathes per Year (Trusitione-Contry)	Background Kds, Before) Kds, After) (ds -Countywide Background (St a-Countywide Background (St Sefore)	ta, Aftar)	-16.01% 26.88 -35.03% 11832 9821 -17.00% 26.56 -34.05% 3439	10000	н 2006 200	6 2010 2011	-s- Otywide -s- Trunklines- Countywide
Average Crathes perYear (Dhywide, Before) Average Crathes perYear (Dhywide, After) Percentage Oxampe Overall Orpolde Projected Average Crathes perYear uting Oth Parcent Change for Site Adjusted for Chywide Average Crathes perYear (Trunkline-Courtyw Percentage Change perYear (Trunkline-Courtyw Projected Average Crathes perYear sting Trunk Percent Change for Site Adjusted for Trunkline Average Crathes perYear (Trunkline-Ophylic Average Crathes perYear (Trunkline-Ophylic Average Crathes perYear (Trunkline-Ophylic	Background Kda, Sefora) Kda, Aftar) Kda Kilnes-Countywide Background (St e-Countywide Background (Stefora) Sefora) Sefora)	te, After)	-36.01% 26.38 -35.03% 11832 9021 -17.00% 26.56 -34.05% 3459 3112	2000 - 2002 200 2002 200 2000		e 2010 2011	-e- Otyvide -e- Trunklines- Countyvide -e- Trunklines-
Average Crathes per Year (Chywlob, Before) Average Crathes per Year (Chywlob, After) Percentage Cranhes per Year utility (Chywlob Penjediad Average Crathes per Year utility (Chywlob Average Crathes per Year (Trunkline-Countys Average Crathes per Year (Trunkline-Countys Percentage Crathes per Year and for Chywlob Percentage Crathes per Year and Tor Trunkline Average Crathes per Year and for Trunkline Average Crathes per Year (Trunkline-Chywlob Average Crathes per Year (Trunkline-Chywlob	Background (ide, Before) (ide, Aftar) (ide kilmes-Countywide Background (SB - Countywide Background , Before) , Aftar)		-16.01% 26.88 -35.03% 11832 9821 -17.00% 26.56 -34.05% 3439 3112 -0.51%	10000 2002 200 10000 6000 4000		e 2010 2012	-s- Otywide -s- Trunklines- Countywide
Average Crashes per Year (Dhywlde, Belbre) Average Crashes per Year (Dhywlde, After) Percentage Dunge Ovenil Orywlde Projekid Average Crashes per Year uting Ohy Percent Change for She Adjusted for Chywlde Average Crashes per Year (Turkline-Courtyw Percentage Crashes per Year (Turkline-Courtyw Projekid Average Crashes per Year uting Tru- Percent Change for She Adjusted for Trunkline Average Crashes per Year (Turkline-Courtyw Percentage Crashes per Year (Turkline-Opywide Average Crashes per Year (Turkline-Opywide Average Crashes per Year (Turkline-Opywide	Background kids, Store) (de Countywide Background (St countywide Background (Star) (After) killnes-Citywide Background (Ste,)		-36.01% 26.38 -35.03% 11832 9021 -17.00% 26.56 -34.05% 3459 3112	10000			-B- Otywide -B- Trunklines- Countywide -B- Trunklines- Otywide

		Site Charac	cteristics				
Site No.	18		Longth (mi)		0.96		
County	Kent		Land Use		Residential		
City	Byron Center		No. of Driveways	Intersections	55/6		
Route/Road Name	Byron Center Ave.		Treatment Type		Receiving within e	sisting curbs with re	w markings
PR/CS No.	434808						
EMP	2.010		Nearest Cross Stre	wet.	92nd St.		
EMP	2.965		Nearest Cross Stre	ant .	Prescott St.		
		Descriptive	Statistics				
			Before Period			After Period	
Year		2002	2005	2004	2006	2007	2008
ADT		8812	6846	n/a	4929	558.3	9515
Crash Frequency (Total)		6	2	7	3	7	2
Crash Rate		1.95	0.84	n/a	1.75	3.60	0.60
Crash Frequency (Recoded)		5	2	6	2	6	2
Crash Frequency (Intersection-related)		i	0	2	2	4	2
Crash Frequency (Driveway-related)			ő				
Crash Frequency (Affected by Road Diet)		;	2	5	2	ě	2
Crash Prequency (Arrected by Road Diet) Crash Prequency (Corrected by Road Diet)		3	6		6		ó
Crash Frequency (Corrected by Road Diet) Crash Frequency (Background, Countywide)		23440	22950	21991	16437	10066	17718
Crash Frequency (Background, Countywide) Crash Frequency (Background, Citywide)		23440	22950	21991	414	10066	17718
		4632	4868	4597	3419	3514	3285
Crash Frequency (Background, Trunklines-Cour		460.2	4000	4397		3014	
Crash Frequency (Background, Trunklinge-City)		o Method: Simple	(Maine) Balana (M	4	16	28	22
Average Crashes per Year (Before)	Crean America	a method: ampre	5.00	-		in the second se	
Average Crashes per Year (After)			4.00	20 Cra	sh Frequency by Ye	en (see)	
Percentage Change			-20.00%				
			4.33	15			
Average Crashes per Year (Recoded, Before)							Total
Average Crashes per Year (Recoded, After)			3.33				Recoded
Percentage Change			-23.08%	30			Affected
Average Crashes per Year (Affected, Before)							
Average Crashes per Year (Affected, After)			3.33 -16.67%	5			-O-Corrected
Percentage Change						4 N	
Average Crashes per Year (Corrected, Before)			2.00				
Average Crashes per Year (Corrected, After)			0.33	• 1 1		006 2007 2008 20	1
Percentage Change			-43.33%			an an an a	
	Crash Analysis Meth	od: Setors/After C	Comparison with I	Sectground Trend	3		
Background Area Location (County, City)							
Juarana Crashas par Year (Countradda, Bafora	1		68381	Average Crathes r	ar Yaar İSha Bahar	-	5.00
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After))		68381 52221		er Year (Site, Befor er Year (Site, After)		5.00
Average Crashes per Year (Countywide, After))		68381 52221 -23.63%	Average Crashes p	er Year (Site, After)		5.00 4.00 -20.00%
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide	-		52221	Average Crashes p Percent Change (5	er Year (Site, After) ite, Defore/After)	Ĩ	4.00 -20.00%
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cour	tywide Background (Site, After)		52221 -25.63% 3.82	Average Crashes p Percent Change (5	er Year (Site, After) ite, Defore/After)		4.00 -20.00%
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cour Percent Change for Site Adjusted for Countywi	tywide Background (Site, After)		52221 -23.63% 3.82 3.63%	Average Crashes p Percent Change (5 32500	er Year (Site, After) ite, Defore/After)	Ĩ	4.00 -20.00%
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Coun Percent Change for Site Adjusted for Countywi Average Crashes per Year (Citywide, Before)	tywide Background (Site, After)		52221 -23.63% 3.82 3.63% 1919	Average Crashes p Percent Change (5	er Year (Site, After) ite, Defore/After)	Ĩ	4.00 -20.00%
Average Crashes per Year (Countywide, After) Percentage Change Owenil Countywide Projected Average Crashes per Year using Countywid Percent Change for Site Adjusted for Countywid Average Crashes per Year (Chywide, Refore) Average Crashes per Year (Chywide, Refore)	tywide Background (Site, After)		52221 -23.63% 3.82 3.63% 1919 1530	Average Crashes ; Percent Change (5 32500 22500	er Year (Site, After) ite, Defore/After)	Ĩ	4.00 -20.00%
Average Crashes per Year (Countyvide, After) Percentage Change Overell Countyvide Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, After) Percentage Change Overell Chyvide	rtywide Background (She, After) de Background		52221 -23.63% 3.82 3.63% 1939 1530 -20.27%	Average Crashes p Percent Change (5 32500	er Year (Site, After) ite, Defore/After)	Ĩ	4.00 -20.00%
Average Crathes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crathes per Year saing Coun- Persent Change for <u>Site Adjusted for Countyvid</u> Average Crathes per Year (Cityvide, Stefor) Average Crathes per Year (Cityvide, After) Percentage Change Overall Cityvide Projected Average Crathes per Year uting Cityv	, tywide Background (Ste, After) de Background vide Background (Ste, After)		52221 -23.63% 3.82 3.63% 1939 1530 -20.27% 3.99	Average Crashes ; Percent Change (5 32500 22500	er Year (Site, After) ite, Defore/After)	Ĩ	4.00 -20.00%
Average Crashes per Year (Countyvide, After) Percentage Change Ovenil Countyvide Projectid Average Crashes per Year safing Coun- Percent: Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, After) Average Crashes per Year (Chyvide, After) Percentage Change Ovenil Chyvide Projected Average Crashes per Year using Chyv Percent Change for Site Adjusted for Chyvide	- rtywide Background (Ste, After) de Background vide Background (Ste, After) Background		52221 -23.63% 3.62 3.63% 1939 1530 -20.27% 3.99 0.27%	Average Crashes ; Percent Change (5 32500 22500	er Year (Site, After) ite, Defore/After)	Ĩ	4.00 -20.00%
Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year uting Countyvid Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywide Projected Average Crashes per Year uting Chy Percent Change for Site Adjusted for Chywidei Average Crashes per Year (Turukither-Courtyvide)	rtywide Background (Ste, After) de Background wide Background (Ste, After) Background Ide, Sefore)		52221 -23.63% 3.62 1939 1530 -20.27% 3.99 0.22% 14297	Average Crather ; Percent Change (5 32500	er Year (Sta, After) ita, Befora/After) Crash Frequency by	r Tear (Background)	4.00 -20.00%
Average Crashes per Year (Countyvide, After) Procentage Change Overall Countyvide Projectad Average Crashes per Year Lang Coun Process Change for Site Adjusted for Countyvid Average Crashes per Year (Dzyvide, Before) Average Crashes per Year (Dzyvide, After) Projectad Average Crashes per Year Lang Chy- Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Trunkine-Countyv Average Crashes per Year (Trunkine-Countyv	rtywide Background (Ste, After) de Background vide Background (Ste, After) Background dide, Before) ide, Before)		52221 -23.63% 3.82 3.63% 1939 1530 -20.27% 3.99 0.27% 3.4297 10218	Average Crasher p Percent Change (5 12500 22500 12500 2500	er Year (Sta, After) ita, Befora/After) Crash Frequency by	r Tear (Background)	4.00 -20.00%
Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year Laing Countyvid Percent: Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, After) Average Crashes per Year (Chyvide, After) Percentage Change Overall Chyvide Average Crashes per Year (Studied for Chyvide) Average Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Countyv	rtywide Background (Ste, After) de Background wide Background (Ste, After) Background dde, Sefore) ide, After) ide		52221 -23.63% 3.82 3.62% 1939 1530 -20.27% 3.99 0.27% 14297 14297 14297 14297	Average Crather p Percent Change (5 32500 12500 12500 2500 2500 2000 20 800	er Year (Sta, After) ita, Befora/After) Crash Frequency by	r Tear (Background)	4.00 -20.00%
Average Crashes per Year (Countyvide, Atter) Percentage Change Overall Countyvide Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Peters) Average Crashes per Year (Chyvide, Atter) Percentage Change Overall Chyvide Percentage Change or Year Lang Chyvide Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Countyv Percentage Change Overall Trunkline-Countyv Percentage Change Overall Trunkline-Countyv Percentage Change Overall Trunkline-Countyv Percentage Change Overall Trunkline-Countyv Percentage Change Overall Trunkline-Fountyv	rtywide Background (Ste, After) de Background Stekground Sackground de, Before) ide, After) ide After)	za, After)	52221 -23.63% 3.82 3.63% 1939 -20.27% 3.99 0.27% 3.027 10218 -28.53% 3.57	Average Crather p Percent Change 5 32500 12500 12500 2500 2500 2000 20	er Year (Sta, After) ita, Befora/After) Crash Frequency by	r Tear (Background)	4.00 -20.00%
Average Crashes per Year (Countyvide, After) Percentage Change Ovenil Countyvide Percent Change for Site Adjusted for Countyvide Average Crashes per Year (Dhyvide, Before) Average Crashes per Year (Dhyvide, Before) Average Crashes per Year (Dhyvide, After) Percentage Change Ovenil Chyvide Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Truikine-Countyv Average Crashes per Year (Truikine-Countyv Average Crashes per Year (Truikine-Countyv Percentage Orange Ovenil Truikine-Countyv Percentage Crashes per Year rung Trui Percent Change for Site Adjusted for Truikine Percent Change for Site Adjusted for Truikine	rtywide Background (Ste, After) de Background Background Background Ide, Background Ide, Store) Ide, After Ide, After Ide Countywide Background (Ste	ia, Aftar)	52221 -23.63% 3.82 3.62% 1939 1530 -20.27% 3.99 0.27% 14297 14297 14297 14297	Average Crather p Percent Change (5 32500 12500 12500 2500 2500 2000 20 800	er Year (Sta, After) ita, Befora/After) Crash Frequency by	r Tear (Background)	4.00 -20.00% Countywide Trunklines- Countywide
Average Crashes per Year (Country vide, Arter) Projected Average Crashes per Year raining Coun- Process Change for Site Adjusted for Country of Average Crashes per Year (Chyvide, Beford) Average Crashes per Year (Chyvide, Arter) Projected Average Crashes per Year raining Chy- Projected Average Crashes per Year raining Chy- Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Trunkline-Country Projected Average Crashes per Year raining Trunkline- Provide Average Crashes per Year raining Trunkline- Average Crashes per Year raining Trunkline- Average Crashes per Year raining Trunkline- Average Crashes per Year raining Trunkline-	ritywide Background (Site, After) de Background Site Sackground Site, Sefore) ida, Star) ida, After) ida kilnes-Countywide Background (Sit Pattora) Jestora)	ia, Aftar)	52221 -23.63% 3.63% 3.1530 -20.27% 3.39 0.27% 14297 10218 -23.53% 3.57 8.53% 7	Average Crather Percent Change 5 12500 1250 12500	er Year (Sta, After) ita, Befora/After) Crash Frequency by	r Tear (Background)	4.00 -20.00% Countywide Trunklines- Countywide Chywide Trunklines-
Average Crashes per Year (Countyvide, After) Proceedings Change Overall Countyvide Projectid Average Crashes per Year Lang Countyvid Average Crashes per Year (Dryvide, Inform) Average Crashes per Year (Dryvide, Inform) Projectid Average Crashes per Year Lang Chy- Projectid Average Crashes per Year Lang Chy- Projectid Average Crashes per Year Lang Chy- Recents Change for Site Adjusted for Chywlide Average Crashes per Year (Trunkline-Countyv Projectid Average Crashes per Year Lang Chy- Recents Change for Site Adjusted for Chywlide Projectid Average Crashes per Year Lang Chy- Recents Change for Site Adjusted for Trunkline- Average Crashes per Year (Trunkline-Countyv Projectid Average Crashes per Year (Trunkline-Countyv Projectid Average Crashes per Year (Trunkline-Chyvlide Average Crashes per Year (Trunkline-Chyvlide	- ttywide Background (Ste, After) de Background Background de, Background de, Before) ide kines-Countywide Background (St e-Countywide Background , Before) , After)	za, Athar)	52221 -23.63% 3.63% 933 1530 -20.27% 3.99 0.27% 14297 10218 -38.53% 8.55% 7 7 73	Average Crather ; Persent Change [5 12500	er Year (Sta, After) ita, Befora/After) Crash Frequency by	r Tear (Background)	4.00 -20.005 Countywide Trunklines- Countywide
Average Crashes per Year (Countyvide, Atter) Percentage Change Overall Countyvide Projectid Average Crashes per Year uting Coun- Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Atter) Percentage Change Overall Chyvide Projected Average Crashes per Year uting Chy Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Turkline-Countyv Average Crashes per Year (Turkline-Countyv Percentage Change Overall Trukline-Countyv Percentage Crashes per Year (Turkline-Countyv Percentage Crashes per Year (Turkline-Countyv Percentage Crashes per Year (Turkline-Countyv Percentage Crashes per Year (Turkline-Countyv Percentage Crashes per Year (Turkline-Chyvide Average Crashes per Year (Turkline-Chyvide Average Crashes per Year (Turkline-Chyvide Average Crashes per Year (Turkline-Chyvide	rtywide Background (Ste, After) de Background Background Background Ide, Store) Ide, After) Ide Kilme-Countywide Background (Ste -Countywide Background , Before) , After)		52221 -23.63% 2915 1530 -20.27% 14297 10218 -28.53% 1.57 8.53% 7 7 942.86%	Average Crather Percent Change 5 22500 12500 2500 2500 4 2000 200 200 200 200 200 20	er Year (Sta, After) ita, Befora/After) Crash Frequency by	r Tear (Background)	4.00 -20.00% Countywide Trunklines- Countywide Chywide Trunklines-
Average Crashes per Year (Countyvide, Atter) Percentage Change Overall Countyvide Protect Average Crashes per Year uting Cou Percent Change for Sta Adjusted for Countyvi Average Crashes per Year (Chyvide, Defore) Average Crashes per Year (Chyvide, Defore) Percentage Change Overall Chyvide Percentage Change Overall Chyvide Average Crashes per Year uting Chy Percent Change for Sta Adjusted for Chyvide Average Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Countyv Percentage Change Overall Trunkline-Countyv Percentage Crashes per Year (Trunkline-Countyv Percentage Crashes per Year (Trunkline-Countyv Percentage Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Chyvide Average Crashes per Year (Trunkline-Chyvide	- tsywide Background (Ste, After) de Background Sackground dis, Before) ide, After) ide Kines-Countywide Background (Ste, J After) , After) kines-Citywide Background (Ste, J		52221 -23.63% 3.63% 933 1530 -20.27% 3.99 0.27% 14297 10218 -38.53% 8.55% 8.55% 7 7 73	Average Crather ; Percent Change [5 12500 1250 12500	er Yees (Ste, Ahar) Is, Befory/Ahar) Orach Frequency by 02 2004 200	Tear (Background)	4.00 -20.00%

		Site Charac	teristics				
Site No.	20		Length (ml)		0.68		
County	Kent		Land Use		Residential		
City	Lowell		No. of Driveways	Intersections	34/9		
Route/Road Name	Hudson St.		Treatment Type		Receiving within e	stitting curbs with new	v markings
	3416247					•	
SMP	4.550		Nearest Cross Str	met .	Chatham St.		
EMP	5.228		Nearest Cross Str	met .	Hunt St.		
		Descriptive					
			Sefore Period		I	After Period	
Year		2003	2004	2005	2007	2008	2009
ADT		n/a	1/2	13799	n/a	12908	11209
Crash Frequency (Total)			10	6	6	2	
Crash Rate		n/a		1.76	n/a	2.82	0.00
Crash Frequency (Recoded)		5		4		5	0
Grash Frequency (Intersection-related)		2	2	2		ŝ	ő
							ő
Crash Frequency (Driveway-related) Crash Frequency (Affected by Road Diet)		-	3	-		6	-
		2	-	2	1	-	0
Crash Frequency (Corrected by Road Diet) Crash Frequency (Background, Countywide)		1 22950	2 21991	2	10055	2	0
		22950	21991	19311	18066		
Crash Frequency (Background, Citywide)		100				74	69
Crash Frequency (Background, Trunklinee-Court		4050	4597	3816	3514	3285	3190
Crash Frequency (Background, Trunklines-Citye		Si Method: Simple	65	20	45	40	42
	Crish Analysis	Method: Simple	(Naive) Before/A	-			
Average Crashes per Year (Before) Average Crashes per Year (After)			5.00	20 Cra	th Frequency by Y	ear (Site)	
			-40.00%				
Percentage Change				25			
Average Crashes per Year (Recoded, Before)			4.33				Total
Average Crashes per Year (Recoded, After)			3.00				Recoded
Percentage Change			-30.77%	30			Affected
Average Crashes per Year (Affected, Before)			2.33			<u> </u>	-t-Corrected
Average Crashes per Year (Affected, After)			3.33	5			-P-Lorrected
Percentage Change			42,86%			·	
Average Crashes per Year (Corrected, Before)			1.67	0		\sim	
Average Crashes per Year (Corrected, After)			0.67		04 2005 2006 2	007 2008 2009 201	
Percentage Change			-60.00%				-
	Crash Analysis Metho	od: Before/After C	omparison with	Beckground Trends			
Background Area Location (County, City)							
Average Crashes per Year (Countralide, Refore)			64252	Average Crather o	ar Vaar i Sha Baitu	-	4.33
Average Crashes per Year (Countywide, Before)			64252		er Year (Site, Befor		8.33
Average Crashes per Year (Countywide, After)			51435	Average Crashes p	er Year (Site, After		5.00
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide			51405	Average Crashes p Percent Change (5	er Year (Site, After te, Before/After)	1	
Average Crashes per Year (Countywide, Afber) Percentage Change Overall Countywide Projected Average Crashes per Year using Coun	tywide Background (Site, After)		51435 -19.95% 6.67	Average Crashes p Percent Change (5	er Year (Site, After te, Before/After)		5.00
Average Crashes per Year (Countywide, Afber) Percentage Change Overall Countywide Projected Average Crashes per Year using Coun Percent Change for Site Adjusted for Countywid	tywide Background (Site, After)		51435 -19.95% 6.67 -20.05%	Average Crashes p Percent Change (5	er Year (Site, After te, Before/After)	1	5.00
Average Crashes per Year (Countywide, Afber) Percentage Change Overall Countywide Projected Average Crashes per Year using Coun Percent Change for Site Adjusted for Countywid Average Crashes per Year (Citywide, Before)	tywide Background (Site, After)		51435 -19.95% 6.67	Average Crathes p Percent Change (5 32500 0	er Year (Site, After te, Before/After)	1	5.00 -40.00%
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Coun Percent Change for Site Adjusted for Countywid Average Crashes per Year (Drywide, After) Average Crashes per Year (Drywide, After)	tywide Background (Site, After)		51435 -19.95% 6.67 -20.05% 303 209	Average Crather p Percent Change (5 12500	er Year (Site, After te, Before/After)	1	5.00 -40.00%
Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average for Site Adjusted for Countyvide Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, After) Percentage Change Overall Coyvide	tywide Background (Site, After) de Background		51435 -19.95% 6.67 -20.05% 303 209 -31.02%	Average Crathes p Percent Change (5 32500 0	er Year (Site, After te, Before/After)	1	5.00 -40.00%
Average Crathes per Year (Countywide, Ather) Percentage Change Overall Countywide Projected Average Crathes per Year using Countywide Average Castone per Year (Chywide, Sefore) Average Crathes per Year (Chywide, After) Percentage Crathe per Year (Chywide, After) Percentage Crathe per Year Unitywide	tywide Background (Sbe, After) de Background vide Background (Sbe, After)		51435 -13.95% 6.67 -20.05% 303 209 -31.02% 5.75	Average Crather p Percent Change (5 32500 C 22500 C 12500 C	er Year (Site, After te, Before/After)	1	5.00 -40.00%
Average Crashes per Year (Countywide, After) Percentage Orange Devenil Countywide Projected Average Crashes per Year caing Count Percent Change for Site Adjusted for Countywide Average Crashes per Year (Dhywide, After) Average Crashes per Year (Dhywide, After) Percentage Orange Oranhes per Year uting Chywide Projected Average Crashes per Year uting Chywide 1 Percent Change Orashe per Year uting Chywide 1	tywide Background (Ste, After) de Background vide Background (Ste, After) actground		51435 -19.95% 6.67 -20.05% 303 209 -31.02% 5.75 -4.95%	Average Crather p Percent Change (5 12500 22500 12500	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -40.00%
Average Crathes per Year [Countywide, Atter] Percentage Dange Overall Countywide Projected Average Crathes per Year using Count Percent Change for Site Adjusted for Countywid Average Crathes per Year [Chywide, Before] Percentage Crathes per Year (Chywide, Before) Projected Average Crathes per Year using Chywide Percentage Crathes per Year using Chywide Percentage Change for Site Adjusted for Chywide 1 Average Crathes per Year (Chywide 1	tywide Background (Ste, After) Se Background Nde Background (Ste, After) Iackground Ga, Before)		51435 -13.95% 6.67 -20.05% 303 -31.02% 5.75 -6.96% 13281	Average Crather p Percent Change (5 12500 22500 12500	er Year (Site, After te, Before/After)	1	5.00 -40.00%
Average Crathes per Year [Countyvide, Ather) Percentage Change Oracial Countyvide Projected Average Crathes per Year using Count Percent Change for Site Adjusted for Countyvid Average Crathes per Year (Chyvide, Enforce) Average Crathes per Year (Chyvide, Ather) Projected Average Crathes per Year using Chyvide Projected Average Crathes per Year (Intelline-Countyvid Average Crathes per Year (Trutiline-Countyvid Average Crathes per Year (Trutiline-Countyvide)	tywide Background (Ste, After) de Background Xde Background (Ste, After) lackground ide, Bafore) ide, Stefore) ide, After)		51435 -19.95% 6.67 -20.05% 203 203 -31.02% 5.75 -6.96% 15281 9989	Average Crather p Percent Change (5 32500 22500 12500 2500 2500 2500 2500 250	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -40.00%
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year saing Count Percent Change for Site Adjusted for Countywide Average Crashes per Year (Chywide, March) Average Crashes per Year (Chywide, March) Percentage Change Overall Chywide Projected Average Crashes per Year using Chyw Percent Change for Site Adjusted for Chywide I Average Crashes per Year (Trunkline-Countyw Average Crashes per Year (Trunkline-Countyw Average Crashes per Year (Trunkline-Countyw	tywide Background (Ste, After) de Background ride Background (Ste, After) lackground ide, Sefore) ide, After) de	a sibari	51435 -19.95% 6.67 -20.05% 303 209 -31.02% 5.75 -6.96% 13201 9969 -24.79%	Average Craher p Percent Change (5 32500 22500 12500 2500 2002 2 2002 2 100 100	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -40.00% -Countywide
Average Crathes per Year [Countywide, Ather) Percentage Change Overall Countywide Projected Average Crathes per Year using Countywide Average Crathes per Year (Chywide, Before) Average Crathes per Year (Chywide, After) Percentage Change Overall Chywide Projected Average Crathes per Year Unit (Chywide J Average Crathes per Year (Chywide J Average Crathes per Year (Chywide J Average Crathes per Year (Chruid) Ian-Countyw Average Crathes per Year (Chruid) Ian-Countyw	tywide Background (Ste, After) de Background Istackground (Ste, After) dackground (de, Stefore) de (Inee-Countywide Background (Ste	a, Aftar)	51435 -19.95% 6.67 -20.05% 209 -31.02% 5.75 -4.98% 13201 9989 -24.79% 6.27	Average Crahes p Percent Change (5 22500 C 22500 C	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -40.00%
Average Crashes per Year (Countywide, Atter) Percentage Change Overall Countywide Projectid Average Crashes per Year Lang Count Percent Change for Site Adjusted for Countywide Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Meri Percentage Change Overall Chywide Percentage Crashes per Year (Landibase-Countywi Average Crashes per Year (Landibase-Countywi Percentage Overall Truskines-Countywi Percentage Orange Overall Truskines-Countywi Percentage Crashes per Year (Landibase-Countywi Percentage Crashes per Year (Landibase-Countywi Percentage Crashes per Year (Landibase-Countywi Percent Change Orabe per Year Candibase for Truskines	tywide Background (Ste, After) Je Background Ade Background (Ste, After) Jackground de, Before) de, After) de Einer-Countywide Background (Ste -Countywide Background (Ste	e, Atter)	51435 -13.97% 6.67 -20.05% 203 -31.02% 5.75 -4.98% 13281 9989 -24.79% 6.27 -15.21%	Average Crather p Percent Change [5 12500 0 12500 0 1	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -40.00%
Average Crathes per Year [Countywide, Atter] Percentage Crathes per Year autog Countywide Projected Average Crathes per Year autog Countywid Average Crathes per Year [Chywide, Before] Average Crathes per Year [Chywide, Before] Protectage Crathes per Year (Chywide, Before) Protectage Crathes per Year autog Chywide Projected Average Crathes per Year autog Chywide Average Crathes per Year (Tunkites-Countyw Average Crathes per Year (Tunkites-Countyw Protectage Crathes per Year autog Tunkites Protectage Crathes per Year autog Tunkites Average Crathes per Year autog Tunkites Protectage for 284 Adjusted for Trunkites	tywide Background (Ste, After) de Background Ade Background (Ste, After) dackground da, Setore) da, Attar) da kilner-Countywide Background (Ste -Countywide Background Before)	n, Atter)	51435 -13.95% -20.05% 303 209 -31.02% 5.75 -3.95% 13281 9989 -34.79% 6.27 -5.21% 112	Average Crather p Percent Change 5 22500 0 22500 0 12500 0 2500 0 2000 0000	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -80.00%
Average Crathes per Year [Countywide, Arber] Percentage Change Overall Countywide Projected Average Crathes per Hear Laing Count Percent Change for Site Adjusted for Countywide Average Crathes per Year (Chywide, Sefore) Average Crathes per Year (Chywide, Sefore) Percentage Change Overall Chywide Percent Change for Site Adjusted for Chywide I Average Crathes per Year (Trunkine-Countywide Average Crathes per Year (Trunkine-Countywide) Percent Change for Site Adjusted for Chywide I Average Crathes per Year (Trunkine-Countywide) Percent Change for Site Adjusted for Chywide I Percent Change for Site Adjusted for Trunkines Average Crathes per Year (Trunkines-Chywide) Average Crathes per Year (Trunkines-Chywide) Average Crathes per Year (Trunkines-Chywide) Average Crathes per Year (Trunkines-Chywide)	tywide Background (Ste, After) de Background Ade Background (Ste, After) dackground da, Setore) da, Attar) da kilner-Countywide Background (Ste -Countywide Background Before)	n, Athar)	51435 -13.95% -20.05% 300 -31.02% 5.75 -5.95% 13281 9989 -24.79% 6.27 -15.21% 182 143	Average Crather p Percent Change [5 12500 0 12500 0 1	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -40.00%
Average Crathes per Year (Countywide, Atter) Percentage Change Overall Countywide Projected Average Crathes per Year Lang Coun- Percent Change for Site Adjusted for Countywide Average Crathes per Year (Dhywide, Before) Average Crathes per Year (Dhywide, Meri) Projected Average Crathes per Year Lang Chywide Projected Average Crathes per Year Lang Chywide Percentage Change Overall Chywide Average Crathes per Year (Tunkites-Countywi Percentage Change Overall Trukites-Countywi Percentage Crathes per Year (Tunkites-Countywi Percentage Crathes per Year (Tunkites-Countywi Percentage Crathes per Year (Tunkites-Countywi Average Crathes per Year (Tunkites-Countywi Average Crathes per Year (Tunkites-Chywide, Average Crathes pe	tywide Background (Ste, After) Je Background Ade Background (Ste, After) Jackground de, Before) de Lines-Countywide Background (Ste -Countywide Background Before) After)		51435 -39.95% -20.05% -20.05% -20.05% -20.05% -31.02% -31.02% -33.02% -34.98% -24.79% -24.79% -23.21% 182 -21.49%	Average Crather p Percent Change 5 22500 0 22500 0 12500 0 2500 0 2000 0000	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -80.00%
Average Crathes per Year [Countywide, Arber] Percentage Crashes per Year along Countywide Percent Change for Site Adjusted for Countywide Average Crashes per Year (Chywide, Sefore) Average Crashes per Year (Chywide, Sefore) Percentage Change Overall Chywide Percent Change for Site Adjusted for Chywide I Average Crashes per Year (Trunkine-Countywide Average Crashes per Year (Trunkine-Countywide Average Crashes per Year (Trunkine-Countywide Percent Change for Site Adjusted for Chywide I Percent Change for Site Adjusted for Chywide I Percent Change for Site Adjusted for Chywide Average Crashes per Year (Trunkine-Countywide Average Crashes per Year (Trunkine-Chywide Average Crashes per Year (Trunkine-Chywide) Average Crashes per Year (Trunkine-Chywide) Average Crashes per Year (Trunkine-Chywide)	tywide Background (Ste, After) de Background Isckground (de, Background (de, Sefore) (de, After) de (inee-Countywide Background (Ste, A Before) After) (inee-Chywide Background (Ste, A		51435 -13.95% -20.05% 300 -31.02% 5.75 -5.95% 13281 9989 -24.79% 6.27 -15.21% 182 143	Average Crather p Percent Change 5 12200 0 12200 0 12000 0 1000 0000	er Year (Sta, After ta, Defore/After) rash Frequency by) Year (Background)	5.00 -80.00%

		Site Chara	cturistics				
Site No.	22		Length (ml)		0.22		
					Commercial		
	Lake Baldwin		Land Use		12/3		
Oby Route/Road Name	Daidwin M-37		No. of Driveways/in	ter sectors		dating curbs with re	
	M-37 1338906/43011		Treatment Type		Repaying within ex	deting curbs with n	w markings
	5.816		Nearest Cross Street		9th St.		
EMP	5.816		Nearest Cross Street				
LMP	6.033			5	Washington St.		
		Descriptive					
			Before Period			After Period	
Year		1995	1996	1997	1999	2000	2001
ADT		6421	5700	8860	8448	8241	8507
Crash Frequency (Total)		30	10	5		2	3
Crash Rate		19.66	22.15	7.12	11.96	3.06	4.56
Crash Frequency (Recoded)							3
Crash Frequency (Intersection-related)							3
Crash Frequency (Driveway-related)			no data prior to 2001		no data pr	for to 2001	0
Crash Frequency (Affected by Road Diet)							3
Crash Frequency (Corrected by Road Diet)							0
Crash Frequency (Background, Countywide)		313	337	314	292	328	279
Crash Frequency (Background, Citywide)		34	32	24	22	2	15
Crash Frequency (Background, Trunklines-Court	tywide)	50	56	57	42	41	42
Crash Frequency (Background, Trunklines-City)	(de)	19	23	14	14	1	
	Crash Analysis	Method: Simple	(Naive) Before/Aft	er Analysis			
Average Crashes per Year (Before)			8.33	20 Cras	h Frequency by Yea	r (Site)	
Average Crashes per Year (After)			4.33				
Percentage Change			-48.00%	-			
Average Crashes per Year (Recoded, Before)			n/a	15			Total
Average Crashes per Year (Recoded, After)			3.00				Recoded
Percentage Change			n/a	30			
Average Crashes per Year (Affected, Before)			n/a		\ •	1	Affected
Average Crashes per Year (Affected, After)			3.00	5	\sim	1	-0-Corrected
Percentage Change			n/a	-		× •	
Average Crashes per Year (Corrected, Before)			a/a			a second se	
Average Crashes per Year (Corrected, After)			0.00	0			
Percentage Change			n/a	1994 1995 19	96 1997 1998 199	99 2000 2001 20	02
	Crash Analysis Methor	d: Before/After	Comparison with Ba	ckground Trends			
Background Area Location (County, Oty)							
Average Crashes per Year (Countywide, Before)	1		964		er Year (Site, Before		8.33
Average Crashes per Year (Countywide, After))		899	Average Crashes p	er Year (Site, After)		4.33
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide	-		899 -6.74%	Average Crashes p Percent Change (S	er Year (Site, After)		
Average Crashes per Year (Countywide, Afber) Fercentage Change Overall Countywide Projected Average Crashes per Year using Cour	tywide Background (Site, After)		899 -6.74% 7.77	Average Crathes p Percent Change (5	er Year (Site, After)		4.33
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Countywide Percent Change for Site Adjusted for Countywi	tywide Background (Site, After)		899 -6.74% 7.77 -41.26%	Average Crathes p Percent Change (5	er Year (Site, After) te, Defore/After)		4.33
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cour Percent Change for Site Adjusted for Countywid Average Crashes per Year (Chrywide, Befrei)	tywide Background (Site, After)		899 -6.74% 7.77 -41.26% 90	Average Crashes p Percent Change (S 400 Cras	er Year (Site, After) te, Defore/After)		4.35
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cour Percent Change for Site Adjusted for Countywi Average Crashes per Year (Chywide, Refre) Average Crashes per Year (Chywide, Refre)	tywide Background (Site, After)		899 -6.74% 7.77 -41.26% 90 42	Average Crashes p Percent Change (S 400 Cras	er Year (Site, After) te, Defore/After)		4.33 -48.00%
Average Crashes per Year (Countywide, After) Percentage Change Overell Countywide Projected Average Crashes per Year using Countywid Percent Change for Site Adjusted for Countywid Average Crashes per Year (Chywide, After) Percentage Change Overall Chywide, After) Percentage Change Overall Chywide	rtywide Background (Ste, After) de Background		899 -6.74% 7.77 -41.20% 90 42 -53.33%	Average Crathes p Percent Change (5 400 Cra 350 - Cra 300 - Cra	er Year (Site, After) te, Defore/After)		4.33
Average Crashee per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashee per Year Laing Countyvid Average Crashee per Year (Chyvide, Sefore) Average Crashee per Year (Chyvide, After) Percentage Crashee Crashe Countyvide, After) Percentage Crashee Crashee Countyvide, Sefore)	, tywide Background (Ste, After) de Background wide Background (Ste, After)		899 -6.745 7.77 -41.20% 90 42 -53.33% 3.89	Average Crathes p Percent Change (5 400 Cra 350	er Year (Site, After) te, Defore/After)		4.33 -48.00%
Average Crashes per Year (Countyvide, After) Percentage Change Overnil Countyvide Projectid Average Crashe per Year saing Coun- Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Dywide, After) Average Crashes per Year (Dywide, After) Percentage Change Overnil Chyvide Projected Average Crashes per Year using Chyv Percent Change for Site Adjusted for Chyvide 1	rtywide Background (SBe, After) de Background vide Background (SBe, After) Background		899 -6.74% 7.77 -41.20% 90 42 -55.33% 3.89 5.33%	Average Crather p Percent Change (5 400 Cra 350	er Year (Site, After) te, Defore/After)		4.33 -48.00%
Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, After) Percentage Change Overall Chyvide Projected Average Crashes per Year raing Chyv Percent Change for Site Adjusted for Chyvide 1 Average Crashes per Year (Tunkither-Countyvide)	rtywide Baciground (Ste, After) de Baciground wide Baciground (Ste, After) Baciground Ilaciground Ide, Before)		899 -6.74% 7.77 -41.20% 90 42 -53.33% 3.89 5.33% 163	Average Crathes p Percent Change (5 400 Cra 350 - Cra 300 - Cra	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea		4.33 -48.00%
Average Crashes per Year (Countyvide, After) Percentage Change Ovenil Countyvide Projectid Average Crashes per Year Laing Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, After) Percentage Change Ovenil Chyvide Projectid Average Crashes per Year Laing Chyv Percent Change for Site Adjusted for Chyvide 1 Average Crashes per Year (Trutiline-Countyv Average Crashes per Year (Trutiline-Countyv	- trywide Background (SRe, After) de Background Vide Background (SRe, After) Background Ide, Betren) Ide, After)		899 -6.74% 7.77 -41.26% 90 42 -53.37% 3.89 5.33% 163 125	Average Crathes p Percent Change (5 400 Cra 150 Cra 150 250 250 250 200 200 200 200 200 200 2	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea	r (Beckground)	4.33 -48.00%
Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projectid Average Crashe per Year Laing Countyvide Average Crashes per Year (Dryvide, Before) Average Crashes per Year (Dryvide, After) Percentage Change Overall Chyvide Projected Average Crashes per Year Laing Cityv Percent Change Crashes per Year Laing Cityv Average Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Countyv	rtywide Background (Ste, After) de Background vide Background (Ste, After) Background dde, Refore) ide, After) ide		899 -6.74% 7.77 -41.26% 90 -42 -53.33% 1.89 5.33% 1.63 1.25 -23.31%	Average Crathes p Percent Change (5 400 Cra 350	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea	r (Beckground)	4.33 -48.00%
Average Crashes per Year (Countyvide, Arber) Percentage Change Overall Countyvide Projected Average Crashes per Year Lang Countyvid Average Crashes per Year (Chyvide, Sefore) Average Crashes per Year (Chyvide, Petron) Percentage Crashes per Year (Chyvide, Afber) Percentage Crashes per Year (Chyvide, Afber) Percentage Crashes per Year (Chyvide) Average Crashes per Year (Chyvide) Average Crashes per Year (Chyvide) Average Crashes per Year (Chruid) Ina-Countyv Percentage Crashes per Year auton (Chu	rtywide Background (Ste, After) de Background Background Background die, Before) ide, After) ide After) ide	,After)	899 - 4.76% 7.77 - 41.26% 90 42 - 53.33% 3.89 5.33% 163 125 - 23.31% 6.39	Average Crashes p Percent Owners (5 400 150 300 250 250 200 3094 3994 30	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea	r (Beckground)	4.33 -48.00%
Average Crashes per Year (Countyvide, After) Percentage Change Ovenil Countyvide Projectid Average Crashes per Year saing Countyvid Average Crashes per Year (Dhyvide, Before) Average Crashes per Year (Dhyvide, Before) Percentage Change Ovenil Chyvide Projectid Average Crashes per Year uting Chyvide Percent Change for Site Adjusted for Chyvide 1 Average Crashes per Year (Tunkites-Countyv Percentage Change Ovenil Trukites-Countyv Percentage Change Ovenil Trukites-Countyv Percentage Crashes per Year runkites-Countyv Percentage Crashes per Year runkites-Countyv Percentage Crashes per Year runkites-Countyv	- ttywide Background (Ste, After) de Background Background Jackground ide, Background ide, Afterne) ide e-Countywide Background (Ste, -Countywide Background (Ste,	,Ahar)	899 -6.76% 7.77 -41.26% 90 42 -53.37% 143 5.35% 143 125 -23.31% 6.39 -34.69%	Average Crather p Percent Change (5 400 150 200 200 1994 190 50 40	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea	r (Beckground)	4.33 -41.00%
Average Crashes per Year (Countyvide, Arber) Percentage Change Overall Countyvide Projected Average Crashes per Year Lang Countyvid Average Crashes per Year (Chyvide, Sefore) Average Crashes per Year (Chyvide, Petron) Percentage Crashes per Year (Chyvide, Afber) Percentage Crashes per Year (Chyvide, Afber) Percentage Crashes per Year (Chyvide) Average Crashes per Year (Chyvide) Average Crashes per Year (Chyvide) Average Crashes per Year (Chruid) Ina-Countyv Percentage Crashes per Year auton (Chu	- ttywide Background (Ste, After) de Background Background Jackground ide, Background ide, Afterne) ide e-Countywide Background (Ste, -Countywide Background (Ste,	.Atar)	899 - 4.76% 7.77 - 41.26% 90 42 - 53.33% 3.89 5.33% 163 125 - 23.31% 6.39	Average Crahes p Percent Change (5 400 Cra 150 Cra 150 250 250 br>250 250 250 250 250 250 250 250 250 250 250	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea	r (Beckground)	4.33 -48.00%
Average Crashes per Year (Countyvide, After) Percentage Change Ovenil Countyvide Projectid Average Crashes per Year saing Countyvid Average Crashes per Year (Dhyvide, Before) Average Crashes per Year (Dhyvide, Before) Percentage Change Ovenil Chyvide Projectid Average Crashes per Year uting Chyvide Percent Change for Site Adjusted for Chyvide 1 Average Crashes per Year (Tunkites-Countyv Percentage Change Ovenil Trukites-Countyv Percentage Change Ovenil Trukites-Countyv Percentage Crashes per Year runkites-Countyv Percentage Crashes per Year runkites-Countyv Percentage Crashes per Year runkites-Countyv Percent Change Crashes per Year runkites-Countyv	ritywide Background (Site, After) de Background Site Background (Site, After) Background Ide, Batron) Ide, Fatron) Ide, Fatron) Ede Background (Site, -Countywide Background (Site,	, Attar)	899 -6.76% 7.77 -41.26% 90 42 -53.37% 143 5.35% 143 125 -23.31% 6.39 -34.69%	Average Crahes p Percent Change (5 400 Cra 150 Cra 150 250 250 250 250 250 250 250 250 250 2	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea	r (Beckground)	4.33 -40.00%
Average Crashes per Year [Countyvide, Arber] Percentage Change Overall Countyvide Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Arber) Percentage Crashes per Year (Chyvide, Arber) Percentage Crashes per Year (Chyvide, Arber) Percentage Crashes per Year runniblene-Countyv Average Crashes per Year (Trunkline-Countyv Percentage Crashes per Year runkline-Countyv Percentage Crashes percentage Crashes percent	- tywide Background (Ste, After) de Background Background Ide, Sefore) ide, Sefore) ide, Kiner-Countywide Background (Ste, e-Countywide Background , Before) , After)	, Attar)	899 -4.74% 7.77 -41.26% 90 42 -53.32% 163 125 -23.32% -33.32% -33.32% -33.32% -33.32% -34.29% -36	Average Crashes p Percent Change (5 400 Cra 150 Cra 150 250 250 250 250 250 250 250 250 250 2	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea	r (Beckground)	4.33 -48.00%
Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvides Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Edicre) Average Crashes per Year (Chyvide, Edicre) Percentage Change Overall Chyvide Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Trunkline-Countyvid Average Crashes per Year (Trunkline-Countyvid Average Crashes per Year (Trunkline-Countyvid Percent Change for Site Adjusted for Chyvide I Average Crashes per Year (Trunkline-Countyvid Percent Change for Site Adjusted for Chyvide I Percent Change for Site Adjusted for Trunkline Average Crashes per Year (Trunkline-Countyvid Average Crashes per Year (Trunkline-Chyvide) Average Crashes per Year (Trunkline-Chyvide) Average Crashes per Year (Trunkline-Chyvide)	- tywide Background (Ste, After) de Background Background (Ste, After) Background dde, Background dde, After) (de killene-Countywide Background (Ste, -Countywide Background , Before) , After)		899 -4.76% 7.77 -41.26% 42 -53.33% 129 -33.35% -23.35% -24.69% -24.69% -56 23	Average Cracher p Percent Change (5 900 Cra 150 Cra 150 200 200 200 200 200 200 200 200 200 20	er Year (Ste, Atter) te, Defore/Atter) sh Frequency by Yea	r (Beckground)	4.33 -40.00%

		Site Chara	ctoristics				
Site No.	23		Length (mi)		0.50		
County			Land Use		Commercial		
	Losco				23/9		
City	Oscoda Township		No. of Driveways	Internections			
Route/Road Name	US-23		Treatment Type		Repaying within ex	deting curbs with ne	w markings
PR/CS No.	1251607/35032				Olylapa St.		
BMP	24.014		Nearest Cross Stre				
EMP	24.511		Nearest Cross Stre	HR.	Evergreen Dr.		
		Descriptive	Statistics				
			Before Period			After Period	
Year		2004	2005	2006	2008	2009	2010
ADT		16647	16856	13659	12970	13528	14054
Crash Frequency (Total)		25	22	24	23	14	12
Crash Rate		8.28	7.19	9.55	9.78	5.70	4.71
Crash Frequency (Recoded)		14	14	36	16	9	
Crash Frequency (Intersection-related)		4	5	7	2	5	1
Grash Frequency (Driveway-related)		0	0	1	0	1	1
Crash Frequency (Affected by Road Diet)		7	13	15	14		÷
Crash Frequency (Corrected by Road Diet)		÷	2			2	2
Grash Frequency (Background, Countywide)		589	529	471	431	381	335
Grash Frequency (Background, Citywide)		164	163	130	139	107	101
Grash Frequency (Background, Trunkliner-Cou	(ablance)	26	76	71		74	48
Crash Frequency (Background, Trunklines-City							
		Method: Simple	(Naive) Before/Al	ter Analysis			
Average Crashes per Year (Before)		and the second second	23.67		ah Frequency by Ye	as (Cital)	
Average Crashes per Year (After)			16.33	10 - Car	an reduced of a	an freezel	
Percentage Change			-30.99%	25			
Average Crashes per Year (Recoded, Before)			14.67			t	
Average Crathet per Year (Recoded, After)			11.00	20	-	1	Total
Percentage Change			-25.00%	15	- 1		Recoded
Average Crashes per Year (Affected, Before)			11.67		-		-h-Affected
Average Crather per Year (Affected, After)			10.00	10		<u> </u>	Corrected
Percentage Change			-14.29%	6		and the second se	 Corrected
				5			
Average Crashes per Year (Corrected, Before)			0.33				
				0			
Average Crashes per Year (Corrected, Afber)			3.00	0			
Average Crashes per Year (Corrected, After) Percentage Change			-64.00%	2008 2004 26	05 2006 2007 20	08 2009 2010 20	51
Fercentage Change	Crash Analysis Metho	od: Sefore/After	-64.00%	2008 2004 26		08 2009 2010 20	11
Percentage Change Background Area Location (County, Oty)		od: Before/After	-64.00% Comparison with I	2003 2004 24 Background Trends	•		
Percentage Change Background Area Location (County, City) Average Crashes per Year (Countywide, Befor	•)	od: Sefore/After	-64.00% Comparison with I 1589	2003 2004 20 Beckground Trends Average Crather p	a ver Year (Site, Before	0	23.67
Percentage Change Background Area Location (County, City) Average Crashes per Year (Countywide, Befor Average Crashes per Year (Countywide, After)	•)	od: Before/After	-64.00% Comparison with I 1589 1147	2003 2004 20 Beckground Trends Average Crathes p Average Crathes p	a xer Year (Site, Before xer Year (Site, After)	0	23.67 16.33
Percentage Change Background Area Location (County, City) Average Crashes per Year (Countywide, Befor Average Crashes per Year (Countywide, Afber) Percentage Change Overall Countywide	•)	od: Sefore/After	-64.00% Comparison with I 1589 1147 -27.02%	2003 2004 24 Beckground Trends Average Crather p Average Crather p Percent Change (S	s xer Year (Site, Before xer Year (Site, After) ite, Before/After)	N	23.67
Percentage Change Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, Ather) Percentage Change County yelde Projected Average Crathes per Year using Cou	e) ntywide Background (Site, After)	od: Before/Alter (-64.00% Comparison with I 1589 1147 -27.02% 17.08	2003 2004 24 Beckground Trends Average Crather p Average Crather p Percent Change (S	a xer Year (Site, Before xer Year (Site, After)	N	23.67 16.33
Percentage Change Background Area Location (County, City) Average Crashes per Year (Countywide, Refon Average Crashes per Year (Countywide, Afber) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw	e) ntywide Background (Site, After)	od: Before/After (-64.00% Comparison with 1 1589 1147 -27.02% 17.08 -3.17%	2003 2004 24 Beckground Trends Average Crather p Average Crather p Percent Change (S	s xer Year (Site, Before xer Year (Site, After) ite, Before/After)	N	23.67 16.33
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Befor Average Crashes per Year (Countyvide, Atbar) Percentage Change Overall Countyvide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyvide, Before Average Crashes per Year (Chydide, Before)	e) ntywide Background (Site, After)	od: Before/After (-64.00% Comparison with 1 1589 1147 -27.82% 17.08 -3.17% 457	2003 2004 20 Background Trends Average Crashes p Average Crashes p Percent Change (S 700 600	s xer Year (Site, Before xer Year (Site, After) ite, Before/After)	N	23.67 16.33
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Befor Average Crashes per Year (Countyvide, Afber) Percentage Change Overall Countyvide Percentage Change Overall Countyvide Percent Change for Site Adjusted for Countyv Average Crashes per Year (Chyvide, Afber) Average Crashes per Year (Chyvide, Afber)	e) ntywide Background (Site, After)	od: Before/After (-64.00% Comparison with 1 1589 1147 -27.82% 17.08 -3.17% 457 347	2003 2004 24 Beckground Trends Average Crathes p Average Crathes p Percent Change (5 700 0	s xer Year (Site, Before xer Year (Site, After) ite, Before/After)	N	23.67 16.33
Percentage Orange Background Area Location (County, Oty) Average Crashes per Year (Countywide, Befon Average Crashes per Year (Countywide, After) Percentage Onage Overall Countywide Projected Average Crashes per Year using Gou Percent Orange for Site Adjusted for Countyw Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Before)	n) ntywide Background (Ste, After) Ide Background	od: Before/After (-54.00% Comparison with 1 1589 1147 -27.82% 17.08 -3.17% 457 347 -24.07%	2003 2004 20 Background Trends Average Crather p Percent Change (5 200 0 600 0 500 0	s xer Year (Site, Before xer Year (Site, After) ite, Before/After)	N	23.67 16.33 -30.99%
Percentage Change Background Area Location (County, City) Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, Arbar) Percentage Change Overall Countyvide Projected Average Crathes per Year Countyvide Average Crathes per Year (Cityvide, Arbar) Average Crathes per Year (Cityvide, Arbar) Percentage Change Overall Cityvide, Arbar)	n) Intywide Baciground (Ste, After) Ide Baciground Wide Baciground (Ste, After)	od: Before/After	-64.00% Comparison with I 1599 1147 -27.22% 17.08 -3.17% 457 347 -34.07% 17.97	2003 2004 20 Background Trends Average Crashes p Average Crashes p Percent Change (S 700 600	s xer Year (Site, Before xer Year (Site, After) ite, Before/After)	N	23.67 16.33 -30.99%
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Parcentage Change Overall Chywlde Projekted Average Chanhes per Year (Innikine-Countywide, Background (Ste, After) Parcentage Chanhes per Year (Innikine-Countywide, Background (Ste, After) Parcentage Chanhes per Year (Innikine-Countywide Background (Ste, After) Parcentage Chanhes Per Year (Innikine-Chywide Background (Ste, After) Parcentage Change Orables (The Parcent and Innikine-Chywide Background (Ste, After) Parcentage Change Orables per Year (Innikine-Chywide Background (Ste, After) Parcentage Change Orables (The Parcent and Innikine-Chywide Background (Ste, After) Parcentage Change Orables (The Parcent and The Parcentage Orables (The Parcent and The Parcentage Change Orables (The Parcent and The Parcentage Change Orables (The Parcentage Change Orables (The Parcentage Orables (The Parcenta							- countration
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Parcent Orange for Ste Adjusted for Chyvide Background -43.23% Average Crashes per Year (Trunkline-Countyvide, Before) 300 Nerrage Crashes per Year (Trunkline-Countyvide Background (Ste, After) 377 Parcent Gauge Orables per Year (Trunkline-Countyvide Background (Ste, After) 300 Parcent Gauge Orables per Year (Trunkline-Countyvide Background Chyvide Parcent Gauge Orables per Year (Trunkline-Countyvide Background Chyvide Parcent Gauge Orables per Year (Trunkline-Chyvide Background Chyvide Parcent Gauge Orables per Year (Trunkline-Chyvide Background (Ste, After) 80 Digeted Average Crashes per Year (Trunkline-Chyvide Background (Ste, After) 77 Parcent gas Orables per Year (Trunkline-Chyvide Background (Ste, After) 30 Parcent gas Orables per Year (Trunkline-Chyvide Background (Ste, After) 30 Parcent gas Orables per Year (Trunkline-Chyvide Background (Ste, After) 30		Atteri		200			
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Percent Change for Site Adjusted for Trunkline-Countywide Background 452.92% 30 Average Crashes per Year (Trunkline-Chyvide, Before) 80 Average Crashes per Year (Trunkline-Chyvide, Before) 77 Percentage Change Overall Trunkline-Chyvide Background (Ste, Atter) 5.13 Originated Average Crashes per Year using Trunklines-Chyvide Background (Ste, Atter) 5.13		ckground (Site, After)		40	\sim		
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Average Crashes per Year (Trunkline-Chywlde, After) 77 30 Percentage Change Ownell Trunkline-Chywlde Background (Ste, After) 3.17% 0 Trojected Average Crashes per Vare uning Trunkline-Chywlde Background (Ste, After) 3.18	Percent Change for Site Adjusted for Trunklines-Countywide Backgro						. Tradition
Percentage Change Overall Trunkline-Chyelde Background (Ste, After) 5.13	Percent Change for Site Adjusted for Trunklines-Countywide Backgro Average Crashes per Year (Trunklines-Otywide, Before)		80				
Projected Average Crashes per Year using Trunklines-Chywlde Background (Site, After) 5.13 0	Average Crashes per Year (Trunklines-Otywide, Before)						
	Average Crashes per Year (Trunklines-Otywide, Before) Average Crashes per Year (Trunklines-Otywide, After)		77				
Percent Change for Site Adjusted for Trunklines-Citywide Background -52.50% 1998 2000 2002 2008 2008	Average Crashes per Year (Trunklines-Chywide, Before) Average Crashes per Year (Trunklines-Chywide, After) Percentage Change Overall Trunkline-Chywide	mund (Ste After)	77 -3.75%	30	, ,		

		Site Chara	cteristics				
Site No.	29		Length (mi)		0.49		
County	Otango		Land Upp		Residential		
Oby	Gavlard		No. of Driveways/	Internetline	30/4		
Route/Road Name	M-32		Treatment Type	internet of the		ditting curbs with n	
PR/CS No.	1079903/69021		Treatment Type		Repaying within a	atting curbs with h	w markings
IMP	11407		Nearest Cross Stre		Calc Ave.		
EMP	11.902		Nearest Cross Stre		Hayes Rd.		
LMP	11.902			*	HEYEE HO.		
		Descriptive					
			Sefore Period			After Period	
Year		2002	2003	2004	2006	2007	2008
ADT		11998	12105	10424	30793	10621	8538
Crash Frequency (Total)		5	13	13	3	2	5
Crash Rate		2.31	5.94	6.90	1.54	1.04	3.24
Crash Frequency (Recoded)		5	10	5	3	2	3
Grash Frequency (Intersection-related)		4	6	3	1	•	1
Crash Frequency (Driveway-related)		•	0	0	0	•	0
Crash Frequency (Affected by Road Diet)		3	6		2	1	1
Crash Frequency (Corrected by Road Diet)		3	3	6	0	0	0
Grash Frequency (Background, Countywide)		898	965	991	803	737	606
Crash Frequency (Background, Citywide)		331	317	317	287	257	222
Crash Frequency (Background, Trunklines-Cou	ntywide)	301	303	282	292	245	228
Grash Frequency (Background, Trunklines-City		248	229	213	217	190	163
		Method: Simple	(Naive) Before/Aft	ter Analysis			
Average Crashes per Year (Before)			10.33	20 Cra	sh Frequency by Ye	ar (Site)	-
Average Crashes per Year (After)			3.33				
Percentage Change			-67.74%				
Average Crashes per Year (Recoded, Before)			6.67	15			- Total
Average Crashes per Year (Recoded, After)			2.67				-
Percentage Change			-60.00%	20			Recoded
Average Crashes per Year (Affected, Before)			5.67				Affected
Average Crashes per Year (Affected, After)			1.33		~		-é-Corrected
Percentage Change			-76.47%			. /.	-
Average Crashes per Year (Corrected, Before)			4.00				
Average Crashes per Year (Corrected, After)			0.00	0			1
Percentage Change				2000 2000 20	00 2004 2005 20	06 2007 2008 20	000
			-100.00%	2001 2002 20	65 2004 2000 20		
	Crash Analysis Meth	od: Before/After					
Background Area Location (County, Oty)		od: Before/After	Comparison with B	Beckground Trends	1		
Average Crashes per Year (Countywide, Before	•)	od: Before/After	Comparison with 8	Average Crashes p	er Year (Site, Before		10.33
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After)	•)	od: Before/After	Comparison with 8 2854 2226	Average Crathes p Average Crathes p	er Year (Site, Befor er Year (Site, After)		10.33
Average Crathes per Year (Countywide, Befor Average Crathes per Year (Countywide, After) Percentage Change Overall Countywide	e)	od: Before/After	2854 2226 -22.00%	Average Crashes p Average Crashes p Average Crashes p Percent Change (S	er Year (Site, Before er Year (Site, After) ite, Before/After)		10.33
Average Crashes per Year (Countywide, Befon Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou	e) Intywide Background (Site, After)	od: Before/After	Comparison with 8 2854 2226 -22.00% 8.06	Average Crashes p Average Crashes p Average Crashes p Percent Change (S	er Year (Site, Befor er Year (Site, After)		10.33
Average Crashes per Year (Countywide, Befon Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw	e) Intywide Background (Site, After)	od: Before/After	Comparison with 8 2854 2226 -22.00% 8.06 -45.74%	Average Crashes p Average Crashes p Percent Change (5 1200 Cr	er Year (Site, Before er Year (Site, After) ite, Before/After)		10.33
Average Crashes per Year (Countywide, Befor Average Crashes per Year (Countywide, After) Percentage Ohange Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw Average Crashes per Year (Chywide, Before)	e) Intywide Background (Site, After)	od: Before/After	Comparison with 8 2256 -22.00% 8.06 -45.74% 965	Average Crashes p Average Crashes p Average Crashes p Percent Change (S	er Year (Site, Before er Year (Site, After) ite, Before/After)		10.33
Average Crashes per Year (Countywide, Befon Average Crashes per Year (Countywide, Arbar) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Before)	e) Intywide Background (Site, After)	od: Before/After	Comparison with 8 2854 2226 -22.005 8.06 -45.74N 965 766	Average Crashes p Average Crashes p Percent Change (5 1200 Cr	er Year (Site, Before er Year (Site, After) ite, Before/After)		10.33 3.35 -67.74%
Average Crathes per Year (Countyvide, Befon Average Crathes per Year (Countyvide, Alber) Percentage Change Overall Countyvide Percent Change for Site Adjusted for Countyw Average Crathes per Year (Chywlde, Before) Average Crathes per Year (Chywlde, Before) Average Crathes per Year (Chywlde, Before) Average Crathes per Year (Chywlde, Before)	n) Intywide Background (Ste, After) Idde Background	od: Before/After	Comparison with 8 2854 2226 -22.00% 8.06 -45.74% 965 766 -20.62%	Average Crashes p Average Crashes p Percent Change (5 1200 Cr	er Year (Site, Before er Year (Site, After) ite, Before/After)		10.33
Average Crashes per Year (Countywide, Befon Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw Average Crashes per Year (Chywide, After) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywlde	e) Intywide Background (Ste, After) Inde Background Wide Background (Ste, After)	od: Before/After	Comparison with 8 2854 2226 -22.00% 8.06 -45.74% 965 766 -20.62% 8.20	Average Crashes p Average Crashes p Average Crashes p Percent Change (5 1200 Cr 1000	er Year (Site, Before er Year (Site, After) ite, Before/After)		10.33 3.35 -67.74%
Average Crathes per Year (Countyvide, Befon Average Crathes per Year (Countyvide, Alber) Percentage Change Overall Countyvide Percent Change for Site Adjusted for Countyw Average Crathes per Year (Chywlde, Before) Average Crathes per Year (Chywlde, Before) Average Crathes per Year (Chywlde, Before) Average Crathes per Year (Chywlde, Before)	e) Intywide Background (Ste, After) Inde Background Wide Background (Ste, After)	od: Before/After	Comparison with 8 2854 2226 -22.00% 8.06 -45.74% 965 766 -20.62%	Average Crashes p Average Crashes p Average Crashes p Percent Change [5 1000 Gr 1000 Gr 800 Gr	er Year (Site, Before er Year (Site, After) ite, Before/After)		10.33 3.35 -67.74%
Average Crashes per Year (Countywide, Befon Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw Average Crashes per Year (Chywide, After) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywlde	n) intywide Background (Ste, After) ide Background Wide Background (Ste, After) Background	od: Sefore/After	Comparison with 8 2854 2226 -22.00% 8.06 -45.74% 965 766 -20.62% 8.20	Average Crather p Average Crather p Average Crather p Fercent Change (5 1200 Cr 1000 Cr 1000 Cr	er Year (Site, Befor er Year (Site, After) ite, Before/After) auth Frequency by Y	eer (Beckground)	10.33 3.33 -67.74%
Average Crashes per Year (Countywide, Befon Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw Average Crashes per Year (Chywide, After) Percentage Change per Year ang Chy Percentage Change Overall Chywide Average Crashes per Year (Turkither-Countyw Average Crashes per Year (Turkither-Countyw Average Crashes per Year (Turkither-Countyw	n) Intywide Background (Ste, After) Ide Background Wide Background (Ste, After) Background Mide, After)	od: Sefore/After	Comparison with 8 2854 2228 -22.00% 8.06 -85.74% 965 766 -20.62% 8.20 -47.12% 886 705	Average Crather p Average Crather p Average Crather p Percent Change (5 1000 000 000 600 2000 2000	er Year (Site, Befor er Year (Site, After) ite, Before/After) auth Frequency by Y	ear (Background)	10.33 3.35 -67.74%
Average Crashes per Year (Countyvide, Befor Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year using Cou Percent Change for Ste Adjusted for Countyv Average Crashes per Year (Chyvide, Sefere) Average Crashes per Year (Chyvide, After) Percentage Change Overall Chyvide Projected Average Crashes per Year using Chy Percent Change for Ste Adjusted for Chyvide Average Crashes per Year (Chryvide	n) Intywide Background (Ste, After) Ide Background Wide Background (Ste, After) Background Mide, After)	od: Sefore/After	Comparison with 8 2854 2226 -22.005 8.05 965 766 -20.62% 8.20 -47.12% 806	Average Crathes p Average Crathes p Percent Change (5 1000 600 2000 2000 250 m	er Year (Site, Befor er Year (Site, After) ite, Before/After) auth Frequency by Y	eer (Beckground)	10.33 3.33 -67.74%
Average Crashes per Year (Countywide, Befon Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw Average Crashes per Year (Chywide, After) Percentage Change per Year ang Chy Percentage Change Overall Chywide Average Crashes per Year (Turkither-Countyw Average Crashes per Year (Turkither-Countyw Average Crashes per Year (Turkither-Countyw	n) Intywide Background (Ste, After) Idde Background Sackground Sackground wide, Before) wide, Before) wide		Comparison with 8 2854 2228 -22.00% 8.06 -85.74% 965 766 -20.62% 8.20 -47.12% 886 705	Average Crather p Average Crather p Percent Change (5 1000 600 2000 2000 1000 2000 2000	er Year (Site, Befor er Year (Site, After) ite, Before/After) auth Frequency by Y	eer (Beckground)	10.33 3.33 -67.74% -€-Countywide
Average Crathes per Year (Contryvide, Befon Average Crathes per Year (Contryvide, Afber) Percentage Change Overall Contryvide Percent Change for Site Adjusted for Contryvide Average Crathes per Year (Chywlde, Before) Average Crathes per Year (Chywlde, Before) Average Crathes per Year (Chywlde, Before) Percentage Change Overall Chywlde Projected Average Crathes per Year uning Chy Percentage Crathes per Year (Turkiline-Countyy Average Crathes per Year (Turkiline-Countyy Average Crathes per Year (Turkiline-Countyy Average Crathes per Year (Turkiline-Countyy	e) intywide Background (Ste, After) ide Background wide Background Background wide, Before) wide, Stefore) wide Kilnes-Countywide Background (St		Comparison with 8 2854 2225 -22.00% -45.74% 965 766 -20.62% 8.20 -47.12% 806 765 -13.66%	Average Crathes p Average Crathes p Percent Change (5 1000 800 800 800 800 800 800 800 800 80	s er Year (Sta, Befor er Year (Sta, Ather) ta, Before/Athar) ash Frequency by Y 2004 2006	eer (Beckground)	10.33 1.33 -67.74% -0-Countywide -0-Chyelde -0-Turklines-
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		Site Chare	cteristics						
Site No.	30		Length (mi)		0.36				
County	St. Joseph		Land Use		Mixed commercial	cashing the			
Oby	Sturgis		No. of Driveways/	at a set of the set	25/8				
Route/Road Name	US-12		Treatment Type	internections.	Reconstruction cha				
PR/CS No.	232106/78022		(reachers (ype		Neconstruction chi	inging readway with	20		
BMP	17.967		Nearest Cross Stre		Maple St.				
EMP	18,350		Nearest Cross Stre		Lakeview Ave.				
LMP	18.300			*	Lakeview Ave.				
		Descriptive							
			Before Period			After Period			
Year		2003	2004	2005	2007	2008	2009		
ADT		7462	7417	8209	8070	6592	8508		
Crash Frequency (Total)		9	16		10	4	11		
Crash Rate		8.63	15.43	6.97	8.86	4.34	9.48		
Crash Frequency (Recoded)		4		4	9	4	11		
Grash Frequency (Intersection-related)		•	5	3	4	2	1		
Crash Frequency (Driveway-related)		0	0	0	•	1	1		
Crash Frequency (Affected by Road Diet)		3	9	4	6	3	2		
Crash Frequency (Corrected by Road Diet)		2	6	2	2	1	0		
Crash Frequency (Background, Countywide)		1574	1719	1552	1400	1162	1141		
Crash Frequency (Background, Citywide)		296	335	305	275	225	206		
Crash Frequency (Background, Trunklines-Cou	ntywide)	392	440	395	382	292	308		
Grash Frequency (Background, Trunklines-City)	(alda)	85	96	95	102	77	70		
	Crash Analysiz	Method: Simple	(Naïve) Before/Af	ter Analysis					
Average Crathes per Year (Before) 11.00 10 Crath Frequency by Year (Site)									
Average Crashes per Year (After)			8.33						
Percentage Change			-24.24%	25					
Average Crashes per Year (Recoded, Before)			5.33	20			-t-Total		
Average Crashes per Year (Recoded, After)			8.00	20					
Percentage Change			50.00%	15	<u>ر</u>		-s-Recoded		
Average Crashes per Year (Affected, Before)			5.33		N		-a-Affected		
Average Crashes per Year (Affected, After)			3.67	10			Corrected		
Percentage Change			-31.25%		A	\sim			
Average Crashes per Year (Corrected, Before)			3.33		N .	A second			
Average Crashes per Year (Corrected, After)			1.00	0		-			
Percentage Change			-70.00%	2002 2003 20	04 2005 2006 200	17 2008 2009 20	10		
	Crash Analysis Meth	od: Before/After	Comparison with B	leckground Trends					
Background Area Location (County, City)									
						-			
Average Crashes per Year (Countywide, Before	0		4845		er Year (Site, Before	0	11.00		
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After)	0		3708	Average Crashes p	er Year (Site, After)	0	0.33		
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide	-		3705		er Year (Site, After)	•			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Court	ntywide Background (Site, After)		3703 -23.57% 8.41	Average Crashes p Percent Change (5	er Year (Site, After)		0.33		
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countywi	ntywide Background (Site, After)		3703 -23.57% 8.41 -0.67%	Average Crashes p Percent Change (5	er Year (Site, After) te, Defore/After)		0.33		
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Owenil Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countywi Average Crashes per Year (Chywide, Sefore)	ntywide Background (Site, After)		3703 -23.57% 8.41 -0.67% 926	Average Crathet p Percent Change (S Cra	er Year (Site, After) te, Defore/After)		8.33 -24.24%		
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Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year uting Cou Percent Change for Site Adjusted for Countywid Average Crashes per Year (Chywide, After) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywide Thojected Average Crashe per Year uting Chy	rtywide Background (Ste, After) ide Background wide Background (Ste, After)		3703 -23.57% 8.41 -0.67% 926 706 -23.76% 8.39	Average Crathet p Percent Change (5 1800 1300	er Year (Site, After) te, Defore/After)		8.33 -24.24%		
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Average Crashes per Year (Countyvide, Befon Average Crashes per Year (Countyvide, After) Percentage Orania of Countyvide Projected Average Crashes per Year using Coun- Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percentage Orange Orania Per Year using Chy- Percent Change for Site Adjusted for Chyvide Projected Average Crashes per Year using Chyvide Average Crashes per Year (Thurkither-Countyv Average Crashes per Year (Thurkither-Countyv Percentage Change Orania per Year using Thur Projected Average Crashes per Year using Thur	- ntywkie Background (Ste, After) lde Background Background Ads, Sefore) ride, After) ride Akine-Countywide Background (Ste	a, After)	3703 -23.57% 8.41 -0.67% 926 -23.76% 8.39 -0.46% 1227 982 -13.97% 8.80	Average Crathes p Percent Change (5 1800 1300 2002 20 500 400	er Year (Ste, After) te, Before/After) sh Frequency by Yea	ar (Background)	6.33 -34.24% Countywide Chywide		
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Average Crashes per Year (Countyvide, Beford Average Crashes per Year (Countyvide, Atter) Percentage Change Overall Countyvide Projected Average Crashes per Year utiling Countyvide Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percentage Change Overall Chyvide, Percentage Percentage Change Overall Chyvide Projected Average Crashes per Year utiling Chy Percentage Crashes per Year (Trushine-Countyv Average Crashes per Year (Trushine-Countyv Average Crashes per Year (Trushine-Countyv Percentage Change Orashes per Year utiling Thur Percentage Change Per Year Utiline-Chyvide	- rtywide Background (Ste, After) ide Background Background Mide, Sefore) Ada, Stere) Ada, After) Ada Mana-Countywide Background (St a-Countywide Background (St	a, Attar)	3703 -23.57% -23.57% 926 926 -23.76% 8.39 -0.45% 1227 902 -13.97% 8.80 -4.22% 276	Average Crathes p Percent Change (5 1800 1300 2002 20 500 400	er Year (Ste, After) te, Before/After) sh Frequency by Yer	ar (Background)	8.33 -34.245 		
Average Crathes per Year (Countywide, Reford Average Crathes per Year (Countywide, After) Percentrage Crathes per Year utiling Cou- Percent Change for Sta Adjusted for Countywide Percent Change for Sta Adjusted for Countywide Average Crathes per Year (Chywide, After) Percentrage Crathes per Year (Chywide, After) Percentrage Crathes per Year (Chywide, After) Percent Change for Sta Adjusted for Chywide Average Crathes per Year (Chywide, After) Percent Change for Sta Adjusted for Chywide Average Crathes per Year (Trunkine-Countyw Average Crathes per Year (Trunkine-Countyw Projected Average Crathes per Year tang Ton Percent Change for Sta Adjusted for Trunkine Percent Change for Sta Adjusted for Trunkine	- rtywide Background (Ste, After) ide Background Background Mide, Sefore) Ada, Stere) Ada, After) Ada Mana-Countywide Background (St a-Countywide Background (St	a, Attar)	3703 -23.57% 8.41 -0.67% 926 706 -23.76% 8.39 -0.48% 1227 982 -139.97% 8.80 -4.22%	Average Crather p Percent Change (5 1800 1800 1000 2002 20 20 20 20 20 20 20 2	er Year (Ste, After) te, Before/After) sh Frequency by Yer	ar (Background)	L33 -34.245 -Countywide -Chywlde -Chywlde -Truskines- Countywide -Truskines-		
Average Crashes per Year (Countyvide, Beford Average Crashes per Year (Countyvide, Atter) Percentage Change Overall Countyvide Projected Average Crashes per Year utiling Countyvide Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percentage Change Overall Chyvide, Percentage Percentage Change Overall Chyvide Projected Average Crashes per Year utiling Chy Percentage Crashes per Year (Trushine-Countyv Average Crashes per Year (Trushine-Countyv Average Crashes per Year (Trushine-Countyv Percentage Change Orashes per Year utiling Thur Percentage Change Per Year Utiline-Chyvide	- rtywide Background (Ste, After) lide Background Mide Background (Ste, After) Background vide, Bfore) vide, March Mines-Countywide Background (St e-Countywide Background , Before) , Atter)	a, Attar)	3703 -23.57% -23.57% 926 926 -23.76% 8.39 -0.45% 1227 902 -13.97% 8.80 -4.22% 276	Average Crather p Percent Change (5 1800 1800 2002 20 2002 20 200 200 200 200 200 2	er Year (Ste, After) te, Before/After) sh Frequency by Yer	ar (Background)	8.33 -34.245 		
Average Crashes perYear (Countyvide, Beford Average Crashes perYear (Countyvide, After) Percentage Change Ovenil Countyvide Percentage Change Ovenil Countyvide Percentage Change for Site Adjusted for Countyvid Average Crashes perYear (Chyvide, Before) Average Crashes perYear (Chyvide, Before) Percentage Change Ovenil Chyvide Projected Average Crashes perYear using Chyvide Average Crashes perYear (Truskine-Countyv Average Crashes perYear (Truskine-Countyv Percentage Change Crashes perYear using Percentage Change Crashes perYear using Chyvide Average Crashes perYear (Truskine-Countyv Percentage Change for Site Adjusted for Truskine Average Crashes perYear (Truskine-Countyv Percentage Change perYear (Truskine-Countyv Average Crashes perYear (Truskine-Chyvide Average Crashes perYear (Truskine-Chyvide	rtywide Background (Ste, After) ide Background Background Mde, Background Mde, Sterre) ide Kilhee-Countywide Background (St e-Countywide Background , Before) , After)		3703 -22.57% 8.41 -0.67% 925 706 -23.76% 8.39 -0.42% 13227 902 -33.97% 902 -33.97% 902 -33.97% 902 -32.97% 27% 289	Average Crather p Percent Change (5 1800 1800 2002 20 500 400 2002 20 500 100 0 0	er Year (Ste, After) te, Before/After) sh Frequency by Yer	ar (Background)	L33 -34.245 -Countywide -Chywlde -Chywlde -Truskiese- Countywide -Truskiese-		

		Site Chare	ctoristics						
Site No.	33		Length (mi)		0.69				
	Westord		Land Use		Mixed commercia	l analdanatiai			
County	Weators		No. of Driveways/	-	19/6				
City Route/Road Name	Meticx M-115/M-37			meneccons	New markings				
	M-115/M-37 1127810/83012		Treatment Type		New markings				
PR/CS No. BMP					M-37				
	5.241		Nearest Cross Stre						
EMP	5.930		Nearest Cross Stre	HEC	Clark St.				
		Descriptive							
			Before Period			After Period			
Year		2003	2004	2005	2007	2008	2009		
ADT		7349	7275	7039	7033	6702	6834		
Crash Frequency (Total)		12	17	12	6	10	5		
Crash Rate		6.49	9.29	6.78	3.39	5.93	2.66		
Grash Frequency (Recoded)		9	10		3	9	4		
Crash Frequency (Intersection-related)		2	5	2	3	4	1		
Crash Frequency (Driveway-related)		2	1	1	•	•	0		
Crash Frequency (Affected by Road Diet)				5	3	7	4		
Crash Frequency (Corrected by Road Diet)		5	2	2	0	2	1		
Crash Frequency (Background, Countywide)		1259	1317	1003	1030	992	895		
Crash Frequency (Background, Citywide)		20	24	38	11	13	9		
Crash Frequency (Background, Trunklines-Cou	ntywide)	522	668	497	518	499	446		
Crash Prequency (Background, Trunklines-City		12	17	20	7	10	9		
		Method: Simple	(Naive) Before/Aft	ter Analysis					
Average Crashes per Year (Before) 13.47 20 - Crash Requency by Year (Step)									
Average Crashes per Year (After)			7.00						
Percentage Change			-48.78%	25			-		
Average Crashes per Year (Recoded, Before)			9.00				- Total		
Average Crashes per Year (Recoded, After)			5.33	20					
Percentage Change			-40.74%	15			Recoded		
Average Crashes per Year (Affected, Before)			7.00		N		Affected		
Average Crashes per Year (Affected, After)			4.67	30	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-d-Corrected		
Percentage Change			-33.33%	5			_		
Average Crashes per Year (Corrected, Before)			1.00		· · · ·				
Average Crashes per Year (Corrected, After)			1.00	0			٦		
Percentage Change			-66.67%	2002 2003 20	04 2005 2006 20	07 2008 2009 2	010		
	Crash Analysis Meth	od: Before/After	Comparison with R						
the second data and second second second				leckground Trends					
Background Area Location (County, City)				leckground Trends	•				
Background Area Location (County, City) Average Crashes per Year (Countywide, Before	0		3609	-	a ver Year (Site, Befor	•)	13.67		
				Average Crashes p			13.67		
Average Crashes per Year (Countywide, Before			3609	Average Crashes p Average Crashes p	er Year (Site, Befor				
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, Afber)			3609 2925	Average Crashes p Average Crashes p Percent Change (5	er Year (Site, Befor er Year (Site, After) ite, Before/After)		7.00		
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide	ntywide Background (Site, After)		3609 2925 -18.95%	Average Crashes p Average Crashes p Percent Change (5	er Year (Site, Befor er Year (Site, After)		7.00		
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou	ntywide Background (Site, After)		3609 2925 -18.95% 11.08	Average Crashes p Average Crashes p Percent Change (5	er Year (Site, Befor er Year (Site, After) ite, Before/After)		7.00		
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw	ntywide Background (Site, After)		3609 2925 -18.95% 11.08 -29.03%	Average Crashes p Average Crashes p Percent Change (5 1700 Cr	er Year (Site, Befor er Year (Site, After) ite, Before/After)		7.00		
Average Crashes per Year (Countywide, Beford Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyw Average Crashes per Year (Chywide, Sefore)	ntywide Background (Site, After)		3609 2925 -18.95% 11.00 -29.85% 62	Average Crather p Average Crather p Percent Change (5 1700 Cr 1200 Cr	er Year (Site, Befor er Year (Site, After) ite, Before/After)		7.00		
Average Crashes per Year (Countyvide, Befon Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyv Average Crashes per Year (Dityvide, Before) Average Crashes per Year (Dityvide, Ref)	rtywide Background (Site, After) ide Background		3609 2925 -18,93% 11.08 -29,83% 62 33	Average Crashes p Average Crashes p Percent Change (5 1700 Cr	er Year (Site, Befor er Year (Site, After) ite, Before/After)		7.00 -40.70%		
Average Crathes per Year (Countyvide, Befon Average Crathes per Year (Countyvide, Ather) Percentage Change Overall Countyvide Projected Average Crathes per Year utiling Cou Percent Change for Site Adjusted for Countywide Average Crathes per Year (Chywide, Before) Average Crathes per Year (Chywide, Before) Average Crathes per Year (Chywide, Before)	rtywide Background (Ste, After) ide Background wide Background (Ste, After)		3609 2925 -11.95% 11.08 -29.03% 62 33 -46.77%	Average Crashes p Average Crashes p Percent Change (5 1700 Cr 1200 Cr	er Year (Site, Befor er Year (Site, After) ite, Before/After)		7.00 -40.79%		
Average Crashes per Year (Countyvide, Befon Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyv Average Crashes per Year (Chyvide, After) Average Crashes per Year (Chyvide, After) Projected Average Crashes per Year using Chy Projected Average Crashes per Year using Chyvide	rtywide Background (Ste, After) ide Background wide Background (Ste, After) Background (Ste, After)		3608 2935 -18.95% 11.08 -29.83% 62 33 -46.77% 7.27	Average Crathes p Average Crathes p Percent Change (5 1200 Cr 1200 Cr 1200 Cr 1200 Cr	er Year (Sta, Defor er Year (Sta, After) ita, Before/After) main Frequency by 1	ier (Beckground)	7.00 -40.79%		
Average Crashes per Year (Countyvide, Befor Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year uning Cou Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Beford) Average Crashes per Year (Chyvide, Miter) Percentage Change Overall Chyvide Projected Average Crashes per Year uning Chy	ntywide Background (SBe, After) Ide Background Wide Background (Ste, After) Background Vide, Before)		3606 2935 -18.95% 11.08 -29.83% 62 35 -46.77% 7.27 -2.01%	Average Crathes p Average Crathes p Percent Change (5 1200 Cr 1200 Cr 1200 Cr 1200 Cr	er Year (Site, Befor er Year (Site, After) ite, Before/After)		7.00 -40.79%		
Average Crashes per Year (Countyvide, Befor Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyvide Average Crashes per Year (Chyvide, Beford) Average Crashes per Year (Chyvide, After) Percentage Change Overall Chyvide Average Crashes per Year (Invidine-Countyvide Average Crashes per Year (Trunkine-Countyvide- Average Crashes per Year (Trunkine-Countyvide-	ntywide Background (Ste, After) ide Background Background (Ste, After) Background Vide, Background Vide, After)		3609 2325 -11.95% 11.08 -29.05% 62 35 -46.77% 7.27 -2.01% 1687	Average Crashes p Average Crashes p Percent Change (5 1200 200 200 200 200 200 200 200 200 20	er Year (Sta, Defor er Year (Sta, After) ita, Before/After) main Frequency by 1	ier (Beckground)	7.00 -40.79%		
Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crathes per Year uning Cou Percent Change for Ste Adjusted for Countyvid Average Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, After) Percentage Change Overall Chyvide Projected Average Crathes per Year uning Chy Percent	rtywide Background (Ste, After) ide Background Wide Background (Ste, After) Background Wide, After) ide	.a. Aftar)	3609 2925 -18.95% 11.06 -29.87% 62 33 -46.77% 7.27 -2.01% 1687 1463	Average Crathes p Average Crathes p Percent Change (5 1700 Cr 1200 Cr 200 2002 2 2002 2 25	er Year (Sta, Defor er Year (Sta, After) ita, Before/After) main Frequency by 1	ier (Beckground)	7.00 -40.78%		
Average Crashes per Year (Countyvide, Beford Average Crashes per Year (Countyvide, After) Percentage Countyvide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Beford) Average Crashes per Year (Chyvide, Beford) Percentage Crashes per Year (Chyvide, After) Percentage Crashes per Year (Chyvide, Projected Average Crashes per Year using Chy Average Crashes per Year (Trusitione-Countyv Average Crashes per Year (Trusitione-Countyv Percentage Crashes per Year using Chy Projected Average Crashes Year (Trusitione-Countyv Percentage Crashes Per Year using Thur	ntywide Background (Site, After) Ide Background Background Background vide, Sefore) vide, After) ride skinee-Countywide Background (Sit	ie, After)	3609 2925 -18.95% 11.08 -29.05% 62 33 -46.77% 7.27 -2.01% 2687 1463 -13.28% 11.15	Average Crathes p Percent Change (2 1700 Cr 1200 Cr 12	er Year (Sta, Defor er Year (Sta, After) ita, Before/After) main Frequency by 1	ier (Beckground)	7.00 -40.70%		
Average Crathes per Year (Countyvidis, Befon Average Crathes per Year (Countyvidis, Afber) Percentage Crathes per Year utility (Countyvidis Perjedied Average Crathes per Year utility (Cou Percentage Crathes per Year (Chyvidis, Medre) Average Crathes per Year (Chyvidis, Afber) Percentage Crathes per Year (Chyvidis, County) Average Crathes per Year (Thuribine-County) Average Crathes per Year (Thuribine-County) Projected Average Crathes per Year utility Thuribine- Bereard Charge for Sita Adjusted for Thuribine	rtywide Background (Ste, After) ide Background wide Background (Ste, After) Background wide, Store) wide, After) ride skilher-Countywide Background (St	is, After)	3605 2925 -18.97% 11.08 -29.07% 62 33 -46.77% 7.27 -2.01% 1667 1463 -13.28% 11.85 -35.50%	Average Crathes p Average Crathes p Percent Change (5 1200 200 200 200 200 215	er Year (Sta, Defor er Year (Sta, After) ita, Before/After) main Frequency by 1	ier (Beckground)	7.00 -45.79% Countywide Trunklines- Countywide		
Average Crathes per Year (Countyvide, Befor Average Crathes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crathes per Year uting Cou Percent Change for Ste Adjusted for Countyvid Average Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Percentage Change Overall Cryvide, After) Percentage Change Overall Cryvide Projected Average Crathes per Year uting Chy Average Crathes per Year (Trunkine-Countyv Average Crathes per Year (Trunkine-Countyv) Percentage Crathes per Year (Trunkine-Countyv) Percentage Crathes per Year uting Tru Percentage Crathes per Year uting Tru Percentage Crathes per Year uting Trunkine Average Crathes per Year Unitine-Countyv	ntywide Background (SBe, After) ide Background Background Background Kide, Before) vide, After) vide After) vide skilnes-Countywide Background (Sb s-Countywide Background (Sb	ia, Aftar)	3605 2015 -18.97% 11.00 -29.87% 62 33 -46.77% 7.27 -2.01% 1463 -13.28% 11.85 -35.55% 39	Average Crathers p Average Crathers p Percent Change (5 1200 CP 1200 200 2000 24 25 20 15 6	er Year (Sta, Defor er Year (Sta, After) ita, Before/After) main Frequency by 1	ier (Beckground)	7.00 -42.79%		
Average Crashes per Year (Countyvide, Beford Average Crashes per Year (Countyvide, Arbor) Percentage Crashes per Year (countyvide Projected Average Crashes per Year uting Cou Percentage Crashes per Year (Chyvide, Beford) Average Crashes per Year (Chyvide, Beford) Average Crashes per Year (Chyvide, Beford) Percentage Crashes per Year (Chyvide, Arbor) Percentage Crashes per Year (Chyvide, Projected Average Crashes per Year uting Chyvide Average Crashes per Year (Chrvidione-Countyv Average Crashes per Year (Chrvidione-Countyv Percentage Crashes per Year (Chrvidione-Countyv Percentage Crashes per Year (Chrvidione-Countyv Percentage Crashes per Year (Chrvidione-Chyvide Average Crashes per Year (Chrvidione-Chyvide Average Crashes per Year (Chrvidione-Chyvide	ntywide Background (Ste, After) ide Background Background Vide, Background Vide, Before) vide, Before) vide, Mare) ride Mitme-Countywide Background (St e-Countywide Background e, Before) e, After)	ia, Aftar)	3606 2925 -11.975 -10.975 -29.87% 62 33 -46.77% 62 33 -46.77% 7.27 -2.01% 1463 -13.28% 11.85 -35.50% 39 26	Average Crathes p Average Crathes p Percent Change (5 1200 200 200 200 200 215	er Year (Sta, Defor er Year (Sta, After) ita, Defore/After) main Frequency by 1	ier (Beckground)	7.00 -45.79% Countywide Trunklines- Countywide		
Average Crathes per Year (Contryvide, Befor Average Crathes per Year (Contryvide, After) Percentage Crathes per Year utiling Cou Percent Change for Site Adjusted for Contryvide Percent Change for Site Adjusted for Contryvide Percentage Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Percentage Change Overall Cryvide, After) Percentage Crathes per Year utiling Chy Percentage Crathes per Year (Tunkline-Courtyv Average Crathes per Year (Tunkline-Courtyv Average Crathes per Year (Tunkline-Courtyv Percentage Crathes per Year (Tunkline-Courtyv Percentage Crathes per Year (Tunkline-Courtyv Percentage Crathes per Year (Tunkline-Courtyv Percentage Crathes per Year (Tunkline-Cotyvide Average Crathes per Year (Tunkline-Cotyvide Average Crathes per Year (Tunkline-Cotyvide Average Crathes per Year (Tunkline-Chyvide	rtywide Background (Ste, After) ide Background Wide Background Wide, Background Wide, After) Wide After) Mide -Countywide Background (Ste -Countywide Background N, Before) A, After)		3605 2925 -18.95% 11.08 -23.0% 62 33 -46.77% 7.27 -2.0% 1667 1463 -13.28% 1.185 -35.50% 39 26 -33.3%	Average Crather p Average Crather p Percent Change (5 1700 C 1200 2002 20 2002 20 2002 20 2002 20 2002 20 20 20 20 20 20 20 20 20 20 20 20 20 2	er Year (Ste, Befor er Year (Ste, After) ta, Before/After) nañ Frequescyby T 004 2005	Teer (Background)	7.00 -48.79% Truskine- Courtywide Truskine- Courtywide Truskine- Chywide		
Average Crashes perYear (Countyvide, Beford Average Crashes perYear (Countyvide, Arber) Percentrage Change Ovenil Countyvide Projected Average Crashes perYear uting Cou Percent Change for Site Adjusted for Countyvid Average Crashes perYear (Chyvide, Before) Percentrage Change Ovenil Chyvide Projected Average Crashes perYear uting Chy Percent Change for Site Adjusted for Chyvide Average Crashes perYear (Trusitione-Countyv Average Crashes perYear (Trusitione-Countyv Percentage Change Crashes perYear uting Thy Percentage Change Crashes perYear Uting Countyv Average Crashes perYear (Trusitione-Countyv Percentage Change for Site Adjusted for Truskion Average Crashes perYear (Trusitione-Chyvide Average Crashes perYear (Trusitione-Chyvide	ntywide Background (Ste, After) Ide Background Background Background Vide, Sefore) Vide, After) Ide Kilner-Countywide Background (Ste e-Countywide Background (Ste, / Kefore) , After)		3606 2925 -11.975 -10.975 -29.87% 62 33 -46.77% 62 33 -46.77% 7.27 -2.01% 1463 -13.28% 11.85 -35.50% 39 26	Average Crather p Average Crather p Percent Change (5 1700 C 1200 2002 20 2002 20 2002 20 2002 20 2002 20 20 20 20 20 20 20 20 20 20 20 20 20 2	er Year (Sta, Defor er Year (Sta, After) ita, Defore/After) main Frequency by 1	ier (Beckground)	7.00 -48.79% Trunkine- Countywide B-Otywide Trunkine- Citywide		

		Site Charac	ctoristics							
Site No.	54		Length (mil)		0.46					
County	Delta		Land Use		Commercial					
Oby	Dark River		No. of Driveways/		22/2					
Route/Road Name	US-2/US-41		Treatment Type			anging roadway wid				
PR/CS No.	1351805/21021		Treatment Type		Neconstruction cr	anging resoway we	20			
IMP	1351805/21021		Nearest Cross Stre		D Rd.					
EMP	1.296		Nearest Cross Stre		12th Rd.					
LMP	1.286			HK.	Latin KG.					
		Descriptive								
			Before Period			After Period				
Year		2003	2004	2005	2007	2008	2009			
ADT		8174	8133	7089	7896	7509	7512			
Grash Frequency (Total)		11	7	4	6	5	3			
Crash Rate		8.05	5.14	3.37	4.54	3.97	2.56			
Crash Frequency (Recoded)		10	2	4	3	4	2			
Crash Frequency (Intersection-related)		3	1	1	3	1	2			
Crash Frequency (Driveway-related)		2	0	0	0	•	0			
Crash Frequency (Affected by Road Diet)			3	2	4	2	2			
Crash Frequency (Corrected by Road Diet)		2	2	1	1	0	0			
Crash Frequency (Background, Countywide)		1123	1165	977	882	879	826			
Crash Frequency (Background, Citywide)		48	47	35	35	27	25			
Grash Frequency (Background, Trunklines-Cour	(ebiwot	171	101	87	67	88	79			
Grash Frequency (Background, Trunklines-City)						1	2			
		Method: Simple	(Naive) Before/Af	ter Analysis						
Average Crashes per Year (Before) 7.33 20 Crash Frequency by Year (SHe)										
Average Crashes per Year (After)			4.67							
Percentage Change			-36.36%							
Average Crashes per Year (Recoded, Before)			5.33	15						
Average Crashes per Year (Recoded, After)			3.00							
Percentage Change			-43.75%	30			Recoded			
Average Crashes per Year (Affected, Before)			4.33				-4-Affected			
Average Crashes per Year (Affected, After)			2.67			A	Corrected			
Percentage Change			-38.46%	5	>		-			
Average Crashes per Year (Corrected, Before)			1.67		R					
Average Crashes per Year (Corrected, After)			0.33	0		· · · · ·	1			
Percentage Change			-80.00%							
	Crash Analysis Metho	d: Before/After (Comparison with E	Beckground Trend	5					
Background Area Location (County, City)										
	~									
Average Crashes per Year (Countywide, Before)		3265		per Year (Site, Befor		7.33			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After))		2587	Average Crashes p	per Year (Site, After)		4.67			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide	-		2587 -20.77%		per Year (Site, After)					
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Court	tywide Background (Site, After)		2587 -20.77% 5.81	Average Crashes p Percent Change (3	per Year (Site, After)		4.67			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, Afber) Percentage Change Overall Countywide Projected Average Crashes per Year using Cour Percent Change for Site Adjusted for Countywi	tywide Background (Site, After)		2587 -20.77% 5.81 -15.60%	Average Crathes p Percent Change (3 3400 0	per Year (Site, After) Site, Before/After)		4.67			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Owenil Countywide Projected Average Crashes per Year using Countywide Percent Change for Site Adjusted for Countrywid Average Crashes per Year (Chrywide, Before)	tywide Background (Site, After)		2587 -20.77% 5.81 -15.60% 130	Average Crashes p Percent Change (3	per Year (Site, After) Site, Before/After)		4.67			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, Arber) Percentage Crashes per Year using Countywide Projected Average Crashes per Year using Countywide Percent Change for Site Adjusted for Countywid Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Afber)	tywide Background (Site, After)		2587 -20.77% 5.81 -15.60% 130 87	Average Crathes p Percent Change (3 3400 0	per Year (Site, After) Site, Before/After)		4.67 -36.36%			
Average Crather per Year (Countywide, Beford Average Crather per Year (Countywide, Ader) Percentage Change Ovenil Countywide Percent Change for 128 Adjusted for Countywide Average Crather per Year (Chywide, Before) Average Crather per Year (Chywide, Before) Average Crather per Year (Chywide, Before) Average Crather per Year (Chywide, Before)	- rtywide Background (Site, After) de Background		2587 -20.77% 5.81 -15.60% 130 87 -33.08%	Average Crather ; Percent Change (5 1400 0 1200 0 1000 0	per Year (Site, After) Site, Before/After)		4.67			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year ruting County Percent Change for Site Adjusted for Countywide, Average Crashes per Year (Chywide, After) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywlde Thojected Average Crashe per Year uting Chyw	, tywide Background (Site, After) de Background vide Background (Site, After)		2587 -20.77% 5.81 -15.60% 130 87 -33.08% 4.91	Average Crather (Percent Change () 1400	per Year (Site, After) Site, Before/After)		4.67 -36.36%			
Average Crather per Year (Countywide, Beford Average Crather per Year (Countywide, Ader) Percentage Change Ovenil Countywide Percent Change for 128 Adjusted for Countywide Average Crather per Year (Chywide, Before) Average Crather per Year (Chywide, Before) Average Crather per Year (Chywide, Before) Average Crather per Year (Chywide, Before)	, tywide Background (Site, After) de Background vide Background (Site, After)		2587 -20.77% 5.81 -15.60% 130 87 -33.08%	Average Crather Percent Change 3 1400 C 1200	per Year (Site, After) Site, Before/After)		4.67 -36.36%			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year ruting County Percent Change for Site Adjusted for Countywide, Average Crashes per Year (Chywide, After) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywlde Thojected Average Crashe per Year uting Chyw	- tywide Background (Ste, After) de Background vide Background (Ste, After) Background		2587 -20.77% 5.81 -15.60% 130 87 -33.08% 4.91	Average Crashes ; Percent Change (3 3400	per Year (Sta, Aftar) ita, Befora/Aftar) inah Frequency by 1	Year (Background)	4.67 -36.36%			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Orange Overall Countywide Projected Average Crashes per Year using Countywide Percent Change for Site Adjusted for Countywide, Average Crashes per Year (Citywide, After) Average Crashes per Year (Citywide, After) Percentage Change Overall Citywide Projected Average Crashes per Year using Citywide Percent Change for Site Adjusted for Citywide	rtywide Background (Ste, After) de Background wide Background (Ste, After) Background Itackground ida, Sefore)		2587 -20.77% 5.81 -15.62% 130 87 -33.08% 4.91 -3.29%	Average Crashes ; Percent Change (3 3400	per Year (Site, After) Site, Before/After)		4.67 -36.36%			
Average Crashes per Year (Countywide, Beford Average Crashes per Year (Countywide, After) Percentage Change Ovenil Countywide Projected Average Crashes per Year utiling Countywid Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, After) Percentage Change Ovenil Chywide Projected Average Crashes per Year utiling Chy Percent Change for Site Adjusted for Chywide Average Crashes per Year (Chywide	- trywide Background (Ste, After) de Background vide Background (Ste, After) Background Ide, Before) ide, After)		2587 -20.77% 5.81 -15.60% 130 87 -33.05% 4.91 -3.29% 309	Average Crahes ; Percent Change (3 1400 C 1200	per Year (Sta, Aftar) ita, Befora/Aftar) inah Frequency by 1	Year (Background)	4.67 -36.36%			
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Countege Versil Countywide Projected Average Crashes per Year uting Countywide Average Crashes per Year (Chywide, Sefore) Average Crashes per Year (Chywide, After) Percentage Change Oranie per Year uting Chyw Percent Change for 28th Adjusted for Chywlide Average Crashes per Year (Trunkline-Countyw Average Crashes per Year (Trunkline-Countyw	rtywide Background (Ste, After) de Background vide Background (Ste, After) Background dae, Sefore) ide, After) ide	n, Athar)	2587 -20.77% 5.81 -15.60% 130 87 -33.08% 4.91 -3.29% 209 234	Average Crather Percent Change 5 1400 1200 2000 2002 200	per Year (Sta, Aftar) ita, Befora/Aftar) inah Frequency by 1	Year (Background)	4.67 -36.36%			
Average Crashe per Year (Countywide, Beford Average Crashe per Year (Countywide, Adar) Percentage Crashe per Year unitywide Percent Change for Sta Adjusted for Countywide Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Before) Percentage Change Overall Chywide Percentage Change Overall Chywide Percentage Change Orts Adjusted for Chywide Average Crashes per Year (Trusiline-Countyw Average Crashes per Year (Trusiline-Countyw Average Crashes per Year (Trusiline-Countyw Average Crashes per Year (Trusiline-Countyw	- ttywide Background (Ste, After) de Background Background das, Before) ide, After) ide After) ide	n, Athar)	2587 -20.77% 5.81 -15.60% 130 87 -33.08% 4.91 -3.29% 309 234 -24.27%	Average Crahes ; Percent Change (3 3400 1200 3000 800 600 2002 20	per Year (Sta, Aftar) ita, Befora/Aftar) inah Frequency by 1	Year (Background)	4.67 -36.36%			
Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, Arber) Percentage Orange Ovenil Countyvide Projected Average Crashes per Year utiling Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percentage Orange Ovenil Chyvide Projected Average Crashes per Year using Chyvide Average Crashes per Year (Chyvide) Average Crashes per Year (Chyvide)	- tywide Background (Ste, After) de Background Background (Ste, After) Background Ide, Background Ide, After) Ide Countywide Background (Ste -Countywide Background (Ste	s, Attac)	2587 -20.77% 5.81 -15.60% 87 -33.08% 4.91 -3.29% 309 234 -24.27% 5.55	Average Cratter Percent Change 1400 C 1200 C 1	per Year (Sta, Aftar) ita, Befora/Aftar) inah Frequency by 1	Year (Background)	4.67 -36.36%			
Average Crashes per Year (Countyvide, Beford Average Crashes per Year (Countyvide, Keler) Percentage Change Ovenil Countyvide Projected Average Crashes per Year utiling Coun- Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Beford) Percentage Change Ovenil Chyvide, Percentage Percentage Change Ovenil Chyvide, Projected Average Crashes per Year utiling Chy Percentage Crashes per Year (Tunkline-Countyv Average Crashes per Year (Tunkline-Countyv Percentage Crashes per Year (Tunkline-Countyv Percentage Crashes per Year (Tunkline-Countyv Percentage Crashes per Year (Tunkline-Countyv Projected Average Crashes per Year utiling Than Percent Change for Site Adjusted for Tunkline- Average Crashes per Year (Tunkline-Countyv	ritywide Background (Ste, After) de Background Stelground Stelground Ida, Batora) Ida, After) Ida Kilner-Countywide Background (Str -Countywide Background J. Batora)	s, Afbar)	2587 -20.77% 5.81 -15.60% 130 87 -33.09% 4.91 -3.29% 209 234 -34.27% 5.55 -11.09%	Average Crather Percent Change 5 1400 1200 2000 2002 200	Ser Year (Stea Ather) Its, Befory(Ather) Insh Frequency by 004 2006	Tear (Background)	4.67 -36.36%			
Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, Arber) Percentage Countyvide, Arber) Percentage Countyvide Projected Average Crashes per Year utiling Coun- Percentage Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percentage Change Orashes per Year utiling Chy- Percentage Change Orashes per Year utiling Chyvide Projected Average Crashes per Year utiling Chyvide Average Crashes per Year (Truskine-Countyv Average Crashes per Year (Truskine-Countyv Percentage Change Crashes per Year utiling Trus Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Truskine-Countyv Percentage Change per Year utiling Trus Percent Change for Site Adjusted for Truskine Average Crashes per Year (Truskine-Chyvide Average Crashes per Year (Truskine-Chyvide	- ttywide Background (Ste, After) de Background Background Isolground ide, Before) ide, Kiner-Countywide Background (Ste =-Countywide Background , Before) , After)	s, Afber)	2567 -20.77% 5.61 -15.62% 87 -33.03% 4.91 -3.23% 234 -3.427% 234 -3.427% 234 -3.427% 234 -3.23% 234 -3.25% 24 -3.25%	Average Cratter Percent Change 1400 C 1200 C 1	per Year (Sta, Aftar) ita, Befora/Aftar) inah Frequency by 1	Tear (Background)	4.67 -36.36%			
Average Crashes per Year (Countyvide, Beford Average Crashes per Year (Countyvide, Keler) Percentage Change Ovenil Countyvide Projekted Average Crashes per Year utiling Coun Percent: Change for Site Adjusted for Countyvid Average Crashes per Year (Dryvide, Before) Percentage Change Ovenil Chyvide, Percentage Percentage Change Ovenil Chyvide, Percentage Change Ovenil Chyvide Percentage Crashes per Year utiling Chy Percentage Crashes per Year (Tunkline-Countyv Percentage Crashes per Year (Tunkline-Countyv Percentage Crashes per Year (Tunkline-Countyv Percentage Change Ovenil Tunkline-Countyv Percentage Change Ovenil Tunkline-Countyv Percentage Change Ovenil Tunkline-Countyv Percentage Change Ovenil Tunkline-Countyv Percentage Change Ovenil Tunkline-Countyv	tywide Background (Ste, After) de Background Background Background dis, Before) dis, After) (de kilher-Countywide Background (Ste -Countywide Background , Before) , After)		2587 -20.77% -20.77% -31.05% -33.08% -33.08% -34.29% -34.27% 5.55 -32.27% -34.27% 5.55 -32.09% -21	Average Crather Percent Change 2 3400 C 3000 C 300 C	Ser Year (Stea Ather) Its, Befory(Ather) Insh Frequency by 004 2006	Tear (Background)	4.67 -36.36%			

		Site Chara	ctoristics				
Site No.	36		Length (mi)		0.86		
County	Delta		Land Use		Mixed commercial	-residential	
City	Powers		No. of Driveways/	Internettions	42/5		
Route/Road Name	US-41		Treatment Type			dating curbs with re	w marking
PR/CS No.	1322308/55012	1920201/55022					
IMP	41.002	0.000	Nearest Cross Stre		and St.		
EMP	42.277	0.363	Nearest Cross Stre		Spring Rd.		
		Descriptive					
			Before Period			After Period	
ADT		2002	2008	2004	2006	2007	2008
Crash Frequency (Total)		300	4	9	4004	4	4443
Crash Rete		4.72	2.34	5.32	2.09	2.73	2.87
Crash Requency (Recoded)		7	2.54	5.32	2.00	3	28/
Crash Frequency (Intersection-related)		2	1		:	2	6
		_		-	-		
Crash Frequency (Driveway-related)		2	0	1	•	•	0
Crash Frequency (Affected by Road Diet)		5	1	-	-	3	1
Crash Frequency (Corrected by Road Diet) Crash Frequency (Background, Countywide)		3	0	5	0 871	1 882	0 879
				1165	50	882	679
Crash Frequency (Background, Citywide)		51	58	101	50	35 67	44
Crash Frequency (Background, Trunkline-Cou		115		101	~	67	
Crash Frequency (Background, Trunklines-City)		2	(Naive) Before/Af	0	0	0	0
Average Crashes per Year (Before)	Creat Analysi	a method: ample	7.00			terre to	
Average Crashes per Year (After)			3.67	20 Cra	sh Frequency by Ye	ar (Site)	-
Percentage Change			-47.62%				
			4.67	15			-
Average Crashes per Year (Recoded, Before)			2.00				Total
Average Crashes per Year (Recoded, After) Percentage Change			-57.14%	10			Recoded
Average Crashes per Year (Affected, Before)			4.00		*		- Affected
Average Crashes per Year (Affected, After)			1.67		1.		- Corrected
Percentage Change			-58,33%	5 40			- Contected
Average Crashes per Year (Corrected, Before)			2.67		1		
Average Crashes per Year (Corrected, Serore) Average Crashes per Year (Corrected, After)			0.33		<u> </u>		
Percentage Change			-87,50%	2001 2002 20	08 2004 2005 20	06 2007 2008 20	
	Crash Assabais Math	od: Refere (After (
			Companison with I	lackersund Trends			
Eachermond Area Location (County, Chu)		and a second product of	Comparison with I	Beckground Trends			
Background Area Location (County, City) Average Crashes per Year (Countywide, Before			Comparison with L		er Year (Site, Before	4	7.00
	•)			Average Crashes p			7.00
Average Crashes per Year (Countywide, Before	•)		3441	Average Crashes p	er Year (Site, Before er Year (Site, After)		
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After)	0		3441 2632	Average Crathes p Average Crathes p Percent Change (5	er Year (Site, Before er Year (Site, After) ite, Before/After)		3.67
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide	e) ntywide Background (Site, After)		3441 2632 -23.51%	Average Crathes p Average Crathes p Percent Change (5	er Year (Site, Before er Year (Site, After)		3.67
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, Afber) Percentage Change Overall Countywide Projected Average Crashes per Year using Court	e) ntywide Background (Site, After)		3441 2632 -23.51% 5.35	Average Crathes p Average Crathes p Percent Change (5	er Year (Site, Before er Year (Site, After) ite, Before/After)		3.67
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countywi	e) ntywide Background (Site, After)		3441 2632 -23.51% 5.35 -24.11%	Average Crashes p Average Crashes p Percent Change (5 1400 0	er Year (Site, Before er Year (Site, After) ite, Before/After)		3.67 -47.62%
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Owenil Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countrywi Average Crashes per Year (Chywide, Sefore)	e) ntywide Background (Site, After)		3441 2632 -23.51% 5.35 -24.11% 176	Average Crashes p Average Crashes p Percent Change (5 1400 0 1200 •	er Year (Site, Before er Year (Site, After) ite, Before/After)		3.67
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, Arber) Percentage Change Overall Countywide Projected Average Crashes per Year using Cou Percent Change for Site Adjusted for Countywid Average Crashes per Year (Chywide, Before) Average Crashes per Year (Chywide, Arber)	n) ntywide Background (Ste, After) Idde Background		3441 2632 -23.51% 5.35 -24.11% 178 129	Average Crashes p Average Crashes p Percent Change (5 1400 0	er Year (Site, Before er Year (Site, After) ite, Before/After)		3.67 -47.62%
Average Crather per Year (Countyvide, Befon Average Crather per Year (Countyvide, Atter) Percentage Change Overall Countyvide Percent Change for Sta Adjusted for Countyvide Average Crather per Year (Chywlde, Befors) Average Crather per Year (Chywlde, Befors) Average Crather per Year (Chywlde, Befors) Average Crather per Year (Chywlde, Befors)	e) Intywide Background (Ste, After) Ide Background Wide Background (Ste, After)		3441 2632 -23.51% 5.35 -24.11% 178 129 -27.53%	Average Crashes p Average Crashes p Percent Change (5 1400 C 1200 %	er Year (Site, Before er Year (Site, After) ite, Before/After)		3.67 -47.62%
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide Projected Average Crashes per Year uting Cou Percent Change for Site Adjusted for Countywid Average Crashes per Year (Chywide, After) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywide	n) ritywide Background (Ste, After) Ide Background Background (Ste, After) Background		3441 2652 -23.51% 5.35 -24.11% 178 129 -27.53% 5.07	Average Crathes p Average Crathes p Percent Change (C 1200 0 1000 0 1000 0	er Year (Ste, Defor er Year (Ste, After) te, Defore/After) rash Frequency by 1	lear (Background)	3.67 -47.62%
Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Orange Overall Countywide Projected Average Crashes per Year using Countywide Percent Change for Site Adjusted for Countywide Average Crashes per Year (Chywide, After) Average Crashes per Year (Chywide, After) Percentage Change Overall Chywide Projected Average Crashes per Year using Chy Percent Change Orabes per Year using Chywide	n) ntywide Background (Ste, After) Ide Background Wide Background (Ste, After) Background Wide, Before)		3441 2432 -23.51% 5.35 -24.11% 178 129 -27.53% 5.07 -20.09%	Average Crashes p Average Crashes p Percent Change (5 1400 C 1200 %	er Year (Ste, Defor er Year (Ste, After) te, Defore/After) rash Frequency by 1	lear (Background)	3.67 -47.62%
Average Crashes perYear (Countyvide, Beford Average Crashes perYear (Countyvide, Alter) Percentage Change Ovenil Countyvide Projected Average Crashes perYear utiling Coun- Percent Change for Ste Adjusted for Countyvid Average Crashes perYear (Chyvide, Before) Average Crashes perYear (Chyvide, Percentage Percentage Change Ovenil Chyvide Projected Average Crashes perYear utiling Chy Percent	n) ntywide Background (Ste, After) ide Background Wide Background (Ste, After) Background Wide, After)		3441 2632 -23.51% 5.35 -24.11% 178 129 -27.53% 5.07 -20.09% 337	Average Crathes p Average Crathes p Percent Change (5 1400 C 1200 0 1000 0 1000 0 1000 0000	er Year (Ste, Defor er Year (Ste, After) te, Defore/After) rash Frequency by 1	lear (Background)	3.67 -47.62%
Average Crashes perYear (Countyvide, Before Average Crashes perYear (Countyvide, Arber) Percentage Crashes perYear uting Cou Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Setors) Average Crashes per Year (Chyvide, Setors) Percentage Change Oranie per Year uting Chy Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Trunkine-Countyvide Average Crashes per Year (Trunkine-Countyvide)	n) ntywide Background (Ste, After) ide Background Wide Background (Ste, After) Background vide, Before) vide, Before) vide		3441 3632 -23.51% 5.35 -24.11% 178 129 -27.53% 5.07 -20.09% 337 223	Average Crathes p Average Crathes p Percent Change (5 3400 0 3000 0000	er Year (Ste, Defor er Year (Ste, After) te, Defore/After) rash Frequency by 1	lear (Background)	1.67 -47.62%
Average Crathes per Year (Countyvide, Beford Average Crathes per Year (Countyvide, Atter) Percentage Crathes per Year utility, Countyvide Perceit: Change Crathes per Year utility, Cou Perceit: Change for Stat Adjusted for Countyvide Average Crathes per Year (Chywide, Before) Average Crathes per Year (Chywide, Before) Percentage Change Overall Chywide Perceitage Change Overall Chywide Average Crathes per Year utility, Chywide Average Crathes per Year (Trutilities-Countyv Average Crathes per Year (Trutilities-Countyv Average Crathes per Year (Trutilities-Countyv Average Crathes per Year (Trutilities-Countyv	n) ritywide Background (Ste, After) ide Background Wide Background (Ste, After) Background wide, Refore) wide, After) ide Milmer-Countywide Background (St		3441 2632 -23.51% 5.35 -24.11% 120 -27.53% 5.07 -20.09% 337 -20.09%	Average Crathes p Average Crathes p Percent Change (5 1400 C 1200 0 1000 0 1000 0 1000 0000	er Year (Ste, Defor er Year (Ste, After) te, Defore/After) rash Frequency by 1	lear (Background)	3.67 -47.62%
Average Crashes per Year (Countyvide, Beford Average Crashes per Year (Countyvide, After) Percentage Orania Graver (Countyvide Projected Average Crashes per Year uting Cou Percent (Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percentage Orange Orania Per Year uting Chy- Percent (Change for Site Adjusted for Chyvide Projected Average Crashes per Year uting Chy- Average Crashes per Year (Trunkine-Countyv Average Crashes per Year (Trunkine-Countyv Percentage Change Orania Per Year uting Tou- Projected Average Crashes Per Year uting Tou- Projected Average Crashes Per Year uting Tou-	n) ntywide Background (Ste, After) ide Background Background Stefaron wide, Before) wide, After) wide wides-Cauthywide Background (Ste «Countywide Background (Ste		3441 2632 -22.51% 5.35 -24.11% 178 129 -27.53% 5.07 -20.09% 337 233 -30.06% 4.54	Average Crathes p Average Crathes p Percent Change (5 3400 0 1200 0 3000 0 2000 2000 100 0 100 0	er Year (Ste, Defor er Year (Ste, After) te, Defore/After) rash Frequency by 1	lear (Background)	1.67 -47.62%
Average Crathes per Year (Country dide, Befon Average Crathes per Year (Country dide, After) Percentage Crathes per Year utility (Country dide Percentage Crathes per Year utility (Country dide Average Crathes per Year (Chyvide, Meter) Average Crathes per Year (Chyvide, After) Percentage Crathes per Year (Chyvide, After) Percentage Crathes per Year utility (Chyvide Recent Charge for Sta Adjusted for Chyvide Average Crathes per Year (Turkithes-Countrys Average Crathes per Year (Turkithes-Countrys Recent Charge For Sta Adjusted for Thrukith Recent Charge Crathes per Year utility Theo Recent Charge Crathes per Year utility Theo Recent Charge Crathes per Year utility Theo Recent Charge for Sta Adjusted for Thrukith	a) ntywide Background (Sta, After) Ide Background (Sta, After) Background wide, Background wide, Star) wide, Star) wide, Star) wide, Star) science, Countywide Background (Sta wide, Star)		3441 2632 -25.51% 5.55 -24.11% 178 129 -27.53% 5.07 -20.09% 337 233 -30.86% 4.54 -4.57%	Average Crathes p Average Crathes p Percent Change (5 3400 0 3000 0000	er Year (Ste, Defor er Year (Ste, After) te, Defore/After) rash Frequency by 1	lear (Background)	3.67 -47.62%
Average Crashes per Year (Countyvide, Merico Average Crashes per Year (Countyvide, Alter) Percentage Change Ovenil Countyvide Projected Average Crashes per Year utiling Coun- Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Before) Percentage Change Ovenil Chyvide, Percentage Parcentage Change Ovenil Chyvide Projected Average Crashes per Year utiling Chy Percentage Crashes per Year (Trusiline-Countyvid Average Crashes per Year (Trusiline-Countyvid Average Crashes per Year (Trusiline-Countyvid Average Crashes per Year (Trusiline-Countyvid Percentage Change Ovenil Trusiline-Countyvid Percentage Change For Site Adjusted for Trusiline	n) ritywide Background (Ste, After) ide Background wide, Background wide, Background wide, After) vide wide, After) vide wichae-Countywide Background (St w-Countywide Background s, Before) w.After)		3441 2632 -23.51% 5.55 -24.13% 128 -27.53% 5.07 -20.09% 337 -20.09% 337 -20.09% 4.54 -4.54 -36.76% 2	Average Crathes p Average Crathes p Percent Change (5 3400 0 1200 0 3000 0 2000 2000 100 0 100 0	er Year (Ste, Defor er Year (Ste, After) te, Defore/After) rash Frequency by 1	lear (Background)	3.67 -47.62%
Average Crashes perYear (Countyvide, Beford Average Crashes perYear (Countyvide, After) Percentage Change Ovenil Countyvide Projected Average Crashes perYear uting Cou Percent Change for Site Adjusted for Countyvid Average Crashes perYear (Chyvide, Beford) Average Crashes perYear (Chyvide, Beford) Percentage Change Ovenil Crashes perYear uting Chyvide Projected Average Crashes perYear uting Chyvide Average Crashes perYear (Truskine-Countyvi Average Crashes perYear (Truskine-Countyvi Percentage Change Crashes perYear uting Trus Percent Change for Site Adjusted for Chyvide Average Crashes perYear (Truskine-Countyv Percentage Change Ovenil Truskine-Countyv Percent Change for Site Adjusted for Truskine Average Crashes perYear (Truskine-Countyvie Average Crashes perYear (Truskine-Chyvide	n) ntywide Background (Ste, After) ide Background (Ste, After) Background wide, Background wide, After) ride wide, Steroe) wide, Steroe) a, Steroe) a, After)	te, After)	3441 2632 -23.51% 325 -24.11% 178 129 -27.53% 337 -20.09% 337 -20.09% 337 -20.09% 4.84 -36.76% 2 0	Average Crathes p Average Crathes p Percent Change (5 3400 0 1200 0 3000 0 2000 2000 100 0 100 0	er Year (Ste, Before er Year (Ste, After) te, Before/After) mah Frequency by 1 2004 2005	lear (Background)	3.67 -47.62N -e-Countywide -e-Chywlde -d-Thukines- Countywide -f-Thukines-

		Site Charac	teristics						
Site No.	37		Length (mil)		0.30				
County	Eaton		Land Use		Commercial				
Oby	Grand Ledge		No. of Driveways/		4/4				
Route/Road Name	M-100		Treatment Type	internet octors		dating curbs with re			
PR/CS No.	566510/23072		Treatment Type		separang waran e	atting curos with h	w marcings		
IMP	9.511		Nearest Cross Stre		River St.				
EMP	9.511		Nearest Cross Stre						
LMP	3.20B			HK.	Washington St.				
		Descriptive							
			Before Period			After Period			
Year		2004	2005	2006	2008	2009	2010		
ADT		14135	14460	14315	13201	14216	14657		
Crash Frequency (Total)		20	5	34	7	2	30		
Crash Rate		13.05	3.19	9.02	4.89	1.30	6.29		
Crash Frequency (Recoded)		11	4	,	5	2			
Crash Frequency (Intersection-related)			0	5	1	1	0		
Crash Frequency (Driveway-related)		•	0	0	•	•	0		
Crash Frequency (Affected by Road Diet)		14	1	7	4	2	5		
Grash Frequency (Corrected by Road Diet)		9	i	5	1	ĩ	3		
Crash Frequency (Background, Countywide)		3082	2732	2332	2506	2201	2389		
Grash Frequency (Background, Citywide)		177	145	135	143	142	116		
Grash Frequency (Background, Trunklines-Cour	tywide)	1217	1005	936	890	826	848		
Grash Frequency (Background, Trunklines-City)		120	87	54	94		85		
		Method: Simple							
Average Crashes per Year (Before)			13.00	30 Cm	ah Frequency by Ye	ar (Sha)			
Average Crashes per Year (After)			6.33	~	and a second set of	an (secol			
Percentage Change			-51.20%	25					
Average Crashes per Year (Recoded, Before)			7.33	1			Total		
Average Crashes per Year (Recoded, After)			5.00	20					
Percentage Change			-31.02%				Recoded		
Average Crashes per Year (Affected, Before)			7.33	11 11			Affected		
Average Crashes per Year (Affected, After)			3.67	16 - 16 - 04	1		-t-Corrected		
Percentage Change			-50.00%						
Average Crashes per Year (Corrected, Before)			5.00	• • • • • • •					
			1.67	0			1		
Average Crather per rear (Corrected, Arter) Percentage Change	Crash Analysis Metho	od: Before/After (1.67 -66.67%	2003 2004 20		08 2009 2010 20	1		
	Crash Analysis Metho	od: Before/After (-66.67%	2003 2004 20		08 2009 2010 20	1		
Fercentage Change		od: Before/After (-66.67%	2003 2004 20 Seckground Trends			13.00		
Percentage Change Background Area Location (County, Oty)		od: Before/After (-66.67% Comparison with I	2003 2004 20 Beckground Trends Average Crather p	•	•			
Percentage Change Background Area Location (County, City) Average Crashes per Year (Countywide, Before		od: Before/After C	-66.57% Comparison with I 8146	2003 2004 20 Background Trends Average Crathes p Average Crathes p	a xer Year (Site, Defor xer Year (Site, After)	•	13.00		
Percentage Change Background Area Location (County, Chy) Average Crathes per Year (Countywide, Before Average Crathes per Year (Countywide, After) Percentage Change Overail Countywide)	od: Before/After (-66.67% Comparison with I 8146 7096	2003 2004 20 Beckground Trends Average Crather p Average Crather p Percent Change (S	s ver Year (Site, Beforn ver Year (Site, After) ite, Before/After)	•)	13.00 6.33 -51.29%		
Percentage Change Beckground Area Location (County, City) Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, Atter) Percentage Change Overall Countyvide Projected Average Crashes per Year using Cou) tywide Dackground (Site, After)	od: Before/After (-66.57% Comparison with I 8146 7096 -12.89% 11.32	2003 2004 20 Beckground Trends Average Crather p Average Crather p Percent Change (S	s ver Year (Site, Beforn ver Year (Site, After) ite, Before/After)	•	13.00 6.33 -51.29%		
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countywide, Before Average Crashes per Year (Countywide, After) Percentage Change Orashes per Year uting Court Percent Change for Site Adjusted for Countywide) tywide Dackground (Site, After)	od: Before/After C	-66.67% Comparison with I 8146 7096 -12.89% 11.32 -38.39%	2003 2004 20 Jackground Trends Average Crashes p Percent Change (5 3500 4	s ver Year (Site, Beforn ver Year (Site, After) ite, Before/After)	•)	13.00 6.33 -51.29%		
Percentage Change Background Area Location (County, Chy) Average Crather per Year (Countyvide, Sefore Average Crather per Year (Countyvide, Arter) Percentage Change Overall Countyvide Projected Average Crather per Year utiling Countyvide Percent Change for Site Adjusted for Countyvide Average Crather per Year (Chyvide, Sefore)) tywide Dackground (Site, After)	od: Before/After C	-66.57% Comparison with I 8146 7096 -12.89% 11.32	2003 2004 20 Beckground Trends Average Crather p Average Crather p Percent Change (S	s ver Year (Site, Beforn ver Year (Site, After) ite, Before/After)	•)	13.00 6.33 -51.29%		
Percentage Change Beckground Area Location (County, Chy) Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, Atter) Percentage Change Crashes per Year using Countyvide Percent Change for 25te Adjusted for Countyvid Average Crashes per Year (Chyvide, Atter) Average Crashes per Year (Chyvide, Atter)) tywide Dackground (Site, After)	od: Before/After C	-66.57% Comparison with I 8146 7096 -12.89% 11.32 -38.39% 457 401	2003 2004 20 Background Trends Average Crashes p Average Crashes p Percent Change (5 3500 4 2500 4	s ver Year (Site, Beforn ver Year (Site, After) ite, Before/After)	•)	13.00 6.33 -51.29%		
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, After) Percentage Change Ovenil Countyvide Projected Average Crashes per Year Lafte Cou Percent Change for Site Adjusted for Countyvid Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percentage Change Ovenil Chyvide, Before)) tywide Baciground (Sbs, After) de Baciground	od: Before/After C	-66.67% Comparison with 1 8146 7096 -12.89% 11.32 -38.39% 457 401 -12.27%	2003 2004 20 Background Trend: Average Crashes p Average Crashes p Percent Change (5 3500 4 2500 4 1000 4	s er Year (Sta, Defon er Year (Sta, After) ita, Defora/After) Crash Frequency by	•)	13.00 6.33 -51.28%		
Percentage Dunge Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Before Average Crathes per Year (Countyvide, Arber) Percentage Orange Oranhes per Year using Court Percent Change for Site Adjusted for Countyvid Average Crathes per Year (Chyvide, Sefore) Average Crathes per Year (Chyvide, After) Percentage Crathes per Year (Chyvide, After)) tywide Background (Sbe, After) de Background vide Background (Ste, After)	od: Before/After C	-66.67% Comparison with I 8146 7066 -12.89% 11.32 -38.39% 457 401 -12.25% 11.41	2003 2004 20 Background Trend: Average Crashes p Average Crashes p Percent Change (5 3500 4 2500 4 1000 4	s ver Year (Site, Beforn ver Year (Site, After) ite, Before/After)	•)	13.00 6.33 -51.29%		
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Reford Average Crashes per Year (Countyvide, Reford Percentage Change Overall Countyvide Percent Change for T&A Adjusted for Countyvid Average Crashes per Year (Chyvide, Reford) Average Crashes per Year (Chyvide, Reford) Average Crashes per Year (Chyvide, Reford) Percent Change Overall Chyvide Percent Change For T&A Adjusted for Chyvide) tywide Background (Site, After) de Background socground (Site, After) accground	od: Before/After C	-66.67% comparison with 1 8146 7096 -12.89% 11.32 -30.39% 401 -12.25% 11.41 -39.03%	2003 2004 20 Iackground Trends Average Crather p Percent Change (5 1500 6 1500 6 500 6 500 6	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	*) Year (Background)	13.00 6.33 -51.29% -&- Countywide -&- Trunklines- Countywide		
Percentage Change Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Sefore Average Crathes per Year (Countyvide, Arter) Percentage Change Overall Countyvide Projected Average Crathes per Year uting Countyvid Average Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Percentage Change Overall Chyvide, Before) Percentage Change Overall Chyvide, Arter) Percentage Change Overall Chyvide Projected Average Crathes per Year uting Chyl Average Crathes per Year (Lhyvide, Before) Percent) tywide Background (Ste, After) de Background Vide Background (Ste, After) Background tide, Sefore)	od: Before/After C	-66.67% Comparison with I 8146 7096 -12.89% 11.132 -38.39% 457 457 401 -122.25% 11.41 10.41 -32.03% 3156	2003 2004 20 teckground Trends Average Crather p Average Crather p Percent Change (5 1500 4 2500 4 1500 4 1500 5 1500	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	•) Year (Background)	13.00 6.33 -51.29% -&- Countywide -&- Trunklines- Countywide		
Percentage Dunge Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Before Average Crathes per Year (Countyvide, Marc) Percentage Orange Ovenil Countyvide Projected Average Crathes per Year using Countyvide Average Crathes per Year (Chyvide, Sefore) Average Crathes per Year (Chyvide, After) Percentage Crathes per Year (Chyvide, After) Percentage Crathes per Year (Chyvide, After) Percentage Crathes per Year (Chyvide, After) Average Crathes per Year (Invitine-Countyvi Average Crathes per Year (Trunkline-Countyvi Average Crathes per Year (Trunkline-Countyvi) tywide Background (Ste, After) de Background Vide Background (Ste, After) Background dide, Before) dide, After)	od: Before/After C	-66.67% Comparison with 1 8146 7096 -12.89% 11.32 -38.39% 401 -12.25% 401 -12.25% 3156 2564	2003 2004 20 Iackground Trends Average Crather p Percent Change (5 1500 6 1500 6 500 6 500 6	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	•) Year (Background)	13.00 6.33 -51.29% -&- Countywide -&- Trunklines- Countywide		
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crashes per Year utiling Coun- Percent Change for Site Adjusted for Countyvide Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Average Crashes per Year (Chyvide, Before) Percentage Change Overall Chyvide, After) Percentage Change Overall Chyvide Average Crashes per Year (Invisione-Countyv Average Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Countyv Average Crashes per Year (Trunkline-Countyv) tywide Background (Ste, After) de Background tel Background (Ste, After) dackground tide, Sefore) tide, Attar) tide		-66.67% Comparison with I 8146 7096 -12.89% 11.132 -36.39% 401 -12.25% 11.41 -30.03% 3156 2564 -13.76%	2000 2004 20 Average Crather p Average Crather p Percent Charge 2 3500 500 500 2002 200	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	•) Year (Background)	13.00 6.33 -51.29%		
Percentage Dunge Background Area Location (County, Oty) Average Crathes per Year (Countyvide, Before Average Crathes per Year (Countyvide, Marc) Percentage Onage Overall Countyvide Projected Average Crathes per Year uting Countyvide Average Crathes per Year (Dayvide, Before) Average Crathes per Year (Dayvide, Before) Average Crathes per Year (Dayvide, Before) Percentage Crathes per Year (Dayvide, Before) Percentage Crathes per Year (Dayvide, Before) Average Crathes per Year (Dayvide, Before) Average Crathes per Year (Dayvide, Before) Average Crathes per Year (Dayvide, Before) Percentage Crathes per Year (TrunkIne-Countyw Average Crathes per Year uting Trunk Projected Average Crathes per Year uting Trunk) tywide Background (Ste, After) de Background sciground ide, Sefore) ide, Ketre) ide line-Countywide Background (Str		-66.67% Comparison with 1 8146 7096 -12.89% 11.52 -33.39% 401 -12.25% 401 -30.03% 2564 -31.76% 20.56	2003 2004 20 teckground Trends Average Crather p Average Crather p Percent Change (5 1500 4 2500 4 1500 4 1500 5 1500	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	•) Year (Background)	13.00 6.33 -51.29%		
Percentage Change Background Area Location (County, Chy) Average Crashe per Year (Countyvide, Reford Average Crashe per Year (Countyvide, Ader) Percentage Change Overall Countyvide Percentage Change Overall Countyvide Percentage Crashes per Year (Chyvide, After) Percentage Crashes per Year (Turkiline-Countyw Average Crashes per Year (Turkiline-Countyw Percentage Change Overall Turkiline-Countyw Percentage Crashes per Year (Turkiline-Countyw Percentage Crashes per Year (Turkiline-Countyw Percentage Crashes per Year Turkiline-Countyw Percentage Crashes per Year Change Turkiline-Countyw Percentage Crashes per Year Chyvide for Turkiline) tywide Background (Ste, After) de Background ackground dis, Background (Ste, After) ide, After) ide kines-Countywide Background (Str -Countywide Background (Str		-66.67% Comparison with 1 8146 7096 -12.89% 11.32 -33.39% 457 -12.25% 457 -12.25% 457 -13.25% 3156 -13.76% 10.56 -33.57%	2000 2004 20 Average Crather p Average Crather p Percent Charge 2 3500 500 500 2002 200	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	•) Year (Background)	13.00 6.33 -51.29% -Countywide -Countywide -countywide		
Percentage Change Background Area Location (County, Chy) Average Crathes per Year (Countyvide, Sefore Average Crathes per Year (Countyvide, After) Percentage Change Overall Countyvide Projected Average Crathes per Year uting Coun- Percentage Change Per (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Average Crathes per Year (Chyvide, Before) Percentage Change Overall Chyvide, Before) Percentage Change Overall Chyvide, Before) Percentage Change Overall Chyvide, Before) Percentage Change Overall Chyvide Average Crathes per Year (Tunkline-Countyw Average Crathes per Year (Tunkline-Countyw Projected Average Crathes per Year uting Trus Percentage Change Overall Thruskine-Countyw Projected Average Crathes per Year uting Trus Percentage Change Per Year uting Trus Percentage Change Per Year uting Trus Percentage Change Per Year uting Truskine-Countyw Percentage Change Per Year Utinkine-Countyw Percentage Change Percentage Perce) tywide Background (Ste, After) de Background Background Background Ide, After) Ide, After) Ide, After) Ide Alther-Countywide Background (Ste -Countywide Background Before)		-66.67% Comparison with 1 8146 7096 -12.89% 11.32 -30.39% 401 -12.27% 11.43 -30.03% 3156 2564 -13.76% 30.56 -25.52% 259	2000 2004 20 acciground Trends Average Crasher p Percent Charge 5 3500 4 2500 500 200 200 200 200 200 200 200 20	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	•) Year (Background)	13.00 6.33 -51.28% -&- Countywide -&- Trunklines- Countywide -&- Trunklines-		
Percentage Dunge Background Area Location (County, Ohy) Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, Sefore Percentage Onage Overall Countyvide, Sefore Projected Average Crashes per Year using Countyvide Projected Average Crashes per Year Countyvide, Average Crashes per Year (Chyvide, Sefore) Average Crashes per Year (Chyvide, Sefore) Projected Average Crashes per Year (Chyvide, Projected Average Crashes per Year (Chyvide) Average Crashes per Year (Chyvide) Average Crashes per Year (Chuvide) Percent Change for Site Adjusted for Chyvide) Projected Average Crashes per Year (Innitine-Countyw Projected Average Crashes per Year (Innitine-Countyw) Projected Average Crashes per Year (Innitine-Countyw) Projected Average Crashes per Year (Innitine-Countyw) Projected Average Crashes per Year (Innitine) tywide Background (Ste, After) de Background Background Background Ide, After) Ide, After) Ide, After) Ide Alther-Countywide Background (Ste -Countywide Background Before)		-66.67% Comparison with 1 8146 7096 -12.89% 11.52 -33.39% 401 -12.25% 401 -12.25% 401 -39.03% 3156 2564 -33.52% 239 273	2000 2004 20 Average Crather p Average Crather p Percent Charge 2 3500 500 200 200 200 200 200	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	•) Year (Background)	13.00 6.33 -51.29% -Countywide -Countywide -countywide		
Percentage Change Background Area Location (County, Chy) Average Crashes per Year (Countywide, Befors Average Crashes per Year (Countywide, Refors Percentage Change Overall Countywide Projected Average Crashes per Year stafts Countywide Percentage Crashes per Year (Chywide, Befors) Average Crashes per Year (Trusiline-Countyw Percentage Crashes per Year (Trusiline-Chywide Average Crashes per Year (Trusiline)) tywide Background (Ste, After) de Background Ste, After) de, Background dide, Sterne) die Alterne) de Destrej After)	n, Athar)	-66.67% Comparison with 1 8146 7096 -12.89% 11.32 -38.39% 457 401 -12.25% 457 457 457 457 2564 -13.76% 2564 -13.75%	2000 2004 20 acciground Trends Average Crasher p Percent Charge 5 3500 4 2500 500 200 200 200 200 200 200 200 20	s ser Year (Sta, Defor ser Year (Sta, After) ita, Defore/After) Inash Frequency by	•) Year (Background)	13.00 6.33 -51.28% -&- Countywide -&- Trucklines- Countywide -&- Trucklines-		
Percentage Change Eackground Area Location (County, Chy) Average Crashes per Year (Countyvide, Before Average Crashes per Year (Countyvide, Sefore Percentage Change Ovenil Countyvide, Sefore Percentage Change Ovenil Countyvide, Sefore Average Crashes per Year (Chyvide, Sefore) Average Crashes per Year (Chyvide, Sefore) Average Crashes per Year (Chyvide, Sefore) Percentage Change Ovenil Chyvide Percentage Change Ovenil Chyvide Average Crashes per Year (Chyvide) Average Crashes per Year (Chyvide) Average Crashes per Year (Chyvide) Average Crashes per Year (Trunkline-Countyw Percentage Change Ovenil Trunkline-Countyw Percent Change for Site Adjusted for Chyvide Average Crashes per Year (Trunkline-Countyw Percent Change for Site Adjusted for Trunkline Average Crashes per Year (Trunkline-Chyvide Average Crashes per Year (Trunkline-Chyvide)) tywide Background (Ste, After) de Background Background ide, Background ide, Background ide, Background ide (Bine-Countywide Background (Ste -Countywide Background (Ste, A Refer) After)	n, Athar)	-66.67% Comparison with 1 8146 7096 -12.89% 11.52 -33.39% 401 -12.25% 401 -39.03% 11.41 -39.03% 2564 -31.76% 10.56 -32.52% 239 273	2000 2004 20 ackground Trends Average Crather p Percent Change 5 3500 4 2500 4 2	s er Year (Sta, Befor Ita, Before/After) Crash Prequency by	*) Year (Background) 2010 2012 2010 2012	13.00 6.33 -51.28% -& Countywide -& Trunklines- Countywide -& Trunklines- Chywide		

		Site Chara	charistics				
Site No.	10		Length (mil)		0.39		
					Residential		
County	Alpena		Land Use		Residential 14/5		
City	Alpena		No. of Driveways/	Intersections			
Route/Road Name	9th Awe.		Treatment Type		New markings		
PR/CS No.	3040011						
	0.615		Nearest Cross Stre		Chisoim St.		
EMP	1.005		Nearest Cross Stre	Het.	Oldfield St.		
		Descriptive	Statistics				
			Before Period			After Period	
Year		1999	2000	2001	2005	2004	2005
ADT		n/a	n/a	n/a	n/a	n/a	n/a
Crash Frequency (Total)		27	32	38	15	12	30
Crash Rate		n/a	n/a	n/a	n/a	n/a	n/a
Crash Frequency (Recoded)				9	11	5	6
Crash Frequency (Intersection-related)				4	10	2	2
Crash Frequency (Driveway-related)		no data pr	for to 2001	0	0	0	0
Crash Frequency (Affected by Road Diet)					ü	š	ē
Crash Frequency (Corrected by Road Diet)					3	ĩ	ĩ
Crash Frequency (Background, Countywide)		889	979	730	799	685	612
Crash Frequency (Background, Chywide)		445	434	308	330	240	240
Crash Frequency (Background, Trunkline-Cour	(ablance)	131	140	115	132	149	71
Crash Frequency (Background, Trunkline-Ctv		56	38	37	32	42	27
		Method: Simple					4
Average Crashes per Year (Before)			25.67	-	uh Frequency by Yes	ar (Site)	_
Average Crashes per Year (After)			12.55	~			
Percentage Change			-51.95%	40			
Average Crashes per Year (Recoded, Before)			9.00				-t-Total
Average Crashes per Year (Recoded, After)			7.33	30	•		
Percentage Change			-18.52%	- • • • • • • • • • • • • • • • • • • •	N		Recoded
Average Crashes per Year (Affected, Before)			8.00	20	<u> </u>		Affected
Average Crashes per Year (Affected, After)			7.33		· · · ·		Corrected
Percentage Change			4.32%	10		and the second s	-
Average Crashes per Year (Corrected, Before)			7.00		•	1 miles	
Average Crashes per Year (Corrected, After)			1.67	0			-
Percentage Change			1.67 76.19% 1998 1999 2000 2001 2002 2003 2004 2005 2			03 2004 2005 20	06
	Crash Analysis Meth	od: Before/After		ackground Trend			
Background Area Location (County, Oty)					-		
Average Crashes per Year (Countywide, Before			2598	Average Crashes p	er Year (Site, Before	0	25.67
Average Crashes per Year (Countywide, After)			2096		er Year (Site, After)		12.33
Percentage Change Overall Countywide			-19.32%	Percent Change (S	its, Before/After)		-51.95%
Projected Average Crathes per Year using Cour	tywide Background (Site, After)		20.71		trash Prequency by 1	lear (Background)	
Percent Change for Site Adjusted for Countywi	de Background		-32.63%				
Average Crashes per Year (Citywide, Before)			1190	1			
Average Crashes per Year (Citywide, After)			818	1000			
Percentage Change Overall Citywide			-31.26%		S		-Countywide
Projected Average Crathes per Year using City	vide Background (Site, After)		17.64		~~~	~	
Percent Change for Site Adjusted for Citywide I			-20.69%		*	-	
Average Crashes per Year (Trunklines-Countyw			306	500			
Average Crashes per Year (Trunklines-Countyw			352		2002	2004 2006	
Percentage Change Overall Trunkline-Countyw			-0.01%	500	-		-8-Otywide
Projected Average Crathes per Year using Trun		a Afteri	23.41	400	<u> </u>		
a colorense successive real real real film			-43.14%	300	~~		-a-Trunkines-
Demant Change for Site Adjusted for Truckling	CONTRACTOR DESCRIPTION OF THE PARTY OF THE P						Countywide
Percent Change for Site Adjusted for Trunkline Average Crasher per Ver (Trunkline) Charida	Reform		131				
Average Grashes per Year (Trunklines-Otywide,			151	200			d. Tranking or
Average Crashes per Year (Trunklines-Otywide, Average Crashes per Year (Trunklines-Otywide,			101	100	• <u>• •</u> • •	-	-t-Trunklines-
Average Crashes per Year (Trunklines-Otywide Average Crashes per Year (Trunklines-Otywide Percentage Change Overall Trunkline-Citywide	After)		101 -22.90%		*****		-t-Trunklines- Citywide
Average Crashes per Year (Trunklines-Otywide, Average Crashes per Year (Trunklines-Otywide,	After) klines-Citywide Background (Site, A	Atter)	101	100	* * * * * * * * * *	2004 2006	Citywide

		Site Chare	ctoristics					
Site No.	40		Length (mi)		0.50			
County	Oscoda		Land Use		Commercial			
Oby	Dig Creek		No. of Driveways/	Internections	31/7			
Route/Road Name	M-33		Treatment Type		Reconstruction wi	thin existing curbs		
PR/CS No.	1334402/58011				New signal timing			
EMP	9.395		Nearest Cross Stre	*	14th St.			
EMP	9.892		Nearest Cross Stre		9th St.			
		Descriptive						
		Descriptive	Before Period		1	After Period		
Year ADT		2002	2008	2004	2006	2007	2008	
Crash Frequency (Total)		4	3/8/	3	5	1		
Crash Requency (rocal)		5.76	11.61	4.26	7,53	13.67	16.54	
Crach Rate Crach Frequency (Recoded)		5.76	4	4.26	7.55	13.67	16.54	
		-		-	-	-	-	
Crash Frequency (Intersection-related)		1	1	1	1	•	0	
Crash Frequency (Driveway-related)		0	0	0	1	•	1	
Crash Frequency (Affected by Road Diet)		1	3	1	2	•	1	
Crash Frequency (Corrected by Road Diet)		1	2	0	1	•	1	
Crash Frequency (Background, Countywide)		236	237	217	166	141	140	
Crash Frequency (Background, Citywide)		115	110	111	87	81	78	
Crash Frequency (Background, Trunklines-Cour		90	99	87	68	54	48	
Crash Frequency (Background, Trunklines-City)		8	61	42	43	34	30	
	Crash Analysis	Method: Simple	(Naive) Before/Af	ter Analysis				
Average Crashes per Year (Defore)			5.00	20 Cn	ash Frequency by Te	ar (Site)	-	
Average Crashes per Year (After)			7.00					
Percentage Change			40.00%	15			_	
Average Crashes per Year (Recoded, Before)			3.00				Total	
Average Crashes per Year (Recoded, After)			6.00				Recoded	
Percentage Change			100.00%	10			Affected	
Average Crashes per Year (Affected, Before)			1.67		Α	<u> </u>		
Average Crashes per Year (Affected, After)			1.00	5	1		-0-Corrected	
Percentage Change			-40.00%		*			
Average Crashes per Year (Corrected, Before)			1.00			· · · · ·		
Average Crashes per Year (Corrected, After)			0.67	0	00 2004 2005 2		-	
Percentage Change			-33.33%			06 2007 2008 2		
	Crash Analysis Metho	d: Before/After	Comparison with B	leckground Trend	la 🛛			
Background Area Location (County, Oty) Average Crashes per Year (Countywide, Before)			690		per Year (Site, Befor		5.00	
	,		447		per Year (Site, After) per Year (Site, After)		7.00	
Average Crashes per Year (Countywide, After) Percentage Change Overall Countywide			-35,22%		per Year (Site, After) Site, Before/After)		7.00	
Percentage Change Overall Countywide Projected Average Crashes per Year using Court	tracida Backson and (Cha. Albert		-35.22%				40.00%	
				250 Crash F	requency by Year (D	ackground)		
Percent Change for Site Adjusted for Countywi	de Background		75.22%	- · ·	- N			
			347	1 1	1			
Average Crashes per Year (Citywide, Before)								
Average Crashes per Year (Citywide, Before) Average Crashes per Year (Citywide, After)			246	200				
Average Crashes per Year (Citywide, Before) Average Crashes per Year (Citywide, After) Percentage Change Overall Citywide			246	200			Countywide	
Average Crashes per Year (Citywide, Before) Average Crashes per Year (Citywide, After) Percentage Change Overall Citywide Projected Average Crashes per Year using Cityv			246 -29.11% 3.54					
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		Site Chara	ctoristics				
Site No.	43		Length (mi)		0.62		
			Land Use		Mixed commercial-re	and a second sec	
County	Ingham East Lansing		No. of Driveways/	at a set of the set	27/11		
Oby Route/Road Name	Abbott Rd.			memeccons	New markings		
	Abbott Rd. 349410		Treatment Type		New markings		
PR/CS No. BMP					Albert Ave.		
	0.174		Nearest Cross Stre				
EMP	0.791		Nearest Cross Stre	#C	Whitehills Dr./ Oxfor	0 R.C.	
		Descriptive					
			Before Period			After Period	
Year		1996	1997	1998	2000	2001	2002
ADT		n/a	15190	n/a	8239	n/a	17550
Crash Frequency (Total)		51	48	46	37	41	51
Crash Rate		n/a	14.05	n/a	19.94	n/a	12.90
Crash Frequency (Recoded)						28	39
Crash Frequency (Intersection-related)					and the set of the	7	9
Crash Frequency (Driveway-related)			no data prior to 2003		no data prior to 2001	2	2
Crash Frequency (Affected by Road Diet)					2001	26	32
Crash Frequency (Corrected by Road Diet)						7	6
Grash Frequency (Background, Countywide)		11549	11560	10376	11048	10712	10768
Crash Frequency (Background, Citywide)		1178	1215	1229	1132	1114	1144
Grash Frequency (Background, Trunklines-Cour	tywide)	3067	3086	2781	2716	2745	2696
Crash Frequency (Background, Trunklines-City)		312	352	373	311	259	242
		Method: Simple	(Naive) Before/Aft				
Average Crashes per Year (Defore)			48.33	100 Cra	ah Frequency by Year	(Site)	_
Average Crashes per Year (After)			43.00				
Percentage Change			-11.03%				_
Average Crathes per Year (Recoded, Before)			a/a	~			Total
Average Crashes per Year (Recoded, After)			33.50				
Percentage Change			n/a	- e			-s-Recoded
Average Crashes per Year (Affected, Before)			n/a		····•	-	Affected
Average Crathes per Year (Affected, After)			29.00			-	Corrected
Percentage Change			n/a	20			_
Average Crashes per Year (Corrected, Before)			n/a			-	
Average Crashes per Year (Corrected, After)			6.50	0			7
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	Crash Analysis Meth	od: Before/After	Comparison with B	eckground Trends	1		
Background Area Location (County, City)							
Average Crashes per Year (Countywide, Before)		33405	Average Crashes p	er Year (Site, Before)		48.33
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			-2.00%	Parrant Change (5)	ite, Before/After)		-11.03%
Percentage Change Overall Countywide							
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APPENDIX E

ADDITIONAL IMPLEMENTATION INFORMATION

Road Diet Implementation – A community guide

Road diets have been gaining considerable attention as a relatively new roadway conversion that promotes safety to all modes of transportation while maintaining the intended function of the corridor. In many instances, conversion of a roadway by road diet has achieved positive results. These results have been published and discussed by transportation officials and researchers, however, the methods and techniques by which success has been achieved are discussed only briefly. The intent of this section is to provide a complete guide to the implementation of a road diet within a community.

Road diets have been implemented in several states including California, Washington, Iowa, Minnesota, Michigan, Connecticut, and Florida. Many of these projects have extensively evaluated the effects on crash reduction associated with road diets.¹⁻⁸ However, for the purpose of developing an implementation guide, studies that present information on the process of implementing a road diet were further reviewed. These studies included advantages and disadvantages of a road diet, motivating factors for conversion, and lessons learned following the project.⁹⁻¹⁵

Although the implementation of road diets has generally had positive results, the new roadway design can face many challenges which generally originate from resistance within a community. Primarily, the dislike of road diets stems from the counter-intuitiveness of maintaining an acceptable level of service while reducing the capacity of the roadway. To challenge the general thinking, many agencies implementing road diets have experienced success by utilizing techniques that both educate and involve the community.

A concise implementation guide, which organizes the project and gives community goals primary importance, can assist in overcoming many of the challenges associated with road diet implementation.

An implementation guide should encompass all aspects of the project in a beginning-to-end fashion. Continuous community involvement should be maintained through each phase of the road diet conversion. In general, the project can be divided into pre-construction (Phase I), construction (Phase II), and post-construction (Phase III) with the following primary objectives for each phase:

- Phase I Community education and acceptance for the road diet project.
- Phase II Mitigate any negative effects associated with construction and roadway operations.
- Phase III Demonstrate how the road diet fulfilled community objectives while highlighting the benefits of the new corridor.

Success of a road diet project can be measured on several levels, however, when a road diet fulfills the needs of a community while maintaining the necessary function of the corridor, success is generally recognized.

Phase I – Community education and acceptance

Road diets can have lasting effects on a community, therefore it is essential to promote community involvement from the beginning. In doing this, citizens gain a sense of ownership for the road diet project and the decisions being made are felt as their own. Many agencies implementing road diets have involved the public through town hall meetings, workshops, and newspaper postings which detail the road diet project specifically.^{8,10} Others have found success by implementing road diet projects through city master plans or other citywide initiatives such as Complete Streets or a community bicycle plan. For example, the Michigan's Genesee County Metropolitan Alliance adopted a "Complete Streets" approach where "Transportation improvements in Genesee County are planned, designed and constructed to encourage walking, bicycling, and transit use while promoting safety for all users".¹² Another example includes the pedscape plan adopted by the city of Charlotte, North Carolina.¹⁰ These techniques provide an accepting atmosphere because residents are more receptive to change and look forward to "reinventing" their community in a broader scope. Additionally, this groups a road diet project with other beautification elements that aim to restore out-dated downtown settings. The intent of public meetings should be as follows:

- Gain an understanding of the needs of a community by generating a list of transportation, economic, and safety objectives.
- Develop a broad scope plan such as a master plan, which considers community objectives and provides a list of projects which fulfill these objectives.
- Consider supplemental redevelopment motifs such as complete streets, green streets, or a community bicycle/walking plan.
- Provide several alternatives to road diets and explain how elements of the alternatives fail to meet the goals of corridor and the community.
- Demonstrate how a road diet will affect all modes of transportation by providing equal access to motorists, cyclists, and walkers while maintaining safety.
- Provide both benefits and disadvantages of road diets overstating the benefits of a road diet sets the project up for failure in the public eye.

Public involvement could be in the form of focus sessions including emergency services, senior citizens, transit personnel, merchants, and the disabled to identify areas of the community they see as beneficial to improve.⁸ Once a list of clear objectives is established, several alternatives which meet the objectives should be developed. Proposing several alternatives alongside a

road diet provides the opportunity to make decisions about the project. A review of the advantages and disadvantages of each alternative generally affirms that the road diet alternative provides the most benefit to all users. Although a detailed preliminary analysis is not always needed, demonstrating before and after level of service and similar corridor characteristics can strengthen the argument.

Work with residents on the project and design details and reiterate that the roadway can be restored to the original cross-section if the project is unsuccessful. Employing stamped concrete, brick accents, planter boxes, curb out-crops, and other city beautification techniques can also aid in gaining community approval. While there are a limited number of studies that have focused on economic impacts of road diets, research has cited that economic activity has increased along road diet sites accompanied by an increase in average residential housing values.¹⁵

To maintain community involvement from beginning to end, many road diet projects have utilized public forums such as blogs or social networking sites.¹⁶⁻¹⁹ A public forum allows citizens to voice concerns, opinions, or praise concerning the process of the design and implementation. In turn, this gives the implementing agency an opportunity to answer questions which generally alleviate concerns voiced by community members. These sites also provide a central hub for pertinent information regarding street closures, detours, and project progress.

Phase II – Road diet construction

Public concern generally arises during the planning phase of the project however it can become agitated when construction begins. The degree of discontent will largely be based on the extent of the redesign. If a road diet is being converted simply by pavement remarking, negative response will be minimal. If the project requires reconstruction, causing commuting to become difficult, additional measures will be necessary to alleviate public concerns. Regardless of the size of the project, any precautions that will lessen the stress associated with the road diet should be taken. Based on past road diet experiences, the following techniques have been used to maintain a positive attitude throughout the community during the construction phase:¹⁰

- Reduce the impact of constructing the road diet on the community by shortening the construction timeline.
- Provide proper detours to maintain access and mobility through or around the project site.
- Consider public transportation options through the corridor.
- Select a design which uses the existing curb width.

- Change signal timing before construction to allow motorists to become acquainted with the new cycle lengths.
- Implement a road diet when other projects are being considered such as installing new utilities, repaving, new sidewalks, or new striping of the roadway.

Clearly, by reducing the construction timeline the negative effects of the new roadway design will be reduced. Primary focus should be placed on restoring mobility to motorists as this is generally where most discontent arises. In addition to motorist mobility, there is a need to address access for motorists, cyclists, and walkers. This requires proper phasing of the project, while roadway construction is the primary concern, sidewalks, cross-walks, planters, and landscaping elements become secondary. Proper detours are necessary to redirect traffic through or around the project. If possible, two-lanes should continuously remain available for two-way through traffic. If this is not possible, one lane should remain open for through traffic in one direction while a detour redirects the other direction of traffic around the site. Many cases require signal timing to be changed due to the new traffic characteristics of the threelane roadway. It is important to change the signal timing prior to any construction taking place to allow motorists to become acquainted with the new cycle lengths and intersection operations.¹⁰ Additionally, this allows engineers to ensure proper cycle lengths have been designed for the new three-lane TWTL and given level of traffic. Finally, just as a road diet should be included in a community master plan, other updating elements should be included in the construction phase to minimize any future reconstruction.

Again, the use of a blog or website can keep users up-to-date on the progress of the project while relaying important detour and closure information.

Phase III – A follow-up demonstrating road diet success

A road diet is a substantial redesign of a roadway and therefore the resulting operational characteristics should be studied to determine if the project was successful. This assessment will be important to members of the community who will want to know if the project met the intended objectives. Similarly, other agencies will be interested to know if this type of roadway conversion would be successful in their own communities. Success of a road diet should not be based solely on motorist delay and similar operational characteristics, but on the project in its entirety including cyclists, walkers, and local businesses. The following aspects of the project should be addressed as they relate to the road diet project:^{10,15}

- Level of service, intersection delay, and similar corridor characteristics including cross street traffic.
- Assessment of motorist speed characteristics.

- Overall safety of for walkers, cyclists, and motorists.
- Operational difficulties such as improper use of the two-way left-turn lane.
- Walker and cyclists volumes.
- Resulting parking characteristics.
- Economic activity for business and change in residential housing values.

It is important to demonstrate how the road diet maintains the function of the corridor even though the capacity has been reduced. This can be accomplished by evaluating traffic characteristics including level of service, delay, ADTs, and motorist's speeds. In many cases, level of service and ADTs have been reduced slightly while delay has slightly increased. Similarly, it has been shown through several examples that conversion of a roadway by road diet is successful in reducing the 85th percentile speed as well as the maximum speed.¹⁰ Although results may indicate that some of these characteristics have been negatively affected, it is possible to provide the information in a positive light. Generally, a primary objective of a road diet is to restore safety to all users. By reducing motorist's speeds, fewer high-speed accidents are expected to occur, and pedestrians and cyclists experience greater comfort in cross-walks and bike lanes, respectively.¹⁰ At this point it is also necessary to remind community members that the intent of a road diet is to provide benefits to all users of the corridor.

Another aspect of safety can be considered regarding the proper use of the updated roadway. Following several site visits conducted in Michigan it was determined that problems exist with the proper use of the two-way left-turn lane. Significant problems such as delay and accidents can arise if the TWLTL is not being used by left-turning vehicles. For this reason, literature and signage about the proper use of the TWLTL should be presented in various phases. Additionally, a site visit of the updated roadway can determine if the message has been effectively conveyed.

Another objective of a road diet may be to restore the city center of a community by providing a safe and aesthetically pleasing atmosphere. Although this is somewhat subjective, by evaluating the pedestrian/cyclists volumes, parking characteristics of the converted site, and economic activity, one can gain some insight. If the corridor experiences higher walker/cyclist volumes it can be presumed that a sense of safety has been restored to these modes of transportation. If on-street parking is provided by the updated roadway, it should be determined if parking is being utilized by employees or consumers of local businesses. In general, on-street parking should provide access to consumers of local businesses. Additionally, economic data from local businesses can be acquired to assess whether the road diet has promoted business. Finally, a survey can be distributed to community members to assess whether the road diet has had a positive influence on the city center. The survey should address whether motorist's/walker's/cyclist's comfort levels have changed and how community members have changed their use of the city center.

A follow-up evaluation of a road diet plays an important role in the success of the project. By assessing many of the characteristics of the updated roadway and presenting findings to community members, a sense of satisfaction and accomplishment can be instilled in the community. Finally, information collected from a converted site can be of use to other agencies considering a similar roadway conversion.

Additional comments

Several presentations, developed by transportation engineers around the country, have made it evident that starting at the community level has many advantages when implementing a road diet. The following list, presented by Joshua E. Saak in a presentation about the East Boulevard, Charlotte, North Carolina road diet, suggests common questions that can be expected from community members:

- Where does the additional traffic go when the capacity is reduced by half?
- When most communities are widening roadways, why are we narrowing ours?
- How will bus stops be accommodated with a road diet?
- How will emergency response units be affected?
- What if it doesn't work?

Responses for these questions should be developed to provide inquirers with the proper information.

A list of objectives, or measures of effectiveness, should be developed in Phase I of the project. The following list of possible MOEs was presented by the City of Orlando – Transportation Planning Bureau for the Edgewater Drive road diet restriping plan:

- Avoid increased traffic on neighboring streets
- Reduce speeding
- Increase bicyclist volumes
- Increase pedestrian volumes
- Reduce crashes
- Increase on-street parking use rates
- Increase resident and merchant pedestrian travel satisfaction
- Increase parking satisfaction

Although a list of MOEs will be specific to a community it is important that it represents the ideals of the community. Further, the final road diet plan should aim to fulfill many of the MOEs if success is to be expected.

The following list presents additional ways to be successful and gain community acceptance for road diet projects. It also provides things the implementing agency should avoid when proposing a road diet.

- Conduct a thorough analysis of the corridor and make certain a road diet is a suitable alternative for the roadway.
- Avoid implementing a road diet without community involvement.
- Develop a plan that not only encompasses the road diet project but the community as a whole such as complete streets, a new bicycle/pedestrian initiative, or economic plan.
- Avoid overstating the benefits of a road diet as this sets the project up for failure in the public eye.
- Publish other road diet success stories in local newspapers or blogs.
- Use blogs or social networking sites to provide as much information as possible to community members while providing a forum to express any concerns.
- Provide an opportunity for additional beautification elements such as stamped concrete, brick accents, planter boxes, curb out-crops, and added landscaping.

Although these techniques have been successful, they are not overarching. Road diet success has been achieved by many implementing agencies following different approaches. Again, success of a road diet project can be measured on several levels, however, when a road diet fulfills the needs of a community while maintaining the necessary function of the corridor, success is generally recognized.

References for road diet implementation (this appendix)

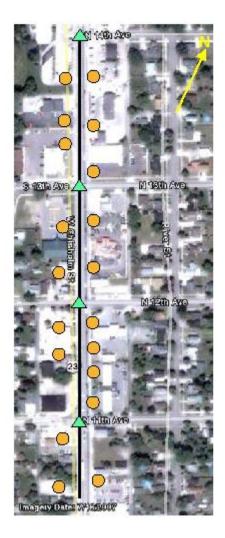
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APPENDIX F

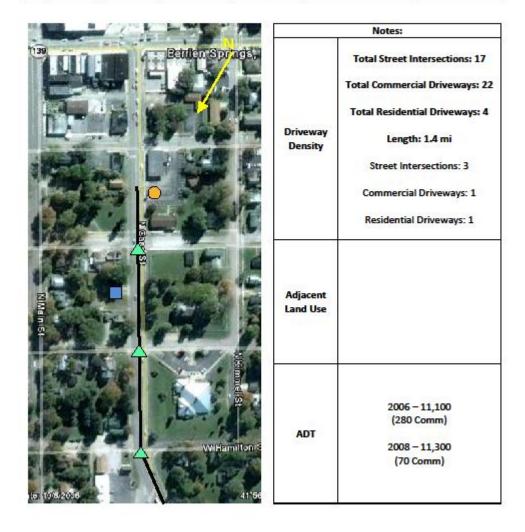
SITE AERIAL VIEWS

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
1	Alpena	Alpena	2000	US-23	Chisholm	0.4



	Notes:
Driveway Density	Total Street Intersections: 4 Total Commercial Driveways: 19 Total Residential Driveways: 0 Length: 0.4 mi
Adjacent Land Use	
ADT	1999 – 15,100 (320 Comm) 2001 – 16,800 (130 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
2	Berrien	Berrien Springs	2007	M-139 (formerly Old 31)	N/A	1.4

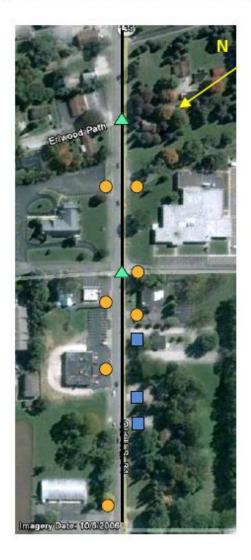


Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
2	Berrien	Berrien Springs	2007	M-139 (formerly Old 31)	N/A	1.4



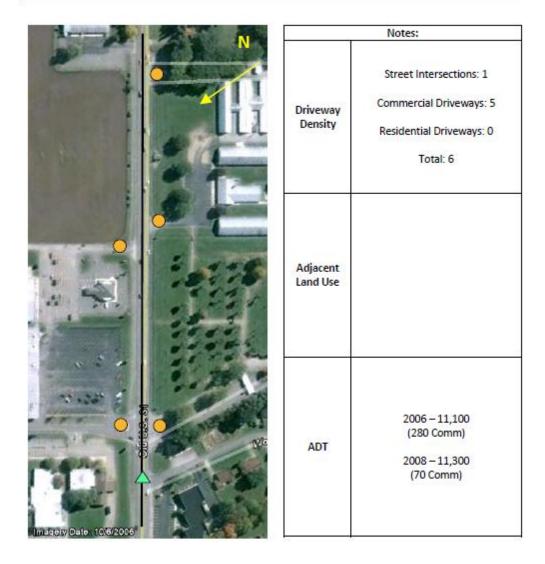
9	Notes:
Driveway Density	Street Intersections: 2 Commercial Driveways: 6 Residential Driveways: 0 Total: 9
Adjacent Land Use	
ADT	2006 – 11,100 (280 Comm) 2008 – 11,300 (70 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
2	<mark>B</mark> errien	Berrien Springs	2007	M-139 (formerly Old 31)	N/A	1.4

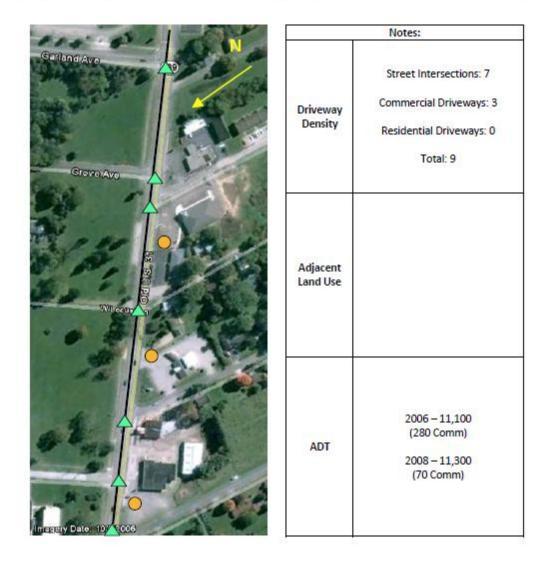


Street Intersections: 2 Commercial Driveways: 7 Residential Driveways: 3 Total: 11
2006 – 11,100 (280 Comm) 2008 – 11,300 (70 Comm)

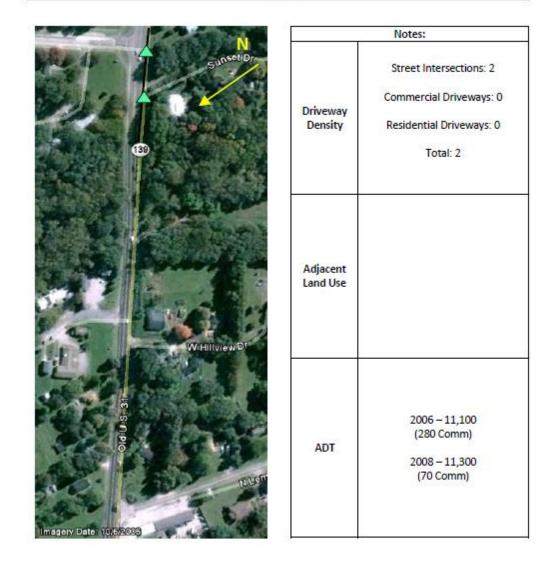
Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
2	Berrien	Berrien Springs	2007	M-139 (formerly Old 31)	N/A	1.4



Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
2	Berrien	Berrien Springs	2007	M-139 (formerly Old 31)	N/A	1.4



Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
2	Berrien	Berrien Springs	2007	M-139 (formerly Old 31)	N/A	1.4

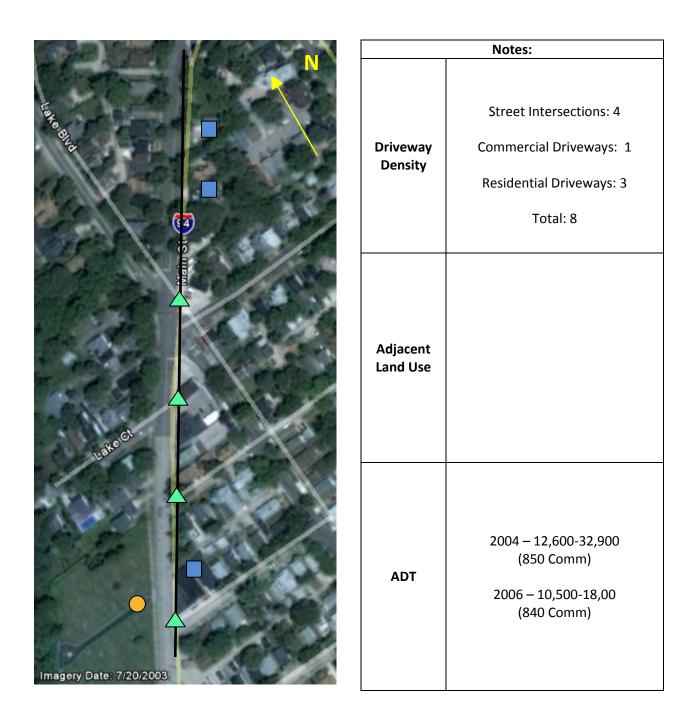


Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



	Notes:
Driveway Density	Total Street Intersections: 35 Total Commercial Driveways: 37 Total Residential Driveways: 63 Length: 4.3 mi Street Intersections: 4 Commercial Driveways: 0 Residential Driveways: 1
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



	Notes:
Driveway Density	Street Intersections: 2 Commercial Driveways: 1 Residential Driveways: 9 Total: 12
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



	Notes:
Driveway Density	Street Intersections: 5 Commercial Driveways: 2 Residential Driveways: 6 Total: 13
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



	Notes:
Driveway Density	Street Intersections: 2 Commercial Driveways: 2 Residential Driveways: 0 Total: 4
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 1 Residential Driveways: 1 Total: 3
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



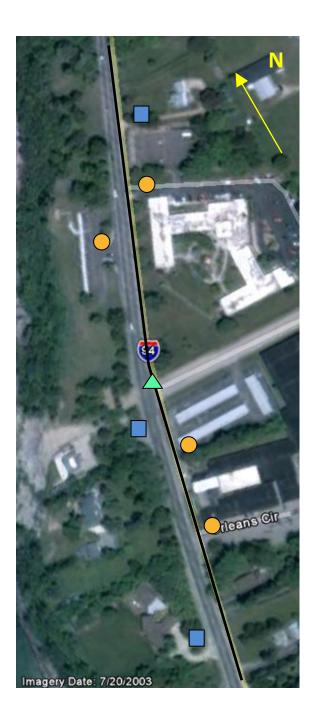
	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 4 Residential Driveways: 0 Total: 5
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



	Notes:			
Driveway Density	Street Intersections: 0 Commercial Driveways: 1 Residential Driveways: 12 Total: 13			
Adjacent Land Use				
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)			

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 4 Residential Driveways: 3 Total: 8
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



Notes:						
Driveway Density	Street Intersections: 2 Commercial Driveways: 3 Residential Driveways: 6 Total: 11					
Adjacent Land Use						
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)					

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



Notes:							
Driveway Density	Street Intersections: 2 Commercial Driveways: 0 Residential Driveways: 8 Total: 10						
Adjacent Land Use							
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)						

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



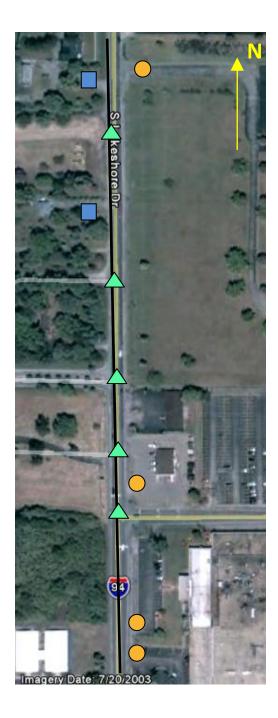
	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 0 Residential Driveways: 7 Total: 8
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



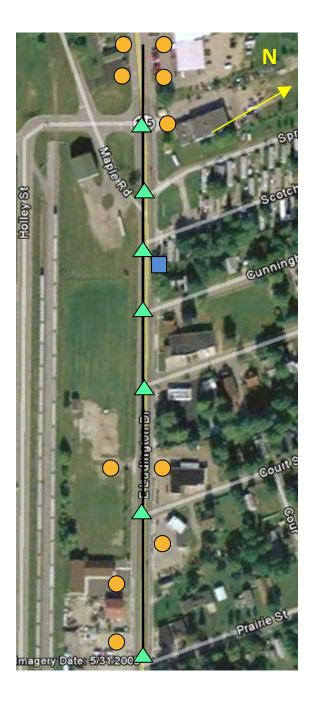
	Notes:							
Driveway Density	Street Intersections: 2 Commercial Driveways: 4 Residential Driveways: 5 Total: 11							
Adjacent Land Use								
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)							

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
3	Berrien	St. Joseph	2005	I-94BL	N/A	4.3



	Notes:
Driveway Density	Street Intersections: 5 Commercial Driveways: 4 Residential Driveways: 2 Total: 11
Adjacent Land Use	
ADT	2004 – 12,600-32,900 (850 Comm) 2006 – 10,500-18,00 (840 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
4	Clare	Clare	2004	M-115	N/A	0.5



Notes:						
	Total Street Intersections: 8					
	Total Commercial Driveways: 15					
	Total Residential Driveways: 1					
Driveway Density	Length: 0.5 mi					
	Street Intersections: 7					
	Commercial Driveways: 10					
	Residential Driveways: 1					
Adjacent Land Use						
ADT	2003 – 9,400 (320 Comm) 2005 – 7,600 (370 Comm)					

Sr. #	county	city	city	ritv l			US or MDOT route #				street/road name (if not US or MDOT #)		length of project (nearest 0.1 miles)
4	Clare	Clare	2004	M-115	5		N/A	0.5					
						/eway nsity	Commercial Residential	ersections: 1 I Driveways: 5 Driveways: 0 tal: 6					
and the second s						acent d Use							
ALL DESCRIPTION OF	Wath ST			The state of the s	Δ	١DT	(320 2005	– 9,400 Comm) – 7,600 Comm)					

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
8	Eaton	Charlotte	2004	I-69BL	N/A	0.8



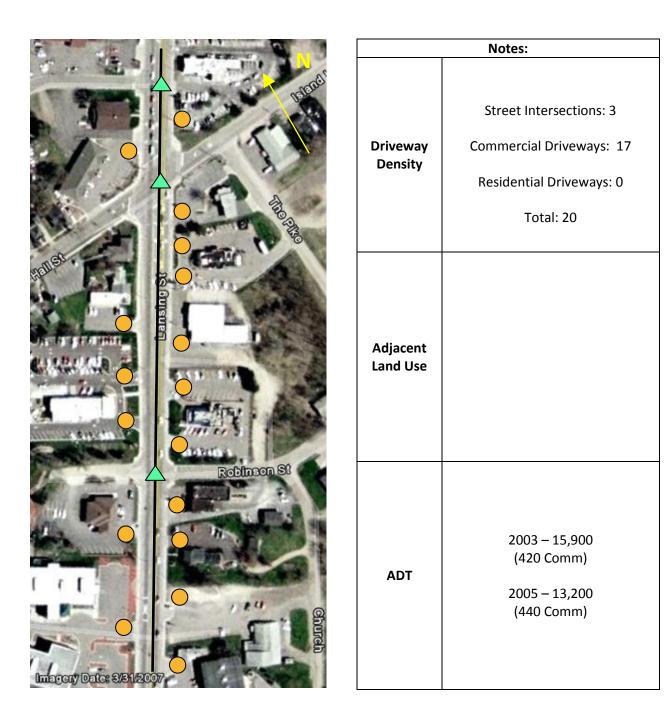
	Notes:
Driveway Density	Total Street Intersections: 7 Total Commercial Driveways: 42 Total Residential Driveways: 7 Length: 0.8 mi Street Intersections: 0 Commercial Driveways: 6 Residential Driveways: 1
Adjacent Land Use	
ADT	2003 – 15,900 (420 Comm) 2005 – 13,200 (440 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
8	Eaton	Charlotte	2004	I-69BL	N/A	0.8



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 17 Residential Driveways: 0 Total: 18
Adjacent Land Use	
ADT	2003 – 15,900 (420 Comm) 2005 – 13,200 (440 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
8	Eaton	Charlotte	2004	I-69BL	N/A	0.8

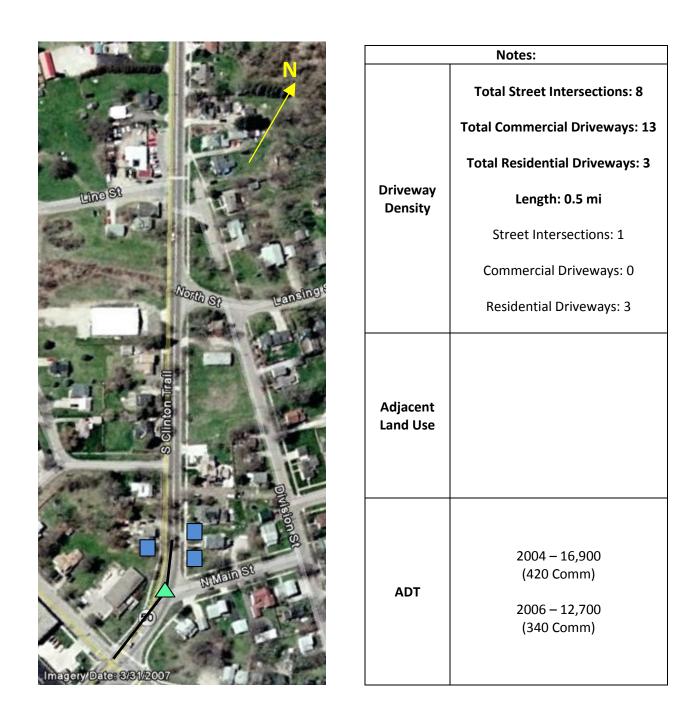


9	Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
	8	Eaton	Charlotte	2004	I-69BL	N/A	0.8



	Notes:
Driveway Density	Street Intersections: 3 Commercial Driveways: 2 Residential Driveways: 6 Total: 11
Adjacent Land Use	
ADT	2003 – 15,900 (420 Comm) 2005 – 13,200 (440 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
9	Eaton	Eaton Rapids	2005	M-50/M-99	N/A	0.5



Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
9	Eaton	Eaton Rapids	2005	M-50/M-99	N/A	0.5



Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
9	Eaton	Eaton Rapids	2005	M-50/M-99	N/A	0.5



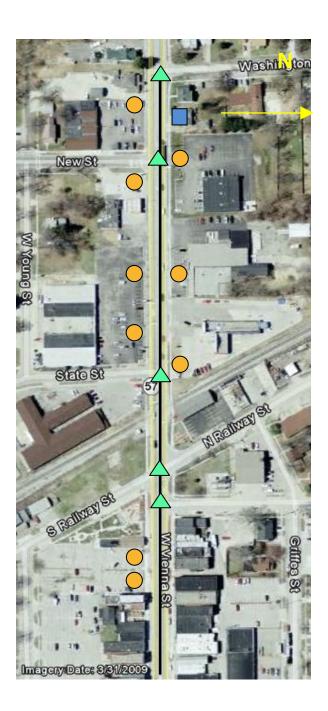
	Notes:
Driveway Density	Street Intersections: 3 Commercial Driveways: 9 Residential Driveways: 0 Total: 18
Adjacent Land Use	
ADT	2004 – 16,900 (420 Comm) 2006 – 12,700 (340 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
11	Genesee	Clio	2005	M-57	Vienna Rd	1.5



	Notes:
Driveway Density	Total Street Intersections: 12 Total Commercial Driveways: 29 Total Residential Driveways: 51 Length: 1.5 mi Street Intersections: 0 Commercial Driveways: 2 Residential Driveways: 12
Adjacent Land Use	
ADT	2004 – 13,900-160 (540 Comm) 2006 – 15,800 (480 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
11	Genesee	Clio	2005	M-57	Vienna Rd	1.5



	Notes:
Driveway Density	Street Intersections: 5 Commercial Driveways: 9 Residential Driveways: 1 Total: 15
Adjacent Land Use	
ADT	2004 – 13,900-160 (540 Comm) 2006 – 15,800 (480 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
11	Genesee	Clio	2005	M-57	Vienna Rd	1.5



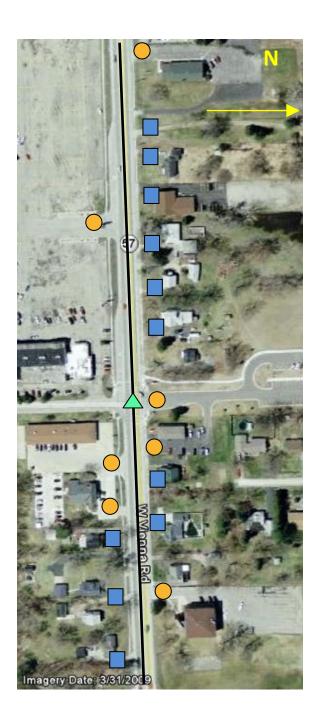
	Notes:
Driveway Density	Street Intersections: 3 Commercial Driveways: 4 Residential Driveways: 10 Total: 17
Adjacent Land Use	
ADT	2004 – 13,900-160 (540 Comm) 2006 – 15,800 (480 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
11	Genesee	Clio	2005	M-57	Vienna Rd	1.5



	Notes:
Driveway Density	Street Intersections: 2 Commercial Driveways: 7 Residential Driveways: 13 Total: 22
Adjacent Land Use	
ADT	2004 – 13,900-160 (540 Comm) 2006 – 15,800 (480 Comm)

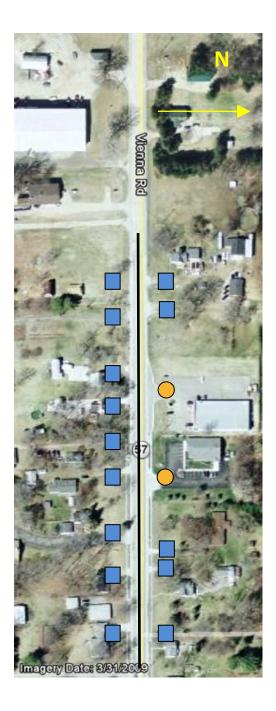
Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
11	Genesee	Clio	2005	M-57	Vienna Rd	1.5



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 7 Residential Driveways: 11 Total: 18
Adjacent Land Use	
ADT	2004 – 13,900-160 (540 Comm) 2006 – 15,800 (480 Comm)

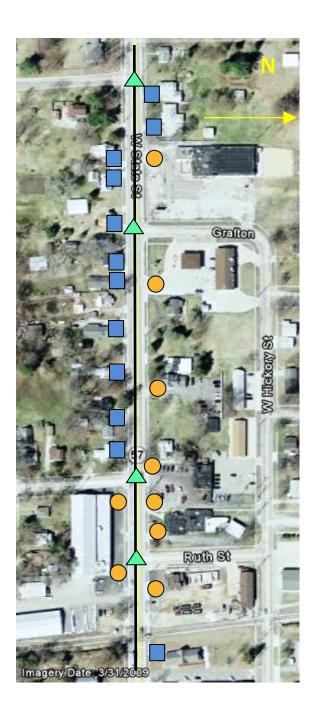
Sr. #	county	city	Year of Construction	US or MDOT route #		et/road name US or MDOT #)	length of project (nearest 0.1 miles)
11	Genesee	Clio	2005	M-57	١	/ienna Rd	1.5
			UDOUTS UDOUTS	Driv De	/eway nsity acent d Use	Notes: Street Inte Commercial Residential	ersections: 1 Driveways: 0 Driveways: 4 tal: 6
lago	ty Date: 3/31/2	W Vienne Rd		4	١DT	(540 2006 -	.3,900-160 Comm) - 15,800 Comm)

13	Genesee	Montrose	2003	M-57	State St	1.3
Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)



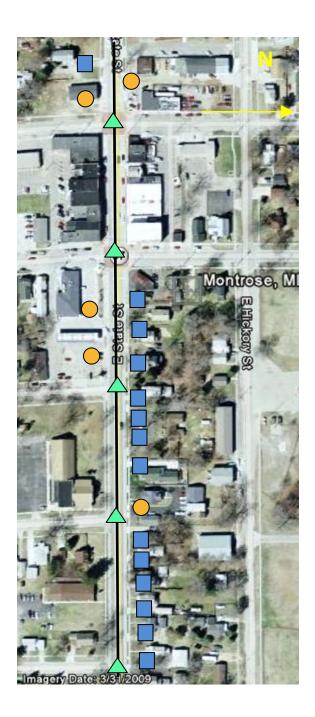
	Notes:
	Total Street Intersections: 11
	Total Commercial Driveways: 35
	Total Residential Driveways: 62
Driveway Density	Length: 1.3 mi
	Street Intersections: 0
	Commercial Driveways: 2
	Residential Driveways: 14
Adjacent Land Use	
ADT	2002 – 6,900-8,200 (730 Comm) 2004 – 6,900-7,900 (770 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
13	Genesee	Montrose	2003	M-57	State St	1.3



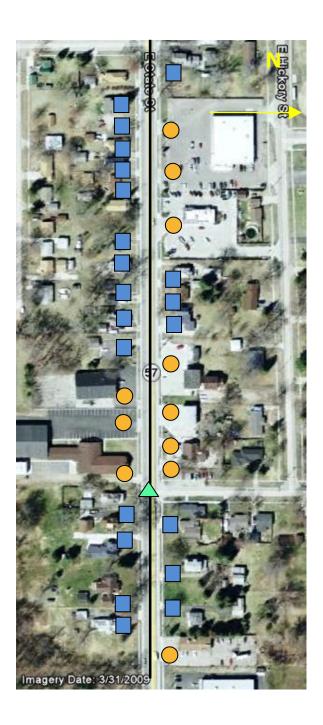
	Notes:
Driveway Density	Street Intersections: 4 Commercial Driveways: 9 Residential Driveways: 12 Total: 33
Adjacent Land Use	
ADT	2002 – 6,900-8,200 (730 Comm) 2004 – 6,900-7,900 (770 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
13	Genesee	Montrose	2003	M-57	State St	1.3



	Notes:
Driveway Density	Street Intersections: 5 Commercial Driveways: 5 Residential Driveways: 14 Total: 24
Adjacent Land Use	
ADT	2002 – 6,900-8,200 (730 Comm) 2004 – 6,900-7,900 (770 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
13	Genesee	Montrose	2003	M-57	State St	1.3



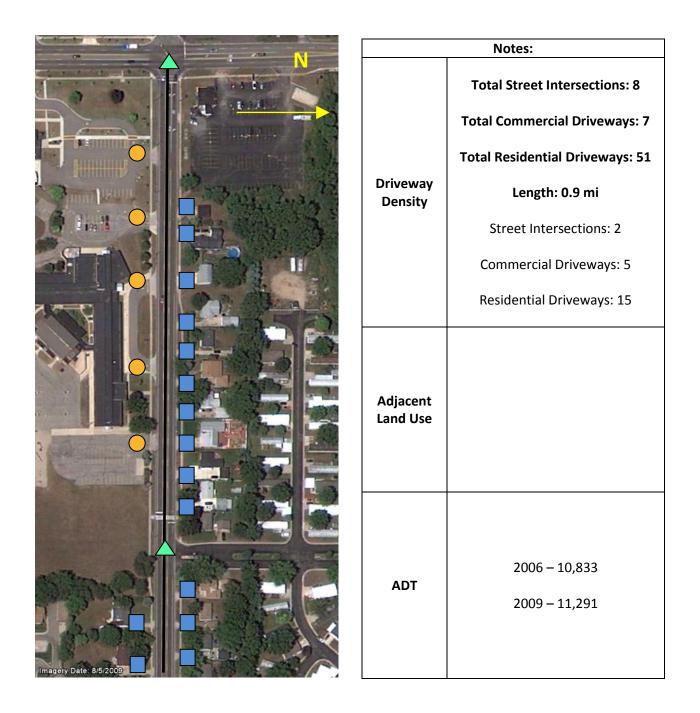
	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 11 Residential Driveways: 21 Total: 33
Adjacent Land Use	
ADT	2002 – 6,900-8,200 (730 Comm) 2004 – 6,900-7,900 (770 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
13	Genesee	Montrose	2003	M-57	State St	1.3



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 8 Residential Driveways: 1 Total: 10
Adjacent Land Use	
ADT	2002 – 6,900-8,200 (730 Comm) 2004 – 6,900-7,900 (770 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
16	Kent	Grand Rapids	2007	N/A	60 th Street	0.9

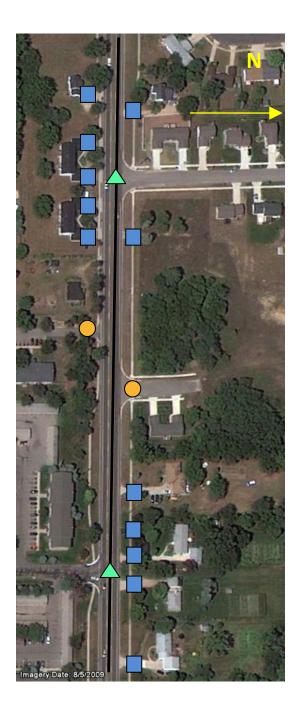


Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
16	Kent	Grand Rapids	2007	N/A	60 th Street	0.9



	Notes:
Driveway Density	Street Intersections: 3 Commercial Driveways: 0 Residential Driveways: 24 Total: 27
Adjacent Land Use	
ADT	2006 – 10,833 2009 – 11,291

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
16	Kent	Grand Rapids	2007	N/A	60 th Street	0.9



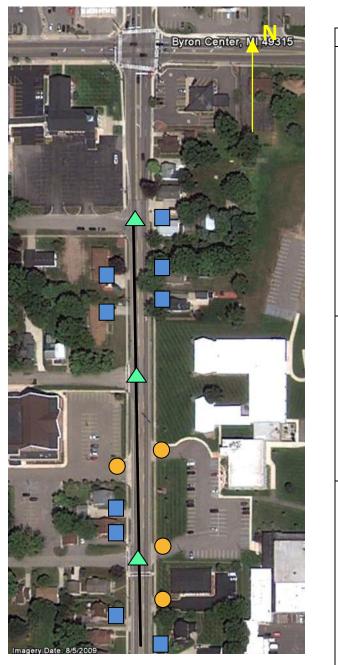
	Notes:
Driveway Density	Street Intersections: 2 Commercial Driveways: 2 Residential Driveways: 12 Total: 16
Adjacent Land Use	
ADT	N2006 – 10,833 2009 – 11,291

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
16	Kent	Grand Rapids	2007	N/A	60 th Street	0.9



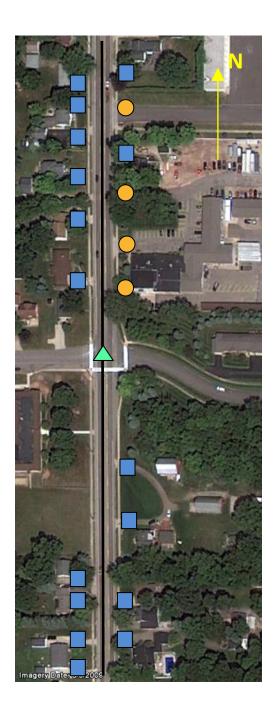
	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 0 Residential Driveways: 0 Total: 2
Adjacent Land Use	
ADT	2006 – 10,833 2009 – 11,291

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
18	Kent	Byron Center	2005	N/A	Byron Center Ave	1.0



	Notes:
	Total Street Intersections: 6 Total Commercial Driveways: 11
	Total Residential Driveways: 44
Driveway Density	Length: 1.0 mi
	Street Intersections: 3
	Commercial Driveways: 4
	Residential Driveways: 9
Adjacent Land Use	
ADT	2007 – 5,583 2008 – 9,515

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
18	Kent	Byron Center	2005	N/A	Byron Center Ave	1.0



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 4 Residential Driveways: 16 Total: 21
Adjacent Land Use	
ADT	2007 – 5,583 2008 – 9,515

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
18	Kent	Byron Center	2005	N/A	Byron Center Ave	1.0



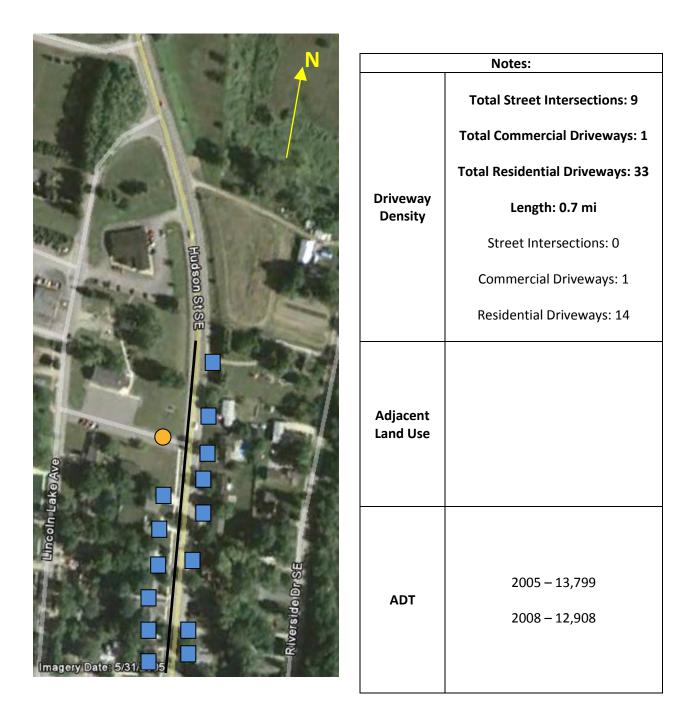
	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 3 Residential Driveways: 9 Total: 13
Adjacent Land Use	
ADT	2007 – 5,583 2008 – 9,515

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
18	Kent	Byron Center	2005	N/A	Byron Center Ave	1.0

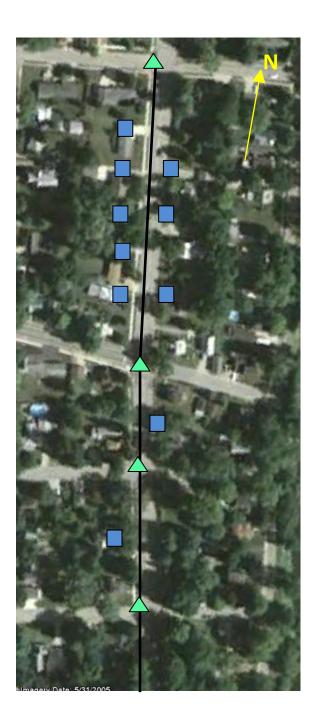


	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 0 Residential Driveways: 10 Total: 11
Adjacent Land Use	
ADT	2007 – 5,583 2008 – 9,515

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
20	Kent	Lowell	2006	N/A	Hudson St	0.7



Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
20	Kent	Lowell	2006	N/A	Hudson St	0.7



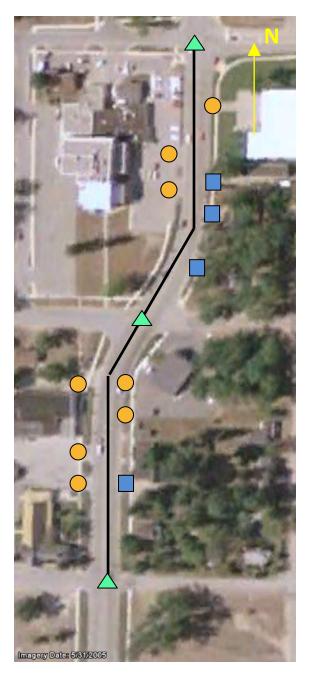
Notes:				
Driveway Density	Street Intersections: 4 Commercial Driveways: 0 Residential Driveways: 10 Total: 14			
Adjacent Land Use				
ADT	2005 – 13,799 2008 – 12,908			

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
20	Kent	Lowell	2006	N/A	Hudson St	0.7



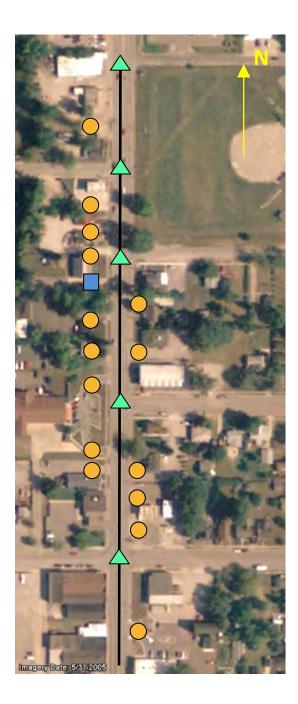
	Notes:			
Driveway Density	Street Intersections: 5 Commercial Driveways: 0 Residential Driveways: 9 Total: 14			
Adjacent Land Use				
ADT	2005 – 13,799 2008 – 12,908			

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
22	Lake	Baldwin	1998	M-37	Michigan Ave	0.2



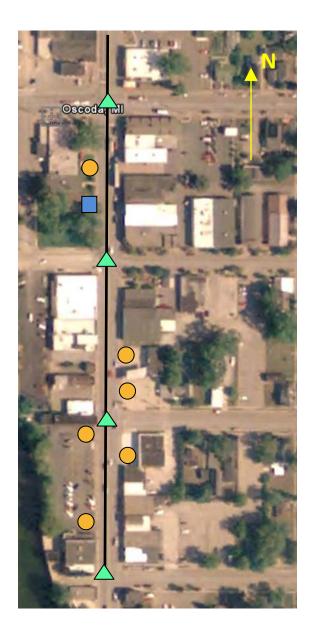
	Notes:				
Driveway Density	Total Street Intersections: 3 Total Commercial Driveways: 8 Total Residential Driveways: 4 Length: 0.2 mi				
Adjacent Land Use					
ADT	1997 – 5,500 (280 Comm) 1999 – 5,800 (290 Comm)				

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
23	losco	Oscoda	2007	US-23	N/A	0.5



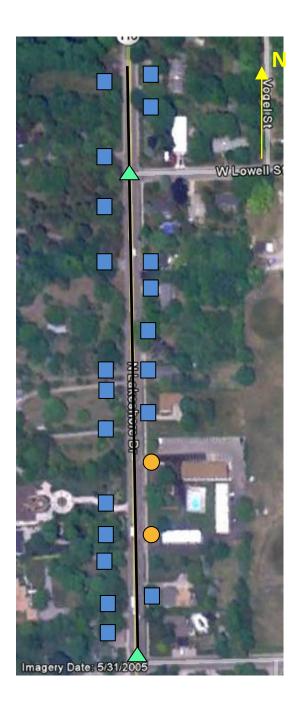
	Notes:
	Total Street Intersections: 9 Total Commercial Driveways: 21
	Total Residential Driveways: 2
Driveway Density	Length: 0.5 mi
	Street Intersections: 5
	Commercial Driveways: 15
	Residential Driveways: 1
Adjacent Land Use	
ADT	2006 – 8,600-9,000 (260 Comm) 2008 – 5,100-7,600 (260 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
23	losco	Oscoda	2007	US-23	N/A	0.5



	Notes:
Driveway Density	Street Intersections: 4 Commercial Driveways: 6 Residential Driveways: 1 Total: 11
Adjacent Land Use	
ADT	2006 – 8,600-9,000 (260 Comm) 2008 – 5,100-7,600 (260 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
25	Mason	Ludington	2006	M-116	Lakeshore Dr	0.8



	Notes:				
	Total Street Intersections: 8				
	Total Commercial Driveways: 4				
	Total Residential Driveways: 34				
Driveway Density	Length: 0.8 mi				
	Street Intersections: 2				
	Commercial Driveways: 2				
	Residential Driveways: 20				
Adjacent Land Use					
ADT	2005 – 10,000 (120 Comm) 2007 – 4,200 (100 Comm)				

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
25	Mason	Ludington	2006	M-116	Lakeshore Dr	0.8



	Notes:
Driveway Density	Street Intersections: 3 Commercial Driveways: 1 Residential Driveways: 9 Total: 12
Adjacent Land Use	
ADT	2005 – 10,000 (120 Comm) 2007 – 4,200 (100 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
25	Mason	Ludington	2006	M-116	Lakeshore Dr	0.8



	Notes:
Driveway Density	Street Intersections: 3 Commercial Driveways: 1 Residential Driveways: 5 Total: 9
Adjacent Land Use	
ADT	2005 – 10,000 (120 Comm) 2007 – 4,200 (100 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
26	Missaukee	Lake City	2006	M-55/M-66	Morey Rd/Main St	0.6



	Notes:
	Total Street Intersections: 5
	Total Commercial Driveways: 3
	Total Residential Driveways: 36
Driveway Density	Length: 0.6 mi
	Street Intersections: 3
	Commercial Driveways: 2
	Residential Driveways: 2
Adjacent Land Use	
ADT	2001 – 11,800 (820 Comm) 2003 – 11,700 (820 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
26	Missaukee	Lake City	2006	M-55/M-66	Morey Rd/Main St	0.6



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 0 Residential Driveways: 11 Total: 12
Adjacent Land Use	
ADT	2001 – 11,800 (820 Comm) 2003 – 11,700 (820 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
26	Missaukee	Lake City	2006	M-55/M-66	Morey Rd/Main St	0.6



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 1 Residential Driveways: 23 Total: 25
Adjacent Land Use	
ADT	2001 – 11,800 (820 Comm) 2003 – 11,700 (820 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
29	Otsego	Gaylord	2005	M-32	N/A	0.5



	Notes:
	Total Street Intersections: 4
	Total Commercial Driveways: 2
	Total Residential Driveways: 28
Driveway Density	Length: 0.5 mi
	Street Intersections: 2
	Commercial Driveways: 2
	Residential Driveways: 11
Adjacent Land Use	
ADT	2004 – 10,100 (330 Comm) 2006 – 4,100 (270 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
29	Otsego	Gaylord	2005	M-32	N/A	0.5



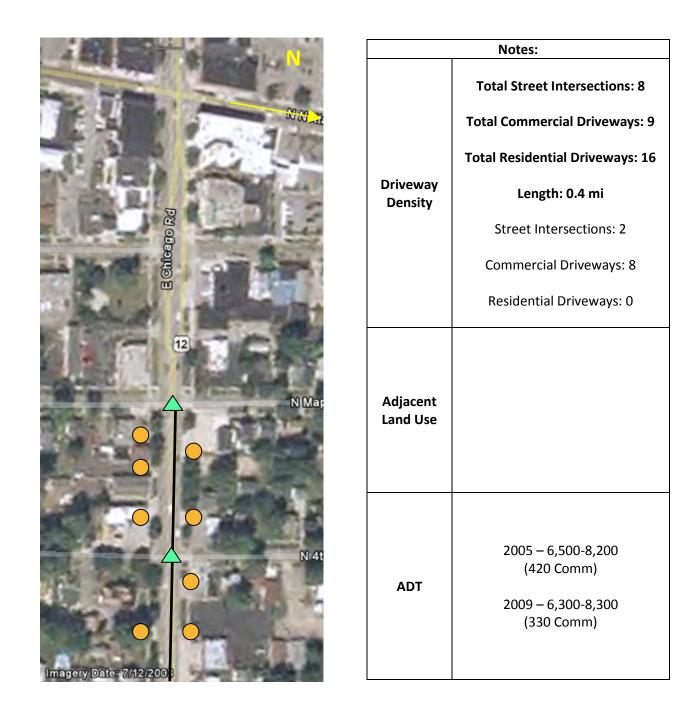
	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 0 Residential Driveways: 10 Total: 11
Adjacent Land Use	
ADT	2004 – 10,100 (330 Comm) 2006 – 4,100 (270 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
29	Otsego	Gaylord	2005	M-32	N/A	0.5



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 0 Residential Driveways: 7 Total: 8
Adjacent Land Use	
ADT	2004 – 10,100 (330 Comm) 2006 – 4,100 (270 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
30	St. Joseph	Sturgis	2006	US-12	N/A	0.4



Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
30	St. Joseph	Sturgis	2006	US-12	N/A	0.4



	Notes:
Driveway Density	Street Intersections: 6 Commercial Driveways: 1 Residential Driveways: 16 Total: 23
Adjacent Land Use	
ADT	2005 – 6,500-8,200 (420 Comm) 2009 – 6,300-8,300 (330 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
33	Wexford	Mesick	2006	M-115/M-37	Mesick Ave	0.7



	Notes:
	Notes.
	Total Street Intersections: 6
	Total Commercial Driveways: 12
	Total Residential Driveways: 7
Driveway Density	Length: 0.7 mi
	Street Intersections: 2
	Commercial Driveways: 7
	Residential Driveways: 3
Adjacent Land Use	
ADT	2005 – 7,400-7,700 (420 Comm) 2007 – 5,100-5,500 (330 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
33	Wexford	Mesick	2006	M-115/M-37	Mesick Ave	0.7



Driveway Density	Street Intersections: 3 Commercial Driveways: 7 Residential Driveways: 3 Total: 13
Adjacent Land Use	
ADT	2005 – 7,400-7,700 (420 Comm) 2007 – 5,100-5,500 (330 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
33	Wexford	Mesick	2006	M-115/M-37	Mesick Ave	0.7



	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 0 Residential Driveways: 1 Total: 2
Adjacent Land Use	
ADT	2005 – 7,400-7,700 (420 Comm) 2007 – 5,100-5,500 (330 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
34	Delta	Bark River	2006	US-2/US-41	N/A	0.5

		Notes:
Bark River, VU-9807	Driveway Density	Total Street Intersections: 2 Total Commercial Driveways: 18 Total Residential Driveways: 4 Length: 0.5 mi Street Intersections: 2 Commercial Driveways: 13 Residential Driveways: 0
Old ULS 41	Adjacent Land Use	
Imagracty Date: 5/51/2005	ADT	2005 – 7,100 (330 Comm) 2007 – 7,900 (480 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
34	Delta	Bark River	2006	US-2/US-41	N/A	0.5



	Notes:
Driveway Density	Street Intersections: 0 Commercial Driveways: 5 Residential Driveways: 4 Total: 9
Adjacent Land Use	
ADT	2005 – 7,100 (330 Comm) 2007 – 7,900 (480 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
36	Delta	Powers	2005	US-41	N/A	0.9



	Notes:
	Total Street Intersections: 5 Total Commercial Driveways: 32
	Total Residential Driveways: 10
Driveway Density	Length: 0.9 mi
	Street Intersections: 1
	Commercial Driveways: 17
	Residential Driveways: 4
Adjacent Land Use	
ADT	2004 – 3,100-8,30 (410-600 Comm) 2006 – 2,800-6,500 (480 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
36	Delta	Powers	2005	US-41	N/A	0.9



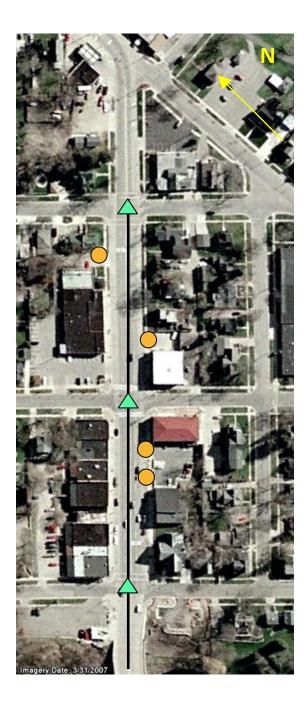
	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 6 Residential Driveways: 6 Total: 13
Adjacent Land Use	
ADT	2004 – 3,100-8,30 (410-600 Comm) 2006 – 2,800-6,500 (480 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
36	Delta	Powers	2005	US-41	N/A	0.9



	Notes:
Driveway Density	Street Intersections: 5 Commercial Driveways: 9 Residential Driveways: 0 Total: 12
Adjacent Land Use	
ADT	2004 – 3,100-8,30 (410-600 Comm) 2006 – 2,800-6,500 (480 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
37	Eaton	Grand Ledge		M-100	Bridge St.	0.3



	Notes:				
	Total Street Intersections: 4				
	Total Commercial Driveways: 4				
	Total Residential Driveways: 0				
Driveway Density	Length: 0.3 mi				
	Street Intersections: 3				
	Commercial Driveways: 4				
	Residential Driveways: 0				
Adjacent Land Use					
ADT	2003 – 7,200 (560 Comm) 2007 – 6,300 (430 Comm)				

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
37	Eaton	Grand Ledge		M-100	Bridge St.	0.3



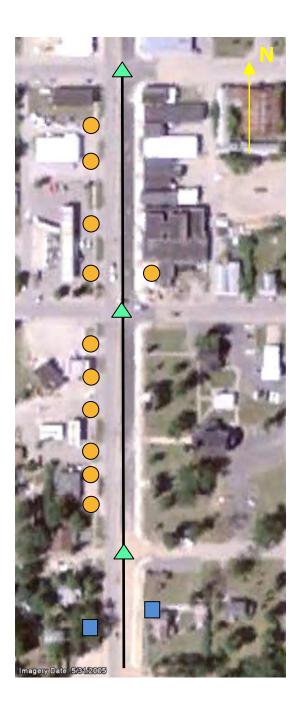
	Notes:
Driveway Density	Street Intersections: 1 Commercial Driveways: 0 Residential Driveways: 0 Total: 1
Adjacent Land Use	
ADT	2003 – 7,200 (560 Comm) 2007 – 6,300 (430 Comm)

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
39	Alpena	Alpena	2002	N/A	9 th St	0.4



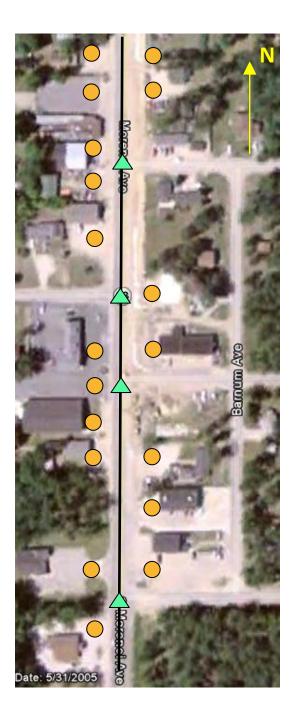
	Notes:
Driveway Density	Total Street Intersections: 5 Total Commercial Driveways: 8 Total Residential Driveways: 6 Length: 0.4 mi
Adjacent Land Use	
ADT	

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
41	Oscoda	Big Creek	2005	M-33	Morenci Ave	0.5



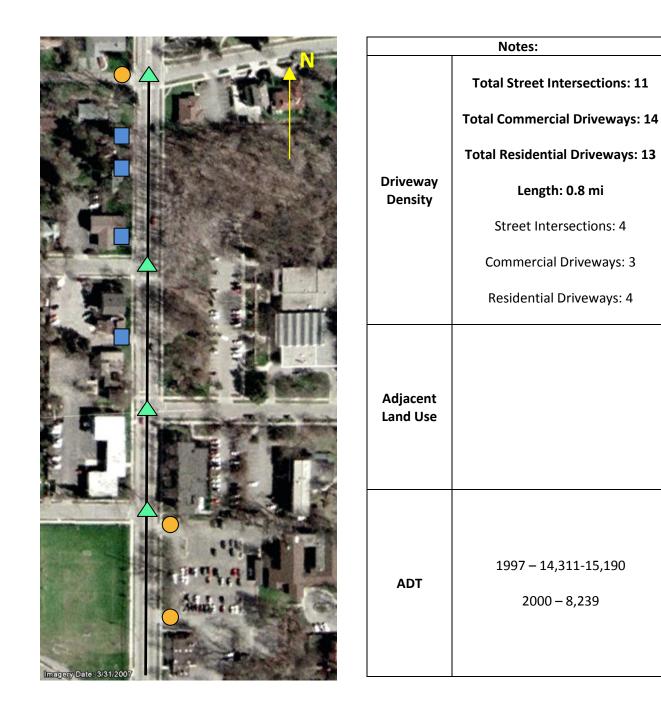
Notes:			
	Total Street Intersections: 7		
	Total Commercial Driveways:29		
	Total Residential Driveways: 2		
Driveway Density	Length: 0.5 mi		
	Street Intersections: 3		
	Commercial Driveways: 11		
	Residential Driveways: 2		
Adjacent Land Use			
ADT	2004 – 3,400 (490 Comm) 2006 – 3,700 (300 Comm)		

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
41	Oscoda	Big Creek	2005	M-33	Morenci Ave	0.5

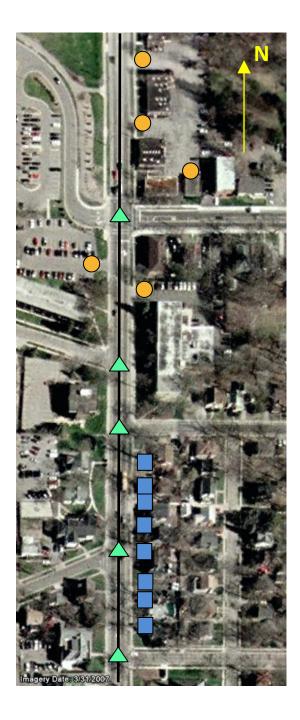


Notes:			
Driveway Density Commercial Driveways: 18 Residential Driveways: 0 Total: 21			
Adjacent Land Use			
ADT	2004 – 3,400 (490 Comm) 2006 – 3,700 (300 Comm)		

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
43	Ingham	East Lansing	1999	N/A	Abbot Rd	0.8

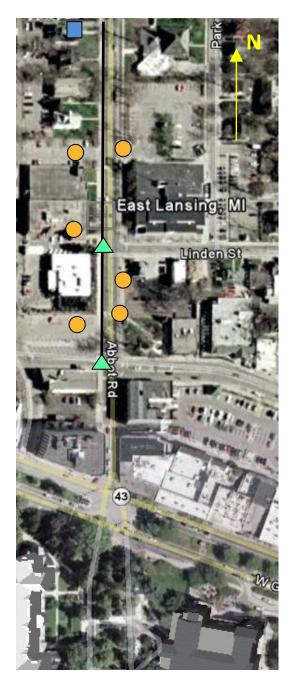


Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
43	Ingham	East Lansing	1999	N/A	Abbot Rd	0.8



Notes:			
Driveway Density	Street Intersections: 5 Commercial Driveways: 5 Residential Driveways: 8 Total: 18		
Adjacent Land Use			
ADT	1997 – 14,311-15,190 2000 – 8,239		

Sr. #	county	city	Year of Construction	US or MDOT route #	street/road name (if not US or MDOT #)	length of project (nearest 0.1 miles)
43	Ingham	East Lansing	1999	N/A	Abbot Rd	0.8



	Notes:
	NOLES:
Driveway Density	Street Intersections: 2 Commercial Driveways: 6 Residential Driveways: 1 Total: 9
Adjacent Land Use	
ADT	1997 – 14,311-15,190 2000 – 8,239

APPENDIX G

SURVEY INSTRUMENT FOR INITIAL SOLICITATION OF SITE INFORMATION

MSU "road diet" project: project/implementation site data request

The Department of Civil and Environmental Engineering at Michigan State University is conducting an MDOT-sponsored study on current "road diet" applications within the state to develop guidelines for future applications. As part of this study, we are cataloging as many of those applications as possible—please describe all applications within your jurisdiction using the form below. Please provide answers in shaded areas (electronically or on a hard copy): "check" the boxes; provide explanation/comments in shaded areas. (The comment boxes will "expand" as you write—don't worry about changes in the pagination that will also occur.) Instructions for sending us the completed form are at the end.

Notes: (1) If you have more than one site, please fill out one form/site. **(2)** If you have plan-view drawings that you can send (or point us to electronically), at least some of the questions below could be answered by sending us those drawings.

Location	
county	
city	
US or MDOT route # (e.g., US-2, M-36)	
street/road name (if not US or MDOT #)	
comment(s) about location:	
Project/Construction Information	
construction start date (work zone in place)	
construction end date (work zone removed)	
control section number/physical road (PR) number	control section: PR:
length of project (use nearest 0.1 miles)	. miles
beginning point cross street/road	
beginning PR/CS mile point of treatment	
ending point cross street/road	
ending PR/CS mile point of treatment	
type of treatment	 check all that apply no physical changes to road (i.e., diet accomplished by signing and/or marking) re-paving and/or reconstruction within existing curbs and roadway width temporary curbs used on existing roadway re-paving/reconstruction that changes roadway width (permanent change) completely new roadway with diet in place new signalization timing new signals—same configuration (e.g., arrows) new signals—new configuration change is reversible if "diet" doesn't work change is permanent, very difficult to change to other configuration
comment(s) about basic project:	

Reasons/Rationale for Road Diet Project			
please indicate which of the listed reasons	check all that apply		
provided the motivation for this road diet project	general community initiative		
(check more than one as needed)	proposed by specific neighborhood		
	please specify:		
	proposed by special interest group (e.g.,		
	bicyclists)		
	please specify:		
	traffic calming		
	street/road safety		
	pedestrian/bicyclist safety		
	reduce vehicular speeds in corridor		
	reduce traffic		
	reduce left-turn problems at intersections		
	reduce mid-block turning movement problems		
	part of larger initiative (e.g., bike path network)		
	please specify:		
	reduce excess capacity of street/road		
	save money		
	other, please specify:		
comment(s) about project rationale:			
Intersection and Signal Data			
intersection data that could be provided for	list of signalized intersections (for both		
intersections in diet section before and after	before and after if different)		
treatment (separately from survey)	type of signal (e.g., fixed, semi-actuated)		
	for each intersection (for both before and after if different)		
	signal timing (for both before and after if		
	different)		
	intersection turning counts		
	PHF values		
	speed study data		
	SYNCHRO or HCS work on intersections		
comment(s) about intersection/signal data:			

Geometric and Other Descriptive Information	
street/road classification	arterial collector local
curb-to-curb street/road width in feet	(insert number)
total number of vehicle travel lanes (not counting	before treatment:
parking lanes)	
	after treatment:
normal lane width	before treatment: 9' 10' 11' 12' >12'
	after treatment: 9' 10' 11' 12' >12'
parking lanes (in addition to travel lanes)	before treatment: none 1 side both sides
	after treatment:
	none 1 side both sides
TWLTLs	TWLTL before treatment: yes no
	TWLTL after treatment: yes no
turning lanes at intersection(s)	before treatment:
	🗌 no LT lane
check all that apply	expand for left turn
	use TWLTL for left turn
Note: if there is significant variation in	expand for right turn
intersection layouts within the road diet	no RT lane
application area, please make a note in the	after treatment:
comment section below. Mark the responses to	no LT lane
the right that represent the most common layout.	expand for left turn
	use TWLTL for left turn
	expand for right turn
	no RT lane
sidewalks	before treatment
	no sidewalks
	adjacent to curb
	back from curb
	if yes, distance from curb =
	width of sidewalk =
	after treatment
	no sidewalks
	adjacent to curb
	back from curb
	if yes, distance from curb =
	width of sidewalk =

geometrics continues...

Geometric and Other Descriptive Information (continues)		
bicycle lanes	before treatment:	
	none none	
	one side only	
	both sides	
	within traveled way (inside curb)	
	outside traveled way;	
	if yes, distance from curb =	
	width of bicycle lane =	
	after treatment:	
	none	
	one side only	
	both sides	
	within traveled way (inside curb)	
	outside traveled way;	
	if yes, distance from curb =	
	width of bicycle lane =	
marked/designated mid-block pedestrian crossings	before treatment	
	none	
	yes	
	if yes, approximate number/block =	
	after treatment	
	none	
	yes	
	if yes, approximate	
	number/block =	
approximate average grade of road	~grade of road = %	
number of driveways/block	(estimated)	
comments about geometric and related data:		

speed limit	before treatment mph	
	after treatment mph	
annual traffic growth factor for corridor	%	
traffic data that could be provided (separately	before treatment	
from survey)—we will contact you for these	ADT estimate	
	24-hour count data	
	intersection turning counts	
	PHF values	
	vehicle type counts (total/commercial)	
	seasonal correction factors	
	speed study data	
	traffic growth factor	
	pedestrian volumes	
	bicycle volumes	
	Synchro/HCS network	
	after treatment	
	ADT estimate	
	24-hour count data	
	intersection turning counts	
	PHF values	
	vehicle type counts (total/commercial)	
	speed study data	
	pedestrian volumes	
	bicycle volumes	
	Synchro/HCS network	

Safety Data (crash been done locally		urces, this section refers only to studies that have
safety-related stud	dies done in the area that could	before treatment
be provided (sepa contact you for th	rately from survey)—we will ese	written vehicular crash-related study done and available
		anecdotal vehicular crash-related information available
		written pedestrian/non-motorized-related
		study done and available
		anecdotal pedestrian/non-motorized-related information available
		after treatment
		written vehicular crash-related study done and available
		anecdotal vehicular crash-related information available
		written pedestrian/non-motorized-related
		study done and available
		anecdotal pedestrian/non-motorized-related
		information available
comments about s	safety data:	
Information for fo	llow-up contact on road diet appli	cations
name:		
title:		
mailing address:		
e-mail address:		
telephone:		

Other general comments:

Please return the completed form to:

save the file with your answers (identify w/your initials) and send electronically via e-mail:

<u>LYLES@egr.msu.edu</u> (electronic attachments are fine)

hard copy via regular mail:

Richard W. Lyles Department of Civil and Environmental Engineering 3546 Engineering Building Michigan State University East Lansing, Michigan 48824-1226

Questions? Please contact via e-mail: LYLES@egr.msu.edu

APPENDIX H

CRASH RECLASSIFICATION SCHEME

Road Diet Crash Re-Coding

Re-coding for road-diet crashes and expectations of 1) whether a road diet should affect crash frequency and 2) whether a road diet should correct the specific crash type. Note that this chart should be used to re-code crash types—a new variable in the crash record for this study. For example, for a ped-involved crash, MDOT crash type = 13, the re-coded value reflects whether the crash occurred midblock or at an intersection (re-code values = 13A and 13B, respectively. The right-most column could be considered a statement of various hypotheses to be tested.

checked/re-coded crash	road diet affects frequency of crash	road diet could correct crash
type	type	type
 [00] uncoded and errors check and re-code as possible; otherwise probably eliminate 	• n/a	• n/a
[11] overturn	• no	• no
[12] hit train	• no	• no
[13] pedestrianmidblock [13A]intersection [13B]	yesmaybe	yes (refuge)maybe
 [14] bicycle crossing main street [14A] longitudinal (going w/or against traffic) [14B] 	• yes • yes	• yes • yes
[15] fixed object	maybe	maybe
[16] other object	maybe	maybe
[17] hit parked vehicle	n/a for MDOT study sites	 n/a for MDOT study sites
[18] animaleliminate!	• n/a	• n/a
[19] misc single vehicle (check and re-code as possible)	• maybe	• maybe
[20] misc multiple vehicle (check and re-code as possible)	• maybe	• maybe

additional notes for crash types (e.g., [21] angle-straight) which are re-coded for left lane/right lane occurrence...

- by our convention, the lane indicated is always for the "dieted" street
- example application of convention for crash type [21] angle-straight in an intersection—"left lane-w/veh from left"...the vehicle in the left lane (whether it is getting hit or is doing the hitting) must be on the diet street with the other vehicle from the intersecting street
- for the "after" period, in general, there is no left lane...these crashes should be occurring in the right lane so the "left lane" crashes should be a moot point; if a crash occurs in the TWLTL, it could still be coded as "left lane" w/the understanding that it is in the TWLTL

checked/re-coded crash	road diet affects frequency of crash	road diet could correct crash
type	type	type
[21] angle-straight		
[<i>intersection only</i> , check to		
convert into angle drive or		
angle turn]	• yes	 yes (eliminates conflict)
 left lane –w/veh 		
from left [21A]	• yes	 yes (eliminates conflict)
 left lane –w/veh 		
from right [21B]	• yes	 no (could incr w/vol)
 right lane –w/veh 		
from left [21C]	• yes	 no (could incr w/vol)
 right lane –w/veh 		
from right [21D]		
[22] angle turn [<i>intersection</i>		
only, check to convert into		
angle drive or head-on LT]		
 left lane –w/veh 	• no	 no (should be no
from left [22A]		change)
 left lane –w/veh 	• no	
from right [22B]		 no (should be no
 right lane –w/veh 	• yes	change)
from left [22C]		
 right lane –w/veh 	• yes	 no (could incr w/vol)
from right [22D]		
		 no (could incr w/vol)
[23] head-on left-turn (not		
necessarily in intersection)		
left lane [23A]	• yes	 maybe (could be
		offsetting)
• right lane [23B]	 no (should be none) 	 no (should be none)
[24] rear-end straight (not		
necessarily in intersection)		
watch for veh at front of		

platoon—is it really going straight (this category) or turning left (should be other category, e.g., [34]) • left lane [24A] • right lane [24B]	 yes (eliminates conflict) yes (incr vol in right lane) 	 yes (lane eliminated) no (could incr w/vol)
checked/re-coded crash type	road diet affects frequency of crash type	road diet could correct crash type
 [25] rear-end left-turn <i>in/at</i> <i>intersection</i> left lane [25A] right lane [25B] 	 yes (eliminates conflict) yes (should be rare in before) 	 yes (should eliminate) yes (if occurs, should elim)
[26] rear-end right-turn <i>in/at intersection</i>		
 left lane [26A] right lane [26B] 	 yes (should be rare before) yes (incr vol in right lane)	 yes (should eliminate) no (could incr w/vol)
[27] dual left turn— shouldn't be occurring for sites	 should be n/a 	 should be n/a
[28] dual right turn— shouldn't be occurring for sites	 should be n/a 	 should be n/a
[31] head-onleft lane [31A]	• yes, RD reduces likelihood	 maybe (corrects some instances, incr head-on potential in TWLTL)
• right lane [31B]	• no, should be rare	 no (should be rare)
[32] side-swipe same	• yes	• yes
[33] side-swipe opposite	• yes	 maybe (could be offsetting)
 [34] angle-drive (watch for intersection vs. driveway, may need recode) left-lane [34A] right-lane (34B] 	• yes • yes	yesno (could incr w/vol)
[35] rear-end drive (could incl veh turning LT or RT into a driveway and getting		

struck from behind; watch for long lines behind turning veh) • left-lane [35A] • right-lane [35B]	• yes • yes	 yes (should elim type) no (could incr w/vol)
[36]other drive—hard category, check to recode as 34, 35, 19, 15	 should be n/a 	 should be n/a
[37] backing—watch for needed recode as driveway- related—otherwise should be n/a	 should be n/a 	 should be n/a

checked/re-coded crash	road diet affects frequency of crash	road diet could correct crash
type	type	type
[38] parking—should be n/a for project sites	 should be n/a 	 should be n/a

Other comments/issues...

Crashes that are really random should be marked for elimination. For example, we had one crash which was a single-vehicle (motorcycle) crash where the throttle stuck and the MC was simply "laid-down" on the pavement/side of road. It was originally coded as an overturn...should be eliminated.

Crash types where all occurrences need to be manually reviewed for relationship to road diet study are:

- [00] uncoded/errors—can any be salvaged;
- [13] pedestrian—what are the circumstances of crash that relate to road diet;
- [14] bicycle—what are circumstances of crash that relate to road diet;
- [15] fixed object—so far, these seem very problematic with respect to having any relationship to the road diet (e.g., skid while turning and hit mailbox or sign post) and so, may be eliminated from analysis
- [16] other object—as fixed object, these seem very problematic with respect to having any relationship to the road diet (e.g., hit a pothole) and so, may be eliminated from analysis
- [19] misc single vehicle crash—can these be re-coded and/or related to road diet;
- [20] misc multiple vehicle crash—can these be re-coded and/or related to road diet (some of these are pretty bizarre and are being eliminated—e.g., a vehicle drifted backwards out of a driveway and across the street where it hit or was hit)

Cross street crashes...

Crashes that are assigned to cross streets (in the crash data base) have also been identified—the UD-10s have been captured, and are being reviewed individually. Basically, one of the following occurs:

- If a crash that was assigned to a side street actually occurred on the diet street, it is reassigned (switched) to the diet street. This is done through a review of the crash diagram. The exception to this is if the side street occurs at the end of the diet (see below).
- If a crash that was assigned to a side street actually occurs on the side street well back from the diet street (e.g., a driveway-related crash 100' back from the diet street) and has no conceivable relation to the road diet, it is eliminated from the analysis.
- If a crash that was assigned to a side street only involved vehicles on the side street (e.g., an angle-turn crash where neither vehicle was already on the diet street), it is eliminated from the analysis (crash has no relation to the diet activity).
- If the side street is an intersecting street at the end of the road diet, a crash involving side street vehicles that are turning on to the diet street toward the diet segment should be "switched" to the diet street. If the vehicle is on the side street and turning away from the diet segment, then it is eliminated as not associated with the diet.
 - For example, consider a N-S side street intersecting w/an E-W diet street but the diet is only on the east side of the intersection w/the west side untreated. If a northbound car turns right (east) toward the diet section and is involved in a crash, it counts in the analysis. If turns left (west) away from diet section, it does **not** count in the analysis.
 - This is also impacted by how the diet ends...sometimes, it is clearly done at the intersection; in other instances, the taper of the diet lanes takes place on the "other" side of the intersection.