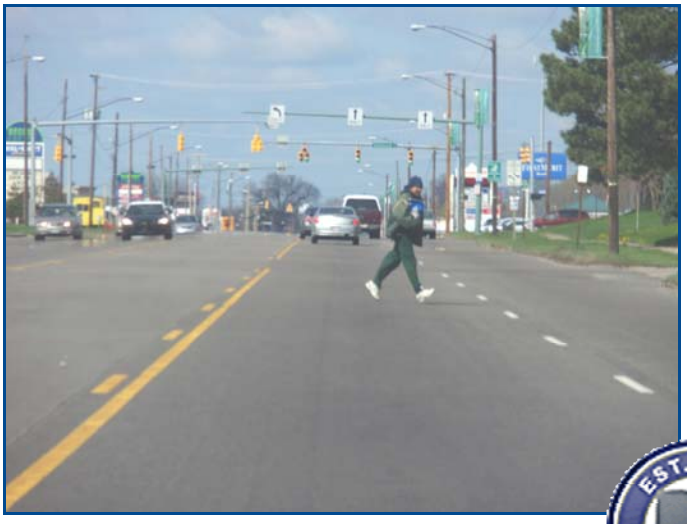
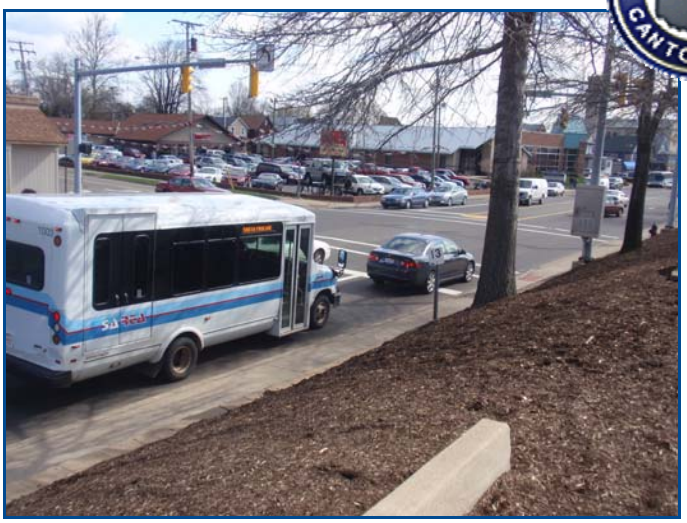
2011 SAFETY PROJECT APPLICATION

STA-172-11.91

SR 172 (TUSCARAWAS STREET WEST)
CANTON, OHIO





SEPTEMBER 2011

PROJECT SPONSOR:
THE CITY OF CANTON
2436 – 30TH STREET NE
CANTON, OHIO 44705

The Mannik & Smith Group, Inc.

SAFETY PROJECT APPLICATION
SR 172 (TUSCARAWAS ST. WEST) – CITY OF CANTON, OHIO
SEPTEMBER 2011

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SECTION 1

PROJECT INTRODUCTION

THE CITY OF
CANTON
WILLIAM J. HEALY II, MAYOR

ENGINEERING DEPARTMENT
Civil/Traffic/Parking/Signal & Lighting/Sign and Pavement Marking
Daniel J. Moeglin, P.E., S.I., City Engineer
2436 -30th Street N.E. / Canton, Ohio 44705
PH (330) 489-3381 / FAX (330) 489-3337

September 14, 2011

Mr. David Griffith, P.E.
Traffic Safety Engineer
ODOT District 4
2088 South Arlington Road
Akron, OH 44306

RE: SR172 (Tuscarawas Street West) Safety Application Submittal

Dear Mr. Griffith:

Please find enclosed three (3) copies of the SR172 (Tuscarawas Street West) Safety Application package which contains all items required, including a detailed safety study which recommends countermeasures for this high crash corridor that is ranked 22nd highest in the state listing of hot spots and that contains two (2) intersections ranked within the top 50 in the state. This study was conducted by the Mannik & Smith Group and funded by the City of Canton. The project scope, as defined by the Safety Study and through local stakeholder input, is fully supported by the City of Canton. The enclosed application is being submitted to apply for Safety Funding; a digital copy of the application package is also included.

At this time, we are only requesting funding for preliminary engineering. Additional funding for subsequent phases will be requested in the future.

The SR172 (Tuscarawas Street West) corridor is an Urban Principal Arterial route that accesses I-77 and downtown Canton. The roadway is primarily a five-lane facility the entire length of the 1.4 mile section with approximately 25,330 vehicles per day from Whipple Avenue eastward to Smith Avenue. This section of roadway has mixed land uses and roadway characteristics along this Urban Principal Arterial. In the three-year crash history period (2008-2010), there was a total of 383 applicable crashes on this

Canton City Hall
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section with a crash rate of 8.52 per Million Vehicle Miles Traveled (MVMT), which is nearly six times higher than the state average of 1.44 crashes per MVMT.

If you have questions or require additional information, please feel free to contact me or Ed Moore, the project manager, at 330-438-6914. Thank you for your consideration of our application.

Respectfully,

Daniel J. Moeglin, P.E., S.I.
Canton City Engineer

DJM/bjc

cc: Patrick L. Etchie, The Mannick & Smith Group
File

Enclosures

LOCATION MAP

Proposed SR 172 (Tuscarawas Street) Study Section (2008-2010 Crash Data)						
ODOT District #	Project Sponsor	County	Route	Section	Crash Rate (per MVMT)	Number of Crashes
4	City of Canton	Stark	SR 172	Whipple Ave. to Smith Ave.	8.52	383

[1]The State average crash rate for a similar facility as SR 172 (Tuscarawas Street West) is 1.44 crashes per MVMT, which means the current rate of the project section being studied is nearly 6 times higher than the State average.

2009 HotSpot Listing for SR 172 (Tuscarawas Street)						
HotSpot State Ranking	Location	# of Crashes	Fatal Crashes	Injury Crashes	Crash Rate	Section Length
HotSpot #22	Whipple Ave. to Schroyer Ave.	460	1	107	12.02	2.00 Mi.
The 2008-2010 High Crash Corridor listings were not available at the time of this safety study, however given the crash data reviewed for the period, it is assumed the corridor remains ranked in the vicinity of Top 30 or better.						

2009 SCATS (Stark Co. MPO) High Crash Listings for SR 172 (Tuscarawas Street)						
SCATS Ranking	Location	# of Crashes	Fatal Crashes	Injury Crashes	Crash Rate	Section Length
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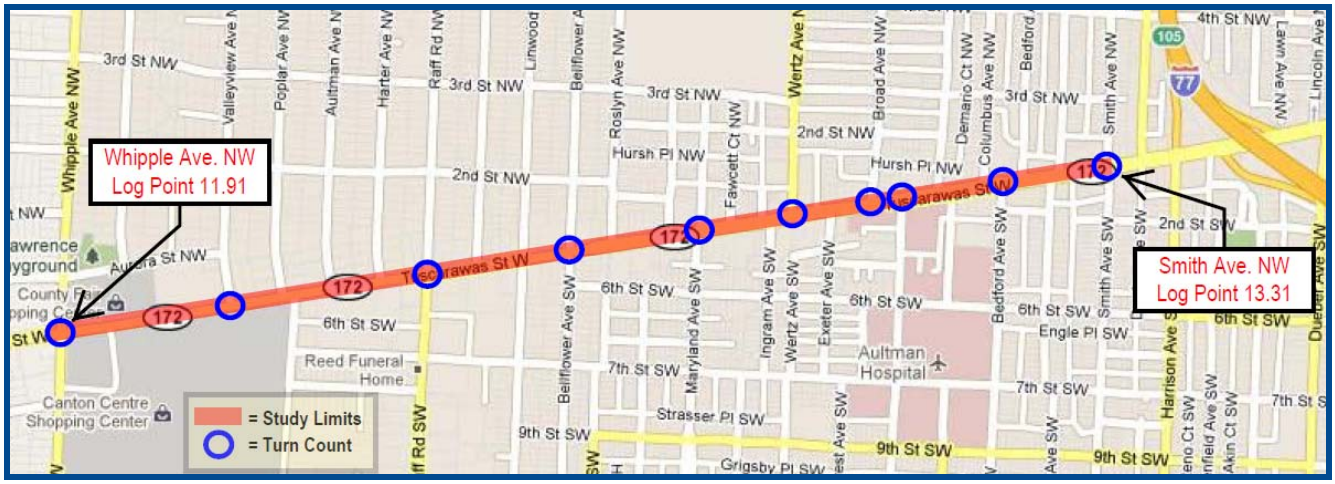
#9	SR 172 & Harrison Ave.	43	0	10	1.48	Intersection
#19	SR 172 & Raff Ave. (SR 791)	33	0	9	1.14	Intersection
#26	SR 172 & Whipple Ave.	40	0	6	1.01	Intersection



Safety Study Conducted by:	Project Sponsor: City of Canton	Located in ODOT District 4
The Mannik & Smith Group, Inc. for City of Canton		
Completion Date:		
August 2011		
Safety Program Submittal Round Deadline:		
September 30, 2011		
Three-Year Data Analyzed:		
2008-2010		

SECTION 2

SAFETY FUNDING APPLICATION

Safety Project Application

General Information

ODOT District	ODOT PID	County	Route	Section (Log)
District Four		Stark	SR 172	11.91 to 13.31
Project Sponsoring Agency				
City of Canton, 2436 – 30th Street NE, Canton, Ohio 44705				
Project Manager (Contact Person)			**Phone Number**	
Mr. Dan Moeglin, P.E., S.I.			(330) 489-3381	
Email Address				
Dan.moeglin@cantonohio.gov				

Project Description

Summary of Problem Statement

The SR172 (Tuscarawas St. West) corridor is the **22nd highest crash HotSpot section in the State as listed by the 2009 ODOT Safety Program**. A detailed *Safety Study* revealed in the most recent three year (2008-2010) period there were a total of 383 applicable crashes as documented by the ODOT CAM-Tool that occurred on SR172 from Whipple to Smith Avenues. **This 1.4 mile section had a crash rate of 8.52 crashes per MVMT which is nearly 6 times higher than the State average of 1.44** for a similar facility. It experienced a total of **8 pedestrian/bicycle crashes which is 1.5 times more than the State average** involving these types of crashes. Based on the *Safety Study* findings, the following elements were identified:

- Nearly 63% of the crashes occurred at an intersection or was intersection related. Additionally, 5.8% of the crashes occurred at driveway access locations. The 26 intersections (8 signalized) and the numerous driveway accesses create excessive turning conflicts on the corridor.
- The four most common crash types includes rear-end, angle, side-swipe and left turn crashes, which account for over 84% of all crashes. The majority of these are turn conflict related.
- Several intersections along the corridor have offset alignments which creates interlocking turning conflicts while motorists negotiate their turning movements.
- Visibility of signalized intersections and optimized operations could be greatly improved by upgrading to the latest technologies. The signals do not currently have video detection, black polycarbonate signal heads per lane with reflective backplates and pedestrian countdown signal heads, all of which would improve intersection visibility and pedestrian safety.
- The SR172 corridor experiences frequent pedestrian and bicycle traffic given the surrounding land uses. Current pedestrian/bicycle facilities do not provide enhanced visibility of these modes of transportation to motorists. Currently there are missing sections of sidewalks and there are no countdown pedestrian signal heads at signalized intersections. Particular emphasis should be focused on enhancing pedestrian/bicycle improvements on the 3,800' section from Bellflower to Smith Avenues since 7 of the 8 pedestrian/bicycle crashes occurred on this particular section. The percentage of pedestrian/bicycle crashes during the three-year period of 2008–2010 was 1.5 times higher than the State Average.

Summary of Recommended Countermeasures

The full recommended improvements being applied for in this funding application include the following (see *Figure 6.1* and *Table 6.1* in the *Safety Study* for a graphical presentation of countermeasures – the *Safety Study* is included in this application package):

SR172 Corridor Full Recommended Improvements:

- Provide full upgrades to the 7 city-owned traffic signals on the corridor and a partial upgrade to the ODOT signal to provide improved traffic operations through more efficient signal controllers & video detection and to provide enhance visibility. The upgrades are needed based on new technologies and new design standards rather than due to a maintenance issue. The existing poles and controllers based on field review and discussions with the City will not support upgrading to the desired standards of providing a signal head per lane; providing reflective backplates; video detection; new controllers; countdown pedestrian signal heads; ADA compliant pushbutton placements; and new signal timing/phasing & progression. These improvements would add weight to existing poles and potentially not meet load standards.
- Enhance intersection safety by improving signing; pavement markings; increasing turning radii where determined necessary/feasible; and improve left turn storage at signalized intersections.
- Provide improved access management on corridor with such techniques as a mix of raised concrete medians (with mountable curbs for emergency vehicles); turn restrictions at identified crash locations; drive consolidations; drive removals; improved geometrics; and U-Turn lanes where feasible; all of which will be determined in the Preliminary Engineering/Design Phase.
- Provide improved lane balancing and striping improvements throughout the corridor. Based on functional classification and that this route is not a designated Federal Aid Primary route, consideration can be given to reduce lane widths to 11' for travel lanes and 10' for turn lanes, which may provide additional width for improved sidewalks and radii improvements;
- It is recommended that missing sections in sidewalk coverage be constructed so to provide continuous sidewalks through the corridor on both sides of the roadway, and that all curb ramps not meeting ADA standards be upgraded to meet current standards;
- Improve signing and crosswalks to provide awareness to motorists of pedestrian/bicycle activity, especially on the 3,800' section from Bellflower to Smith Avenues where 7 of the 8 pedestrian/bicycle crashes occurred;
- Incorporate safer transit stops into corridor as these are also locations where pedestrian/bicycle activity is prevalent;
- Provide solar powered LED school zone flasher sign for the school located just north of SR172 between the intersections of Clarendon and Arlington Avenues.
- Re-align the offset intersections found on the corridor where feasible, or control the movements associated with these offsets through either the use of directional restricted drives or by a raised median or other geometric improvements.
- Relocate a portion of Dartmouth Avenue so that is aligns with the current T-type intersection of Broad Avenue. The feasibility of this improvement will be determined in the Preliminary Engineering/Design Phase. This improvement will require close coordination with the Aultman Hospital as it would entail a need for new right-of-way (ROW), demolition of a building, and vacating/removing a section of Dartmouth. The Aultman Hospital in the past has expressed an interest to the City to revise Dartmouth so to provide a safer ingress/egress for their employees and hospital patient traffic. A separate ROR analyses and cost estimate was conducted in the *Safety Study* for this improvement in case it ever needed to be separated out of the overall project due to time frames for ROW acquisitions, costs, or from the hospital modifying their support for the project. For this application, the cost is included in the overall recommendations.

Work Locations *(Insert additional rows as necessary)*

ODOT NLFID (or County & Route)	Begin Log	End Log	Location Termini (i.e. from street 1 to street 2)
STA-SR172	11.91	13.31	Whipple Ave. to Smith Ave.
STA-SR297	1.92	2.03	7th St. SW to SR172 (Tuscarawas St. W)
STA-MR00450 (Dartmouth Ave. SW)	0.00*	0.09*	Maywood Pl. SW to SR172 (Tuscarwas St. W)

*The log points for Dartmouth were assumed to start at 0.00 at SR172. The work on Dartmouth involves relocating less than 500' of the roadway to the west to align with current Broad Avenue signalized intersection.

Project Priority

Description of project priority (HSP or Local ranking)
This project was listed as the **22nd highest ranked HotSpot corridor in the State** in the HSP 2009 listings, and it continues to experience high frequencies of crashes as documented in the current 2008-2010 period in the *Safety Study*. In addition, the Stark County Area Transportation Study (SCATS) local MPO in 2009 indicated **this corridor contains the #3, #9, #19, & #26 ranked high crash intersections in the MPO region**. The SR172 (Tuscarawas St. West) corridor connects to one of the City's designated "Gateway" corridors into Downtown Canton. The City has made it a priority to improve the safety, operations, pedestrian/bicycle facilities, and appearance of this corridor as it is a key route connecting the Downtown and I-77 to areas west of the City. Given this, the City funded the *Safety Study* portion of the project with local funds to initiate the Safety Project process and to demonstrate their support for improving the corridor in the City of Canton.

Project Development

Project Phase	Completed By	Actual / Projected Completion Date
Safety Study	Mannik & Smith Group, Inc.	September 2011
Interchange Modification Study	N/A	N/A
Environmental (NEPA) Doc.	Consultant Selected by QBS	2012
Detailed Design	Consultant Selected by QBS	2012
Right of Way / Utilities	Consultant Selected by QBS	2012

Crash Data (Previous 3 years)

Data is for intersection (Y/N)	**N**	**Crash Frequency / Density**	236.4
*** Crash Rate**	8.52	**Percent Trucks**	6%
*** Relative Severity Index**	27,440	**Volume to Capacity Ratio**	0.60
*** Equiv. Property Damage**	22.57	**Rate of Return**	+31.40%
App. is for Corridor (Y/N)	Y		

* Refer to ODOT's Safety Policy to calculate crash rate, relative severity index, and equivalent property damage only rate.

Comprehensive Highway Safety Plan / High Risk Rural Roads

Number of Fatalities	Number of Incapacitating Injuries	CHSP Emphasis Area (i.e. Data and Support Systems; Serious Crash Type; High Risk Behaviors/Drivers; Special Vehicles/Roadway Users; Incident and Congestion Related Crashes)
0	10	Serious Crash Types; Special Vehicles/Roadway Users; and Incident/Congestion Related Crashes

CHSP Emphasis Area Strategy

The recommended countermeasures of the proposed safety project are focused on improving safety on the SR172 Corridor to address those specific patterns and crash types identified in the *Safety Study*. These recommendations address 3 of the 5 emphasis areas identified in Ohio's Comprehensive Highway Safety Plan (CHSP), including:

- Emphasis Area II – Serious Crash Types
  The recommendations of the *SR172 (Tuscarawas Street West) Safety Study* addresses the specific target area of *"Intersection"* crashes given that 63.2% of the crashes on this corridor were intersection or intersection related and this is well above the State percentage of 42.1% for similar facilities. Improvement strategies as outlined in Ohio's Safety Plan that are recommended for this corridor include:
  - Improved lane use & guide signs at key intersections so as to improve signs and visibility;
  - Signal upgrades to provide improved signal timing and visibility via use of LED signal heads with back plates; video detection, countdown pedestrian signals, & new controllers;
  - Restrict left turns to private drives in tightly spaced intersections where feasible
- Emphasis Area IV – Special Vehicles/Roadway Users (Pedestrians/Bicycles)
  The SR172 corridor was found to have a percentage of crashes 1.5 times higher than the State average of pedestrian/bicycle crashes. A total of 8 pedestrian/bicycle related crashes occurred on this section from 2008-2010. Given this, the target area of *"Pedestrians/Bicycles"* was targeted for improvements on the corridor in addition to the roadway improvements. Improvement strategies to increase pedestrian/bicycle safety include:
  - Provide continuous sidewalks throughout corridor where feasible;
  - Upgrade intersection curb ramps, sidewalks to ADA, & provide median resting areas where feasible;
  - Provide countdown pedestrian signals at all signalized intersections;
  - Improve crosswalk visibility and prohibit crosswalks where major left turn movements conflict with pedestrian median resting places;
- Emphasis Area V – Incident and Congestion Related Crashes
  The corridor experienced over 43.6% of the crashes as being rear-end type crashes, which is above the State average of 30.9% for a similar facility. Given this, the *"Rear-End crashes"* target of this Emphasis area was addressed.
  - Provide improved lane use & guide signs at key locations to assist the non-local drivers (primarily associated with the Hospital and I-77 area);
  - Upgrade signal installations as necessary to provide latest technologies to improve visibility, traffic signal efficiency in servicing traffic demands, overhead street name and guide signs, countdown pedestrian signals, back plates, etc.;
  - Access management improvements;
  - Turn lane and turn lane storage improvements

Eligible for HRRR Funds (Y/N)	Functional Classification	Section / Entering Traffic Volume
N	Urban Principal Arterial	25,330

Sources of Other (Non-Safety) Funding *(Insert additional rows as necessary)*

Project Phase	Source	Amount
All Phases Listed Below	City of Canton Funds	$510,900
See Note in Explanation	SCATS (Various Programs)	See Note in Explanation
Additional Explanation of other funding		
The City of Canton intends to apply to SCATS (local MPO) for portions of potential funding from programs such as CMAQ, Transportation Enhancements, and STP. At the time of this Safety Application these programs were not accepting applications but will be prior to the preliminary estimate of the 2014 anticipated year of construction.		

Project Funding

Project Phase	Fiscal Year	Other Funding	Previous Safety	New Safety	Total
Safety Study	2011	$14,900	N/A	N/A	$14,900
Interchange Mod. Study	N/A	N/A	N/A	N/A	N/A
Environmental (NEPA) Doc.	2012	$42,000	N/A	$378,000	$420,000
Detailed Design	2012 - 2013	$47,000	N/A	$423,000	$470,000
Right of Way /Utilities	2013 – 2014	$17,000	N/A	$153,000	$170,000
Construction	2014	$390,000	N/A	$3,510,000	$3,900,000
Total		$510,900	N/A	$4,464,000	$4,974,900

Please Note: The City of Canton intends to also apply for funding from several funding programs through the Stark County Area Transportation Study (SCATS) to supplement the funding splits indicated in the table above. Applications to these programs were not being accepted at the time of this application so no specific amounts are indicated above.

Applicant Information

Name (Print)	Title	Phone Number
Mr. Dan Moeglin, P.E., S.I.	City Engineer	(330) 489-3381
Signature		**Date**
Dan Moeglin		9/14/11

The following information should be included in submission of the safety project application:

- Copy of the Safety Engineering Study (including DSRT approval signatures, traffic volume data, project location map, and photographs of the project site, etc.)
- Rate of Return (Economic Analysis)

Please Note: All of the items listed above as well as the Safety Study and other supporting data is provided in this funding application package.

SECTION 3

SAFETY STUDY FOR SR 172

SAFETY STUDY

Proposed SR 172 (Tuscarawas Street) Study Section (2008-2010 Crash Data)						
ODOT District #	Project Sponsor	County	Route	Section	Crash Rate (per MVMT)	Number of Crashes
4	City of Canton	Stark	SR 172	Whipple Ave. to Smith Ave.	8.52	383

[1]The State average crash rate for a similar facility as SR 172 (Tuscarawas Street West) is 1.44 crashes per MVMT, which means the current rate of the project section being studied is nearly 6 times higher than the State average.

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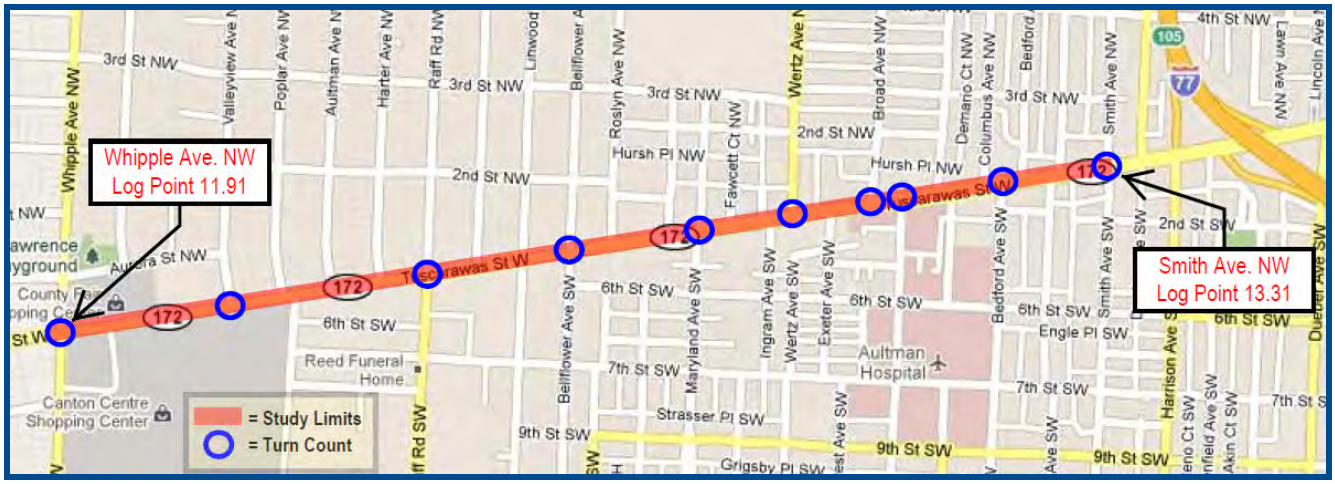


Safety Study Conducted by:	Project Sponsor: City of Canton	Located in ODOT District 4
The Mannik & Smith Group, Inc. for City of Canton		
Completion Date:		
August 2011		
Safety Program Submittal Round Deadline:		
September 30, 2011		
Three-Year Data Analyzed:		
2008-2010		

TABLE OF CONTENTS

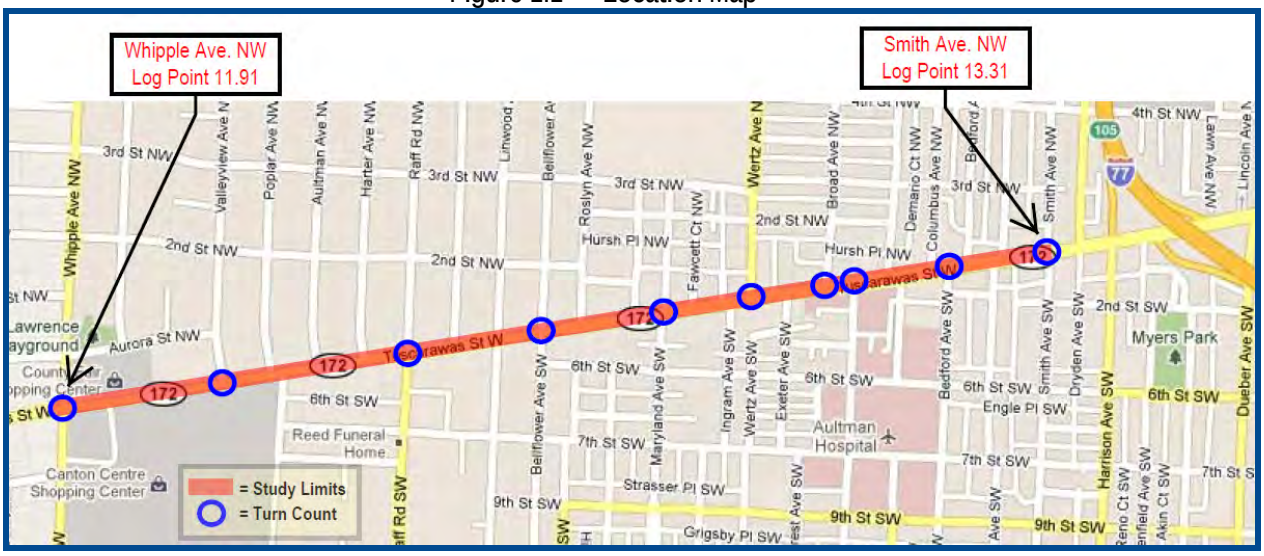
1.0 EXECUTIVE SUMMARY

1.1 Introduction

Study Purpose

This safety study analyzes the 1.4 mile section of SR172 (Tuscarawas Street West) corridor from Whipple Avenue to Smith Avenue located within the City of Canton, as shown on *Figure 1.1*. This roadway is locally referred to as "Tusc-West". This section of roadway has mixed land uses and roadway characteristics found along this Urban Principal Arterial. In the three-year crash history period (2008-2010), there was a total of 383 applicable crashes on this section with a crash rate of 8.52 per Million Vehicle Miles Traveled (MVMT), which is nearly six times higher than the State average of 1.44 crashes per MVMT. The purpose of this safety study is to document and analyze the existing physical conditions, traffic operations, crash patterns and seek input from the City of Canton and the Ohio Department of Transportation (ODOT), which will be used to develop conceptual improvements to enhance safety and operations.

Figure 1.1 Location Map



Background

The SR172 (Tuscarawas Street West) corridor is a commuter route that accesses I-77 and Downtown Canton. The roadway is primarily a five-lane facility the entire length of the 1.4 mile section of SR172 (Tuscarawas Street West) from Whipple Avenue eastward to Smith Avenue. This five-lane section involves two through travel lanes in each direction with a center two way left turn lane which at some intersections becomes a dedicated left turn lane. There is one small six-lane section from Whipple Avenue eastward to approximately Valley View Avenue. This six-lane section involves a small section that contains a dedicated right turn lane for a couple of commercial/retail plazas. Various sources of average daily traffic (ADT) values on the corridor were averaged to develop a corridor ADT, which revealed the roadway is carrying approximately 25,330 vehicles per day between Whipple Avenue and Harrison Avenue on this Urban Principal Arterial. The corridor has diverse adjacent land uses. The land uses along Tuscarawas Street West that most influence traffic patterns are the Canton Center Shopping Center; Wal-Mart; various retail and office businesses; residential areas; Aultman Hospital; and a school. These land uses and the connectivity to various neighborhoods north and south of the corridor result in frequent pedestrian and bicycle traffic at various locations. This pedestrian/bicycle activity is apparent given the seven (7) pedestrian and one (1) bicycle related crashes in the study period.

The corridor experiences frequent stop and go traffic during the peak traffic periods given the presence of eight (8) signalized intersections on this 1.40 mile section of roadway being studied. In addition to the signals, there are numerous unsignalized residential side streets and retail/commercial driveways that create turning conflicts from vehicles entering and exiting these access points as they cross multiple lanes of traffic. The eastern end of the corridor from Broad Avenue to Smith Avenue is particularly influenced from traffic generated by the Aultman Hospital Complex as well as the school located near Bedford Avenue.

The corridor is listed as a HotSpot on the 2007-2009 Listing as it was ranked as the 22nd highest crash corridor for the two mile section from Whipple Avenue eastward to Schroyer Avenue. The section of SR172 (Tuscarawas Street West) from Harrison east to Schroyer underwent major upgrades from late 2006 to early 2008 in which this section was improved, including the interchange with I-77. Given this recent upgrade, this study solely focuses on the portion of SR172 (Tuscarawas Street West) from Whipple Avenue to Smith Avenue since there is continued crash problems on this section and no recent safety or roadway improvements have been constructed.

Crash Rankings of Corridor:

- Current ranking is #22 on the 2009 HotSpot listings;
- Corridor contains 4 of SCATS' Top 30 crash intersections

Quick Crash Facts of Corridor:

- 383 crashes (2008-2010)
  - ✓ 43.6% Rear-End
  - ✓ 24.0% Angle
  - ✓ 11.0% Sideswipe (passing)
  - ✓ 8.4% Left Turn;
- Rear-end crashes higher than State Avg. of 30.9%;
- Angle crashes higher than State Avg. of 15.6%;
- Sideswipe Passing higher than State Avg. of 8.7%;
- Left Turn crashes higher than State Avg. of 5.2%;
- Intersection and I/S Related crashes account for 63.2% of crashes, which is higher than the State Avg. of 42.1%;
- Pedestrian and Bicycle crashes account for 2.1% of crashes on corridor, which is 1.5 times higher than the State Avg.;
- Crash rate of 8.52 per MVMT is nearly six times higher than the State Avg. rate of 1.44 MVMT

1.2 Purpose & Need of Project

Project History

The SR172 (Tuscarawas Street West) corridor from Whipple Avenue east to Schroyer Avenue in recent years has been listed in the ODOT Highway Safety Program (HSP) as one of the top ranked high crash corridors in the State of Ohio. Most recently in 2009 it was ranked as the #22 highest crash corridors in the State. In addition, the local MPO for Stark County (SCATS) has documented in 2009 that four intersections on this corridor were in the Top 30 highest crash intersections.

In 2007 to early 2008 the interchange of I-77 with SR172 had a major upgrade constructed, which also included the portion of SR172 (Tuscarawas Street West) from Smith Avenue eastward to Schroyer Avenue. Other than a signal timing/phasing improvement on the corridor in 1999, there has been no recent improvements. Given the continued listing of this corridor as a high crash location, the City of Canton in June 2011 authorized that a Safety Study be conducted to determine appropriate improvement countermeasures for reducing crash frequency.

Purpose Statement

The purpose of the proposed project is to reduce the frequency of crash occurrences, while improving safety for vehicular traffic & non-motorized users and addressing deficiencies throughout the corridor. The 1.4 mile section of SR172 (Tuscarawas Street West) from Whipple Avenue eastward to Smith Avenue witnessed 383 crashes in the 2008-2010 timeframe that included eight (8) pedestrian/bicycle related crashes.

Need Elements

Safety: The section of SR172 (Tuscarawas Street West) including the proposed safety project was ranked as the 22nd high crash HotSpot Corridor in the State during the 2009 ODOT Safety Program. The most recent three year (2008-2010) crash history period as documented by the ODOT CAM-Tool indicates a total of 383 applicable crashes have occurred on SR172 (Tuscarawas Street West) from Whipple Avenue to Smith Avenue. This section experienced a total of eight (8) pedestrian/bicycle crashes, which represented 1.5 times more than the State average of percent of crashes involving these types of crashes. This section has a crash rate of 8.52 vehicles per MVMT, which is nearly six times higher than the State average of 1.44 for a similar roadway facility.

Goals and Objectives

The primary goals & objectives of the project will be to reduce crashes and improve corridor operations by:

- Minimizing traffic flow interruptions and unexpected stops by improving traffic operations;
- Reducing the number of turning conflicts throughout corridor;
- Improving intersection visibility and safety;
- Enhancing pedestrian & bicycle safety; and,
- Considering all modes of transportation (vehicles, pedestrians, bicycles and transit) in developing corridor safety improvements.

Logical Termini

The termini include Whipple Avenue as the western terminus as this is a major signalized intersection and is the City of Canton's western corporation limits; and the eastern terminus is Smith Avenue, which is where the recently improved I-77 Interchange Upgrade project (2008) ended, therefore the section of SR172 east of Smith is a recently improved roadway. The section of roadway between Whipple and Smith Avenues is approximately 1.4 miles.

Summary

The SR172 (Tuscarawas Street West) corridor is a commuter route for population centers west of Canton and is also a City designated "Gateway" into Canton. The corridor is heavily traveled (25,330 ADT) and contains a mix of land uses including commercial/retail areas, residential, school, offices and the Aultman Hospital. The corridor is experiencing crash rates nearly six times higher than the State Average. There were also eight (8) pedestrian/bicycle crashes on the corridor from 2008-2010 which represents a percentage of cashes that is 1.5 times higher than the State Average. Given this identified crash history and the importance of the corridor to the City of Canton, a Safety Study was conducted to determine needed improvements to reduce crashes and improve pedestrian/bicycle safety.

1.3 Overview of Conceptual Improvements and Costs

The overall recommended countermeasures are detailed in *Section 6.3* and are graphically presented in *Table 6.1* and on *Figure 6.1*. A brief highlight of recommended safety improvements for SR172 (Tuscarawas Street West) are provided below so as to give a synopsis of the recommendations being suggested to reduce the number of crashes on this corridor.

The table summarizes both Interim Short Term improvements that could be implemented prior to the Full Recommendations being constructed.

Table 1.1 Overview of Recommended Safety Improvements

Recommendations Scenario	Improvement Description	Construction Cost Estimate	Funding Source Comment
Short Term Countermeasures	▪ Maintain all pavement markings (including crosswalk striping); ▪ Install countdown pedestrian signals where feasible; ▪ Consider signal timing/phasing update given recent improvements at eastern end of corridor near I-77 and turn volume data recently collected for this Safety Study; ▪ Update pedestrian crossing times per new standards if not already implemented; ▪ Work with property owners and businesses to see if any short term access management improvements are feasible to implement; ▪ Upgrade signing on corridor, especially those to warn motorists of pedestrian areas; ▪ Revise striping at several intersections to provide more exclusive left turn lane storage	$150,000	Several of these recommendations are being implemented simply from routine maintenance of the corridor by the City.
Long Term Full Recommended Improvements (see Figure 6.1 for conceptual improvements)	▪ Full upgrades of all warranted traffic signals to provide a signal head per lane; black signal heads with reflective border backplates; video detection; countdown pedestrian signal heads & pushbuttons; & improved signal timing/phasing & progression; ▪ Provide improved access management on corridor with such techniques as a mix of raised concrete medians; turn restrictions; drive consolidations; drive removals; improved geometrics; and U-Turn lanes where feasible; ▪ Improved sidewalks and bicycle facilities to meet current ADA standards with a particular focus on the area from Bellflower to Smith; ▪ Re-alignment of offset intersections where feasible if not corrected by raised median or other geometric improvements; ▪ Improved signing and pavement markings; ▪ Increase turning radii where needed; and, ▪ Improve left turn storage lengths	$4,340,000*	Safety Program Application (Sept. 2011) Funding will also be requested from SCATS from CMAQ, Enhancements and TIP funding programs.
Broad/Dartmouth Re-Alignment Improvement	▪ Re-Align Dartmouth Avenue to the west so that it aligns with Broad Avenue; ▪ Remove Pavement and Vacate ROW of the old alignment of Dartmouth Avenue	$653,000*	Safety Program Application (Sept. 2011)

* Note: The cost estimates above for the Long Term Full Recommended and the Broad/Dartmouth Re-Alignment reflect costs that would apply if the projects were separated. This safety funding application will submit these two improvements as a combined project; therefore there will be some cost savings on non-construction items such as Preliminary Engineering, Environmental Screening, Design, etc.

2.0 EXISTING CONDITIONS

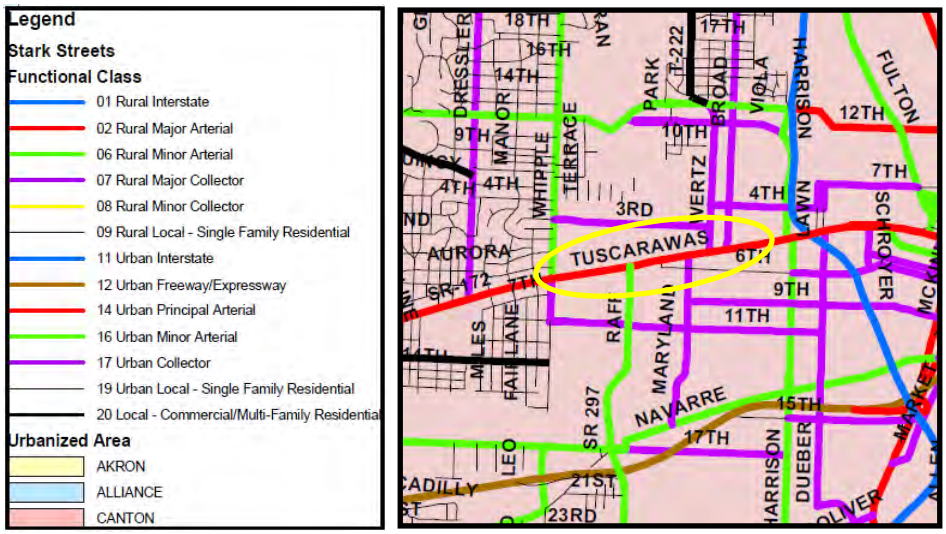
2.1 Conditions Diagrams

An Existing Conditions Diagram was produced for the project section of SR172 (Tuscarawas Street West) being studied and is presented in *Figure 2.1*, which consists of six (6) separate 11x17 figures. These figures display existing signs, lanes, pavement markings, driveways and other roadway features found on the corridor.

2.2 Physical Condition Write-up

The entire study section of SR172 (Tuscarawas Street West) has a functional classification of Urban Principal Arterial as shown on the graphic below. This section of roadway is approximately 1.4 miles in length and, in reviewing several agencies and conducting traffic counts on the corridor, a corridor ADT volume of 25,330 vehicles per day was determined. See *Appendix A* for traffic data and *Appendix B* for Synchro Reports. The percent of trucks on the corridor per the ODOT Traffic Survey Report was around 6% trucks. The roadway is primarily a five lane roadway with four travel lanes and one center two-way left turn lane. There are some small sections of six lanes between Whipple Avenue and Valleyview Avenue on the western end of the corridor as documented on *Figure 2.1*. The roadway has a posted speed limit of 35 MPH, with one 20 MPH School Zone located between Columbus Avenue and Bedford Avenue Northwest. Lane widths vary throughout the corridor between 10'-14' with curbed shoulders in most locations (some areas have limited curb or degraded curbing). The existing pavement on a majority of the corridor based on visual appearance is in good condition. There are a total of eight (8) signalized intersections which occur at the cross streets of Whipple; Valleyview/Wal-Mart; Raff (SR297); Bellflower; Maryland; Wertz; Broad; and Bedford. These signals lack newer technologies such as video detection and countdown pedestrian signal heads that would assist in making the intersections more efficient for traffic operations and safer for improving pedestrian movements.

There is a notable amount of pedestrian and bicycle traffic throughout the corridor given the adjacent land uses and the neighborhoods immediately north and south of the corridor. This pedestrian presence is noted by the fact that there were 8 pedestrian/bicycle related crashes on this corridor, which is nearly 1.5 times higher than the State average percent of crashes for such occurrences. Sidewalks are found in most of the corridor; however there are some sections without sidewalks that does not provide for continuous facilities through the entire corridor. Most existing portions of sidewalks and curb ramps appeared to have been upgraded to ADA standards, however there were a few locations that did upon a site visit that may need some upgrades to meet current ADA standards. The pedestrian crossings at intersections lack high visibility and would benefit from countdown pedestrian signal heads to assist in letting pedestrians know how much time they have to cross roadways.



Based on the 2008-2010 crash data and patterns and site visits to the corridor, there are currently inadequate access management concepts in place and limited pedestrian/bicycle facilities that are contributing to crash frequencies.

Possible Safety Concerns

Particular safety concerns with the SR172 (Tuscarawas Street West) corridor are outlined below. These were identified through the process of reviewing the crash history data, OH-1 reports, field reviews and traffic operations. In addition, input from the City and ODOT assisted in identifying the following issues:

- There are a total of eight (8) signalized intersections and eighteen (18) unsignalized public roadway intersections on this 1.4 mile section of SR172 (Tuscarawas Street West). In addition to these 26 intersections there are numerous private driveway access locations throughout the corridor. Crash data indicates that nearly 63% of the crashes occurred at either an intersection or was intersection related. Additionally, 5.8% of the crashes occurred at driveway access locations. All of these driveway accesses and intersections create excessive turning conflicts on the corridor.

- The numerous turning conflicts throughout this entire section of roadway (caused from private drives and public roadways) results in several common types of crashes associated with such conflicts. The four most common crash types on the corridor includes rear-end, angle, side-swipe and left turn crashes, which account for over 84% of the corridor crashes.

- Several intersections along the corridor have offset alignments and this creates interlocking turning conflicts while motorists negotiate their turning movements.

- Improved visibility of signalized intersections as well as upgrading to the latest technologies is needed to optimize traffic signal operations for improved traffic flow. The signals do not currently have video detection, black polycarbonate signal heads per lane with reflective backplates and pedestrian countdown signal heads, all of which would improve intersection visibility and pedestrian safety;

- The SR172 (Tuscarawas Street West) corridor experiences frequent pedestrian and bicycle traffic given the surrounding neighborhoods north and south of the corridor; a school located near Bedford Avenue; Aultman Hospital; and numerous retail and commercial centers. Current pedestrian/bicycle facilities do not provide enhanced visibility of these modes of transportation to motorists. Currently there are missing sections of sidewalks and there are no countdown pedestrian signal heads at signalized intersections. Intersections could benefit from improving curb ramps to ADA standards where deficiencies exist; installing countdown pedestrian signals; and improving crosswalk markings, signing and pedestrian facilities throughout the corridor. Particular emphasis should be focused on enhancing pedestrian/bicycle improvements on the 3,800’ section from Bellflower to Smith Avenues since 7 of the 8 pedestrian/bicycle crashes occurred on this particular section. The percentage of pedestrian/bicycle crashes during the three-year period of 2008–2010 was 1.5 times higher than the State Average.

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MATCH SHEET 2 OF 6

1 of 6	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 2.1 (SHEET 1 OF 6) EXISTING CONDITIONS WHIPPLE AVE. TO WAL-MART	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET

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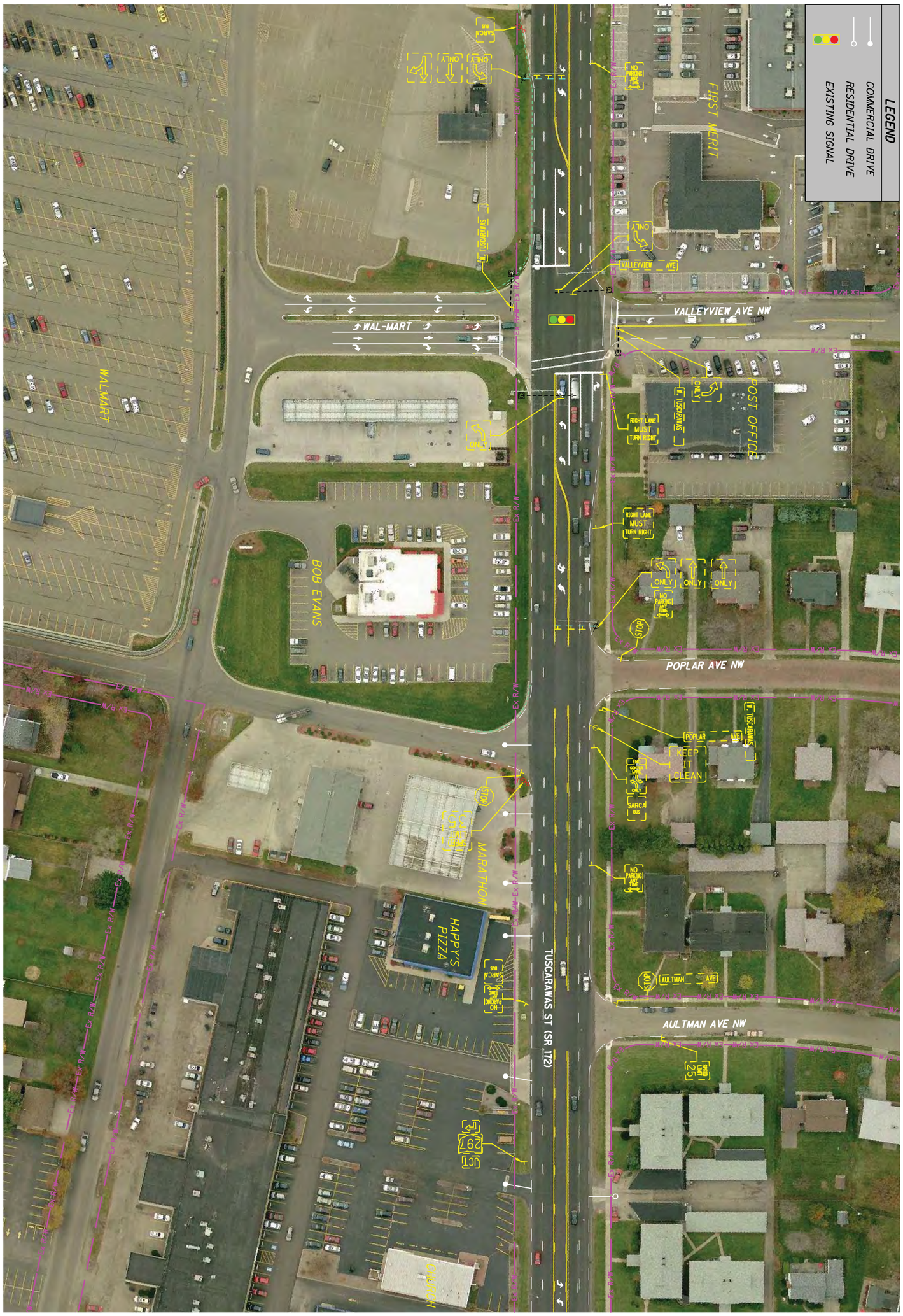
MATCH SHEET 1 OF 6



MATCH SHEET 3 OF 6

6 / 2	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 2.1 (SHEET 2 OF 6) EXISTING CONDITIONS VALLEYVIEW AVE. TO AULTMAN AVE.	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET	N

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MATCH SHEET 2 OF 6

MATCH SHEET 4 OF 6

3 of 6	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 2.1 (SHEET 3 OF 6) EXISTING CONDITIONS HARTER AVE. TO LINWOOD AVE.	CALCULATED MLM CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET	N

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MATCH SHEET 3 OF 6

MATCH SHEET 5 OF 6

4 of 6	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 2.1 (SHEET 4 OF 6) EXISTING CONDITIONS BELLFLOWER AVE. TO FAWCETT CT.	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET

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MATCH SHEET 4 OF 6

PAVEMENT WIDTH = 54'
CURB = 6"
CENTER LANE = 10'
OUTER LANE = 11'
INNER LANE = 11'
APPROX R/W WIDTH = 66'

MATCH SHEET 6 OF 6

6 / 5	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 2.1 (SHEET 5 OF 6) EXISTING CONDITIONS INGRAM AVE. TO CLAREDON AVE.	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET

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MATCH SHEET 5 OF 6

6 of 6	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 2.1 (SHEET 6 OF 6) EXISTING CONDITIONS COLUMBUS AVE. TO SMITH AVE.	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET

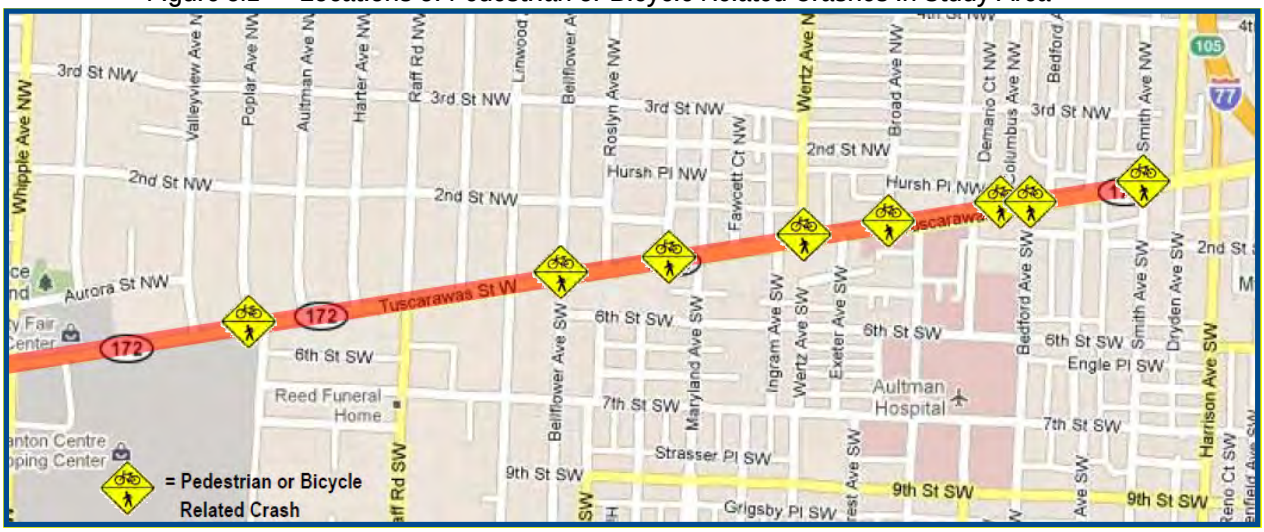
3.0 COLLISION DIAGRAMS (2008-2010)

The SR172 (Tuscarawas Street West) 1.4 mile section of roadway from Whipple Avenue eastward to Smith Avenue, upon a review of the CAM-Tool crash data spreadsheet and a review of OH-1 crash reports, there were a total of 383 applicable crashes, as shown on the Collision Diagrams of *Figure 3.1*. This figure contains eight (8) separate figures given the large number of crashes on this corridor. The collision diagrams provide a visual representation of the types of crashes and locations of where crashes are occurring. The crashes shown on the collision diagrams had to be stacked given the amount of crashes on the corridor, so the first recorded crash starts near the travel lane it occurred on SR172 in the approximate location and then as the number of crashes near that same location are recorded, they are stacked on top of each other beyond the roadway limits. A review of the collision diagrams, OH-1 reports and data analyzed via use of the CAM-Tool indicate the following patterns:

Summary of Crash Locations:

- Overall, the entire 1.4-mile section of SR172 from Whipple Avenue to Smith Avenue contained 383 crashes in the 2008-2010 timeframe and had the following general characteristics:
  - 63.2% of the crashes occurred at intersection or intersection related (within 0.1 mile of intersection) locations, which is well above the State average of 42.1% for such crashes;
  - Most frequent crash types involved Rear-End (43.6%); Angle (24.0%); Sideswipe-Passing (11.0%); and Left Turn (8.4%), which are above Statewide Averages of 30.9%, 15.6%, 8.7% and 5.2% respectively;
  - A total of 6.8% of the crashes were documented as occurring at driveway access locations, which is slightly above the Statewide Average of 5.5%.
- The Collision-Diagrams graphically show that the section between Whipple Avenue and Smith Avenue contains widespread crash patterns throughout the entire corridor, particularly at intersections and driveway accesses. Some of the more notable locations with a higher clustering of crashes include:
  - Raff Road (SR297) intersection shows crashes on both eastbound and westbound approaches on SR172, as well as on the northbound approach on Raff Road south of SR172;
  - Maryland Avenue intersection primarily on eastbound and westbound approaches on SR172; and,
  - Broad Avenue & Dartmouth Avenue offset intersections on all approaches
- The section of SR172 (Tuscarawas Street West) from Poplar Avenue eastward to Smith Avenue contained a total of 8 pedestrian/bicycle related crashes, which accounts for 2.1% of the total crashes on the corridor. This percentage 1.5 times higher than the Statewide Average of 1.4%;
- The graphic below shows the location of the 8 pedestrian/bicycle crashes. There is clearly a cluster between Bellflower and Smith Avenues where 7 of the 8 crashes occurred on this 3,800' section of SR172.

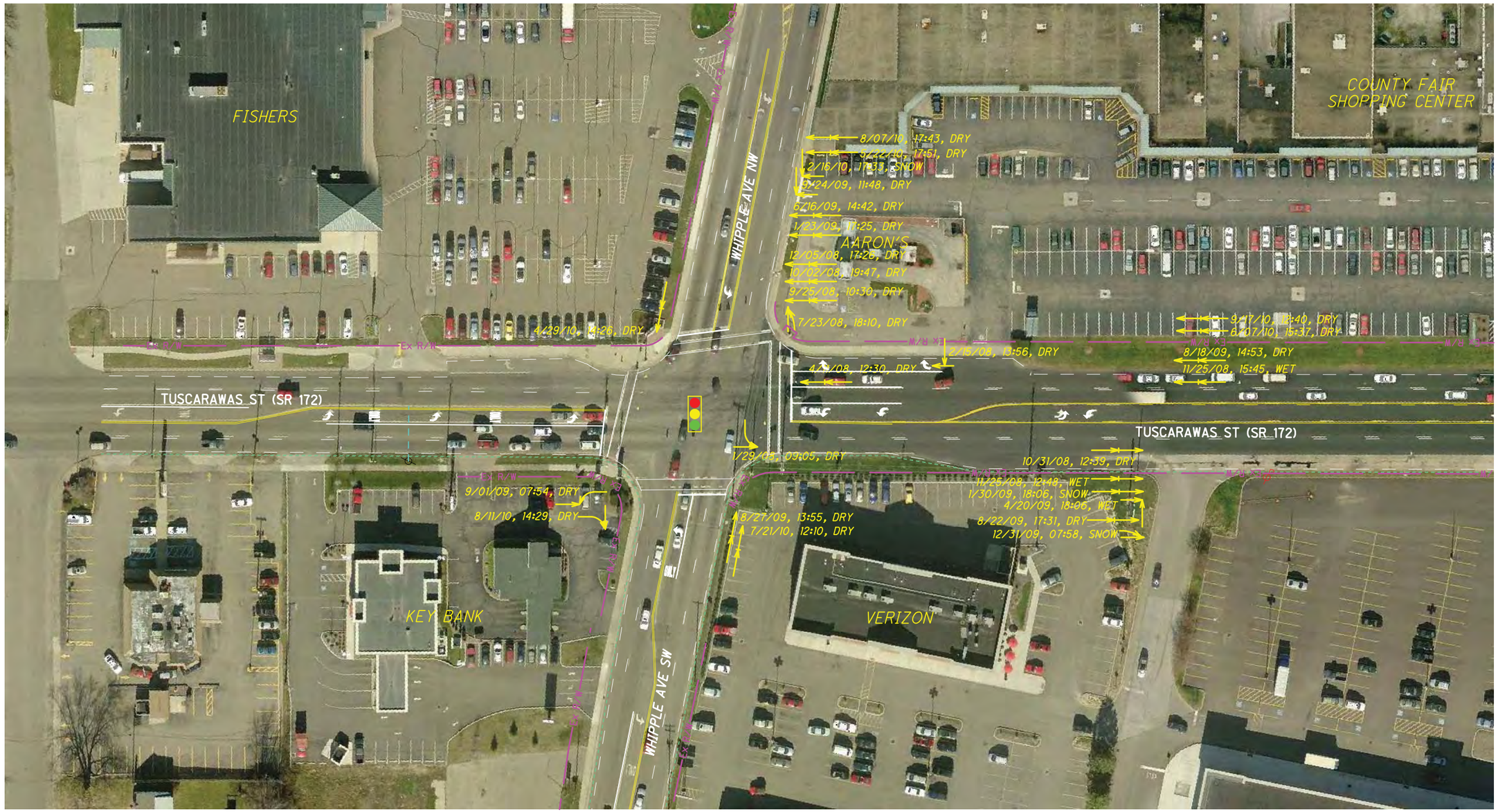
Figure 3.1 Locations of Pedestrian or Bicycle Related Crashes in Study Area



SYMBOLS	TYPES OF COLLISIONS	CRASH YEAR
MOVING VEHICLE BACKING VEHICLE NON-INVOLVED VEHICLE PEDESTRIAN PARKED VEHICLE FIXED OBJECT FATAL ACCIDENT	REAR END HEAD ON SIDE SWIPE OUT OF CONTROL LEFT TURN RIGHT ANGLE	2008 - 2010

SECTION: WHIPPLE AVE TO WAL-MART

PERIOD: 3 YEARS FROM 2008 TO 2010



MATCH SHEET 2 OF 8

CALCULATED MLM
CHECKED PLE

FIGURE 3.1 (SHEET 1 OF 8) COLLISION DIAGRAMS
WHIPPLE AVE. TO WAL-MART

TUSCARAWAS ST.(SR 172)
SAFETY STUDY

1
8

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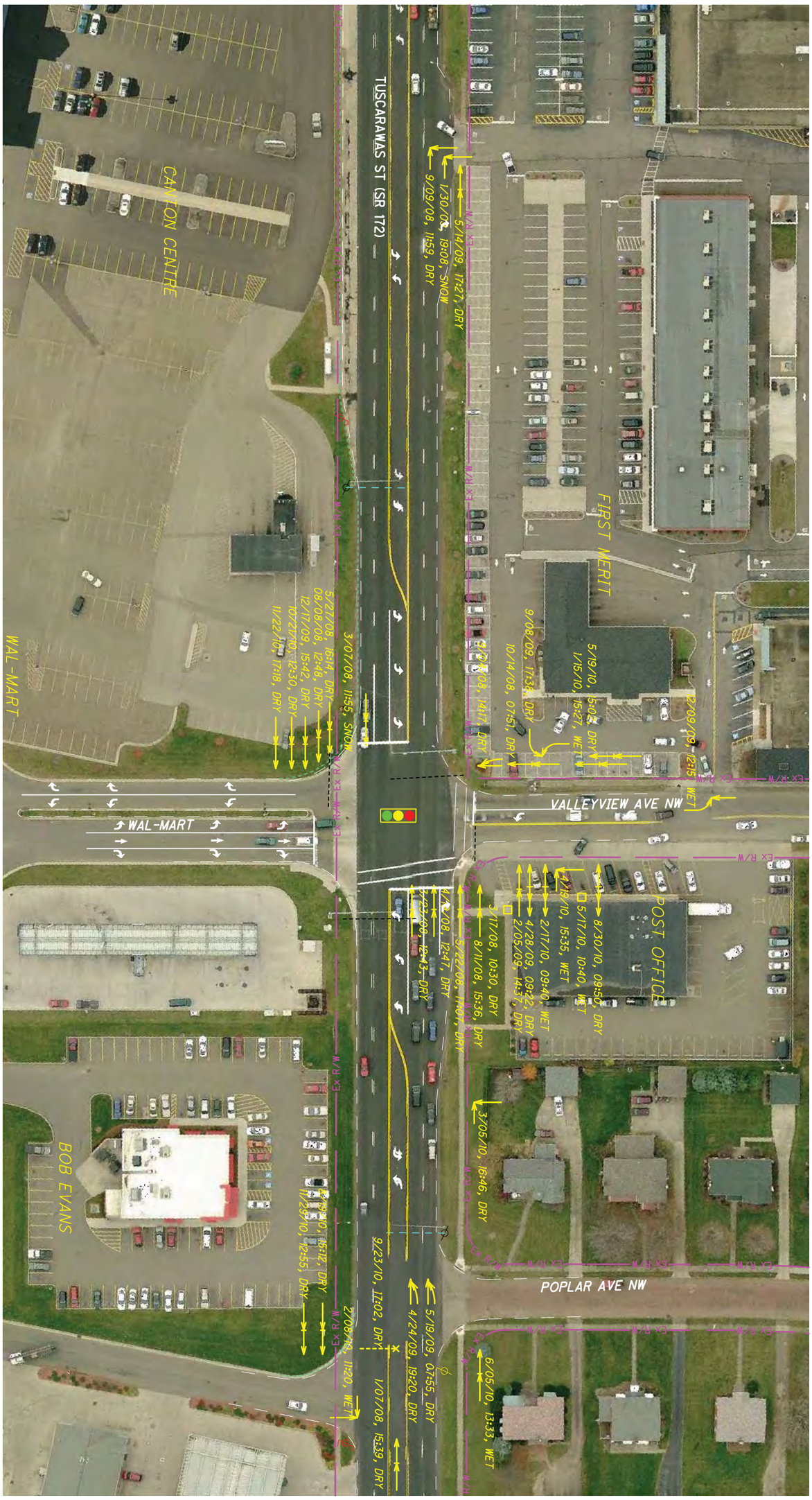
MATCH SHEET 1 OF 8



MATCH SHEET 3 OF 8

SYMBOLS	TYPES OF COLLISIONS	CRASH YEAR
MOVING VEHICLE	REAR END	
BACKING VEHICLE	HEAD ON	
NON-INVOLVED VEHICLE	SIDE SWIPE	
PEDESTRIAN	OUT OF CONTROL	
PARKED VEHICLE	LEFT TURN	
FIXED OBJECT	RIGHT ANGLE	
FATAL ACCIDENT		

SECTION: WAL-MART TO POPLAR AVE.
PERIOD: 3 YEARS FROM 2008 TO 2010

2008 - 2010

8 / 2	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 3.1 (SHEET 2 OF 8) COLLISION DIAGRAMS WAL-MART TO POPLAR AVE.	CALCULATED MLM CHECKED PLE

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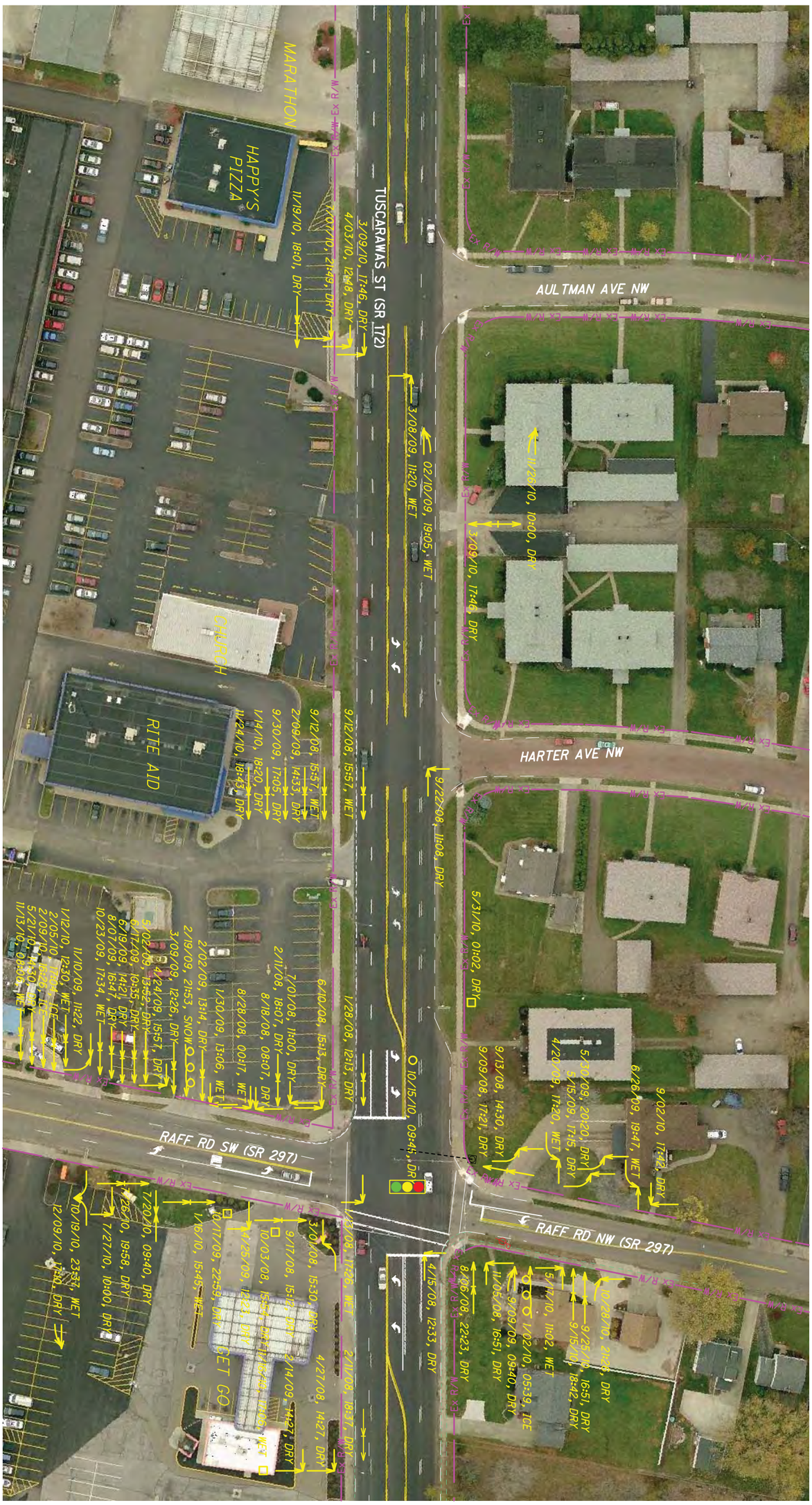
MATCH SHEET 2 OF 8



SYMBOLS	TYPES OF COLLISIONS	CRASH YEAR
MOVING VEHICLE	REAR END	
BACKING VEHICLE	HEAD ON	
NON-INVOLVED VEHICLE	SIDE SWIPE	
PEDESTRIAN	OUT OF CONTROL	
PARKED VEHICLE	LEFT TURN	
FIXED OBJECT	RIGHT ANGLE	
FATAL ACCIDENT		
POT HOLE/OBJECT IN ROADWAY		

SECTION: AULTMAN AVE. FROM RAFF RD. (SR 297)
PERIOD: 3 YEARS FROM 2008 TO 2010

2008 - 2010

MATCH SHEET 4 OF 8

3 of 8	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 3.1 (SHEET 3 OF 8) COLLISION DIAGRAMS AULTMAN AVE. TO RAFF RD. (SR 297)	CALCULATED MLM CHECKED PLE

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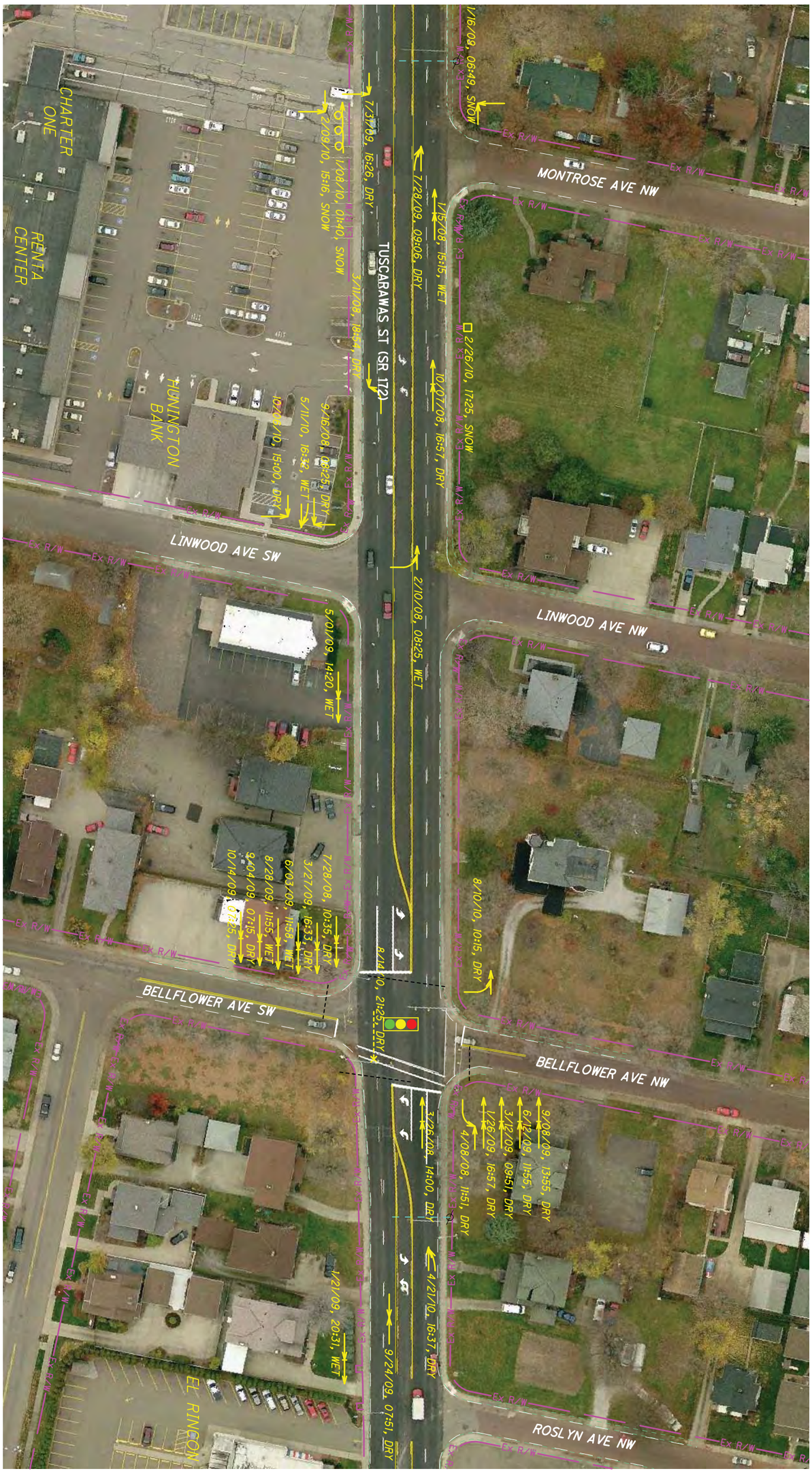
MATCH SHEET 3 OF 8



SYMBOLS	TYPES OF COLLISIONS
MOVING VEHICLE	REAR END
BACKING VEHICLE	HEAD ON
NON-INVOLVED VEHICLE	SIDE SWIPE
PEDESTRIAN	OUT OF CONTROL
PARKED VEHICLE	LEFT TURN
FIXED OBJECT	RIGHT ANGLE
FATAL ACCIDENT	

SECTION:	MONTROSE AVE.	TO	ROSLYN AVE.	CRASH YEAR
PERIOD:	3 YEARS FROM 2008	TO	2010	2008 - 2010

MATCH SHEET 5 OF 8

4 / 8	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 3.1 (SHEET 4 OF 8) COLLISION DIAGRAMS MONTROSE AVE. TO ROSLYN AVE.	CALCULATED MLM CHECKED PLE

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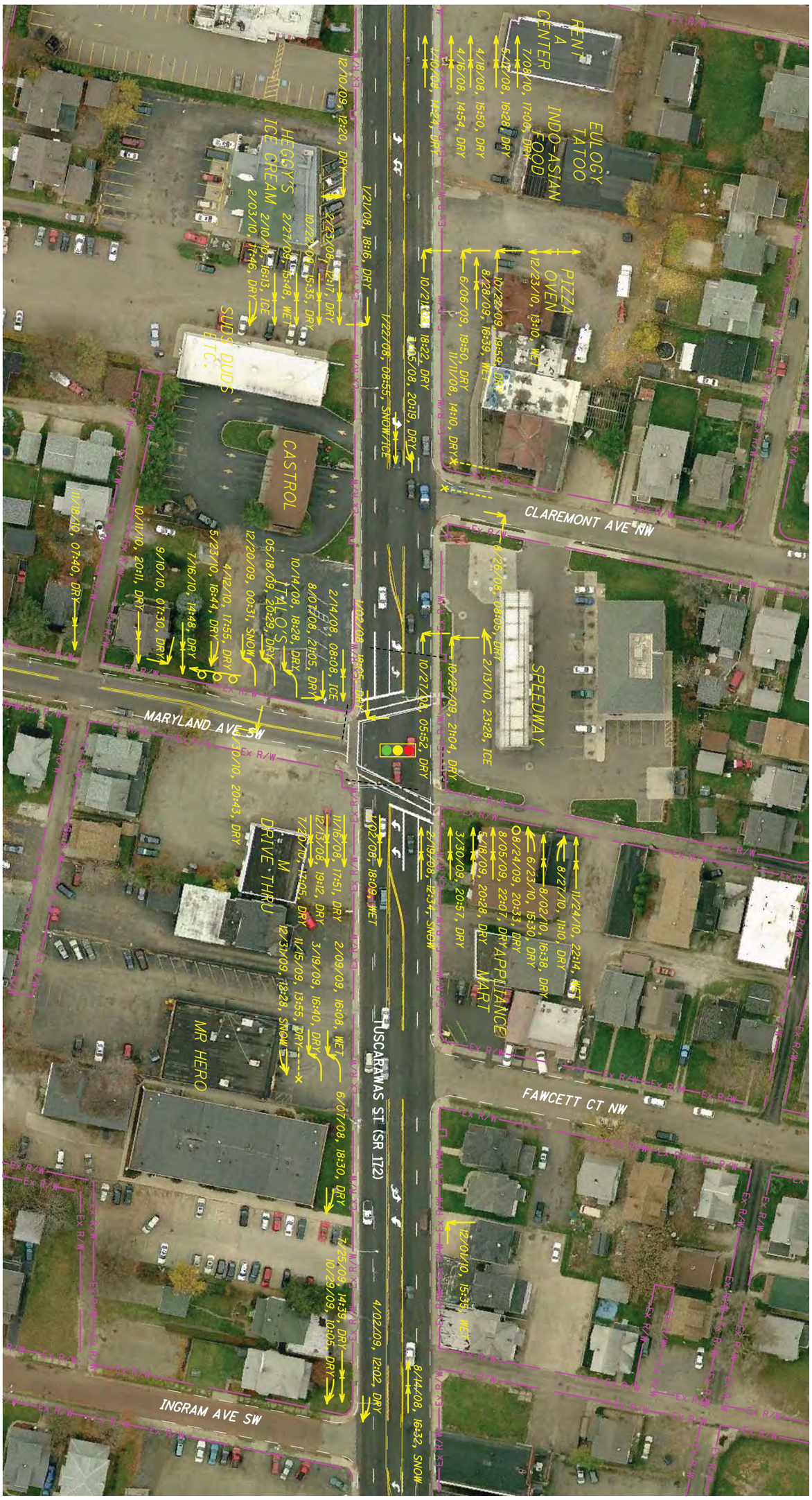
MATCH SHEET 4 OF 8



MATCH SHEET 6 OF 8

SYMBOLS	TYPES OF COLLISIONS
MOVING VEHICLE	REAR END
BACKING VEHICLE	HEAD ON
NON-INVOLVED VEHICLE	SIDE SWIPE
PEDESTRIAN	OUT OF CONTROL
PARKED VEHICLE	LEFT TURN
FIXED OBJECT	RIGHT ANGLE
FATAL ACCIDENT	
POT HOLE/OBJECT IN ROADWAY	

SECTION: CLAREMONT AVE. TO INGRAM AVE.
PERIOD: 3 YEARS FROM 2008 TO 2010

CRASH YEAR: 2008 - 2010

5 of 8	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 3.1 (SHEET 5 OF 8) COLLISION DIAGRAMS CLAREMONT AVE. TO INGRAM AVE.	CALCULATED MLM CHECKED PLE

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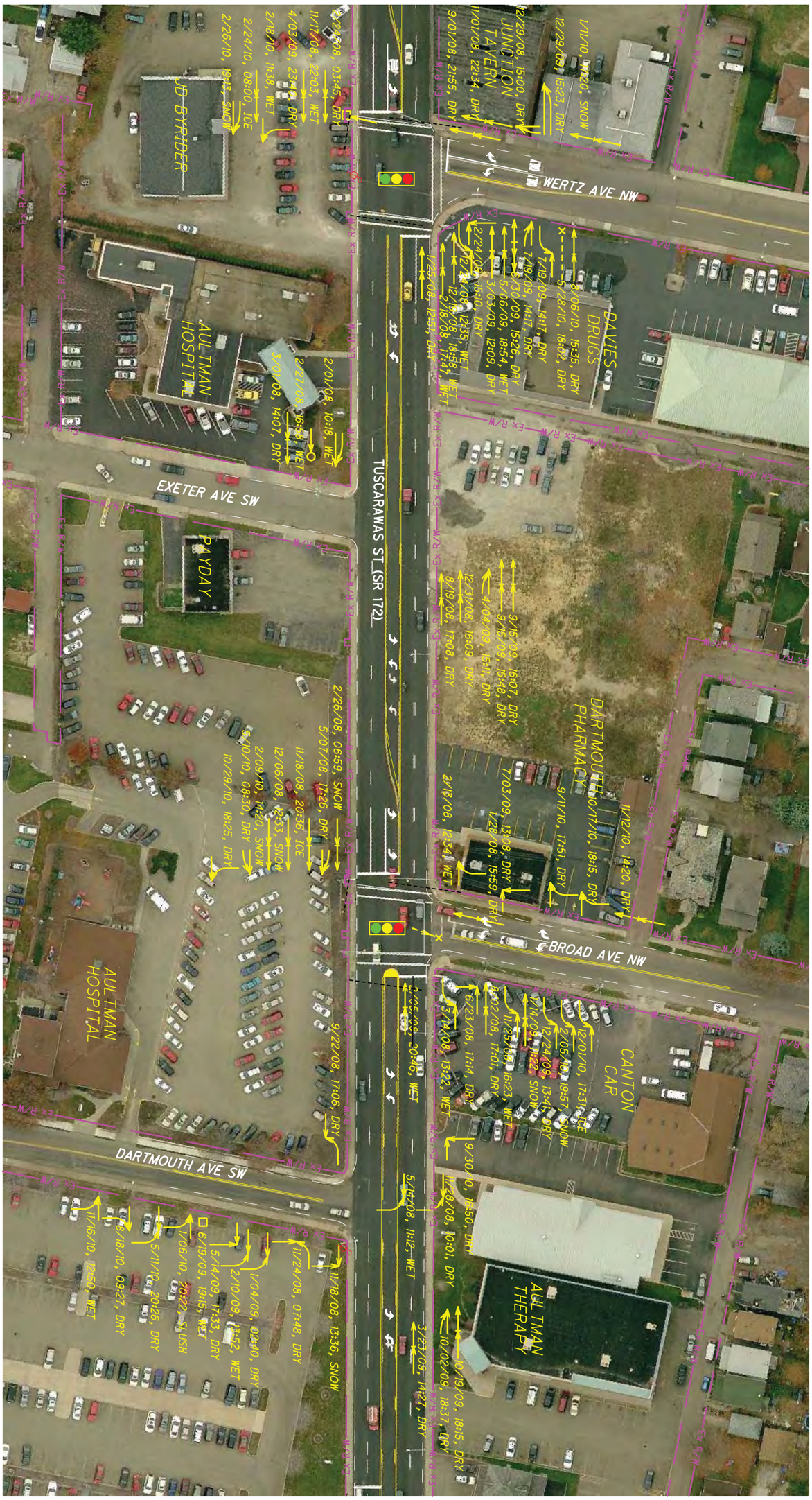
MATCH SHEET 5 OF 8



MATCH SHEET 7 OF 8

SYMBOLS	TYPES OF COLLISIONS	CRASH YEAR
MOVING VEHICLE	REAR END	2008 - 2010
BACKING VEHICLE	HEAD ON	
NON-INVOLVED VEHICLE	SIDE SWIPE	
PEDESTRIAN	OUT OF CONTROL	
PARKED VEHICLE	LEFT TURN	
FIXED OBJECT	RIGHT ANGLE	
FATAL ACCIDENT		
POT HOLE/OBJECT IN ROADWAY		

SECTION: WERTZ AVE. TO DARTMOUTH AVE.
PERIOD: 3 YEARS FROM 2008 TO 2010

8	8	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 3.1 (SHEET 6 OF 8) COLLISION DIAGRAMS WERTZ AVE. TO DARTMOUTH AVE.	CALCULATED MLM CHECKED PLE

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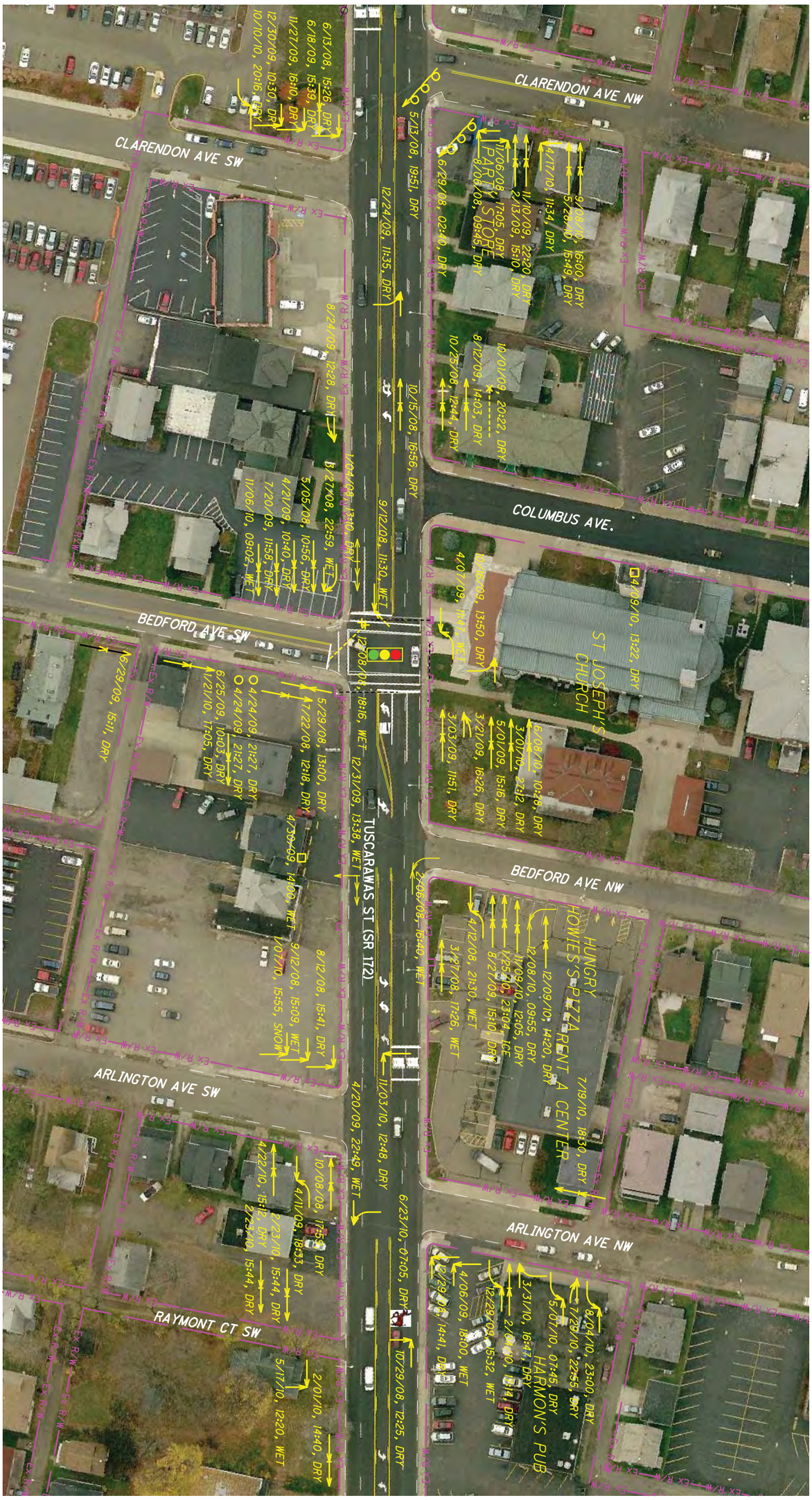
MATCH SHEET 6 OF 8



MATCH SHEET 8 OF 8

SYMBOLS	TYPES OF COLLISIONS
MOVING VEHICLE	REAR END
BACKING VEHICLE	HEAD ON
NON-INVOLVED VEHICLE	SIDE SWIPE
PEDESTRIAN	OUT OF CONTROL
PARKED VEHICLE	LEFT TURN
FIXED OBJECT	RIGHT ANGLE
FATAL ACCIDENT	
POT HOLE/OBJECT IN ROADWAY	
DEER	

SECTION:	CLAREDON AVE.	TO	ARLINGTON AVE.	CRASH YEAR
PERIOD:	3 YEARS	FROM 2008	TO 2010	2008 - 2010

7/8	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 3.1 (SHEET 7 OF 8) COLLISION DIAGRAMS CLARENDON AVE. TO ARLINGTON AVE.	CALCULATED MLM CHECKED PLE

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MATCH SHEET 7 OF 8

SYMBOLS	TYPES OF COLLISIONS	CRASH YEAR
MOVING VEHICLE	REAR END	2008 - 2010
BACKING VEHICLE	HEAD ON	
NON-INVOLVED VEHICLE	SIDE SWIPE	
PEDESTRIAN	OUT OF CONTROL	
PARKED VEHICLE	LEFT TURN	
FIXED OBJECT	RIGHT ANGLE	
FATAL ACCIDENT		
POT HOLE/OBJECT IN ROADWAY		

SECTION					
PERIOD	3 YEARS	SMITH AVE.	TO	HARRISON AVE.	
		FROM: 2008	TO	2010	

8	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 3.1 (SHEET 8 OF 8) COLLISION DIAGRAMS SMITH AVE. TO WEST OF HARRISON AVE.	CALCULATED MLM CHECKED PLE	N

4.0 CRASH DATA (2008-2010)

Crash data was obtained from three different sources. The City of Canton's Police Department provided hard copies of the OH-1 Crash Reports; ODOT provided a CAM-Tool crash analysis spreadsheet; and TSASS (Traffic Safety Analysis, Systems & Services, Inc.) provided a "scrubbed" database of crashes on the SR172 corridor. After all non-applicable crashes (Falling From Vehicle, Workzone Related, Animal, etc.) were removed from the database, there were a total of 383 applicable crashes on the 1.4 mile section of SR172 from Whipple Avenue eastward to Smith Avenue with a crash rate of 8.52 crashes per MVMT. The most recent (2007-2009) HotSpot listings available (at the time of this report) from ODOT crash listings indicate the 2-mile section of SR172 (Tuscarawas Street West) from Whipple Avenue to Schroyer Avenue is ranked #22 in the State.

In addition to the HotSpot listing from ODOT, the Stark County Crash Report (2009) by SCATS was reviewed for high crash locations listed on the corridor. The graphic below shows that the SR172 section from Whipple Avenue to just east of Smith Avenue contains the #3, #9, #19 and #26 highest ranked intersections within the SCATS coverage area. The ODOT Hotspot Listing, SCATS high crash intersection listings and current 2008-2010 crash data indicates a crash problem remain on the corridor despite previous improvements made to the corridor as mentioned previously.

Table 4.1 Locations with Hazard Ratings over 10

Street		Intersecting Street	Crashes by year 2007	2008	2009	3 Year Totals Crashes	Injury	Fatal	Avg Daily Traffic	Severity Index	Crash Rate per Million Vehicles	SCATS Hazard Rating	Jurisdiction
12th St N		Market Ave N	24	18	19	61	28	0	25,615	1.92	2.17	56.51	Canton
US 62		Harmont Ave/Lesh St	22	18	24	64	19	1	31,905	1.77	1.83	45.97	Canton
Central Plaza	#3	Tuscarawas St	17	18	15	50	16	0	23,650	1.64	1.93	35.16	Canton
13/12th St		I-77 Ramps TM Hospital	21	12	13	46	14	0	20,200	1.61	2.08	34.18	Canton
Cleveland Ave		Wright St	3	15	9	27	16	0	10,000	2.19	2.46	32.31	County
30th St NE		Harrisburg Ave	11	8	9	28	9	1	11,345	2.04	2.25	28.53	County
Dueber Ave SW		Navarre Rd	9	9	4	22	12	0	9,400	2.09	2.14	21.83	Canton
Everhard Rd		Whipple Ave	22	17	16	55	17	0	46,500	1.62	1.08	21.35	County
Harrison Ave	#9	Tuscarawas St W	21	12	10	43	10	0	26,430	1.47	1.48	20.79	Canton
I-77		Belden Village & Whipple	13	15	18	46	18	0	40,850	1.78	1.03	18.73	ODOT
SR619		McCallum Ave	8	3	2	13	8	0	4,210	2.23	2.82	18.16	ODOT
Harmont Ave NE		Mahoning Ave	12	9	10	31	11	0	19,105	1.71	1.48	17.44	Canton
US 62		Regent Ave	10	12	14	36	7	1	30,200	1.69	1.09	14.75	ODOT
Clarendon Ave		Navarre Rd	5	5	5	15	7	0	6,000	1.93	2.28	14.70	Canton
13th St NW		Harrison Ave	20	7	6	33	10	0	24,530	1.61	1.23	14.46	Canton
US 30 EB Ramps		Raff Ave	5	11	4	20	8	0	10,550	1.80	1.73	13.84	ODOT
SR687		Everhard Rd	10	18	16	44	11	0	42,740	1.50	0.94	13.78	ODOT
30th St N		Market Ave N SR 43	11	11	9	31	15	0	28,730	1.97	0.98	13.35	Canton
Raff Ave SR791	#19	Tuscarawas St W	8	12	13	33	9	0	26,335	1.55	1.14	12.96	Canton
Dressler Rd		Everhard Rd	11	19	12	42	11	0	42,700	1.52	0.90	12.77	County
US 62		Middlebranch & Harrisburg	13	13	17	43	10	0	43,135	1.47	0.91	12.74	ODOT
Andrews St		Market Ave	3	7	3	13	8	0	6,200	2.23	1.91	12.33	Lake Twp
SR 21 Ramps NB		Erie St	8	6	6	20	5	0	9,900	1.50	1.84	12.29	Massillon
Erie St		Lincoln Way SR172	6	8	14	28	11	0	23,820	1.79	1.07	11.92	Massillon
Elgin Ave		I-77 NB Offramp& Tuscarawas	10	10	8	28	5	0	18,250	1.36	1.40	11.82	Canton
SR172	#26	Whipple Ave	16	12	12	40	6	0	36,030	1.30	1.01	11.71	ODOT

Source: Stark County Crash Report (2009) by SCATS

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5.0 CRASH ANALYSES

5.1 Current Crash Analyses (2008-2010)

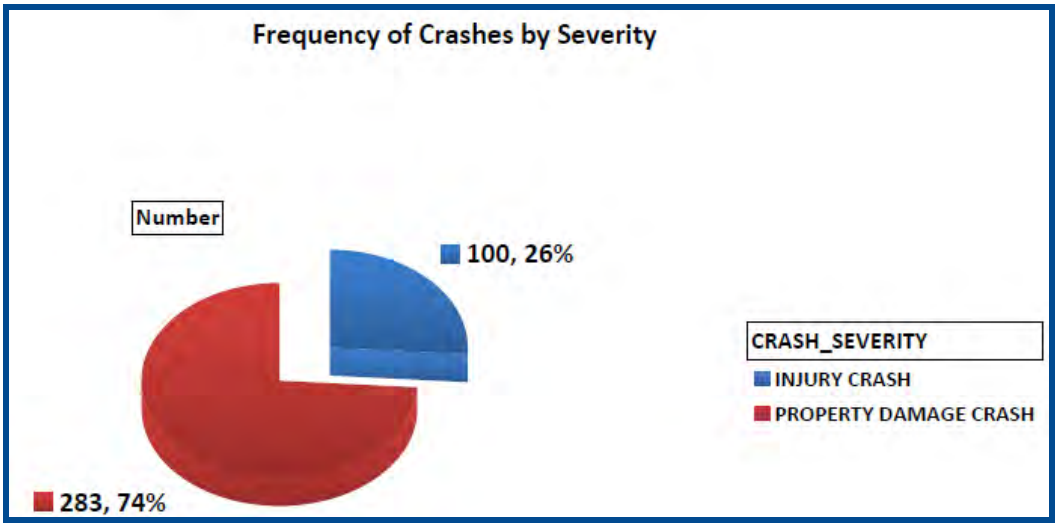
Upon removing all non-applicable crashes from the crash data on SR172 for the years 2008-2010, there were a total of 383 crashes on the 1.4 mile section between Whipple Ave. and Smith Ave. that yielded a section crash rate of 8.52 crashes per MVMT. This rate is nearly six times higher than the Statewide Average for a similar roadway. The following is a highlight of the crash statistics:

Snapshot of the 383 crashes indicated the following:

- Injury crashes accounted for nearly 26.1% of the total crashes (State Average is 25.4%)
- The most common crash types were:
    - 43.6% were Rear-End (State Average is 30.9%)
    - 24.0% were Angle (State Average is 15.6%)
    - 11.0% were Sideswipe Passing (State Average is 8.7%)
    - 8.4% were Left Turns (State Average is 5.2%)
- There were 8 (2.1%) crashes involving pedestrians/bicycles (State Average is 1.4%)
- In regards to weather conditions, 79.1% occurred during no adverse weather conditions
- 72.8% were in daylight hours and 20.9% in dark-lighted conditions
- 63.2% occurred at intersection or intersection related locations (State Average is 42.1%)
- In the primary action of drivers, *Going Straight* accounted for 57.2% of crashes
- Access management related crashes such as the categories of *Turning Left*, *Turning Right* and *Changing Lanes* involved 26.0% of the crashes on the corridor
- In the secondary action of drivers, 44.6% of all crashes involved a vehicle *Stopped in Traffic*

Supporting crash statistics and descriptions of findings:

The following crash tables and graphs are based on the CAM-Tool analyses and they display a summary of the crash statistics of the corridor. Each graphic includes a brief description of what the data represents.



LOCATION	Number	%
INTERSECTION	227	59.3%
NON-INTERSECTION	114	29.8%
DRIVEWAY ACCESS	26	6.8%
INTERSECTION RELATED	15	3.9%
LOCATION NOT STATED	1	0.3%
Grand Total	383	100.0%

The crash data shows that intersection, intersection related (within 0.1 mile of intersection) and driveway access crashes accounted for 70% of the total crashes. These types of locations of crashes indicate a need for improved access management, intersection improvements and enhanced traffic control such as improving traffic signals.

TYPE_OF_CRASH	Number	%
REAR END	167	43.6%
ANGLE	92	24.0%
SIDESWIPE - PASSING	42	11.0%
LEFT TURN	32	8.4%
BACKING	15	3.9%
FIXED OBJECT	12	3.1%
PEDESTRIAN	7	1.8%
PARKED VEHICLE	6	1.6%
OTHER NON-COLLISION	5	1.3%
HEAD ON	2	0.5%
SIDESWIPE - MEETING	2	0.5%
PEDALCYCLES	1	0.3%
Grand Total	383	100.0%

The top four most common types of crashes shown on the table to the left are strong indicators of access management issues on a corridor. The Rear End crashes are results of too many unexpected stops in traffic caused by traffic queuing at frequent signal locations, turning vehicles to the 26 public roadway intersections and from entering/exiting movements to the numerous private access driveways on the corridor. The pedestrian and bicycle crash types account for 2.1% of the crashes on the corridor and indicates a need for improved pedestrian/bicycle facilities and enhancing their visibility to motorists. All these categories are above State Averages.

CONTRIBUTING_FACTOR1	Number	%
FOLLOWING TOO CLOSE	143	37.3%
FAILURE TO YIELD	75	19.6%
FAILURE TO CONTROL	47	12.3%
IMPROPER LANE CHANGE	26	6.8%
RAN RED LIGHT	25	6.5%
OTHER DRIVER ERROR	16	4.2%
IMPROPER BACKING	14	3.7%
IMPROPER TURNING	14	3.7%
DRIVER INATTENTION	8	2.1%
NO DRIVER ERRORS	6	1.6%
RAN STOP SIGN OR YIELD SIGN	4	1.0%
DROVE OFF ROAD-REASON UNKNOWN	3	0.8%
IMPROPER START FROM PARKED POS	1	0.3%
DOWNED TRAFFIC SIGN OR DEVICE	1	0.3%
Grand Total	383	100.0%

The contributing factors to crashes listed for the corridor indicates that Following Too Close is the primary factor. This factor is likely related to the frequent unexpected stops of vehicles due to turning vehicles and also from queuing at traffic signals. The remainder of the contributing factors is also good indications of access management issues and also a need to potentially enhance intersection signal and signing visibility.

ACTION1	Number	%
GOING STRAIGHT	219	57.2%
TURNING LEFT	61	15.9%
CHANGING LANES	30	7.8%
TURNING RIGHT	25	6.5%
PARKING/UNPARKING	19	5.0%
BACKING	14	3.7%
STOPPED IN TRAFFIC	9	2.3%
OTHER ACTION	4	1.0%
ACTION NOT STATED	1	0.3%
DRIVERLESS VEHICLE	1	0.3%
Grand Total	383	100.0%

The driver actions for Vehicle #1 (typically the driver at fault) show that going straight is the most common action prior to the crash which indicates the through movement of traffic as being most prevalent and that most likely stopped traffic impeded this movement prior to the crash. The Turning Left, Changing Lanes and Turning Right actions are related drivers positioning themselves to enter/exit the mainline roadway to gain access to side streets or the private access driveways along the corridor.

ACTION2	Number	%
STOPPED IN TRAFFIC	171	44.6%
GOING STRAIGHT	155	40.5%
TURNING LEFT	22	5.7%
ACTION NOT STATED	21	5.5%
TURNING RIGHT	4	1.0%
PARKED	4	1.0%
OTHER ACTION	3	0.8%
BACKING	1	0.3%
PARKING/UNPARKING	1	0.3%
CHANGING LANES	1	0.3%
Grand Total	383	100.0%

The actions of Vehicle #2 (typically the driver not at fault) clearly show that the most common cause of vehicles striking each other on the corridor is from being stopped in traffic. This is either related to being in a traffic queue at a signalized intersection or from waiting on a vehicle to make a turning movement that is stopped and waiting on traffic.

WEATHER_CONDITION	Number	%
NO ADVERSE WEATHER CONDITION	303	79.1%
SNOW	39	10.2%
RAIN	35	9.1%
OTHER WEATHER CONDITION	4	1.0%
WEATHER NOT STATED	1	0.3%
FOG	1	0.3%
Grand Total	383	100.0%

ROAD_CONDITION	Number	%
ROAD - DRY	273	71.3%
ROAD - WET	76	19.8%
ROAD - SNOW	29	7.6%
ROAD - ICE	5	1.3%
Grand Total	383	100.0%

These two tables indicate that clearly the vast majority of crashes on the SR172 Corridor are not being caused by adverse weather or roadway conditions. The Road-Dry condition is even higher than the State Average of 69.3%. The Road-Wet condition is lower than the State Average of 21.1%. The only category that is worse than the State Average of 5.5% is Road-Snow.

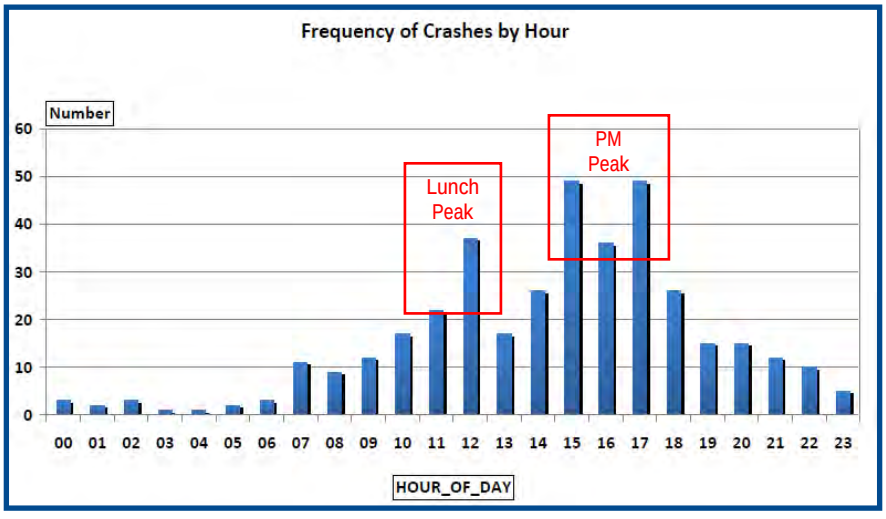
LIGHT_CONDITION	Number	%
DAYLIGHT	279	72.8%
DARK - LIGHTED	80	20.9%
DUSK	18	4.7%
DAWN	3	0.8%
LIGHT NOT STATED	3	0.8%
Grand Total	383	100.0%

The crashes on the corridor are also not being impacted by non-light conditions since 93.7% of all crashes occurred either during the day or at night with lighted conditions.

DRIVER_ALCOHOL1	Number	%
NO ALCOHOL DETECTED	334	87.2%
HBD - ABILITY UNKNOWN	38	9.9%
HBD - ABILITY IMPAIRED	7	1.8%
ALCOHOL NOT STATED	4	1.0%
Grand Total	383	100.0%

DRIVER_DRUGS1	Number	%
NO DRUGS DETECTED	340	88.8%
DRUGS NOT STATED	42	11.0%
USING PRESCRIBED DRUG	1	0.3%
Grand Total	383	100.0%

These two tables convey that neither Alcohol nor Drug impairment are a substantial factor causing crashes on the corridor. Only 7 of the 383 crashes involved an impaired alcohol driver and 1 involved drug impairment.



This graph shows that there are two peaks in the periods in which traffic crashes occur on the corridor. These involve the PM Peak traffic period of 3:00PM to 6:00PM and a secondary crash period peak associated with the Lunch traffic period from 11:00AM to 1:00PM. This is common given these are the most congested periods of the travel day.

5.2 Key Safety Concerns and Supporting Crash Data

A review of the crash data, site visits, physical inventory, existing roadway operations and local input resulted in the identification of several key concerns within the study limits. These concerns are listed below along with the supporting crash data:

Key Concern #1 – Intersection Safety & Operations:

The 8 signalized intersections on the corridor lack newer technology and safety enhancements that could improve the visibility of the intersections for vehicles and pedestrians/bicycles, as well as improve the efficiency of the intersection operations to reduce traffic congestion and unexpected stopped traffic.

Supporting Crash Data:

The evidence that intersections are a key concern for safety on the corridor is supported by the fact that 63.2% of the crashes were at intersections or intersection related. Intersection improvements such as video detection, black polycarbonate heads with backplates, countdown pedestrian signals and crosswalk improvements would all improve intersection visibility and operations.

Key Concern #2 – Access Management:

The entire corridor contains numerous public intersections and private access driveways that create high turning conflict point areas. This creates unexpected stops and slow moving traffic in the through lanes, which is leading to numerous Rear-End, Sideswipe-Passing, Angle and Left Turn types of crashes associated with the intersections and driveways.

Supporting Crash Data:

This is confirmed with 87% of the crashes on the corridor being Rear-End, Angle, Sideswipe-Passing, or Left Turn related crashes. These crash types are indicative of access management problems and too many turning conflicts. The collision diagrams presented previously further support the need for improved access management and reducing turning conflicts overall on the corridor.

Key Concern #3 – Pedestrian and Bicycle Safety:

The presence of pedestrians associated with the hospital, school, neighborhoods and retail areas along SR172 (Tuscarawas Street West) creates frequent pedestrian/bicycle traffic on the entire corridor. The presence of transit riders accessing bus stops along the corridor also contribute to pedestrian traffic. This is evident by the fact that 8 pedestrian/bicycle related crashes occurred on the corridor over three years, which resulted in above State Average percents. These crashes and a review of existing conditions show a need for improved safety and visibility of pedestrians and bicycles. The current signalized intersections do not contain countdown pedestrian signals, which would improve crossing safety. There are also locations where improvements are needed to curb ramps so as to comply with ADA standards. The portions of SR172 with larger roadway widths could benefit from potential raised median resting places for pedestrians that can only cross one half of the roadway at a time.

Supporting Crash Data:

The key supporting crash data is the fact that there were 8 crashes in the 2008-2010 timeframe in which either a pedestrian or bicycle were involved. The percentages of these two categories are higher than the State Average. The collision diagrams indicate that these crashes occurred primarily on the 3,800' section from Bellflower to Smith Avenues (see previous *Section 3.0* for map of locations).

Key Concern #4 – Offset Intersections:

The SR172 (Tuscarawas Street West) study corridor contains 6 public roadway offset intersections on the corridor. All of these offsetting intersections create interlocking left and right turn conflicts during movements that are leading to increased frequency of crashes on this corridor.

Supporting Crash Data:

The collision diagrams show all of the crashes that are occurring at the numerous intersections (including the offsetting intersections). A field recon during the peak hour of traffic also revealed a need to improve traffic flow. Traffic was found to queue between intersections especially where traffic on a north-south roadway that required a "jog" onto SR172 due to being an offset intersection.

The four (4) Key Concerns listed above were found to be supported by the specific crash data discussed for each one, as well as the overall crash history. The 2008-2010 data as discussed previously in *Section 5.1* indicated that crashes on the corridor are occurring during no adverse weather conditions; on dry road conditions; during the daytime; and that only 8 of the 383 crashes involved impaired drivers. Given the lack of weather and driver impairment as major factors, it is interpreted from the crash patterns, existing conditions/operations, field observations and local input that the majority of crashes on the corridor are in part a result of various contributing factors and conditions as discussed above in the key concerns.

Now that the key concerns on the corridor have been identified, the next step involves developing specific countermeasures to address these concerns (see *Section 6.0*). These countermeasures will be developed for both short term (if funding for long term improvements are not available) and long term improvements. Before the countermeasures are developed, the section below discusses previously implemented countermeasures.

5.3 Previous Implemented Countermeasures

The City of Canton and ODOT have implemented several improvements that have impacted the SR172 Corridor. The most notable of these improvements include the following:

- In 2007 to early 2008 the I-77 interchange with SR172 was upgraded by ODOT, which included improving the section of mainline SR172 from just east of Smith Avenue eastward to Schroyer Avenue. This is the basis for ending the current Safety Project at Smith Avenue since improvements were made to the eastern 0.6 miles of the identified 2.0 Mile HotSpot Corridor;
- The City refined signal timing and phasing in 1999 as best as possible at signalized intersections along the corridor given existing traffic signal technologies that was in place. Newer signal controller technologies, improved signal head visibility and video detection would be needed to fully take advantage of obtaining the most efficiency possible out of the signalized intersections;
- There are several locations where pedestrians are prohibited from crossing the corridor to reduce turning conflicts between vehicles and pedestrian/bicycle users;
- ADA curb ramps and sidewalks have had spot improvements along the corridor, however some locations remain that do not meet current design standards for curb ramps and pedestrian pushbuttons;
- The corridor has been maintained in regards to pavement markings and resurfacing in addition to the above safety and improvement initiatives.

Despite the previous improvements and countermeasures listed above, the 1.4 mile section of SR172 (Tuscarawas Street West) from Whipple Avenue eastward to Smith Avenue continues to experience higher than State Average crash rates and frequencies for similar type facilities. In the three-year period of 2008-2010 this section of roadway experienced a total of 383 applicable crashes once non-collision crash types such as Falling From Vehicle and Workzone Related crashes were removed.

6.0 RECOMMENDATIONS

6.1 Development of Countermeasures

Safety improvement countermeasures for the SR172 (Tuscarawas Street West) corridor were developed based on the 2008-2010 crash history analyses as well as existing conditions; a review of existing plans; field visits to view existing conditions; analysis of traffic operations; and local input from City of Canton and ODOT.

The four most common types of crashes involved Rear-End, Angle, Sideswipe-Passing and Left Turn, which accounted for 87% of all crashes. In regards to location, 63.2% of the crashes occurred at an intersection or were intersection related. Common types of driver actions and contributing factors listed for crashes included Following Too Close, Failure To Yield, Failure To Control, Turning Left, Changing Lanes, Going Straight and Stopped in Traffic. These types of statistics indicate a strong need for safety countermeasures on the corridor that focus on improving access management; enhancing the operational efficiency and visibility of intersections; and improving pedestrian/bicycle facilities and visibility. Improvements will be developed to focus on these crash statistics and the four (4) identified key safety concerns of the SR172 Corridor (see *Section 5.2* for details):

1. Intersection Safety & Operations
2. Access Management
3. Pedestrian & Bicycle Safety
4. Offset Intersections

Therefore, the proposed improvements will focus on improving intersection operations & safety; turn lanes and storage lengths; improving intersection geometry; improving visibility of intersections/signing; improving access management in key areas to reduce turning conflicts; and providing safer pedestrian/bicycle travel and visibility on the corridor. Countermeasures will be developed with guidance based on the City of Canton standards and guidance from the *ODOT L&D Manual* as well as the *Ohio Manual of Uniform Traffic Control Devices (OMUTCD)*. An updated *OMUTCD* is scheduled to be released in December 2011; therefore improvements will be developed with the new manual anticipated changes in mind.

6.2 Funding of Short Term and Long Term Countermeasures

The short term countermeasures listed in *Table 6.1* are lower cost improvements with no anticipated right-of-way involvement that could be considered as interim improvements for the corridor if full funding of the Long Term Full Recommendations as presented is not available. The short term lower cost improvements could be implemented via use of local funds or a combination of local funds and other sources (SCATS, ODOT Safety, etc.). Otherwise, if full funding can be secured, it is proposed that both the Long Term Full Recommendations and also the Alternative Broad/Dartmouth Re-Alignment Recommendation be considered as one combined project. The City of Canton intends to submit for funding sources through SCATS for potentially CMAQ, Transportation Enhancement and TIP funding programs. All of the long term improvements are shown on *Figure 6.1* (consists of 6 separate 11x17 sheets) and are listed on *Table 6.1*.

6.3 Summary of Short Term and Long Term Full Recommendations

The Short Term Countermeasures are discussed below and in *Table 6.1*. The recommended Long Term Full Improvements are being submitted to the Safety Funding Program (September 2011) for consideration of being funded. In addition, the City will submit for funding consideration by SCATS through the CMAQ, Transportation Enhancement and TIP programs when they next are accepting applications. Explanations of the improvements being recommended are discussed below:

Short Term Countermeasures:

The Short Term Countermeasures involves continuing routine maintenance and low cost improvements as local funding allows. Routine maintenance would include such items as maintaining all pavement markings (including crosswalk striping) and also keeping signs up to standards. Possible lower cost improvements that might be considered would include installing countdown pedestrian signals where feasible; consider signal timing/phasing & progression updates given recent improvements at eastern end of corridor near I-77 and turn volume data recently collected for this Safety Study; update pedestrian crossing times per new standards if not already implemented; provide enhanced pedestrian and school crossing signing to warn motorists of potential pedestrians/bicyclists; and revise striping at several intersections to provide more exclusive left turn storage (taken from two-way left turn lane). A more complex short term/mid-term improvement would be to meet with individual property owners and businesses to see if any shared drives can be implemented and those properties with multiple drives can eliminate some of their drives.

Long Term Full Recommended Improvements:

These improvements are the full recommended improvements needed to address the types and locations of the crashes that are occurring most frequently on the SR172 Corridor from Whipple Avenue eastward to Smith Avenue (1.4 miles). The section of SR172 just east of Smith Avenue was fully upgraded in association with the I-77 interchange that was completed in early 2008, thus no improvements to that section are required at this time until an evaluation of post crash data can be evaluated in several years.

Intersection Safety & Operation Improvements

- It is recommended to provide full upgrades to all warranted traffic signals on the corridor to provide improved traffic operations through more efficient signal controllers and detection and to provide enhance visibility. The full upgrades are needed based on new technologies and new design standards rather than due to a maintenance issue. The existing poles and controllers based on field review and discussions with the City will not support upgrading to the desired standards of providing a signal head per lane; providing reflective backplates; video detection; new controllers; countdown pedestrian signal heads; ADA compliant pushbutton placements; and new signal timing/phasing & progression. These improvements would add weight to existing poles and would likely not meet current loading requirements.
- Enhance intersection safety by improving signing; pavement markings; increase turning radii where determined necessary and feasible; and improve left turn storage if feasible.

Access Management

- Provide improved access management on corridor with such techniques as a mix of raised concrete medians (with mountable curbs for emergency vehicles); turn restrictions at identified crash locations; drive consolidations; drive removals; improved geometrics; and U-Turn lanes where feasible;
- Provide improved lane balancing and striping improvements throughout the corridor. Based on functional classification and that this route is not a designated Federal Aid Primary route, consideration can be given to reduce lane widths to 11' for travel lanes and 10' for turn lanes, which may provide additional width for improved sidewalks and radii improvements;
- These improvements will be determined during the preliminary engineering and detailed design phases of the project development process once the necessary detailed analyses/studies are completed and stakeholders/public involvement has been provided;

Pedestrian and Bicycle Safety

- Currently there are sidewalks and curb ramps through a majority of the corridor, however there are some locations (particularly west of Valleyview) where sidewalks and curb ramps are missing. It is recommended that the gaps in sidewalk coverage be constructed so to provide continuous sidewalks through the corridor on both sides of the roadway;
- All curb ramps not meeting current ADA standards are also recommended to be improved to current design standards;
- Improved signing and crosswalks to provide awareness to motorists of pedestrian/bicycle activity should be implemented, especially on the 3,800' section from Bellflower to Smith where 7 of the 8 pedestrian/bicycle crashes occurred;
- Incorporate transit stops into corridor as these are also locations where pedestrian/bicycle activity is prevalent;
- Consider providing solar powered LED school zone flasher sign for the school located just north of SR172 between the intersections of Clarendon and Arlington Avenues.

Offset Intersections

- Re-align the offset intersections found on the corridor where feasible, or control the movements associated with these offsets through either the use of directional restricted drives or by a raised median or other geometric improvements.

Alternative Broad Avenue & Dartmouth Avenue Re-Alignment Improvement:

This improvement alternative is being evaluated separately as it would involve a large re-alignment involving additional Right-of-Way (ROW) from the Aultman Hospital and also removing the old Dartmouth Avenue roadway and vacating its ROW. The new re-aligned section of Dartmouth Avenue would align with the signalized intersection of Broad Avenue. There are some elevation changes that will need to be addressed as well as coordination with the Aultman Hospital. The Aultman Hospital in the past has expressed an interest to the City to revise the Dartmouth Avenue so to provide a safer ingress/egress for their employees and hospital patient traffic. It is recommended that this improvement be considered for funding in the Full Recommendations as well, however it is being reviewed separately in this study with a separate Rate of Return (ROR) economic analysis as well as a separate cost estimate in case the project needs to be pursued separately if the Hospital no longer desires to implement these changes or if the ROW would make this portion of the project have a longer time frame to implement.

The *Table 6.1* on the next page and the *Figure 6.1* summarize and graphically show the Long Term Full Recommended Improvements described above.

Table 6.1 Short Term Countermeasures and Long Term Improvements

Recommendations Scenario	Improvement Description[1]	Cost Estimate[2]	Funding Source Comment
Short Term Countermeasures	▪ Maintain all pavement markings (including crosswalk striping); ▪ Install countdown pedestrian signals where feasible; ▪ Consider signal timing/phasing update given recent improvements at eastern end of corridor near I-77 and turn volume data recently collected for this Safety Study; ▪ Update pedestrian crossing times per new standards if not already implemented; ▪ Work with property owners and businesses to see if any short term access management improvements are feasible to implement; ▪ Upgrade signing on corridor, especially those to warn motorists of pedestrian areas; ▪ Revise striping at several intersections to provide more exclusive left turn lane storage	$150,000	Several of these recommendations are being implemented simply from routine maintenance of the corridor by the City.
Long Term Full Recommended Improvements (see Figure 6.1 for conceptual improvements)	▪ Full upgrades of all warranted traffic signals to provide a signal head per lane; black signal heads with reflective border backplates; video detection; countdown pedestrian signal heads & pushbuttons; & improved signal timing/phasing & progression; ▪ Provide improved access management on corridor with such techniques as a mix of raised concrete medians; turn restrictions; drive consolidations; drive removals; improved geometrics; and U-Turn lanes where feasible; ▪ Improved sidewalks and bicycle facilities to meet current ADA standards with a particular focus on the area from Bellflower to Smith; ▪ Re-alignment of offset intersections where feasible if not corrected by raised median or other geometric improvements; ▪ Improved signing and pavement markings; ▪ Increase turning radii where needed; and, ▪ Improve left turn storage lengths	$4,340,000[3]	Safety Program Application (Sept. 2011) Funding will also be requested from SCATS from CMAQ, Enhancements and TIP funding programs.
Alternative Broad/Dartmouth Re-Alignment Improvement	▪ Re-Align Dartmouth Avenue to the west so that it aligns with Broad Avenue; ▪ Remove Pavement and Vacate ROW of the old alignment of Dartmouth Avenue	$653,000[3]	Safety Funding Application (Sept. 2011)

Notes:

[1]All improvements are conceptual and their eventual design will be determined during the preliminary engineering and design phase of project upon completion of the required public involvement and environmental process.

[2]Cost estimates are for planning level purposes only given that costs have been developed based on concepts and not final design and the fact that no detailed surveying or quantities were available during the safety study phase to develop detailed costs. More details on the preliminary cost estimates are provided in *Appendix C*.

[3]Cost estimate reflects a cost that would apply if the projects were independent of each other, however, this safety funding application will submit these two improvements as a combined project. Therefore there will be some cost savings on non-construction items such as Preliminary Engineering, Environmental Screening, Design, etc. This cost savings of combining these two projects into one project is reflected in the Funding Application financial request table of the application.

6.4 Comprehensive Highway Safety Plan Emphasis Areas being Addressed

The recommended countermeasures of this safety study are focused on improving safety on the SR172 Corridor to address those specific patterns and crash types identified in the study. These recommendations also address three of the five emphasis areas identified in Ohio's Comprehensive Highway Safety Plan (CHSP), including the following three emphasis areas:

- Emphasis Area II – Serious Crash Types
  The recommendations of the SR172 (Tuscarawas Street West) safety study addresses the specific target area of *"Intersection"* crashes given that 63.2% of the crashes on this corridor were intersection or intersection related and this is well above the State percentage of 42.1% for similar facilities. Improvement strategies as outlined in Ohio's Safety Plan that are recommended for this corridor include:
    - Improved lane use & guide signs at key intersections so as to improve signs and visibility;
    - Signal upgrades to provide improved signal timing and visibility via use of LED signal heads with back plates; video detection, countdown pedestrian signals, & new controllers;
    - Restrict left turns to private drives in tightly spaced intersections where feasible

- Emphasis Area IV – Special Vehicles/Roadway Users (Pedestrians/Bicycles)
  The SR172 (Tuscarawas Street West) corridor was found to have a percentage of crashes 1.5 times higher than the State average of pedestrian/bicycle crashes. A total of 8 pedestrian/bicycle related crashes occurred on this section from 2008-2010. Given this, the target area of *"Pedestrians/Bicycles"* was targeted for improvements on the corridor in addition to the roadway improvements. Improvement strategies to increase pedestrian/bicycle safety include:
    - Provide continuous sidewalks throughout corridor where feasible;
    - Upgrade intersection curb ramps, sidewalks to ADA, & possibly provide median resting areas;
    - Provide countdown pedestrian signals at all signalized intersections;
    - Improve crosswalk visibility and prohibit crosswalks where major left turn movements possibly conflict with pedestrian median resting places;

- Emphasis Area V – Incident and Congestion Related Crashes
  The corridor experienced over 43.6% of the crashes as being rear-end type crashes, which is above the State average of 30.9% for a similar facility. Given this, the *"Rear-End crashes"* target of this Emphasis area was addressed.
    - Provide improved lane use & guide signs at key locations to assist the non-local drivers (primarily associated with the Hospital and I-77 area);
    - Upgrade signal installations as necessary to provide latest technologies to improve visibility, traffic signal efficiency in servicing traffic demands, overhead street name and guide signs, countdown pedestrian signals, back plates, etc.;
    - Access management improvements;
    - Turn lane and turn lane storage improvements

These three emphasis areas of the State's CHSP are those primarily addressed by the recommended safety improvements for the SR172 (Tuscarawas Street West) corridor. The SR172 identified HotSpot is currently ranked as the 22nd highest crash HotSpot in the State (2009); and the corridor has four of the Top 30 High Crash intersections as ranked by SCATS (2009). Given this, the corridor is routinely experiencing high crash frequencies and implementing countermeasures on this corridor will assist the State in achieving current crash reduction goals.

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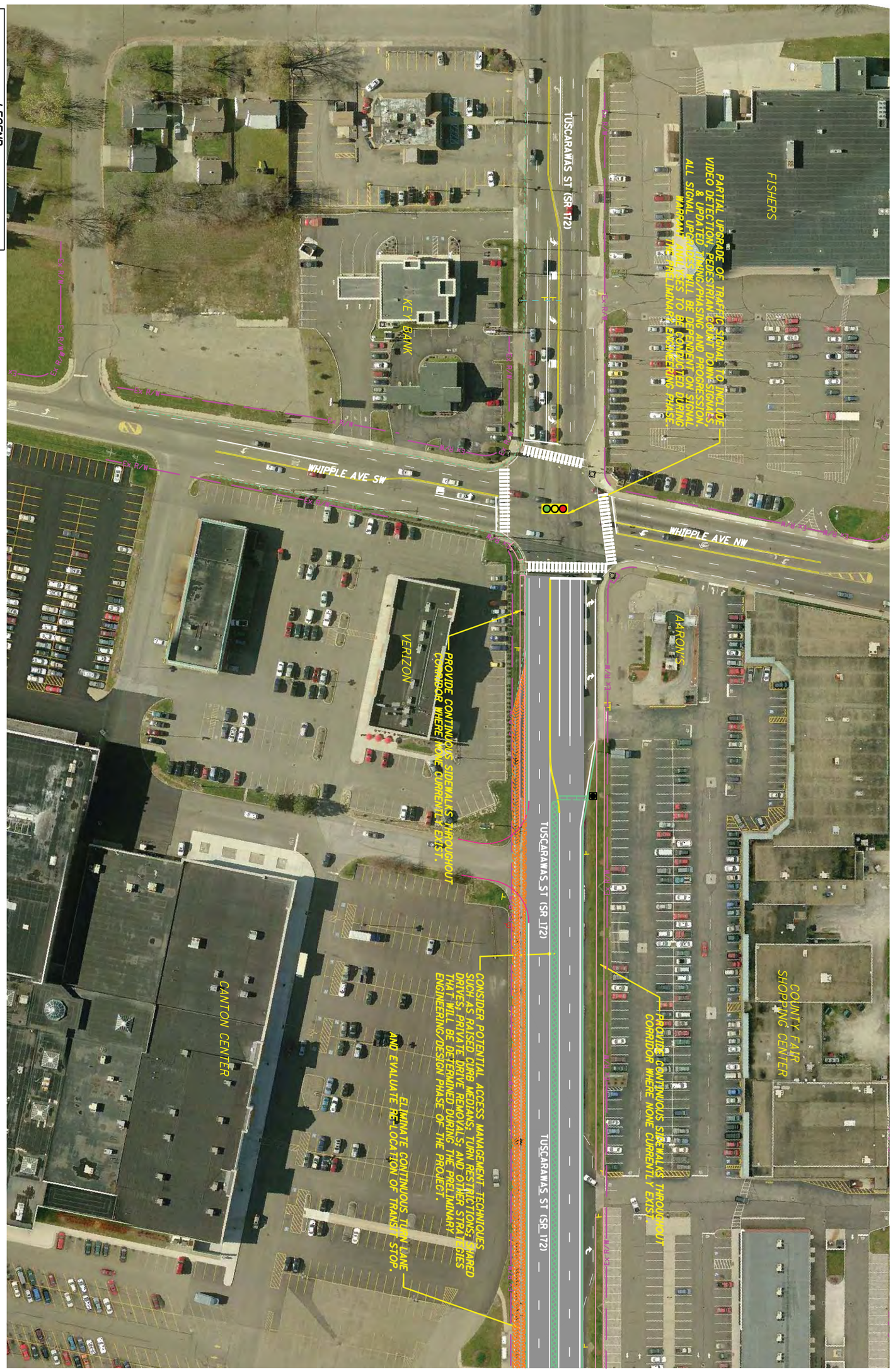
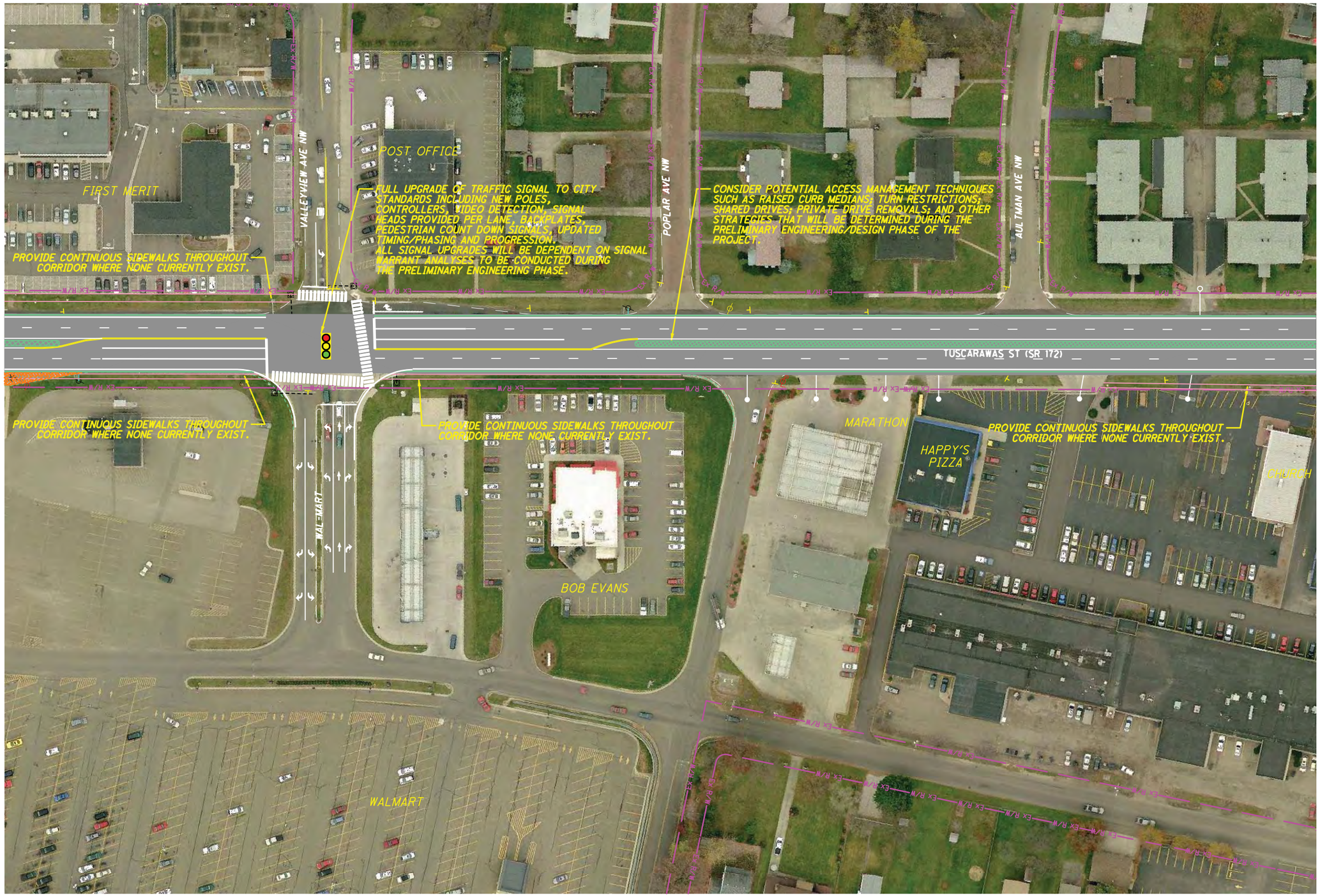


POTENTIAL CORRIDOR-WIDE IMPROVEMENTS INCLUDE: SIGNING, PAVEMENT MARKINGS, CROSSWALKS, PEDESTRIAN/BICYCLE FACILITIES, COMPLIANCE WITH ADA STANDARDS, ADEQUATE TURN LANE STORAGE, AND ACCESS MANAGEMENT TECHNIQUES. ALL IMPROVEMENTS WILL BE FURTHER DEVELOPED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

NOTE: ALL RIGHT-OF-WAY (R/W) AND CONCEPTUAL LAYOUTS ARE BASED ON SECONDARY SOURCES AND PREVIOUS PLANS. ALL R/W AND LOCATIONS OF EXISTING FACILITIES AND UTILITIES WILL BE DOCUMENTED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

MATCH SHEET 2 OF 6

6 / 1	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 6.1 CONCEPTUAL IMPROVEMENTS WHIPPLE AVE. TO WAL-MART	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET



LEGEND

- SIGNAL UPGRADE AS NOTED
- POTENTIAL OVERHEAD SIGN
- NEW SIDEWALK SECTION
- POTENTIAL ACCESS MANAGEMENT
- POTENTIAL LANE REMOVAL
- POTENTIAL ADDITIONAL R/W

POTENTIAL CORRIDOR-WIDE IMPROVEMENTS INCLUDE: SIGNING, PAVEMENT MARKINGS, CROSSWALKS, PEDESTRIAN/BICYCLE FACILITIES, COMPLIANCE WITH ADA STANDARDS, ADEQUATE TURN LANE STORAGE, AND ACCESS MANAGEMENT TECHNIQUES. ALL IMPROVEMENTS WILL BE FURTHER DEVELOPED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

NOTE: ALL RIGHT-OF-WAY (R/W) AND CONCEPTUAL LAYOUTS ARE BASED ON SECONDARY SOURCES AND PREVIOUS PLANS. ALL R/W AND LOCATIONS OF EXISTING FACILITIES AND UTILITIES WILL BE DOCUMENTED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED MLM
CHECKED PLE

FIGURE 6.1 CONCEPTUAL IMPROVEMENTS
VALLEYVIEW AVE. TO AULTMAN AVE.

TUSCARAWAS ST. (SR 172)
SAFETY STUDY

2
6

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LEGEND

- SIGNAL UPGRADE AS NOTED
- POTENTIAL OVERHEAD SIGN
- NEW SIDEWALK SECTION
- POTENTIAL ACCESS MANAGEMENT
- POTENTIAL LANE REMOVAL
- POTENTIAL ADDITIONAL R/W

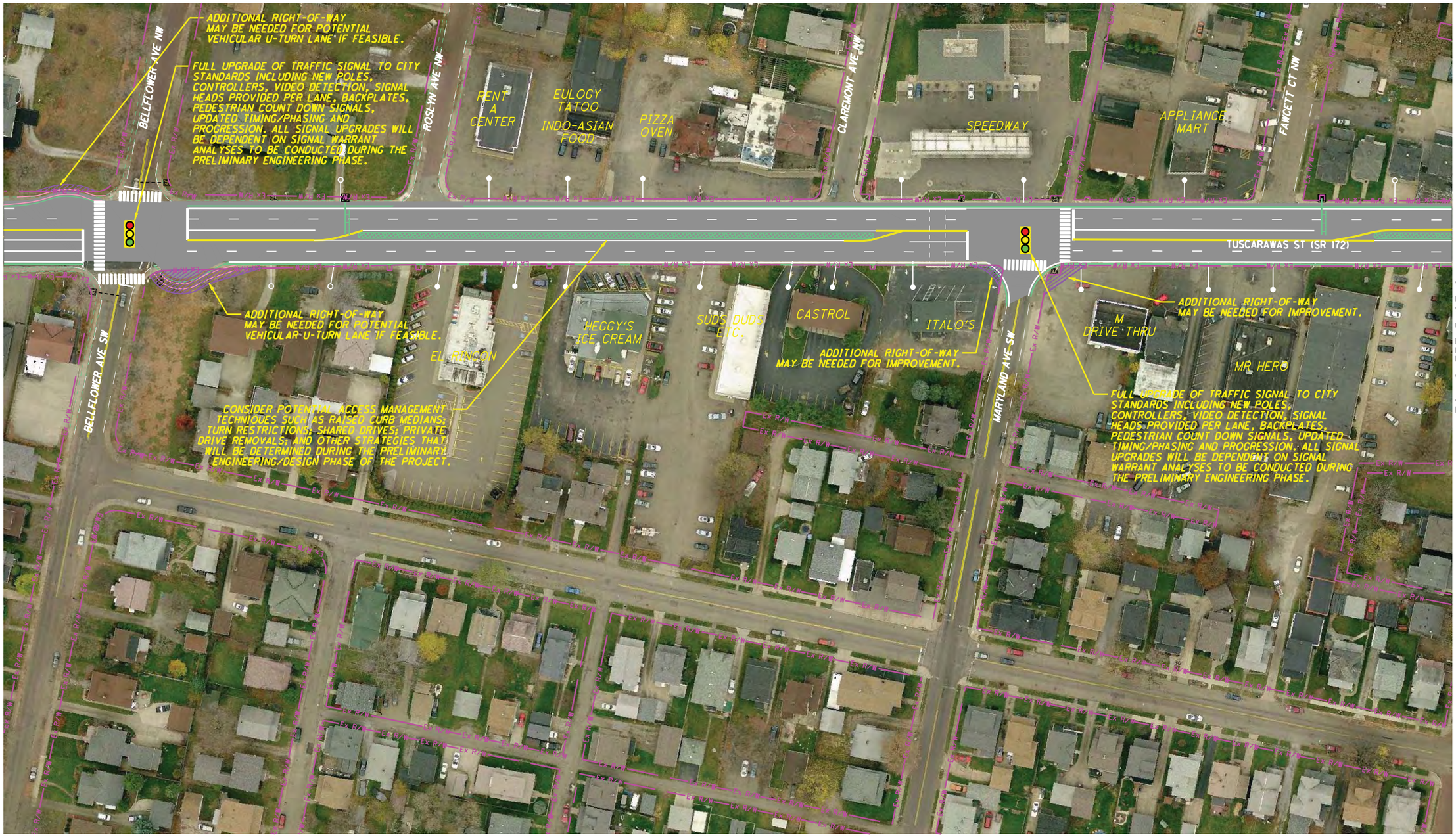
MATCH SHEET 2 OF 6

MATCH SHEET 4 OF 6

POTENTIAL CORRIDOR-WIDE IMPROVEMENTS INCLUDE: SIGNING, PAVEMENT MARKINGS, CROSSWALKS, PEDESTRIAN/BICYCLE FACILITIES, COMPLIANCE WITH ADA STANDARDS, ADEQUATE TURN LANE STORAGE, AND ACCESS MANAGEMENT TECHNIQUES. ALL IMPROVEMENTS WILL BE FURTHER DEVELOPED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

NOTE: ALL RIGHT-OF-WAY (R/W) AND CONCEPTUAL LAYOUTS ARE BASED ON SECONDARY SOURCES AND PREVIOUS PLANS. ALL R/W AND LOCATIONS OF EXISTING FACILITIES AND UTILITIES WILL BE DOCUMENTED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

3 of 6	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 6.1 CONCEPTUAL IMPROVEMENTS HARTER AVE. TO LINWOOD AVE.	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET



LEGEND

- SIGNAL UPGRADE AS NOTED
- POTENTIAL OVERHEAD SIGN
- NEW SIDEWALK SECTION
- POTENTIAL ACCESS MANAGEMENT
- POTENTIAL LANE REMOVAL
- POTENTIAL ADDITIONAL R/W

POTENTIAL CORRIDOR-WIDE IMPROVEMENTS INCLUDE: SIGNING, PAVEMENT MARKINGS, CROSSWALKS, PEDESTRIAN/BICYCLE FACILITIES, COMPLIANCE WITH ADA STANDARDS, ADEQUATE TURN LANE STORAGE, AND ACCESS MANAGEMENT TECHNIQUES. ALL IMPROVEMENTS WILL BE FURTHER DEVELOPED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

NOTE: ALL RIGHT-OF-WAY (R/W) AND CONCEPTUAL LAYOUTS ARE BASED ON SECONDARY SOURCES AND PREVIOUS PLANS. ALL R/W AND LOCATIONS OF EXISTING FACILITIES AND UTILITIES WILL BE DOCUMENTED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

N

0 25 50 100 HORIZONTAL SCALE IN FEET

CALCULATED MLM CHECKED PLE

FIGURE 6.1 CONCEPTUAL IMPROVEMENTS BELLFLOWER AVE. TO FAWCETT CT.

TUSCARAWAS ST. (SR 172) SAFETY STUDY

4 6

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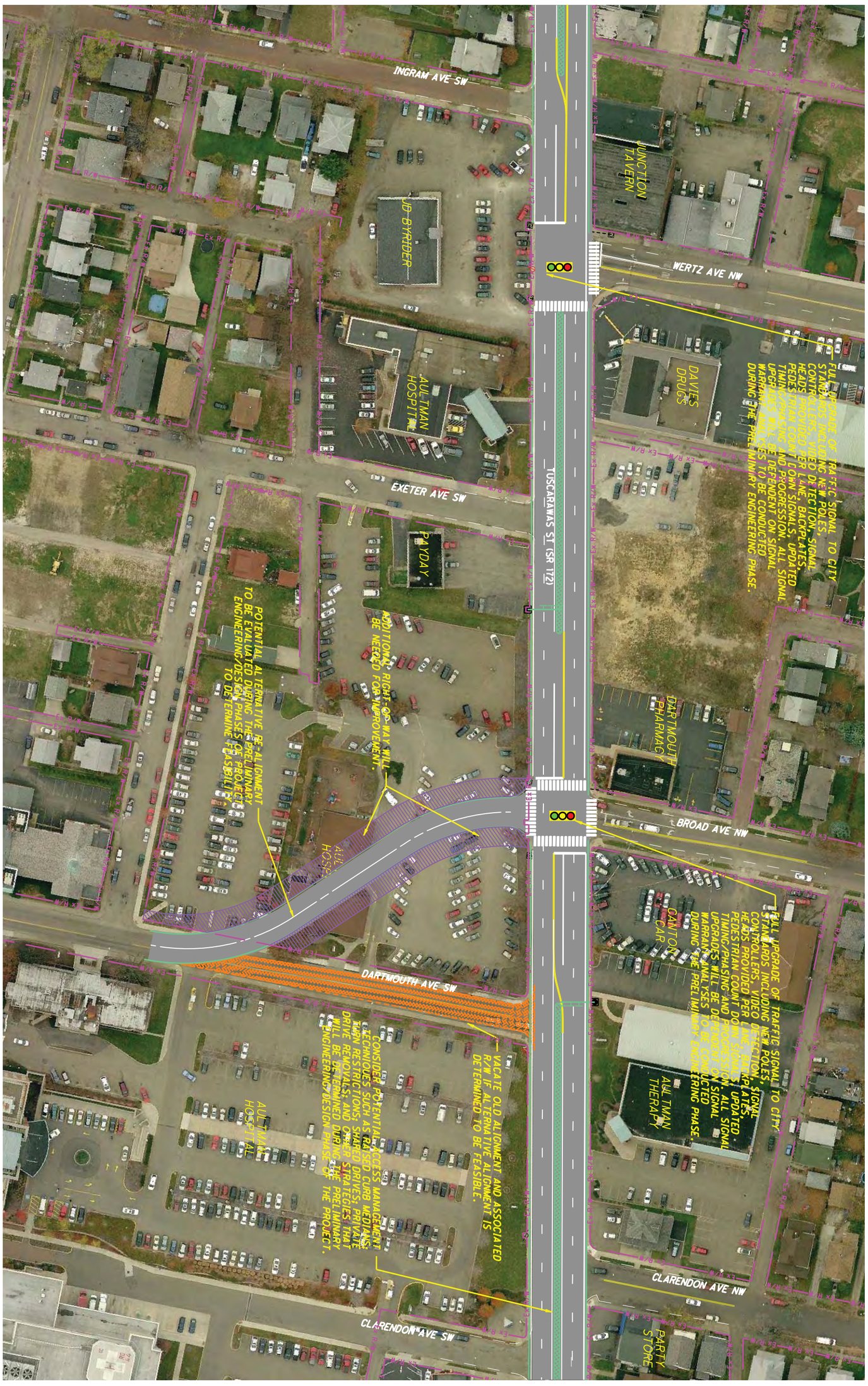
MATCH SHEET 4 OF 6



MATCH SHEET 6 OF 6

LEGEND

- SIGNAL UPGRADE AS NOTED
- POTENTIAL OVERHEAD SIGN
- NEW SIDEWALK SECTION
- POTENTIAL ACCESS MANAGEMENT
- POTENTIAL LANE REMOVAL
- POTENTIAL ADDITIONAL R/W

POTENTIAL CORRIDOR-WIDE IMPROVEMENTS INCLUDE: SIGNING, PAVEMENT MARKINGS, CROSSWALKS, PEDESTRIAN/BICYCLE FACILITIES, COMPLIANCE WITH ADA STANDARDS, ADEQUATE TURN LANE STORAGE, AND ACCESS MANAGEMENT TECHNIQUES. ALL IMPROVEMENTS WILL BE FURTHER DEVELOPED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

NOTE: ALL RIGHT-OF-WAY (R/W) AND CONCEPTUAL LAYOUTS ARE BASED ON SECONDARY SOURCES AND PREVIOUS PLANS. ALL R/W AND LOCATIONS OF EXISTING FACILITIES AND UTILITIES WILL BE DOCUMENTED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

5 of 6	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 6.1 CONCEPTUAL IMPROVEMENTS INGRAM AVE. TO CLAREDON AVE.	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET

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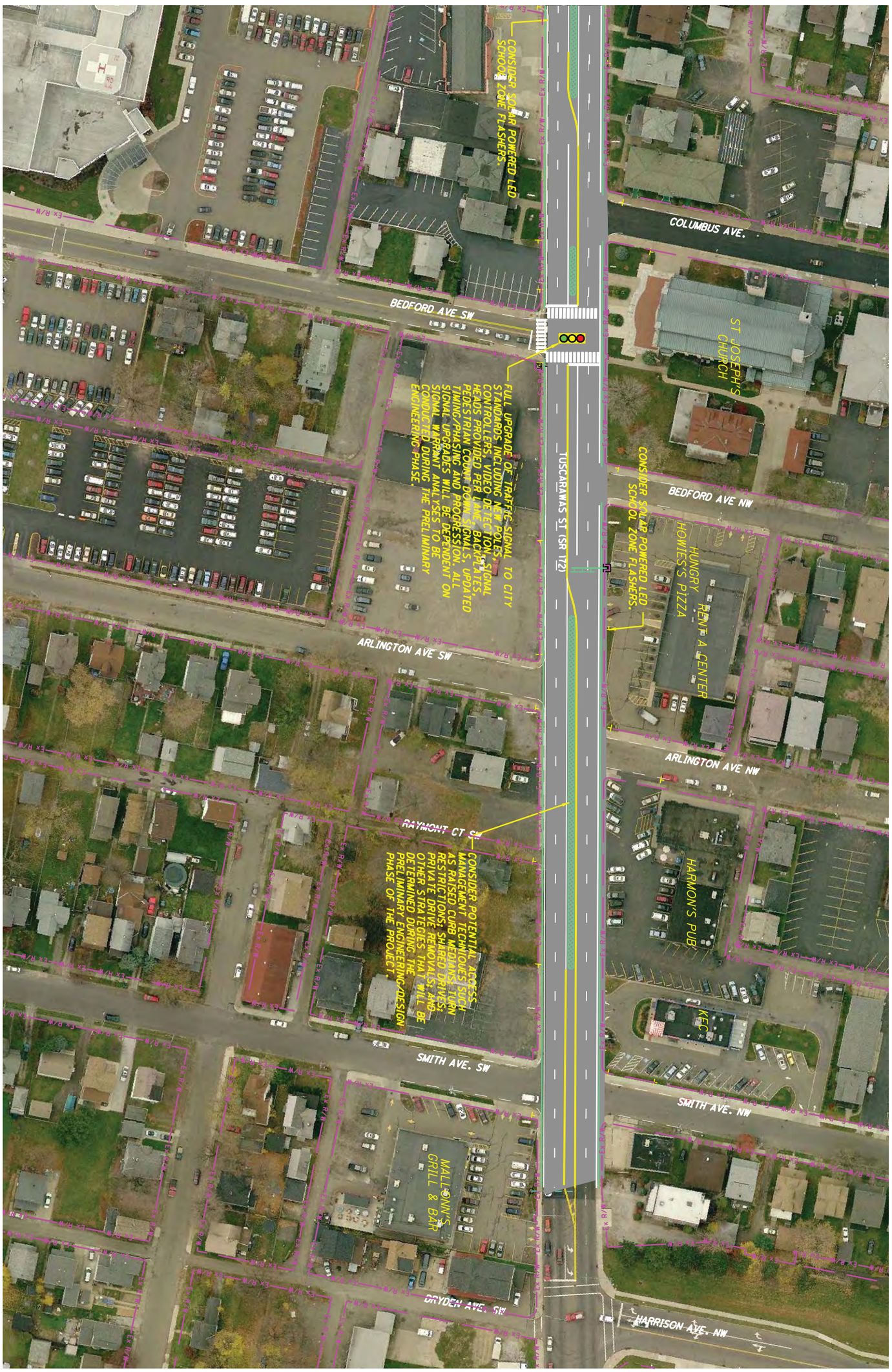
MATCH SHEET 5 OF 6



MATCH SHEET 6 OF 6

LEGEND

- SIGNAL UPGRADE AS NOTED
- POTENTIAL OVERHEAD SIGN
- NEW SIDEWALK SECTION
- POTENTIAL ACCESS MANAGEMENT
- POTENTIAL LANE REMOVAL
- POTENTIAL ADDITIONAL R/W

POTENTIAL CORRIDOR-WIDE IMPROVEMENTS INCLUDE: SIGNING, PAVEMENT MARKINGS, CROSSWALKS, PEDESTRIAN/BICYCLE FACILITIES, COMPLIANCE WITH ADA STANDARDS, ADEQUATE TURN LANE STORAGE, AND ACCESS MANAGEMENT TECHNIQUES. ALL IMPROVEMENTS WILL BE FURTHER DEVELOPED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

NOTE: ALL RIGHT-OF-WAY (R/W) AND CONCEPTUAL LAYOUTS ARE BASED ON SECONDARY SOURCES AND PREVIOUS PLANS. ALL R/W AND LOCATIONS OF EXISTING FACILITIES AND UTILITIES WILL BE DOCUMENTED IN THE PRELIMINARY ENGINEERING/DESIGN PHASES OF PROJECT.

6 / 6	TUSCARAWAS ST. (SR 172) SAFETY STUDY	FIGURE 6.1 CONCEPTUAL IMPROVEMENTS COLUMBUS AVE. TO SMITH AVE.	CALCULATED MLM / CHECKED PLE	0 50 25 100 HORIZONTAL SCALE IN FEET

7.0 RATE OF RETURN

The rate of return represents the benefits expected to be obtained by an improvement and is a measure of expected "yield" or effective return of the safety countermeasures. The rate of return economic analyses for the *SR172 (Tuscarawas Street West) Safety Study* was separated into two separate evaluations since the project includes a potential major re-alignment of two offset intersections involving Broad Avenue and Dartmouth Avenue. This re-alignment was evaluated separately since it would require input from key stakeholders such as Aultman Hospital as it would require significant Right-of-Way (ROW) to accomplish and vacating/removal of the old alignment of Dartmouth Avenue. This project should ideally be considered as part of the safety countermeasures being recommended for the corridor, however it could be separated out if it appears in the more detailed preliminary engineering/design phase of the project that such a re-alignment is not feasible or if it would require a longer timeframe given the amounts of ROW needed to accomplish the project. The *Table 7.1* below summarizes these two recommended long term improvements. The results of the rate of return analyses are shown on two worksheets as presented in *Figure 7.1*.

Table 7.1 Rate of Return Economic Analyses of Recommended Improvements

Improvement Scenario	Rate of Return Results	Comments
Recommended Long Term Improvements	+37.67%	Reflects all applicable crashes on SR172 Corridor.
Re-Alignment of Broad Avenue / Dartmouth Avenue Intersections	+25.14%	Reflects only those crashes associated with the intersections of Broad and Dartmouth and the small section between these two offset intersections, which are intersection related crashes given the short distance between the two intersections.

The rate of return results as displayed in the table above represent the economic benefit of the proposed improvements and the return on investment associated with the costs of those improvements and the likelihood the proposed improvements would have on reducing the types of crashes occurring. Such reductions in crash types would thereby reduce the financial costs associated with the severity & types of crashes. The higher the percent of the rate of return indicates the proposed improvements more effectively address the types of crashes occurring.

The results of the rate of return analyses as shown above reflect the benefits of the proposed improvements for the SR172 corridor and their likelihood of reducing crashes. Given these results, both the Recommended Long Term Improvements and the Re-Alignment Improvement will be submitted to the ODOT Safety Program for a funding request as one project initially to be studied for further detail during the Preliminary Engineering and Design Phases. During these phases, it will be determined if the projects should be separated based on criteria such as costs; time frames associated with ROW acquisitions; local funding commitments, safety program funding availability, and SCATS funding availability. Whether or not the projects are combined or separated, the ROR Analyses supports either scenario as they both provide positive benefits on the investments.

The City of Canton intends to also apply to SCATS (local MPO) for potential funding for improving the corridor. Possible additional funding sources from SCATS include CMAQ funds, Transportation Enhancement funds and TIP funds.

Figure 7.1 Rate of Return Analyses Recommended Long Term Improvements

RATE OF RETURN - ECONOMIC ANALYSIS WORKSHEET

Cells in Yellow Require User Input

Ohio Department of Transportation
Office of Systems Planning and Program Management

County	STA	Main Roadway	0172	Begin SLM	11.79	End SLM 13.41
		Intersecting Roadway	Corridor from Whipple Ave. to Smith Ave.			
Prepared by	D4	Date	9/8/2011	Crash BDate	20080101	Crash EDate 20101231

Year	TIME OF DAY						ROADWAY CONDITION						CRASH TYPE																			
	DAY		DAWN/DUSK		DARK		DRY		WET		SNOW / ICE		REAR END		LEFT		RIGHT		ANGLE		HEAD ON		SS PASS		FIXED OBJ		RAN OFF RD		PEDESTRIAN		OTHER		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	72	20	8	0	22	8	77	17	20	8	6	3	53	6	9	6	0	0	25	8	1	0	9	1	2	1	0	0	0	2	4	4	103	28
2009	67	30	6	1	12	8	60	30	20	9	5	1	41	15	4	6	0	0	16	9	1	0	12	3	1	3	0	0	0	1	10	3	85	40
2010	69	21	4	2	21	9	65	24	14	5	16	3	36	16	5	2	0	0	25	9	0	0	16	1	5	0	0	0	0	4	8	0	95	32
TOTAL	139	50	14	1	34	16	137	47	40	17	11	4	94	21	13	12	0	0	41	17	2	0	21	4	3	4	0	0	0	3	14	7	188	68
AVG.	46.3	16.7	4.7	0.3	11.3	5.3	45.7	15.7	13.3	5.7	3.7	1.3	31.3	7.0	4.3	4.0	0.0	0.0	13.7	5.7	0.7	0.0	7.0	1.3	1.0	1.3	0.0	0.0	0.0	1.0	4.7	2.3	62.7	22.7

--The "TOTAL" and "AVERAGE" row formulas are set to only use 2007-2009 crash data. If the crash data is not for these three years, the formulas must be modified by the user to calculate the associated year data.

RECOMMENDED IMPROVEMENTS		CRASH TYPE	PDO CRASHES							INJ. - FAT. CRASHES						
	Select Countermeasures		R1	R2	R3	R4	RT	AVG PDO	EST. RED.	R1	R2	R3	R4	RT	AVG INJ-FAT	EST. RED.
R1	25 Revise signal timing	LEFT	0.1	0.4	0.27		0.606	4.33	2.63	0.1	0.4	0.27		0.606	4.00	2.42
R2	12 Prohibit turn	RIGHT	0.1	0.4	0.27		0.606	0.00	0.00	0.1	0.4	0.27		0.606	0.00	0.00
R3	23 Reconstruct existing signal - major	ANGLE	0.1	0.4	0.27		0.606	13.67	8.28	0.1	0.4	0.27		0.606	5.67	3.43
R4	26 Add pedestrian heads	REAR END	0.1	0.4	0.27		0.606	31.33	18.98	0.1	0.4	0.27		0.606	7.00	4.24
		HEAD ON	0.1	0.4	0.27		0.606	0.67	0.40	0.1	0.4	0.27		0.606	0.00	0.00
		SS PASS	0.1	0.4	0.27		0.606	7.00	4.24	0.1	0.4	0.27		0.606	1.33	0.81
		FIXED OBJ	0.1	0.4	0.27		0.606	1.00	0.61	0.1	0.4	0.27		0.606	1.33	0.81
		RAN OFF RD	0.1	0.4	0.27		0.606	0.00	0.00	0.1	0.4	0.27		0.606	0.00	0.00
		OTHER	0.1	0.4	0.27		0.606	4.67	2.83	0.1	0.4	0.27		0.606	2.33	1.41
		NIGHT					0	11.33	0.00					0	5.33	0.00
		WET					0	13.33	0.00					0	5.67	0.00
		PEDESTRIAN				0.5	0.5	0.00	0.00				0.5	0.5	1.00	0.50
								ESTIMATED PDO CRASH REDUCTION =	37.96					ESTIMATED INJ. - FAT. CRASH REDUCTION =		13.63

ADT Factor

Project Service Life	20 years						
Present ADT (PADT)	25330 veh / day	Average ADT =	(PADT + FADT)/2 =	(25330	+ 27860	) =	26595
Future ADT (FADT)	27860 veh / day	ADT Factor =	Average ADT / PADT =	26595	/ 25330	=	1.05

Average Annual Benefits

Select Facility Type Below: Cities and Incorporated Villages

Annual PDO Benefits = Estimated PDO Crash Reduction * Avg PDO Cost	=	37.96	*	$ 9,253.52	=	$ 351,295.81
Annual INJ.-FAT. Benefits = Estimated INJ.-FAT. Crash Reduction * Avg INJ.-FAT. Cost	=	13.63	*	$ 78,992.88	=	$ 1,076,330.68
Total Benefits					=	$ 1,427,626.49
AverageAnnual Benefits = Total Benefits * ADT Factor	=	1.05	*	$ 1,427,626.49	=	**$ 1,498,923.27**

Rate of Return

Total Safety Project Cost (Design, Right-of-Way, and Construction)	$3,970,000	Design (PE)	$420,000	Rate of Return	37.67%
Annual Maintenance and Energy Costs	$1,000	Right-of-Way	$50,000		
Salvage Value	$1,000	Construction	$3,500,000		

See Text Box Below for Additional Details on Project Costs for ODOT Safety Projects

Figure 7.2 Rate of Return Analyses Re-Alignment of Broad Ave./Dartmouth Ave. Intersections

RATE OF RETURN - ECONOMIC ANALYSIS WORKSHEET

Cells in Yellow Require User Input

Ohio Department of Transportation
Office of Systems Planning and Program Management

County	STA	Main Roadway	0172	Begin SLM	12.97	End SLM 13.08
		Intersecting Roadway	Broad Ave. & Dartmouth Ave. Realignment			
Prepared by	D4	Date	9/8/2011	Crash BDate	20080101	Crash EDate 20101231

Year	TIME OF DAY						ROADWAY CONDITION						CRASH TYPE																			
	DAY		DAWN/DUSK		DARK		DRY		WET		SNOW / ICE		REAR END		LEFT		RIGHT		ANGLE		HEAD ON		SS PASS		FIXED OBJ		RAN OFF RD		PEDESTRIAN		OTHER		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	10	5	1	0	2	1	7	3	5	2	1	1	6	2	2	2	0	0	4	1	0	0	0	0	1	0	0	0	0	1	0	0	13	6
2009	11	1	1	0	0	1	8	2	4	0	0	0	5	1	1	0	0	0	2	1	0	0	2	0	1	0	0	0	0	0	1	0	12	2
2010	6	2	1	0	5	0	6	1	3	0	3	1	2	2	1	0	0	0	7	0	0	0	2	0	0	0	0	0	0	0	0	0	12	2
TOTAL	21	6	2	0	2	2	15	5	9	2	1	1	11	3	3	2	0	0	6	2	0	0	2	0	2	0	0	0	0	1	1	0	25	8
AVG.	7.0	2.0	0.7	0.0	0.7	0.7	5.0	1.7	3.0	0.7	0.3	0.3	3.7	1.0	1.0	0.7	0.0	0.0	2.0	0.7	0.0	0.0	0.7	0.0	0.7	0.0	0.0	0.0	0.0	0.3	0.3	0.0	8.3	2.7

--The "TOTAL" and "AVERAGE" row formulas are set to only use 2007-2009 crash data. If the crash data is not for these three years, the formulas must be modified by the user to calculate the associated year data.

RECOMMENDED IMPROVEMENTS

Select Countermeasures

R1	25 Revise signal timing
R2	51 Relocate intersection
R3	23 Reconstruct existing signal - major
R4	26 Add pedestrian heads

CRASH TYPE	PDO CRASHES R1	R2	R3	R4	RT	AVG PDO	EST. RED.	INJ. - FAT. CRASHES R1	R2	R3	R4	RT	AVG INJ-FAT	EST. RED.
LEFT	0.1	0.25	0.27		0.507	1.00	0.51	0.1	0.25	0.27		0.507	0.67	0.34
RIGHT	0.1	0.25	0.27		0.507	0.00	0.00	0.1	0.25	0.27		0.507	0.00	0.00
ANGLE	0.1	0.25	0.27		0.507	2.00	1.01	0.1	0.25	0.27		0.507	0.67	0.34
REAR END	0.1	0.25	0.27		0.507	3.67	1.86	0.1	0.25	0.27		0.507	1.00	0.51
HEAD ON	0.1	0.25	0.27		0.507	0.00	0.00	0.1	0.25	0.27		0.507	0.00	0.00
SS PASS	0.1	0.25	0.27		0.507	0.67	0.34	0.1	0.25	0.27		0.507	0.00	0.00
FIXED OBJ	0.1	0.25	0.27		0.507	0.67	0.34	0.1	0.25	0.27		0.507	0.00	0.00
RAN OFF RD	0.1	0.25	0.27		0.507	0.00	0.00	0.1	0.25	0.27		0.507	0.00	0.00
OTHER	0.1	0.25	0.27		0.507	0.33	0.17	0.1	0.25	0.27		0.507	0.00	0.00
NIGHT					0	0.67	0.00					0	0.67	0.00
WET					0	3.00	0.00					0	0.67	0.00
PEDESTRIAN				0.5	0.5	0.00	0.00				0.5	0.5	0.33	0.17
ESTIMATED PDO CRASH REDUCTION =							4.23	ESTIMATED INJ. - FAT. CRASH REDUCTION =						1.35

ADT Factor

Project Service Life	20 years	Average ADT =	(PADT + FADT)/2 =	(25330 +	27860) =	26595
Present ADT (PADT)	25330 veh / day	ADT Factor =	Average ADT / PADT =	26595 /	25330 =	1.05
Future ADT (FADT)	27860 veh / day					

Average Annual Benefits

Select Facility Type Below: Cities and Incorporated Villages

Annual PDO Benefits = Estimated PDO Crash Reduction * Avg PDO Cost	=	4.23	*	$ 9,253.52	=	$ 39,115.41
Annual INJ.-FAT. Benefits = Estimated INJ.-FAT. Crash Reduction * Avg INJ.-FAT. Cost	=	1.35	*	$ 78,992.88	=	$ 106,660.14
Total Benefits					=	$ 145,775.55
AverageAnnual Benefits = Total Benefits * ADT Factor	=	1.05	*	$ 145,775.55	=	**$ 153,055.70**

Rate of Return

Total Safety Project Cost (Design, Right-of-Way, and Construction)	$598,000	Design (PE)	$52,000
Annual Maintenance and Energy Costs	$1,000	Right-of-Way	$120,000
Salvage Value	$1,000	Construction	$426,000

See Text Box Below for Additional Details on Project Costs for ODOT Safety Projects

Rate of Return 25.14%

8.0 PHOTOS

Photos of the corridor were taken approximately every 500 feet and are displayed below.

Eastbound Approach to Whipple

Eastbound at Whipple

Eastbound 0.1-Mile

Eastbound 0.2-Mile

Eastbound 0.3-Mile

Eastbound 0.35-Mile

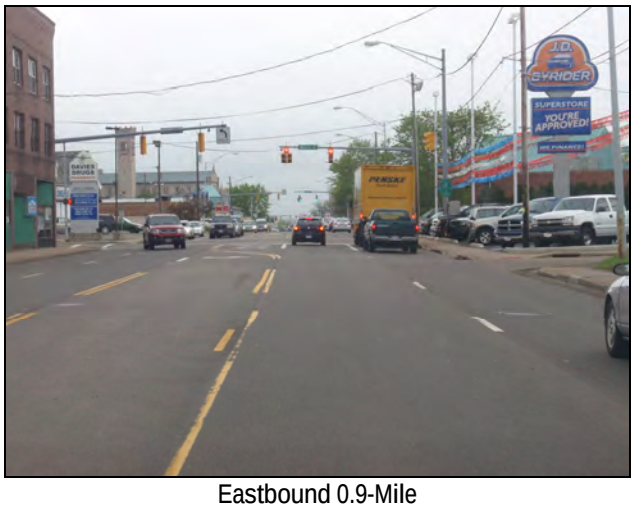
Eastbound 0.4-Mile

Eastbound 0.5-Mile

Eastbound 0.6-Mile

Eastbound 0.7-Mile

Eastbound 0.8-Mile



Eastbound 0.9-Mile

Eastbound 1.0-Mile

Eastbound 1.1-Mile


Eastbound 1.2-Mile

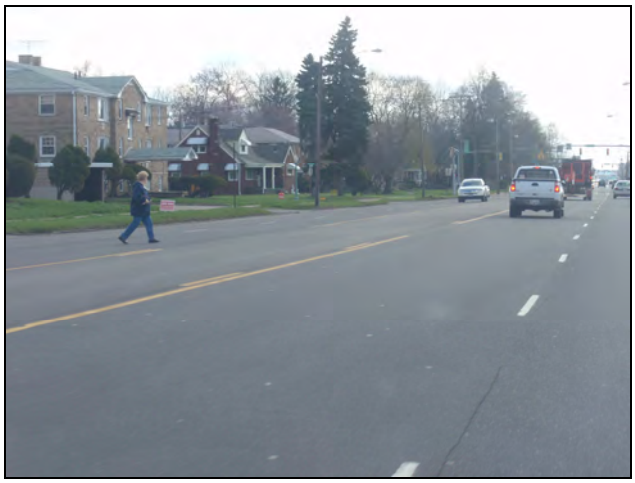

Eastbound 1.3-Mile


Eastbound 1.4-Mile

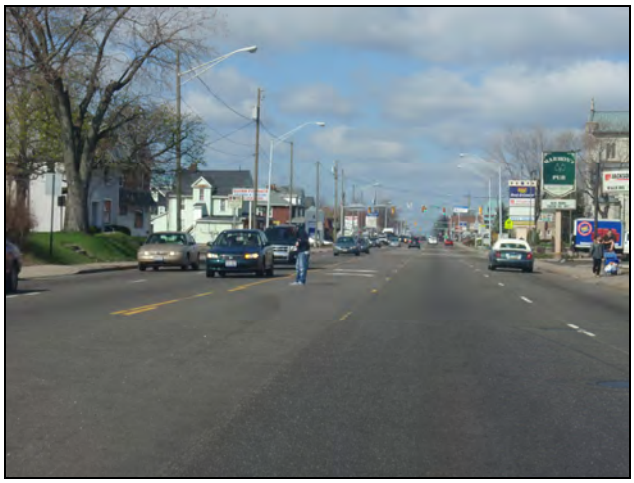

Eastbound 1.5-Mile

No Curb & Gutter Section East of Whipple

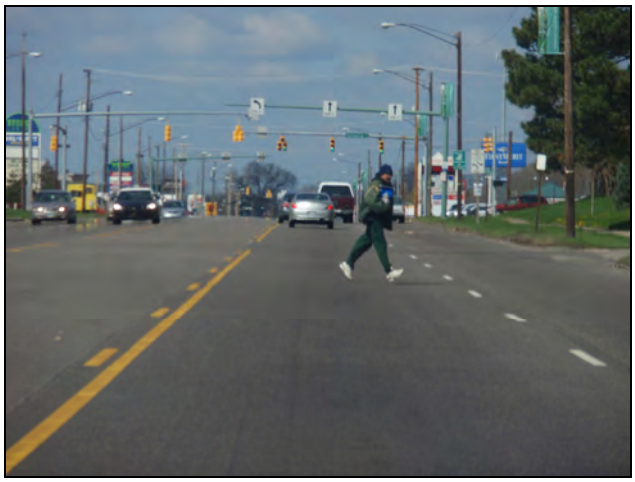
Incomplete Sidewalk at Intersection at Valleyview



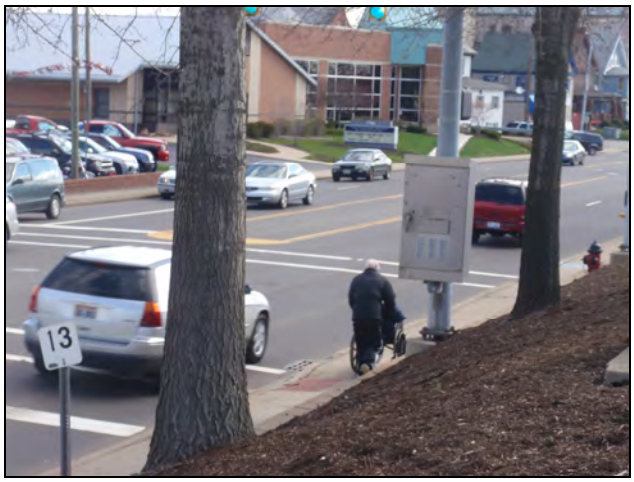
Elderly Pedestrian Crossing Road



Unprotected Pedestrian Waiting in 2-Way Turn Lane



Pedestrian Running in Front of Oncoming Traffic



Wheelchair Pedestrian Unable to Reach A Too High Pushbutton

Transit Stop Located Along Corridor

APPENDIX A

Supporting Traffic Data

SR172 (Tuscarawas St. West)
Calculation of Corridor Average ADT for Safety Study

Roadway	From	To	ADT	Data Year	Source
SR172 (Tuscarawas St. West)	Whipple Ave.	SR297 (Raff Ave.)	20,020	2009	ODOT - Traffic Survey Report (2009)
SR172 (Tuscarawas St. West)	SR297 (Raff Ave.)	Interstate 77	16,980	2009	ODOT - Traffic Survey Report (2009)
SR172 (Tuscarawas St. West)	Bellflower Ave.	Maryland Ave.	26,800	2011	City of Canton Loop System Count (May 2011)
SR172 (Tuscarawas St. West)	Bedford Ave.	Smith Ave.	27,200	2011	City of Canton Loop System Count (May 2011)
SR172 (Tuscarawas St. West)	Whipple Ave.	SR297 (Raff Ave.)	21,230	2009	SCATS - Online Traffic Counts (2009)
SR172 (Tuscarawas St. West)	SR297 (Raff Ave.)	Harrison Ave.	18,010	2009	SCATS - Online Traffic Counts (2009)
SR172 (Tuscarawas St. West)	Whipple Ave.	SR297 (Raff Ave.)	23,570	2003	ODOT - Traffic Survey Report (2009)
SR172 (Tuscarawas St. West)	SR297 (Raff Ave.)	Interstate 77	28,750	2003	ODOT - Traffic Survey Report (2009)
SR172 (Tuscarawas St. West)	Whipple Ave.	Canton Centre Dr.	22,500	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Canton Center Dr.	Valleyview Ave.	23,610	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Valleyview Ave.	Poplar Ave.	24,080	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Harter Ave.	SR297 (Raff Ave.)	25,450	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	SR297 (Raff Ave.)	Montrose Ave.	24,070	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Linwood Ave.	Bellflower Ave.	25,260	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Bellflower Ave.	Roslyn Ave.	24,640	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Claremont Ave.	Maryland Ave.	24,520	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Maryland Ave.	Fawcett Ct.	29,090	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Ingram Ave.	Wertz Ave.	28,030	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Wertz Ave.	Exeter Ave.	26,730	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Exeter Ave.	Broad Ave.	27,950	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Broad Ave.	Dartmouth Ave.	27,040	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Broad Ave.	Dartmouth Ave.	26,580	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Dartmouth Ave.	Clarendon Ave.	28,560	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Columbus Ave.	Bedford Ave. SW	28,900	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Bedford Ave. SW	Bedford Ave. NW	28,250	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Raymont Ct.	Smith Ave.	28,140	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Smith Ave.	Harrison Ave.	27,990	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	**Whipple Ave.**	**Smith Ave.**	**25,331**	**Average of All ADT's**	**Average of all available ADT Data and Sources**

Current ADT Used forSafety Study Analyses:	**25,330**
Future ADT Used forSafety Study Analyses: (0.5% Growth Rate over 20 yrs.)	**27,860**

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
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File Name : Whipple & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/19/2011
Page No : 1

Groups Printed- Cars - Trucks (3+axles)

	WHIPPLE AVE From North					TUSCARAWAS ST. (SR 172) From East					WHIPPLE AVE From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	58	55	51	0	164	50	184	4	0	238	11	51	50	0	112	18	146	46	0	210	724
03:45 PM	47	63	49	0	159	41	188	11	0	240	7	44	29	0	80	13	125	47	0	185	664
Total	105	118	100	0	323	91	372	15	0	478	18	95	79	0	192	31	271	93	0	395	1388
04:00 PM	38	52	44	0	134	59	181	6	0	246	10	55	42	0	107	21	163	40	0	224	711
04:15 PM	66	51	42	4	163	31	176	7	0	214	7	53	28	0	88	23	140	50	0	213	678
04:30 PM	37	36	43	0	116	38	162	4	0	204	8	56	27	0	91	19	154	38	0	211	622
04:45 PM	27	20	60	0	107	52	193	2	0	247	5	38	39	0	82	17	147	40	0	204	640
Total	168	159	189	4	520	180	712	19	0	911	30	202	136	0	368	80	604	168	0	852	2651
05:00 PM	49	38	32	1	120	35	193	3	0	231	5	41	42	0	88	25	150	48	0	223	662
05:15 PM	56	65	55	0	176	52	156	5	0	213	4	40	49	0	93	14	138	47	0	199	681
05:30 PM	40	47	32	0	119	47	145	0	2	194	2	54	33	0	89	22	131	48	0	201	603
05:45 PM	37	47	50	0	134	45	132	2	0	179	0	0	0	0	0	0	0	0	0	0	313
Total	182	197	169	1	549	179	626	10	2	817	11	135	124	0	270	61	419	143	0	623	2259
Grand Total	455	474	458	5	1392	450	1710	44	2	2206	59	432	339	0	830	172	1294	404	0	1870	6298
Apprch %	32.7	34.1	32.9	0.4		20.4	77.5	2	0.1		7.1	52	40.8	0		9.2	69.2	21.6	0		
Total %	7.2	7.5	7.3	0.1	22.1	7.1	27.2	0.7	0	35	0.9	6.9	5.4	0	13.2	2.7	20.5	6.4	0	29.7	
Cars	455	474	458	5	1392	450	1710	44	2	2206	59	432	339	0	830	172	1293	404	0	1869	6297
% Cars	100	100	100	100	100	100	100	100	100	100	100	100	100	0	100	100	99.9	100	0	99.9	100
Trucks (3+axles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
% Trucks (3+axles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1	0

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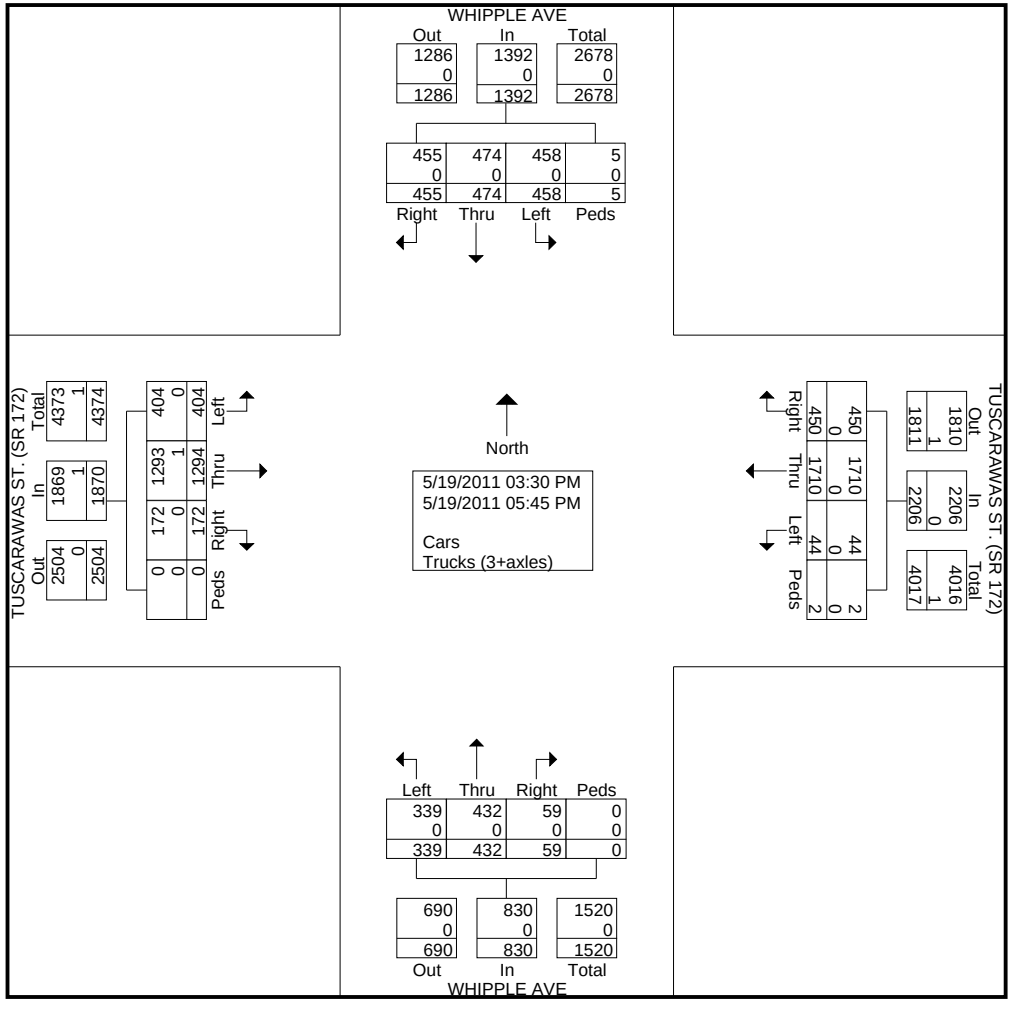

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File Name : Whipple & Tuscarawas (SR 172)
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Start Date : 5/19/2011

	WHIPPLE AVE From North					TUSCARAWAS ST. (SR 172) From East					WHIPPLE AVE From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	58	55	**51**	0	**164**	50	184	4	0	238	**11**	51	**50**	0	**112**	18	146	46	0	210	**724**
03:45 PM	47	**63**	49	0	159	41	**188**	**11**	0	240	7	44	29	0	80	13	125	47	0	185	664
04:00 PM	38	52	44	0	134	**59**	181	6	0	**246**	10	**55**	42	0	107	21	**163**	40	0	**224**	711
04:15 PM	**66**	51	42	**4**	163	31	176	7	0	214	7	53	28	0	88	**23**	140	**50**	0	213	678
Total Volume	209	221	186	4	620	181	729	28	0	938	35	203	149	0	387	75	574	183	0	832	2777
% App. Total	33.7	35.6	30	0.6		19.3	77.7	3	0		9	52.5	38.5	0		9	69	22	0		
PHF	.792	.877	.912	.250	.945	.767	.969	.636	.000	.953	.795	.923	.745	.000	.864	.815	.880	.915	.000	.929	.959

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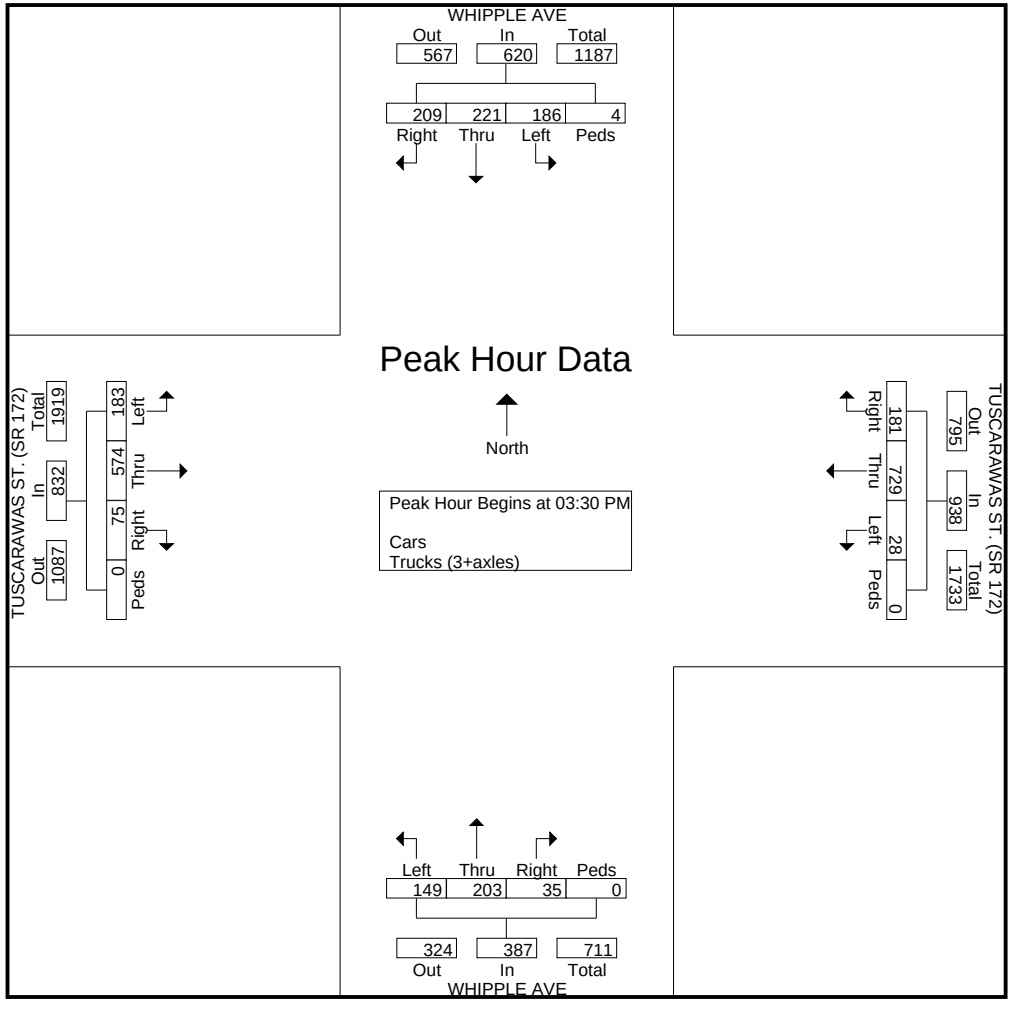

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File Name : ValleyView & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/24/2011
Page No : 1

Groups Printed- Cars - Trucks (3+axles)

	VALLEYVIEW AVE. From North					TUSCARAWAS ST. (SR 172) From East					VALLEYVIEW AVE. From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	11	10	25	2	48	28	227	14	1	270	14	14	27	0	55	24	161	10	1	196	569
03:45 PM	5	12	23	0	40	19	201	21	0	241	20	14	31	0	65	41	175	10	5	231	577
Total	16	22	48	2	88	47	428	35	1	511	34	28	58	0	120	65	336	20	6	427	1146
04:00 PM	13	12	26	0	51	29	186	34	1	250	31	15	38	1	85	31	172	9	0	212	598
04:15 PM	9	10	18	2	39	21	203	32	0	256	13	12	39	1	65	26	161	8	0	195	555
04:30 PM	5	13	30	0	48	24	191	13	0	228	25	10	25	1	61	30	131	8	0	169	506
04:45 PM	11	12	19	0	42	28	213	29	0	270	11	10	24	0	45	20	162	4	0	186	543
Total	38	47	93	2	180	102	793	108	1	1004	80	47	126	3	256	107	626	29	0	762	2202
05:00 PM	8	10	19	0	37	15	207	25	0	247	23	15	22	0	60	40	162	4	0	206	550
05:15 PM	3	15	24	1	43	17	182	9	2	210	11	8	42	0	61	33	171	4	0	208	522
05:30 PM	3	12	21	0	36	19	181	22	0	222	19	13	39	0	71	27	133	8	0	168	497
05:45 PM	3	7	17	0	27	18	183	25	1	227	16	18	25	0	59	25	132	3	0	160	473
Total	17	44	81	1	143	69	753	81	3	906	69	54	128	0	251	125	598	19	0	742	2042
Grand Total	71	113	222	5	411	218	1974	224	5	2421	183	129	312	3	627	297	1560	68	6	1931	5390
Apprch %	17.3	27.5	54	1.2		9	81.5	9.3	0.2		29.2	20.6	49.8	0.5		15.4	80.8	3.5	0.3		
Total %	1.3	2.1	4.1	0.1	7.6	4	36.6	4.2	0.1	44.9	3.4	2.4	5.8	0.1	11.6	5.5	28.9	1.3	0.1	35.8	
Cars	71	113	222	5	411	218	1974	224	5	2421	183	129	312	3	627	297	1560	68	6	1931	5390
% Cars	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Trucks (3+axles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks (3+axles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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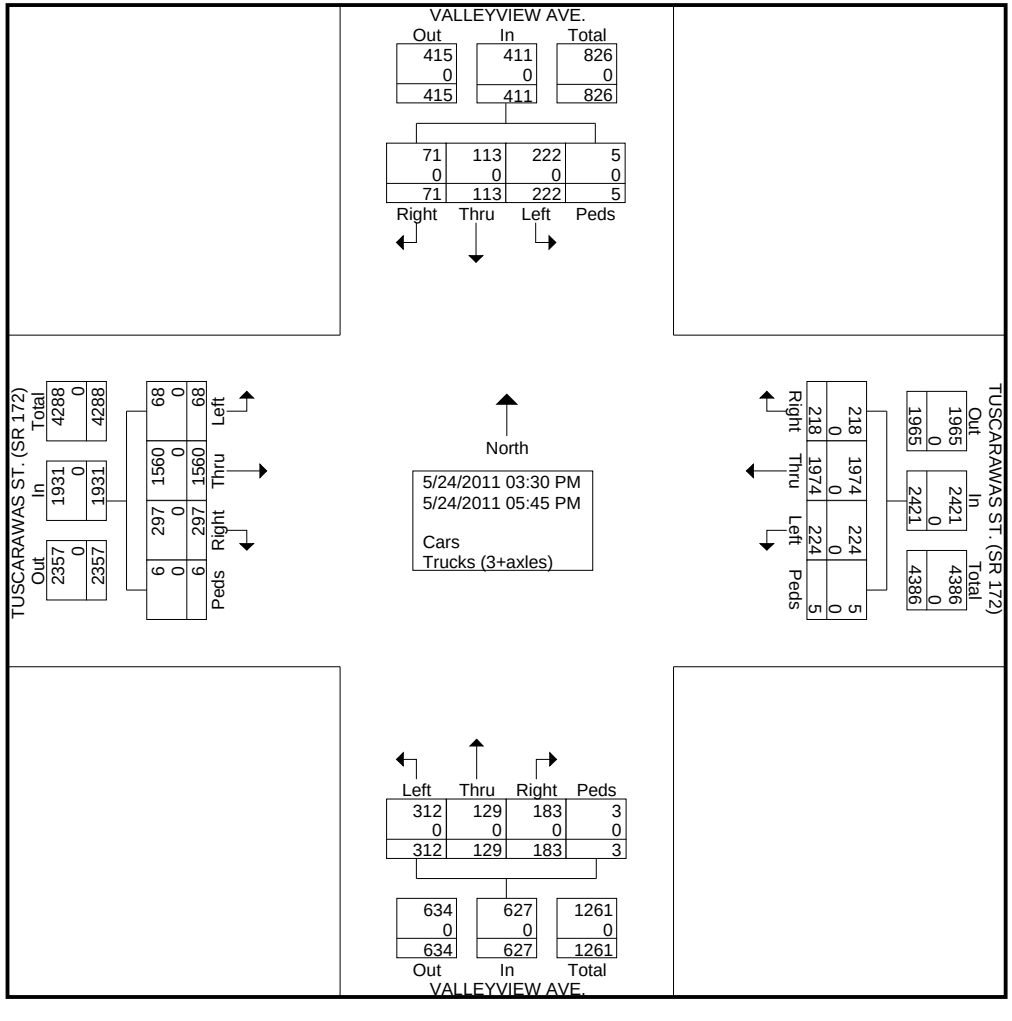

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	VALLEYVIEW AVE. From North					TUSCARAWAS ST. (SR 172) From East					VALLEYVIEW AVE. From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	11	10	25	**2**	48	28	**227**	14	**1**	**270**	14	14	27	0	55	24	161	**10**	1	196	569
03:45 PM	5	**12**	23	0	40	19	201	21	0	241	20	14	31	0	65	**41**	**175**	10	**5**	**231**	577
04:00 PM	**13**	12	**26**	0	**51**	**29**	186	**34**	1	250	**31**	**15**	38	**1**	**85**	31	172	9	0	212	**598**
04:15 PM	9	10	18	2	39	21	203	32	0	256	13	12	**39**	1	65	26	161	8	0	195	555
Total Volume	38	44	92	4	178	97	817	101	2	1017	78	55	135	2	270	122	669	37	6	834	2299
% App. Total	21.3	24.7	51.7	2.2		9.5	80.3	9.9	0.2		28.9	20.4	50	0.7		14.6	80.2	4.4	0.7		
PHF	.731	.917	.885	.500	.873	.836	.900	.743	.500	.942	.629	.917	.865	.500	.794	.744	.956	.925	.300	.903	.961

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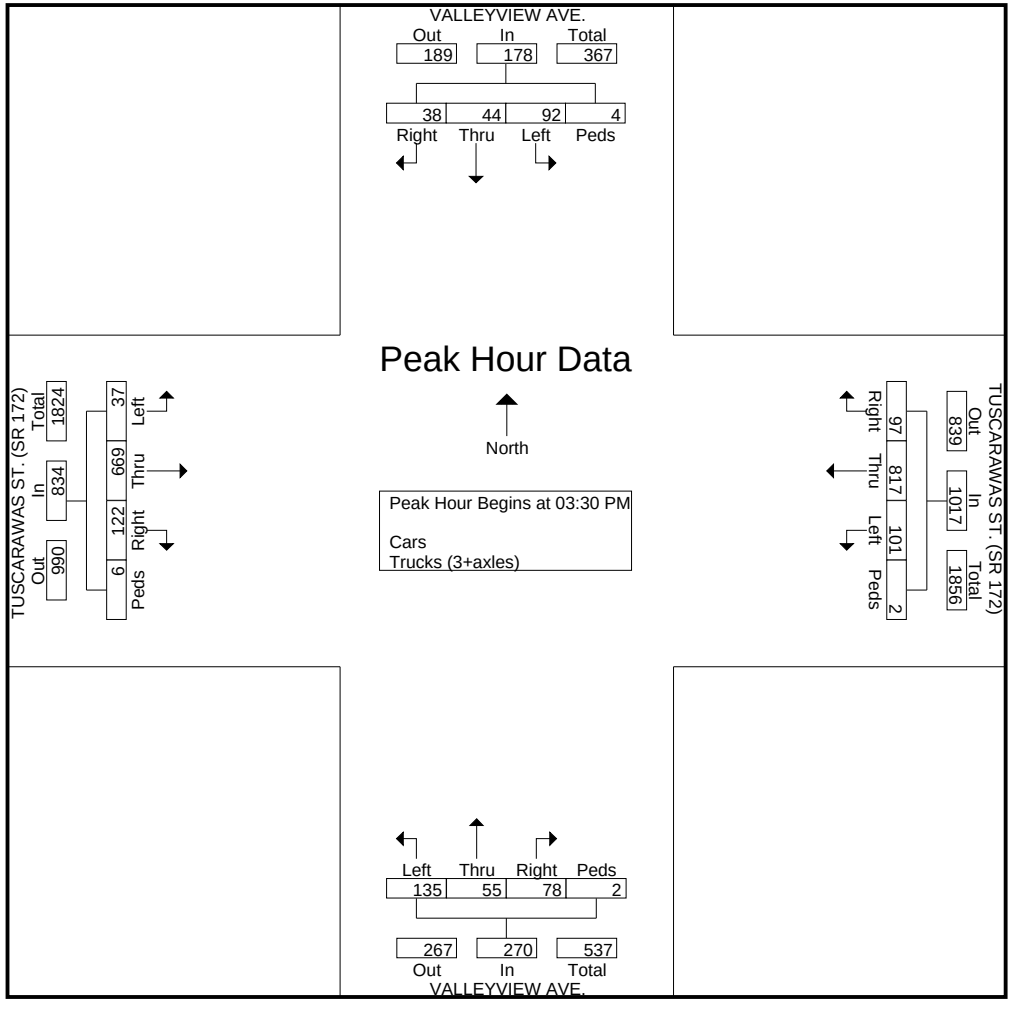

The Mannik & Smith Group, Inc.
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File Name : Raff Rd. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/25/2011
Page No : 1

Groups Printed- Cars - Trucks (3+axles)

	RAFF RD From North					TUSCARAWAS ST. (SR 172) From East					RAFF RD From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	5	9	2	0	16	4	241	23	0	268	35	12	35	0	82	17	160	0	0	177	543
03:45 PM	2	15	2	0	19	2	246	21	0	269	30	8	66	0	104	28	177	1	0	206	598
Total	7	24	4	0	35	6	487	44	0	537	65	20	101	0	186	45	337	1	0	383	1141
04:00 PM	2	2	0	0	4	2	231	21	0	254	26	16	59	1	102	24	182	1	2	209	569
04:15 PM	2	6	3	0	11	2	215	31	2	250	17	11	65	0	93	21	180	0	0	201	555
04:30 PM	0	3	4	0	7	2	227	13	0	242	18	1	53	0	72	25	185	0	2	212	533
04:45 PM	3	4	2	0	9	5	243	21	1	270	16	8	46	0	70	28	152	0	1	181	530
Total	7	15	9	0	31	11	916	86	3	1016	77	36	223	1	337	98	699	1	5	803	2187
05:00 PM	2	7	2	0	11	1	248	22	0	271	36	11	52	0	99	21	126	0	1	148	529
05:15 PM	3	9	1	2	15	3	240	26	2	271	25	8	50	0	83	23	154	1	0	178	547
05:30 PM	3	10	4	1	18	3	191	23	1	218	18	9	44	2	73	23	127	2	0	152	461
05:45 PM	4	11	2	1	18	2	199	17	0	218	29	19	46	2	96	34	167	2	0	203	535
Total	12	37	9	4	62	9	878	88	3	978	108	47	192	4	351	101	574	5	1	681	2072
Grand Total	26	76	22	4	128	26	2281	218	6	2531	250	103	516	5	874	244	1610	7	6	1867	5400
Apprch %	20.3	59.4	17.2	3.1		1	90.1	8.6	0.2		28.6	11.8	59	0.6		13.1	86.2	0.4	0.3		
Total %	0.5	1.4	0.4	0.1	2.4	0.5	42.2	4	0.1	46.9	4.6	1.9	9.6	0.1	16.2	4.5	29.8	0.1	0.1	34.6	
Cars	26	76	22	4	128	26	2281	218	6	2531	250	103	516	5	874	244	1609	7	6	1866	5399
% Cars	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99.9	100	100	99.9	100
Trucks (3+axles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
% Trucks (3+axles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1	0

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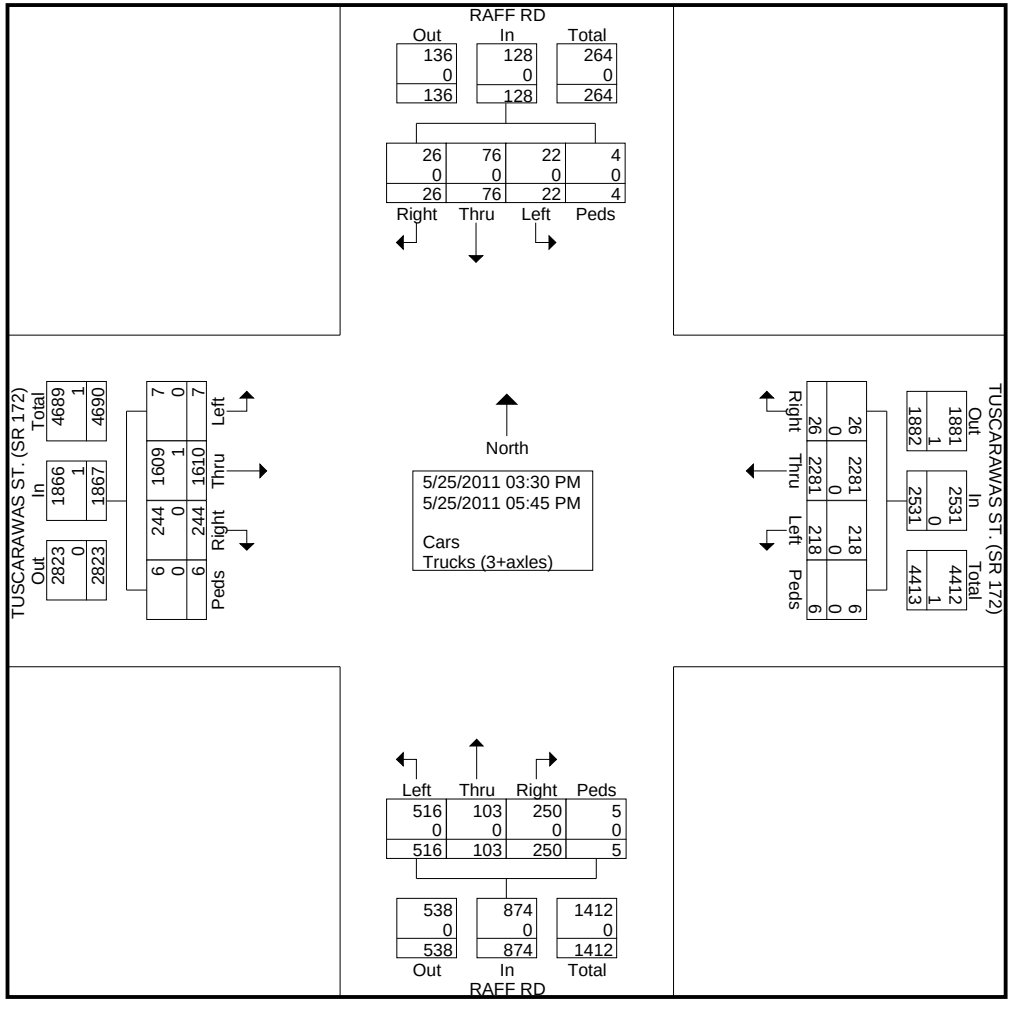

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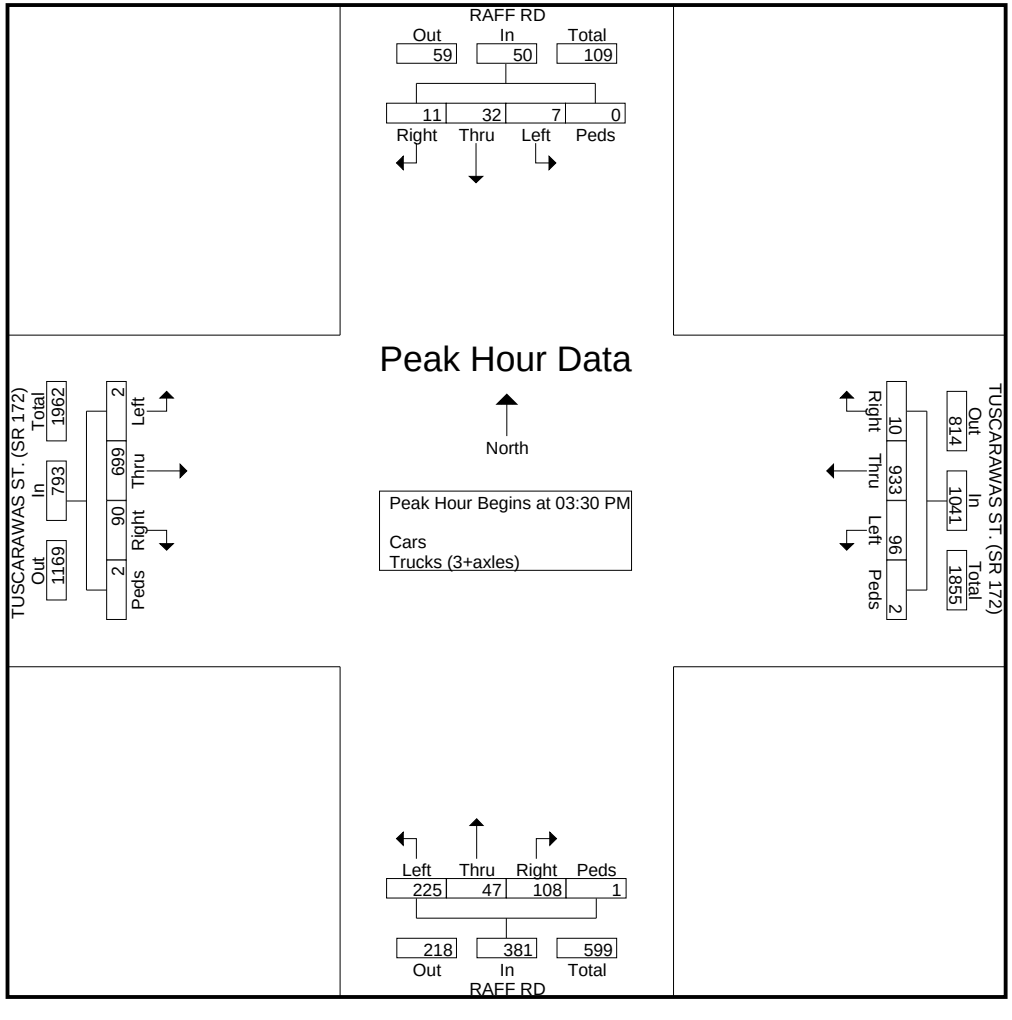
File Name : Raff Rd. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/25/2011

	RAFF RD From North					TUSCARAWAS ST. (SR 172) From East					RAFF RD From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**5**	9	2	0	16	**4**	241	23	0	268	**35**	12	35	0	82	17	160	0	0	177	543
03:45 PM	2	**15**	2	0	**19**	2	**246**	21	0	**269**	30	8	**66**	0	**104**	**28**	177	**1**	0	206	**598**
04:00 PM	2	2	0	0	4	2	231	21	0	254	26	**16**	59	**1**	102	24	**182**	1	**2**	**209**	569
04:15 PM	2	6	**3**	0	11	2	215	**31**	**2**	250	17	11	65	0	93	21	180	0	0	201	555
Total Volume	11	32	7	0	50	10	933	96	2	1041	108	47	225	1	381	90	699	2	2	793	2265
% App. Total	22	64	14	0		1	89.6	9.2	0.2		28.3	12.3	59.1	0.3		11.3	88.1	0.3	0.3		
PHF	.550	.533	.583	.000	.658	.625	.948	.774	.250	.967	.771	.734	.852	.250	.916	.804	.960	.500	.250	.949	.947

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Raff Rd. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/25/2011
Page No : 4



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Bellflower & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/26/2011
Page No : 1

Groups Printed- Cars - Trucks (3+axle)

	BELLFLOWER AVE From North					TUSCARAWAS ST. (SR 172) From East					BELLFLOWER AVE From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	1	1	2	4	261	2	0	267	2	6	22	3	33	4	235	0	0	239	541
03:45 PM	3	2	2	2	9	3	273	6	0	282	4	3	16	0	23	6	220	1	0	227	541
Total	3	2	3	3	11	7	534	8	0	549	6	9	38	3	56	10	455	1	0	466	1082
04:00 PM	2	3	0	1	6	3	274	2	0	279	3	3	15	0	21	4	159	0	0	163	469
04:15 PM	1	2	1	1	5	5	259	3	0	267	3	6	13	2	24	3	172	2	2	179	475
04:30 PM	4	4	1	1	10	2	279	4	0	285	5	7	13	2	27	0	169	1	0	170	492
04:45 PM	1	3	1	0	5	3	291	4	0	298	7	3	20	1	31	4	173	1	0	178	512
Total	8	12	3	3	26	13	1103	13	0	1129	18	19	61	5	103	11	673	4	2	690	1948
05:00 PM	3	4	2	0	9	4	277	3	0	284	2	14	21	3	40	2	150	0	0	152	485
05:15 PM	2	1	3	1	7	2	245	9	0	256	3	6	16	1	26	6	158	5	5	174	463
05:30 PM	4	2	3	0	9	0	243	1	1	245	5	0	15	4	24	7	148	6	0	161	439
05:45 PM	1	1	1	2	5	0	206	9	0	215	2	2	14	0	18	8	130	2	1	141	379
Total	10	8	9	3	30	6	971	22	1	1000	12	22	66	8	108	23	586	13	6	628	1766
Grand Total	21	22	15	9	67	26	2608	43	1	2678	36	50	165	16	267	44	1714	18	8	1784	4796
Apprch %	31.3	32.8	22.4	13.4		1	97.4	1.6	0		13.5	18.7	61.8	6		2.5	96.1	1	0.4		
Total %	0.4	0.5	0.3	0.2	1.4	0.5	54.4	0.9	0	55.8	0.8	1	3.4	0.3	5.6	0.9	35.7	0.4	0.2	37.2	
Cars	21	22	15	9	67	26	2595	43	1	2665	36	50	165	16	267	44	1708	18	8	1778	4777
% Cars	100	100	100	100	100	100	99.5	100	100	99.5	100	100	100	100	100	100	99.6	100	100	99.7	99.6
Trucks (3+axle)	0	0	0	0	0	0	13	0	0	13	0	0	0	0	0	0	6	0	0	6	19
% Trucks (3+axle)	0	0	0	0	0	0	0.5	0	0	0.5	0	0	0	0	0	0	0.4	0	0	0.3	0.4

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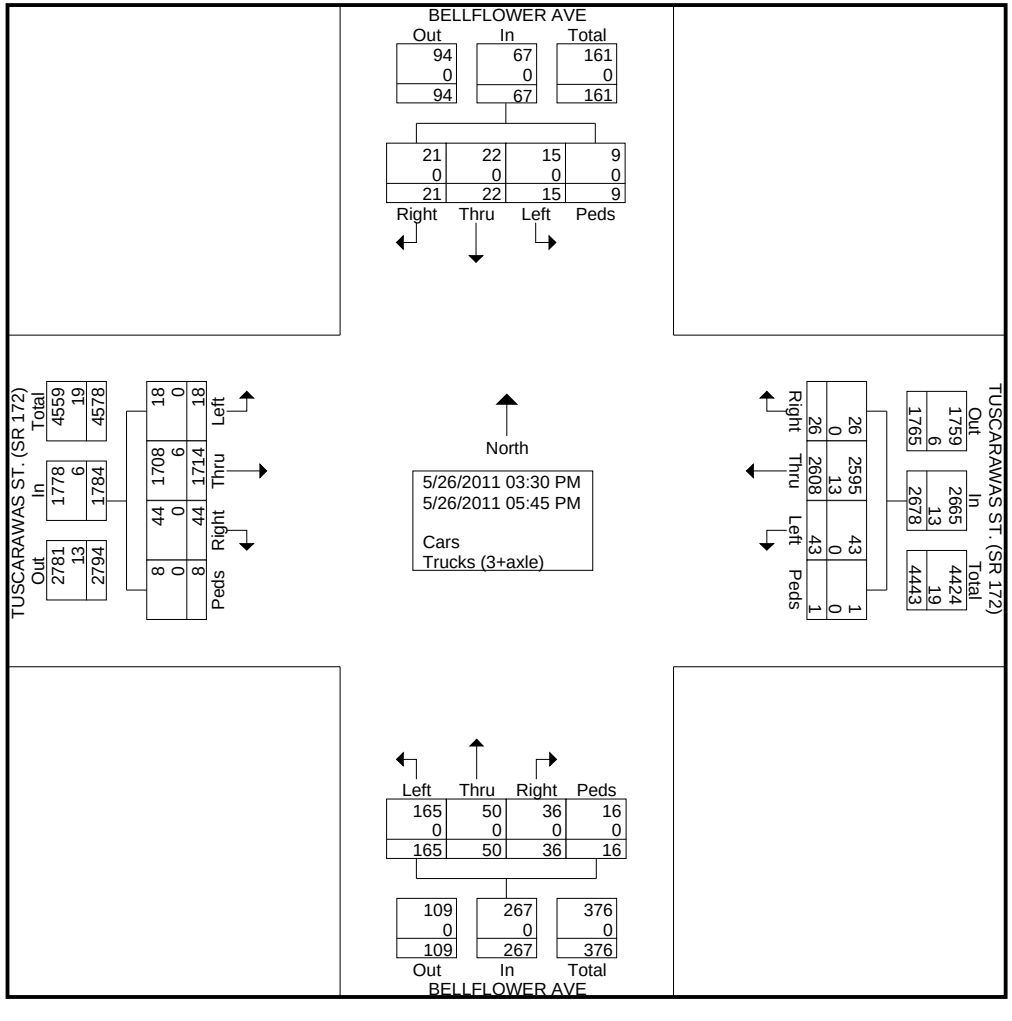
Phone: (419) 891-2222

File Name : Bellflower & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/26/2011



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Bellflower & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/26/2011

	BELLFLOWER AVE From North					TUSCARAWAS ST. (SR 172) From East					BELLFLOWER AVE From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	1	1	2	4	261	2	0	267	2	**6**	**22**	**3**	**33**	4	**235**	0	0	**239**	**541**
03:45 PM	**3**	2	**2**	**2**	**9**	3	273	**6**	0	**282**	**4**	3	16	0	23	**6**	220	1	0	227	541
04:00 PM	2	**3**	0	1	6	3	**274**	2	0	279	3	3	15	0	21	4	159	0	0	163	469
04:15 PM	1	2	1	1	5	**5**	259	3	0	267	3	6	13	2	24	3	172	**2**	**2**	179	475
Total Volume	6	7	4	5	22	15	1067	13	0	1095	12	18	66	5	101	17	786	3	2	808	2026
% App. Total	27.3	31.8	18.2	22.7		1.4	97.4	1.2	0		11.9	17.8	65.3	5		2.1	97.3	0.4	0.2		
PHF	.500	.583	.500	.625	.611	.750	.974	.542	.000	.971	.750	.750	.750	.417	.765	.708	.836	.375	.250	.845	.936

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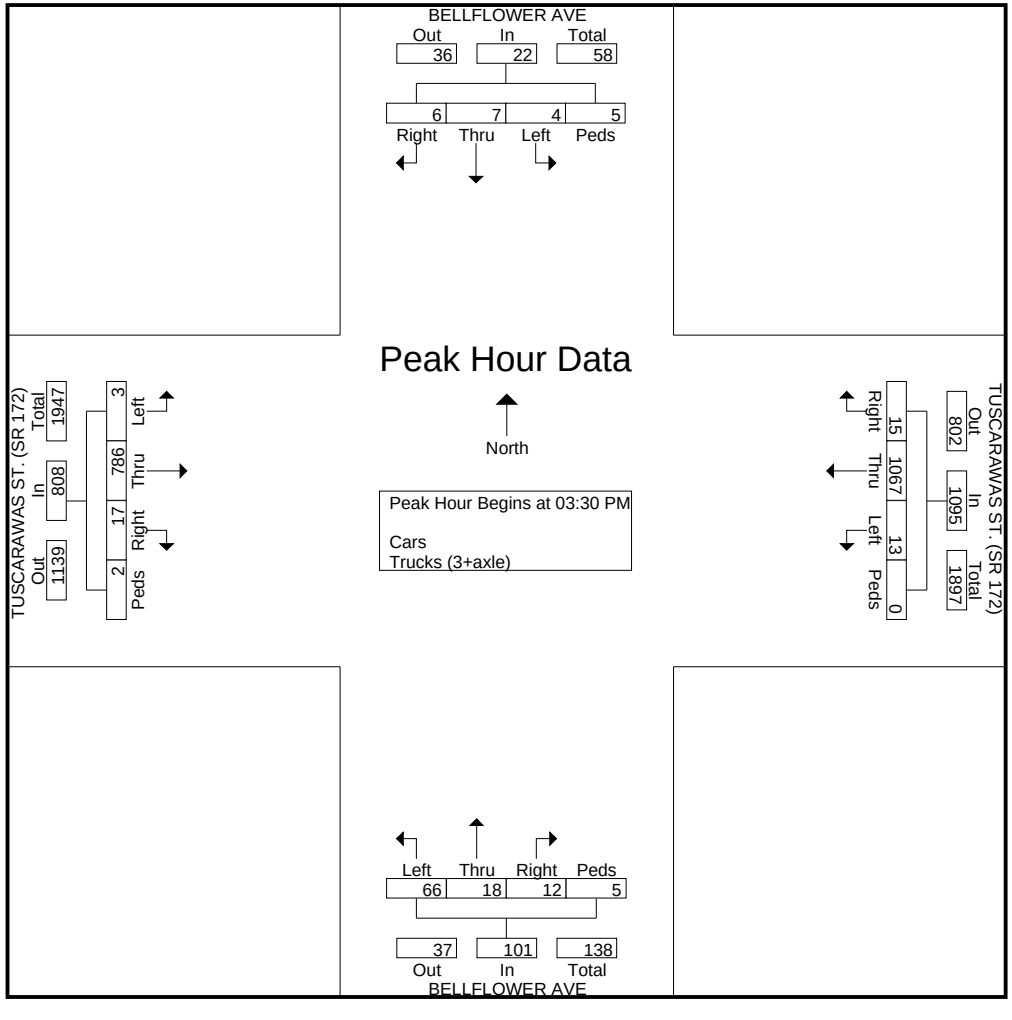
File Name : Bellflower & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/26/2011
Page No : 4



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

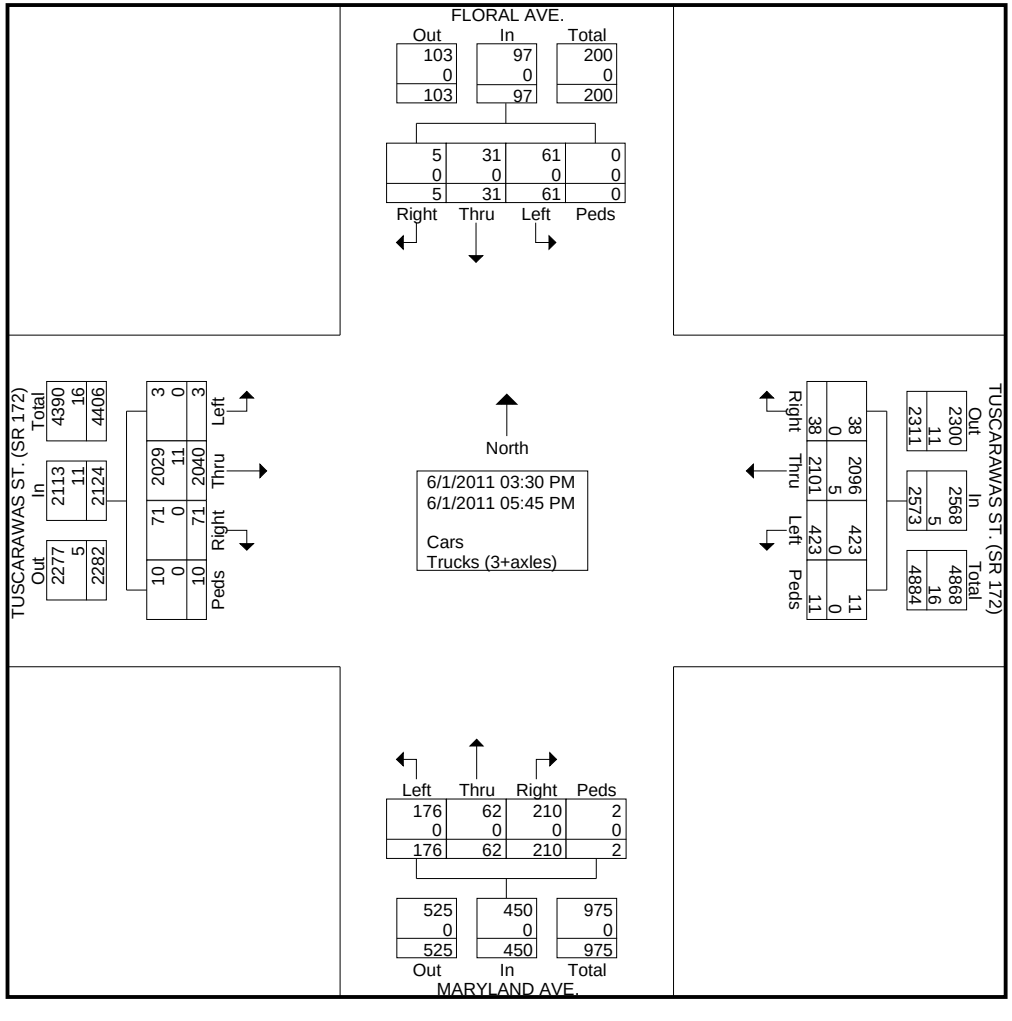
File Name : Maryland Ave & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 6/1/2011

Groups Printed- Cars - Trucks (3+axles)

	FLORAL AVE. From North					TUSCARAWAS ST. (SR 172) From East					MARYLAND AVE. From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	0	7	9	0	16	3	204	304	2	513	36	10	42	0	88	8	254	0	0	262	879
03:45 PM	1	6	4	0	11	6	227	7	0	240	13	8	16	0	37	7	217	0	0	224	512
Total	1	13	13	0	27	9	431	311	2	753	49	18	58	0	125	15	471	0	0	486	1391
04:00 PM	1	1	3	0	5	7	266	19	3	295	22	9	13	0	44	4	220	1	0	225	569
04:15 PM	0	2	6	0	8	3	195	9	6	213	16	5	13	1	35	9	190	0	0	199	455
04:30 PM	2	3	6	0	11	6	202	8	0	216	23	8	18	1	50	4	203	0	6	213	490
04:45 PM	0	5	10	0	15	6	230	23	0	259	15	4	13	0	32	4	199	0	0	203	509
Total	3	11	25	0	39	22	893	59	9	983	76	26	57	2	161	21	812	1	6	840	2023
05:00 PM	1	1	9	0	11	5	231	9	0	245	31	10	19	0	60	8	193	0	3	204	520
05:15 PM	0	3	5	0	8	0	198	20	0	218	19	4	17	0	40	8	169	0	1	178	444
05:30 PM	0	1	7	0	8	2	181	11	0	194	20	3	19	0	42	8	181	1	0	190	434
05:45 PM	0	2	2	0	4	0	167	13	0	180	15	1	6	0	22	11	214	1	0	226	432
Total	1	7	23	0	31	7	777	53	0	837	85	18	61	0	164	35	757	2	4	798	1830
Grand Total	5	31	61	0	97	38	2101	423	11	2573	210	62	176	2	450	71	2040	3	10	2124	5244
Apprch %	5.2	32	62.9	0		1.5	81.7	16.4	0.4		46.7	13.8	39.1	0.4		3.3	96	0.1	0.5		
Total %	0.1	0.6	1.2	0	1.8	0.7	40.1	8.1	0.2	49.1	4	1.2	3.4	0	8.6	1.4	38.9	0.1	0.2	40.5	
Cars	5	31	61	0	97	38	2096	423	11	2568	210	62	176	2	450	71	2029	3	10	2113	5228
% Cars	100	100	100	0	100	100	99.8	100	100	99.8	100	100	100	100	100	100	99.5	100	100	99.5	99.7
Trucks (3+axles)	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	11	0	0	11	16
% Trucks (3+axles)	0	0	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0	0	0.5	0	0	0.5	0.3

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Maryland Ave & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 6/1/2011
Page No : 2



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Maryland Ave & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 6/1/2011

	FLORAL AVE. From North					TUSCARAWAS ST. (SR 172) From East					MARYLAND AVE. From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	**7**	**9**	0	**16**	3	204	**304**	2	**513**	**36**	**10**	**42**	0	**88**	8	**254**	0	0	**262**	**879**
03:45 PM	**1**	6	4	0	11	6	227	7	0	240	13	8	16	0	37	7	217	0	0	224	512
04:00 PM	1	1	3	0	5	**7**	**266**	19	3	295	22	9	13	0	44	4	220	**1**	0	225	569
04:15 PM	0	2	6	0	8	3	195	9	**6**	213	16	5	13	**1**	35	**9**	190	0	0	199	455
Total Volume	2	16	22	0	40	19	892	339	11	1261	87	32	84	1	204	28	881	1	0	910	2415
% App. Total	5	40	55	0		1.5	70.7	26.9	0.9		42.6	15.7	41.2	0.5		3.1	96.8	0.1	0		
PHF	.500	.571	.611	.000	.625	.679	.838	.279	.458	.615	.604	.800	.500	.250	.580	.778	.867	.250	.000	.868	.687

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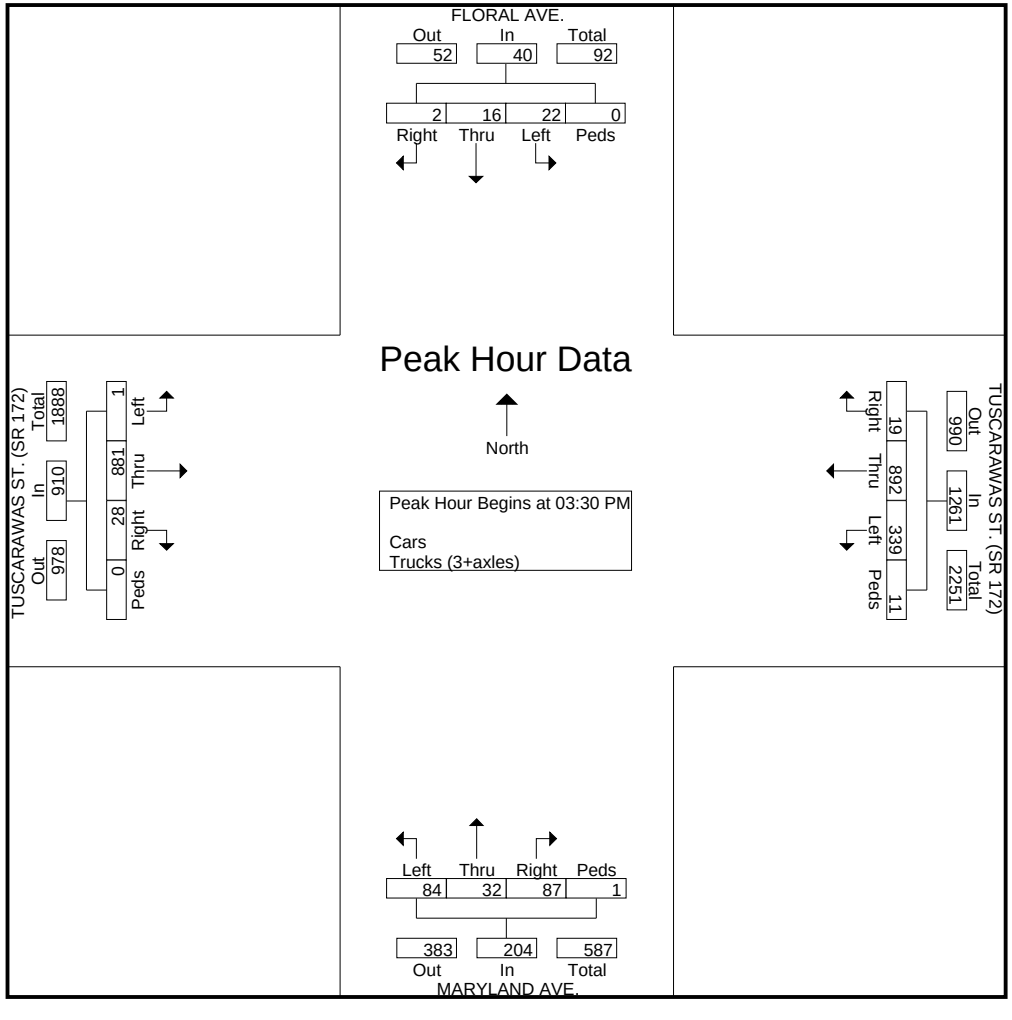
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Maryland Ave & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 6/1/2011
Page No : 4



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Wertz Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/25/2011

Groups Printed- Cars - Trucks (3+axles)

	WERTZ AVE From North					TUSCARAWAS ST. (SR 172) From East					WERTZ AVE From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	41	0	23	0	64	34	251	0	0	285	0	0	0	0	0	0	226	33	1	260	609
03:45 PM	38	0	24	0	62	17	291	0	0	308	0	0	0	0	0	0	211	32	0	243	613
Total	79	0	47	0	126	51	542	0	0	593	0	0	0	0	0	0	437	65	1	503	1222
04:00 PM	36	0	26	1	63	24	244	0	0	268	0	0	0	0	0	0	194	32	0	226	557
04:15 PM	43	0	25	2	70	17	254	0	4	275	0	0	0	0	0	0	197	35	0	232	577
04:30 PM	23	0	19	5	47	24	253	0	0	277	0	0	0	0	0	0	204	33	0	237	561
04:45 PM	39	0	24	0	63	22	263	0	3	288	0	0	0	0	0	0	178	28	0	206	557
Total	141	0	94	8	243	87	1014	0	7	1108	0	0	0	0	0	0	773	128	0	901	2252
05:00 PM	34	0	24	4	62	26	255	0	0	281	0	0	0	0	0	0	175	39	0	214	557
05:15 PM	37	0	25	1	63	20	250	0	0	270	0	0	0	0	0	0	198	36	0	234	567
05:30 PM	48	0	28	2	78	20	221	0	0	241	0	0	0	0	0	0	164	20	0	184	503
05:45 PM	20	0	16	4	40	22	220	0	0	242	0	0	0	0	0	0	205	29	0	234	516
Total	139	0	93	11	243	88	946	0	0	1034	0	0	0	0	0	0	742	124	0	866	2143
Grand Total	359	0	234	19	612	226	2502	0	7	2735	0	0	0	0	0	0	1952	317	1	2270	5617
Apprch %	58.7	0	38.2	3.1		8.3	91.5	0	0.3		0	0	0	0		0	86	14	0		
Total %	6.4	0	4.2	0.3	10.9	4	44.5	0	0.1	48.7	0	0	0	0	0	0	34.8	5.6	0	40.4	
Cars	359	0	232	19	610	226	2491	0	7	2724	0	0	0	0	0	0	1938	316	1	2255	5589
% Cars	100	0	99.1	100	99.7	100	99.6	0	100	99.6	0	0	0	0	0	0	99.3	99.7	100	99.3	99.5
Trucks (3+axles)	0	0	2	0	2	0	11	0	0	11	0	0	0	0	0	0	14	1	0	15	28
% Trucks (3+axles)	0	0	0.9	0	0.3	0	0.4	0	0	0.4	0	0	0	0	0	0	0.7	0.3	0	0.7	0.5

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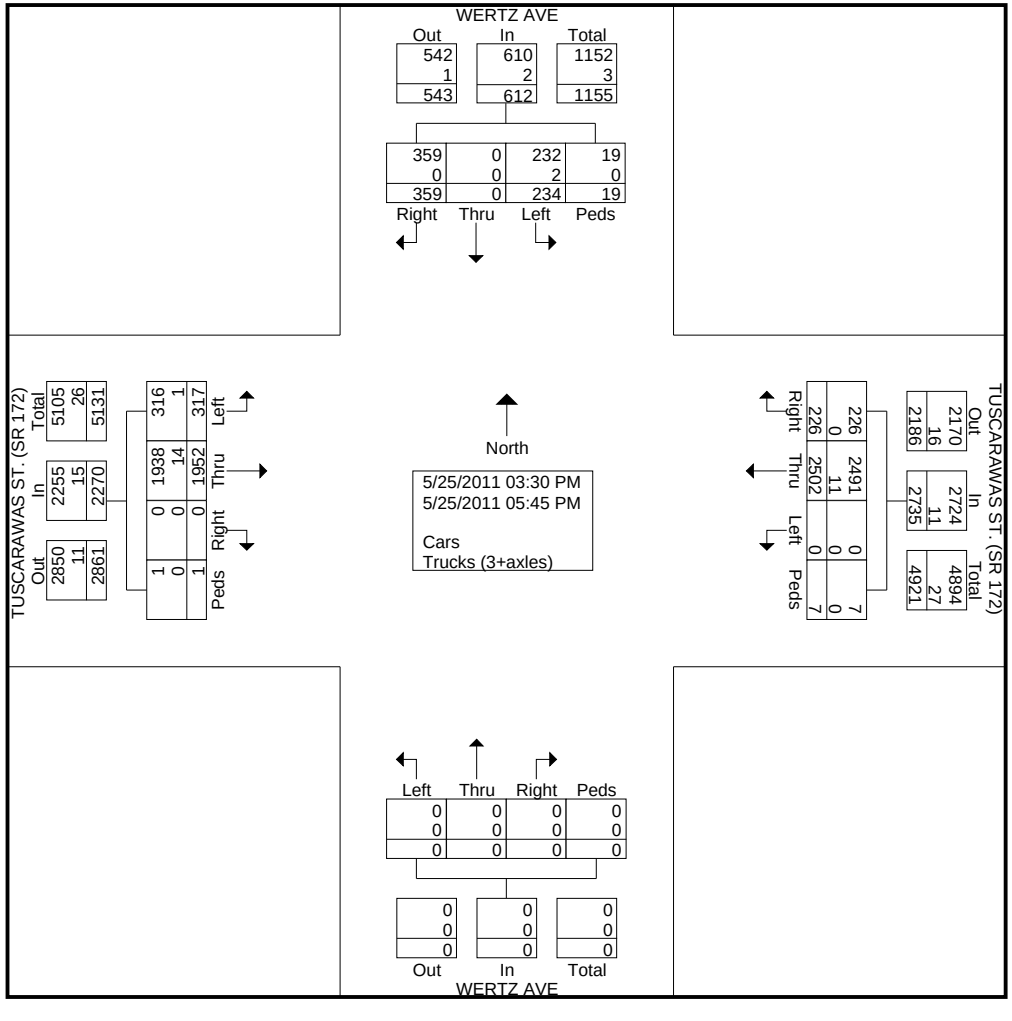
Phone: (419) 891-2222

File Name : Wertz Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/25/2011
Page No : 2



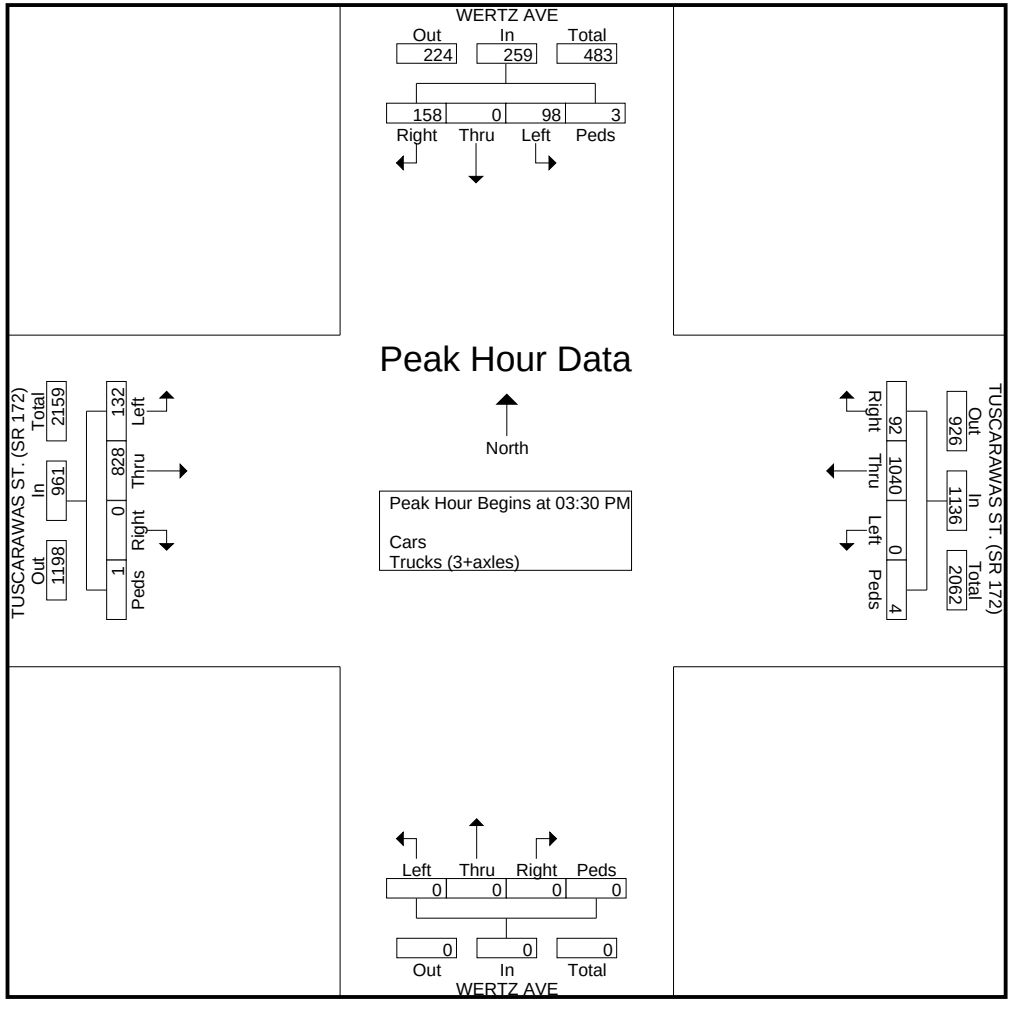
The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Wertz Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/25/2011

	WERTZ AVE From North					TUSCARAWAS ST. (SR 172) From East					WERTZ AVE From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	41	0	23	0	64	**34**	251	0	0	285	0	0	0	0	0	0	**226**	33	**1**	**260**	609
03:45 PM	38	0	24	0	62	17	**291**	0	0	**308**	0	0	0	0	0	0	211	32	0	243	**613**
04:00 PM	36	0	**26**	1	63	24	244	0	0	268	0	0	0	0	0	0	194	32	0	226	557
04:15 PM	**43**	0	25	**2**	**70**	17	254	0	**4**	275	0	0	0	0	0	0	197	**35**	0	232	577
Total Volume	158	0	98	3	259	92	1040	0	4	1136	0	0	0	0	0	0	828	132	1	961	2356
% App. Total	61	0	37.8	1.2		8.1	91.5	0	0.4		0	0	0	0		0	86.2	13.7	0.1		
PHF	.919	.000	.942	.375	.925	.676	.893	.000	.250	.922	.000	.000	.000	.000	.000	.000	.916	.943	.250	.924	.961

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Wertz Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/25/2011
Page No : 4



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

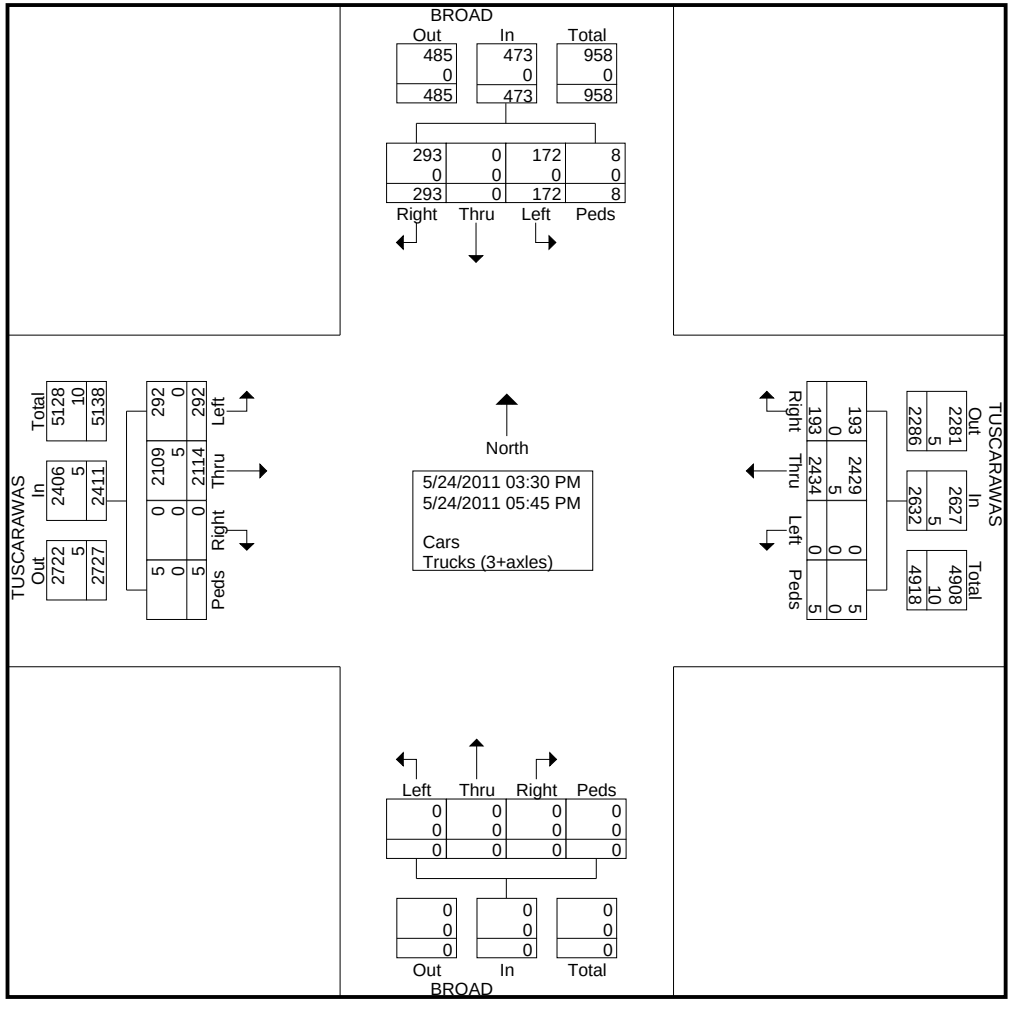
File Name : Broad Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/24/2011

Groups Printed- Cars - Trucks (3+axles)

	BROAD From North					TUSCARAWAS From East					BROAD From South					TUSCARAWAS From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	30	0	11	1	42	20	258	0	0	278	0	0	0	0	0	0	202	33	0	235	555
03:45 PM	35	0	27	0	62	12	244	0	0	256	0	0	0	0	0	0	217	26	0	243	561
Total	65	0	38	1	104	32	502	0	0	534	0	0	0	0	0	0	419	59	0	478	1116
04:00 PM	24	0	19	3	46	22	266	0	0	288	0	0	0	0	0	0	243	16	2	261	595
04:15 PM	20	0	17	0	37	22	265	0	1	288	0	0	0	0	0	0	242	29	1	272	597
04:30 PM	35	0	18	0	53	21	254	0	2	277	0	0	0	0	0	0	193	43	1	237	567
04:45 PM	34	0	19	0	53	17	232	0	0	249	0	0	0	0	0	0	206	24	0	230	532
Total	113	0	73	3	189	82	1017	0	3	1102	0	0	0	0	0	0	884	112	4	1000	2291
05:00 PM	25	0	14	0	39	30	258	0	0	288	0	0	0	0	0	0	215	33	0	248	575
05:15 PM	30	0	14	1	45	24	226	0	0	250	0	0	0	0	0	0	205	39	0	244	539
05:30 PM	26	0	22	1	49	13	223	0	1	237	0	0	0	0	0	0	207	29	0	236	522
05:45 PM	34	0	11	2	47	12	208	0	1	221	0	0	0	0	0	0	184	20	1	205	473
Total	115	0	61	4	180	79	915	0	2	996	0	0	0	0	0	0	811	121	1	933	2109
Grand Total	293	0	172	8	473	193	2434	0	5	2632	0	0	0	0	0	0	2114	292	5	2411	5516
Apprch %	61.9	0	36.4	1.7		7.3	92.5	0	0.2		0	0	0	0		0	87.7	12.1	0.2		
Total %	5.3	0	3.1	0.1	8.6	3.5	44.1	0	0.1	47.7	0	0	0	0	0	0	38.3	5.3	0.1	43.7	
Cars	293	0	172	8	473	193	2429	0	5	2627	0	0	0	0	0	0	2109	292	5	2406	5506
% Cars	100	0	100	100	100	100	99.8	0	100	99.8	0	0	0	0	0	0	99.8	100	100	99.8	99.8
Trucks (3+axles)	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	5	0	0	5	10
% Trucks (3+axles)	0	0	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0	0	0.2	0	0	0.2	0.2

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Broad Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/24/2011
Page No : 2



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Broad Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/24/2011

	BROAD From North					TUSCARAWAS From East					BROAD From South					TUSCARAWAS From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:45 PM																					
03:45 PM	**35**	0	**27**	0	**62**	12	244	0	0	256	0	0	0	0	0	0	217	26	0	243	561
04:00 PM	24	0	19	**3**	46	**22**	**266**	0	0	**288**	0	0	0	0	0	0	**243**	16	**2**	261	595
04:15 PM	20	0	17	0	37	22	265	0	1	288	0	0	0	0	0	0	242	29	1	**272**	**597**
04:30 PM	35	0	18	0	53	21	254	0	**2**	277	0	0	0	0	0	0	193	**43**	1	237	567
Total Volume	114	0	81	3	198	77	1029	0	3	1109	0	0	0	0	0	0	895	114	4	1013	2320
% App. Total	57.6	0	40.9	1.5		6.9	92.8	0	0.3		0	0	0	0		0	88.4	11.3	0.4		
PHF	.814	.000	.750	.250	.798	.875	.967	.000	.375	.963	.000	.000	.000	.000	.000	.000	.921	.663	.500	.931	.972

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File Name : Broad Ave. & Tuscarawas (SR 172)
Site Code : 00000000
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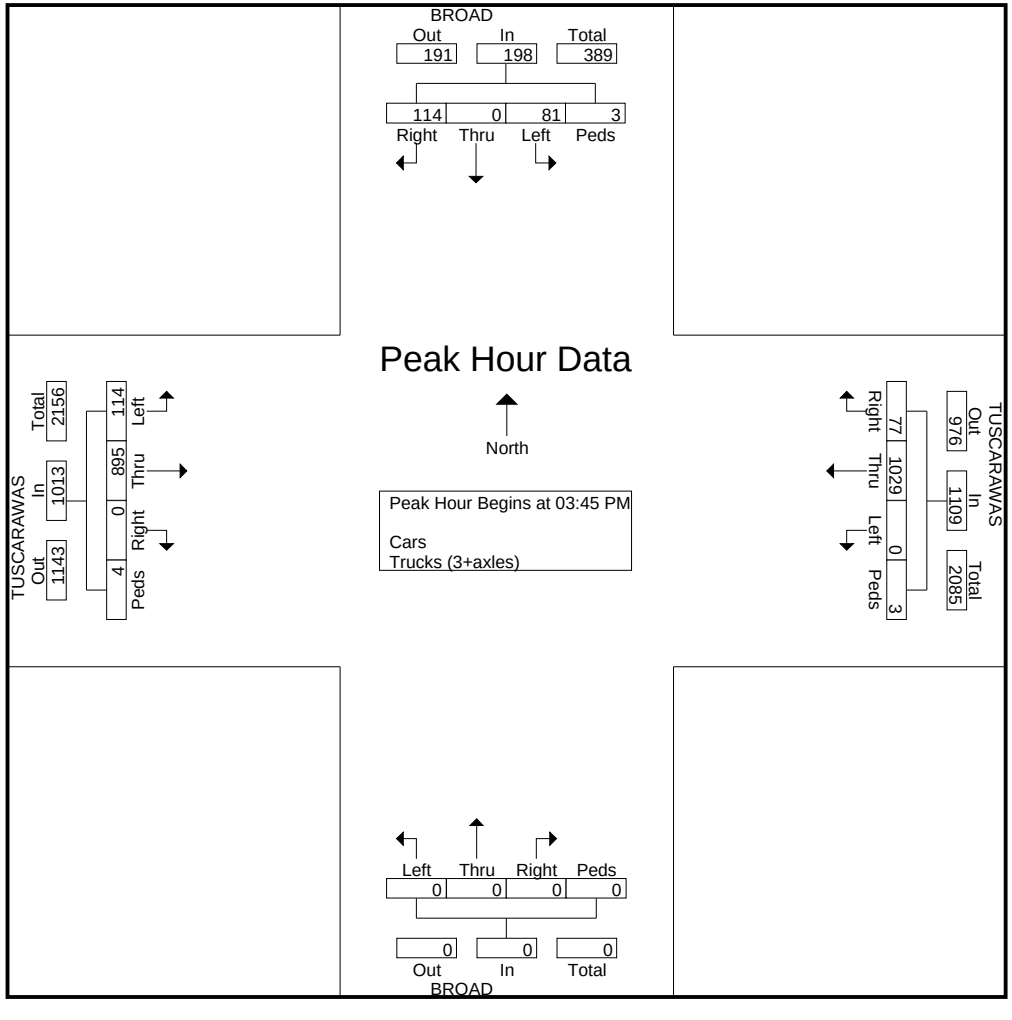

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Bedford AVE. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/16/2011

Groups Printed- Cars - Trucks (3+axles)

	BEDFORD AVE. From North					TUSCARAWAS ST. (SR 172) From East					BEDFORD AVE. From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	0	0	0	0	242	17	1	260	40	0	61	1	102	15	256	0	1	272	634
03:45 PM	0	0	0	0	0	0	237	17	0	254	22	0	47	2	71	23	233	0	0	256	581
Total	0	0	0	0	0	0	479	34	1	514	62	0	108	3	173	38	489	0	1	528	1215
04:00 PM	0	0	0	0	0	0	234	37	1	272	32	0	42	3	77	19	243	0	0	262	611
04:15 PM	0	0	0	0	0	0	242	22	1	265	30	0	41	2	73	12	207	0	1	220	558
04:30 PM	0	0	0	0	0	0	283	22	2	307	25	0	42	5	72	18	260	0	0	278	657
04:45 PM	0	0	0	0	0	0	264	18	3	285	26	0	34	7	67	18	220	0	0	238	590
Total	0	0	0	0	0	0	1023	99	7	1129	113	0	159	17	289	67	930	0	1	998	2416
05:00 PM	0	0	0	0	0	0	260	23	1	284	24	0	50	0	74	15	246	0	0	261	619
05:15 PM	0	0	0	0	0	0	229	20	1	250	27	0	43	1	71	15	228	0	1	244	565
05:30 PM	0	0	0	0	0	0	216	14	1	231	28	0	40	1	69	14	240	0	0	254	554
05:45 PM	0	0	0	0	0	0	171	35	1	207	20	0	25	0	45	18	183	0	0	201	453
Total	0	0	0	0	0	0	876	92	4	972	99	0	158	2	259	62	897	0	1	960	2191
Grand Total	0	0	0	0	0	0	2378	225	12	2615	274	0	425	22	721	167	2316	0	3	2486	5822
Apprch %	0	0	0	0		0	90.9	8.6	0.5		38	0	58.9	3.1		6.7	93.2	0	0.1		
Total %	0	0	0	0	0	0	40.8	3.9	0.2	44.9	4.7	0	7.3	0.4	12.4	2.9	39.8	0	0.1	42.7	
Cars	0	0	0	0	0	0	2367	225	12	2604	274	0	425	22	721	167	2298	0	3	2468	5793
% Cars	0	0	0	0	0	0	99.5	100	100	99.6	100	0	100	100	100	100	99.2	0	100	99.3	99.5
Trucks (3+axles)	0	0	0	0	0	0	11	0	0	11	0	0	0	0	0	0	18	0	0	18	29
% Trucks (3+axles)	0	0	0	0	0	0	0.5	0	0	0.4	0	0	0	0	0	0	0.8	0	0	0.7	0.5

The Mannik & Smith Group, Inc.
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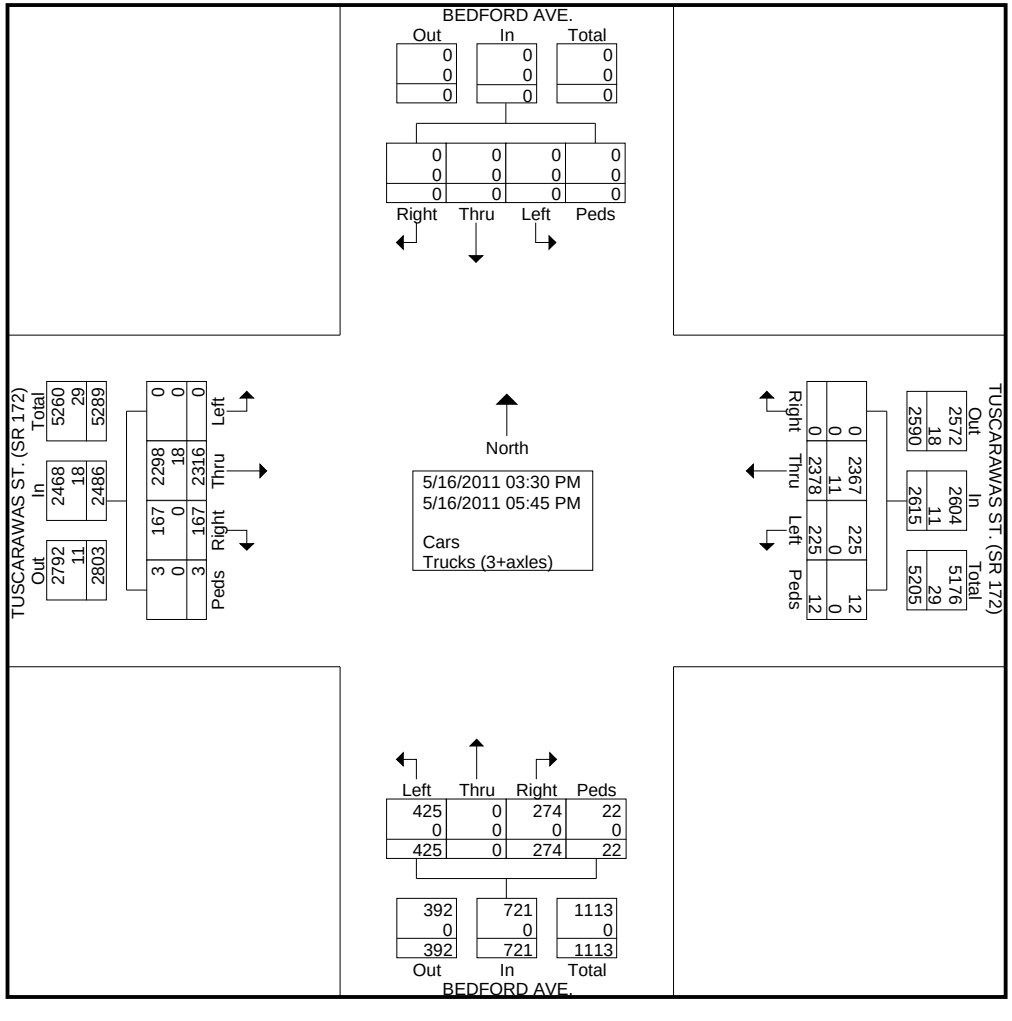
File Name : Bedford AVE. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/16/2011



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1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Bedford AVE. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/16/2011

	BEDFORD AVE. From North					TUSCARAWAS ST. (SR 172) From East					BEDFORD AVE. From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	0	0	0	0	0	0	**283**	22	2	**307**	25	0	42	5	72	**18**	**260**	0	0	**278**	**657**
04:45 PM	0	0	0	0	0	0	264	18	**3**	285	26	0	34	**7**	67	18	220	0	0	238	590
05:00 PM	0	0	0	0	0	0	260	**23**	1	284	24	0	**50**	0	**74**	15	246	0	0	261	619
05:15 PM	0	0	0	0	0	0	229	20	1	250	**27**	0	43	1	71	15	228	0	**1**	244	565
Total Volume	0	0	0	0	0	0	1036	83	7	1126	102	0	169	13	284	66	954	0	1	1021	2431
% App. Total	0	0	0	0		0	92	7.4	0.6		35.9	0	59.5	4.6		6.5	93.4	0	0.1		
PHF	.000	.000	.000	.000	.000	.000	.915	.902	.583	.917	.944	.000	.845	.464	.959	.917	.917	.000	.250	.918	.925

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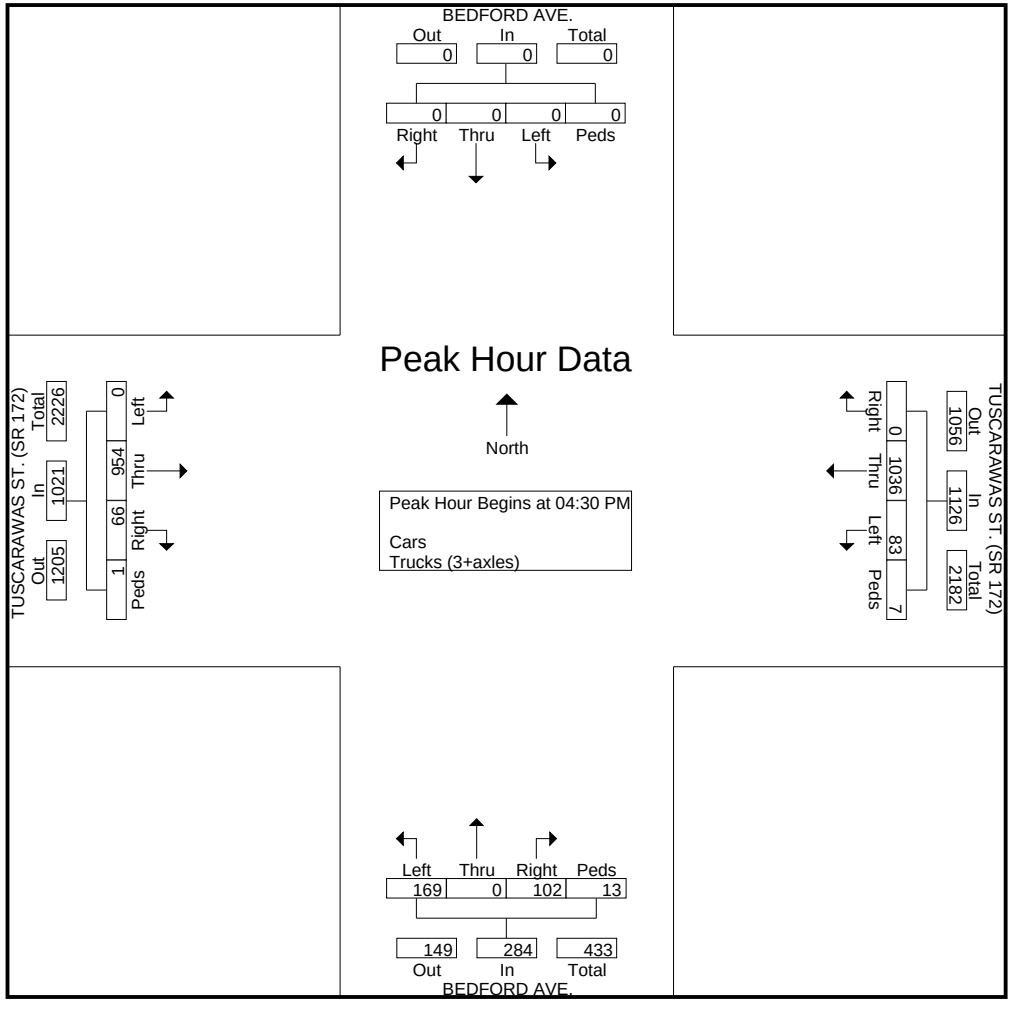
File Name : Bedford AVE. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/16/2011
Page No : 4



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Dartmouth Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/19/2011

Groups Printed- Cars - Trucks (3+axles)

	DARTMOUTH AVE. From North					TUSCARAWAS ST. (SR 172) From East					DARTMOUTH AVE. From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	0	0	0	0	0	0	250	23	0	273	53	0	9	1	63	17	222	0	0	239	575
03:45 PM	0	0	0	0	0	0	236	25	3	264	36	0	13	0	49	21	203	0	0	224	537
Total	0	0	0	0	0	0	486	48	3	537	89	0	22	1	112	38	425	0	0	463	1112
04:00 PM	0	0	0	0	0	0	277	16	0	293	45	0	5	2	52	15	236	0	0	251	596
04:15 PM	0	0	0	0	0	0	252	17	0	269	37	0	4	0	41	14	210	0	0	224	534
04:30 PM	0	0	0	0	0	0	280	21	0	301	38	0	5	7	50	14	206	0	1	221	572
04:45 PM	0	0	0	0	0	0	284	20	0	304	32	0	9	1	42	8	228	0	0	236	582
Total	0	0	0	0	0	0	1093	74	0	1167	152	0	23	10	185	51	880	0	1	932	2284
05:00 PM	0	0	0	0	0	0	244	12	0	256	28	0	5	1	34	6	213	0	0	219	509
05:15 PM	0	0	0	0	0	0	281	9	0	290	26	0	5	0	31	3	188	0	3	194	515
05:30 PM	0	0	0	0	0	0	238	8	0	246	22	0	6	2	30	11	211	0	0	222	498
05:45 PM	0	0	0	0	0	0	253	8	0	261	13	0	5	2	20	5	222	0	0	227	508
Total	0	0	0	0	0	0	1016	37	0	1053	89	0	21	5	115	25	834	0	3	862	2030
Grand Total	0	0	0	0	0	0	2595	159	3	2757	330	0	66	16	412	114	2139	0	4	2257	5426
Apprch %	0	0	0	0		0	94.1	5.8	0.1		80.1	0	16	3.9		5.1	94.8	0	0.2		
Total %	0	0	0	0	0	0	47.8	2.9	0.1	50.8	6.1	0	1.2	0.3	7.6	2.1	39.4	0	0.1	41.6	
Cars	0	0	0	0	0	0	2578	159	3	2740	330	0	66	16	412	113	2125	0	4	2242	5394
% Cars	0	0	0	0	0	0	99.3	100	100	99.4	100	0	100	100	100	99.1	99.3	0	100	99.3	99.4
Trucks (3+axles)	0	0	0	0	0	0	17	0	0	17	0	0	0	0	0	1	14	0	0	15	32
% Trucks (3+axles)	0	0	0	0	0	0	0.7	0	0	0.6	0	0	0	0	0	0.9	0.7	0	0	0.7	0.6

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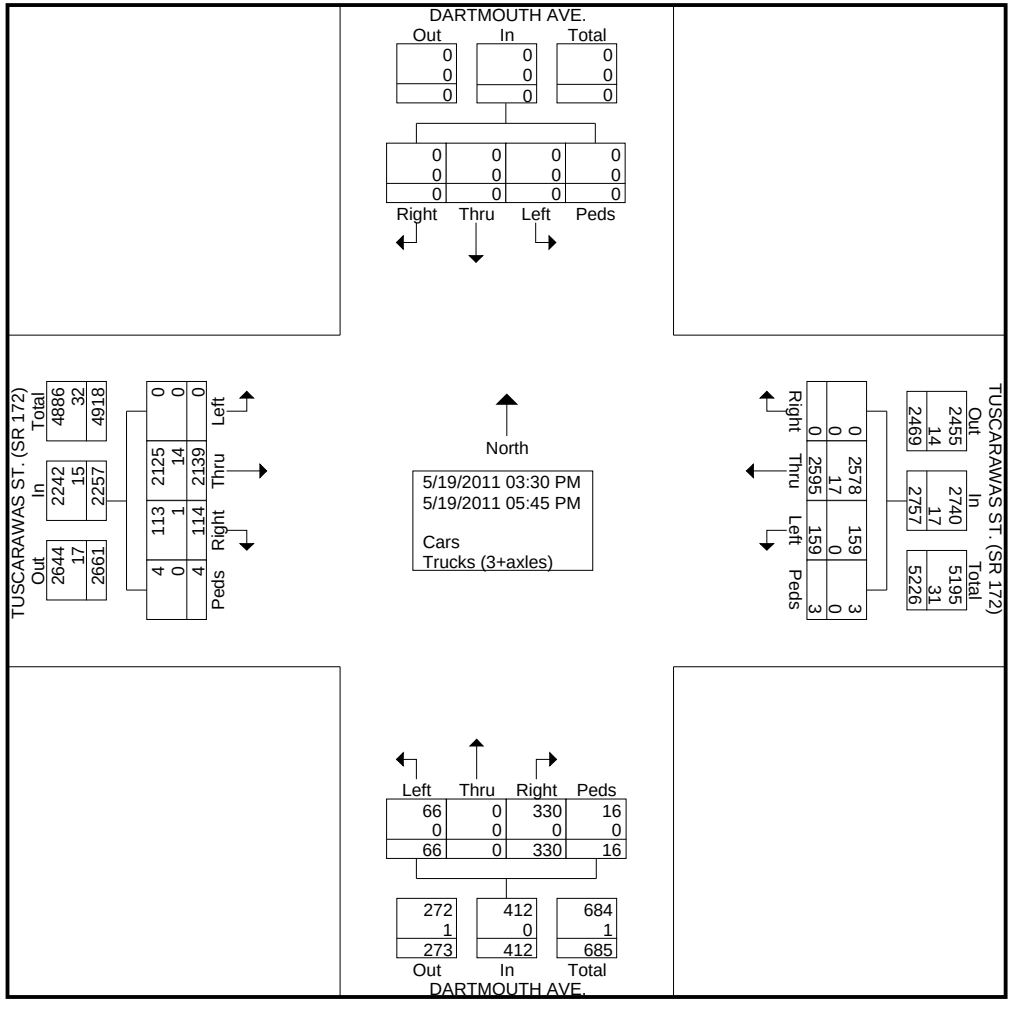
File Name : Dartmouth Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/19/2011



The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Dartmouth Ave. & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/19/2011

	DARTMOUTH AVE. From North					TUSCARAWAS ST. (SR 172) From East					DARTMOUTH AVE. From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	0	0	0	0	0	277	16	0	293	**45**	0	5	2	**52**	**15**	**236**	0	0	**251**	**596**
04:15 PM	0	0	0	0	0	0	252	17	0	269	37	0	4	0	41	14	210	0	0	224	534
04:30 PM	0	0	0	0	0	0	280	**21**	0	301	38	0	5	**7**	50	14	206	0	**1**	221	572
04:45 PM	0	0	0	0	0	0	**284**	20	0	**304**	32	0	**9**	1	42	8	228	0	0	236	582
Total Volume	0	0	0	0	0	0	1093	74	0	1167	152	0	23	10	185	51	880	0	1	932	2284
% App. Total	0	0	0	0		0	93.7	6.3	0		82.2	0	12.4	5.4		5.5	94.4	0	0.1		
PHF	.000	.000	.000	.000	.000	.000	.962	.881	.000	.960	.844	.000	.639	.357	.889	.850	.932	.000	.250	.928	.958

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File Name : Dartmouth Ave. & Tuscarawas (SR 172)
Site Code : 00000000
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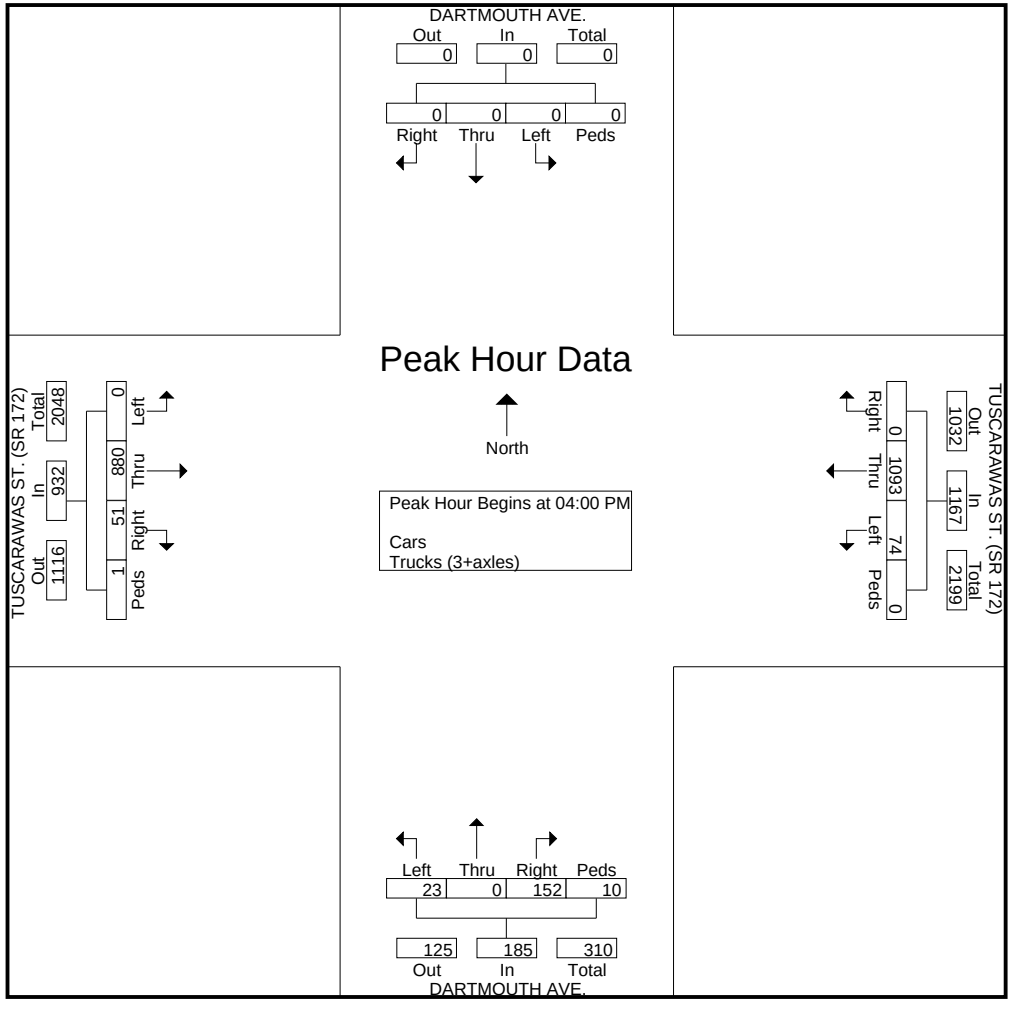

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Smith Ave & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/17/2011
Page No : 1

Groups Printed- Cars - Trucks (3+axles)

	SMITH AVE From North					TUSCARAWAS ST. (SR 172) From East					SMITH AVE From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:30 PM	4	1	1	2	8	8	260	6	0	274	4	0	1	2	7	5	277	5	0	287	576
03:45 PM	3	0	1	3	7	4	247	8	0	259	2	0	1	1	4	10	222	5	0	237	507
Total	7	1	2	5	15	12	507	14	0	533	6	0	2	3	11	15	499	10	0	524	1083
04:00 PM	2	0	0	4	6	5	259	6	1	271	3	1	0	3	7	9	231	3	0	243	527
04:15 PM	0	0	0	2	2	7	280	9	1	297	3	1	0	0	4	10	264	14	0	288	591
04:30 PM	2	0	0	2	4	2	269	6	0	277	4	1	4	2	11	9	259	10	0	278	570
04:45 PM	0	0	1	0	1	7	292	7	0	306	3	0	1	2	6	5	218	4	1	228	541
Total	4	0	1	8	13	21	1100	28	2	1151	13	3	5	7	28	33	972	31	1	1037	2229
05:00 PM	2	0	1	1	4	7	252	8	0	267	6	0	2	2	10	11	250	9	0	270	551
05:15 PM	3	1	1	1	6	6	262	9	0	277	2	0	3	1	6	6	241	12	0	259	548
05:30 PM	2	0	0	6	8	7	197	2	0	206	3	0	4	0	7	10	214	7	1	232	453
05:45 PM	3	0	2	2	7	6	222	11	0	239	1	2	2	2	7	10	212	5	0	227	480
Total	10	1	4	10	25	26	933	30	0	989	12	2	11	5	30	37	917	33	1	988	2032
Grand Total	21	2	7	23	53	59	2540	72	2	2673	31	5	18	15	69	85	2388	74	2	2549	5344
Apprch %	39.6	3.8	13.2	43.4		2.2	95	2.7	0.1		44.9	7.2	26.1	21.7		3.3	93.7	2.9	0.1		
Total %	0.4	0	0.1	0.4	1	1.1	47.5	1.3	0	50	0.6	0.1	0.3	0.3	1.3	1.6	44.7	1.4	0	47.7	
Cars	20	2	7	23	52	59	2530	72	2	2663	31	5	18	15	69	85	2371	73	2	2531	5315
% Cars	95.2	100	100	100	98.1	100	99.6	100	100	99.6	100	100	100	100	100	100	99.3	98.6	100	99.3	99.5
Trucks (3+axles)	1	0	0	0	1	0	10	0	0	10	0	0	0	0	0	0	17	1	0	18	29
% Trucks (3+axles)	4.8	0	0	0	1.9	0	0.4	0	0	0.4	0	0	0	0	0	0	0.7	1.4	0	0.7	0.5

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File Name : Smith Ave & Tuscarawas (SR 172)
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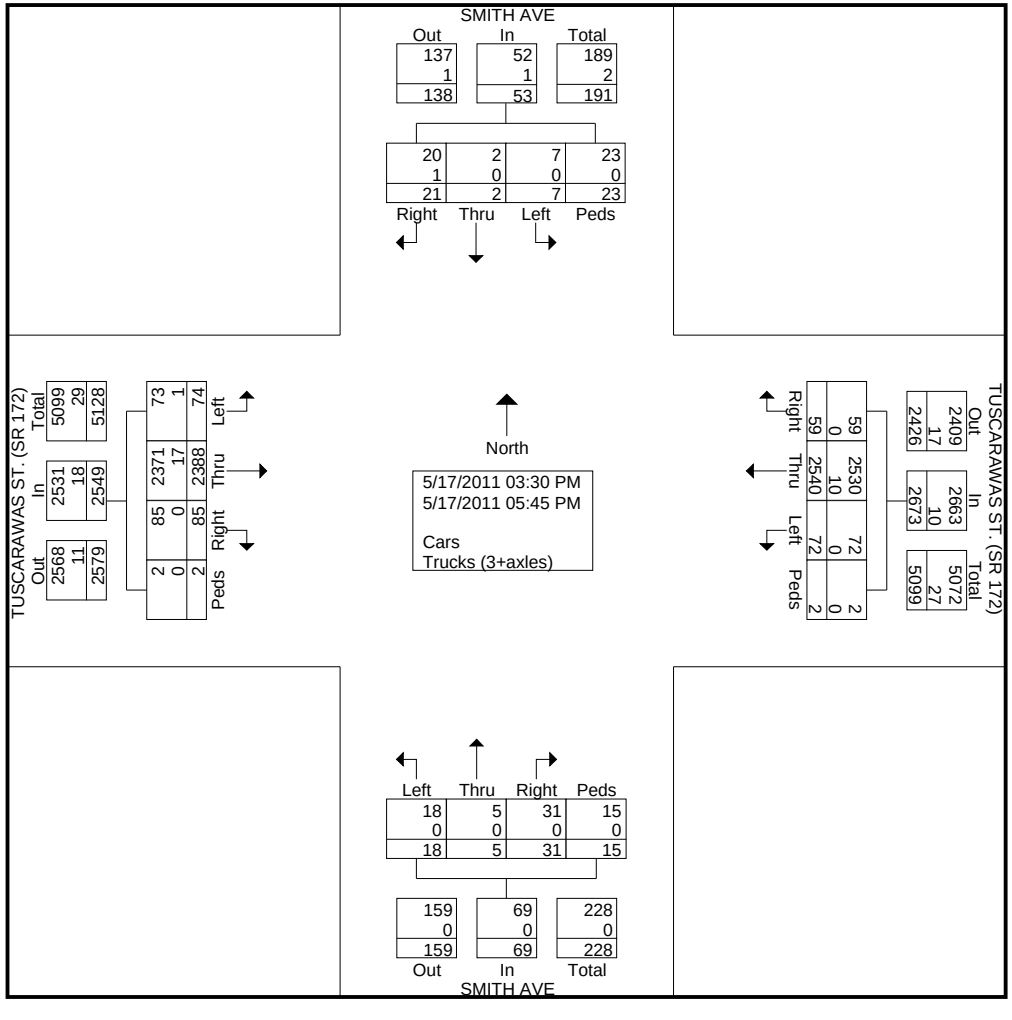

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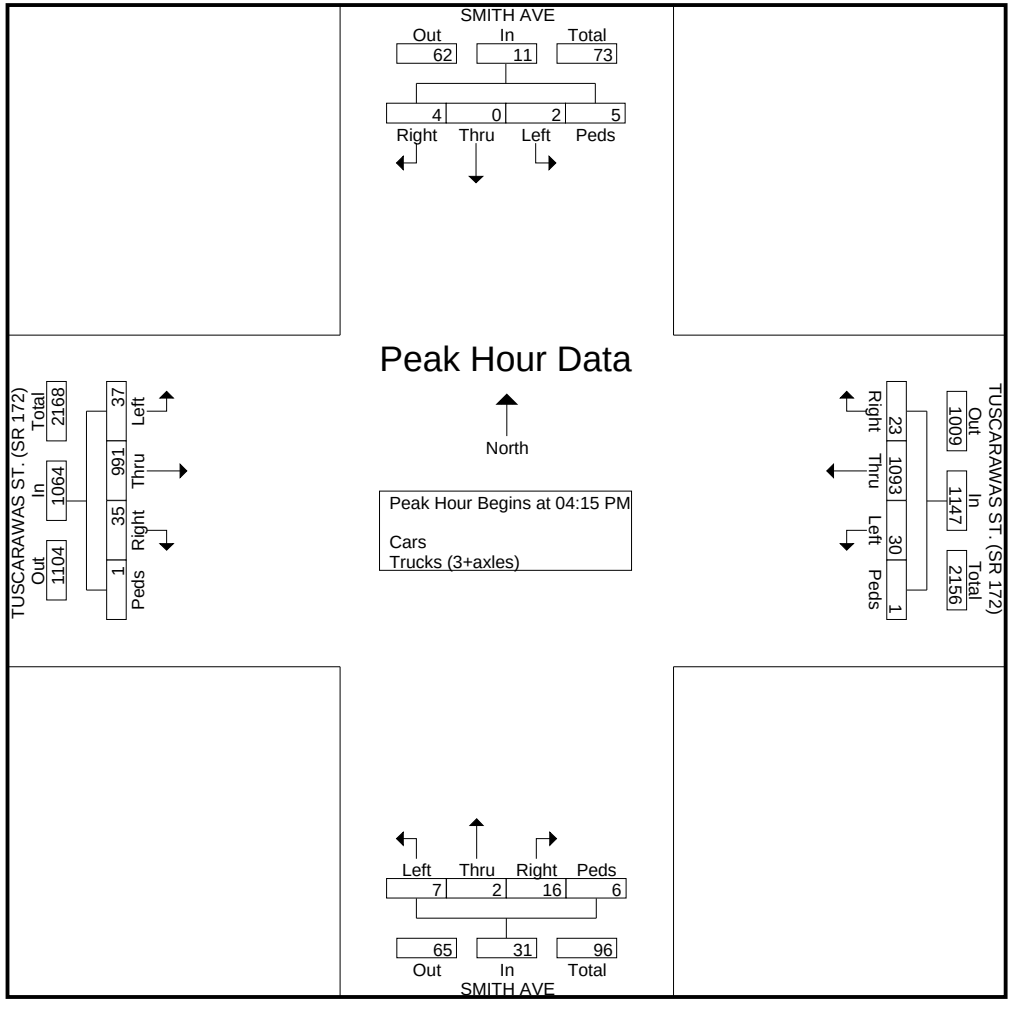
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

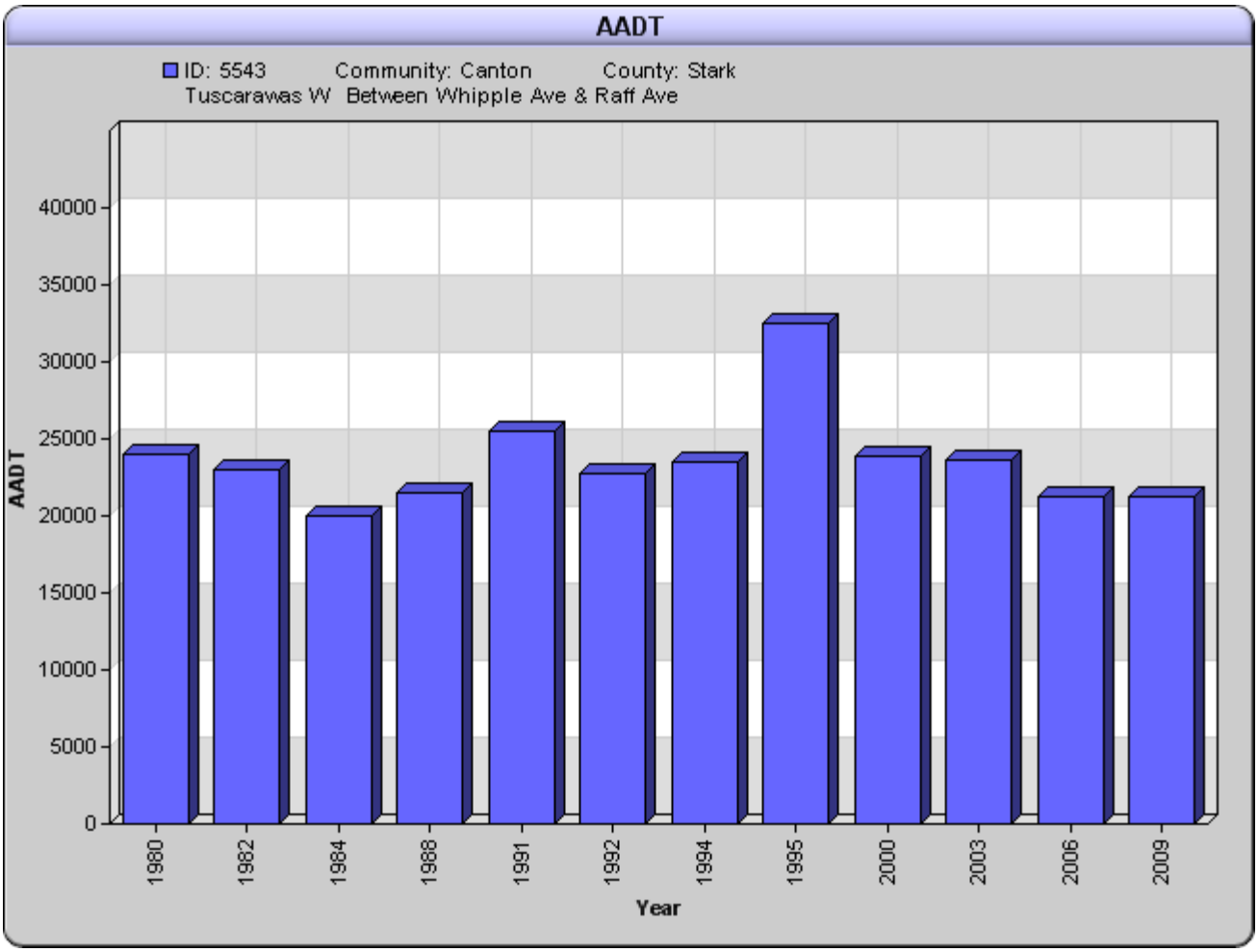
File Name : Smith Ave & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/17/2011

	SMITH AVE From North					TUSCARAWAS ST. (SR 172) From East					SMITH AVE From South					TUSCARAWAS ST. (SR 172) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	0	0	**2**	2	**7**	280	**9**	**1**	297	3	**1**	0	0	4	10	**264**	**14**	0	**288**	**591**
04:30 PM	**2**	0	0	2	**4**	2	269	6	0	277	4	1	**4**	**2**	**11**	9	259	10	0	278	570
04:45 PM	0	0	**1**	0	1	7	**292**	7	0	**306**	3	0	1	2	6	5	218	4	**1**	228	541
05:00 PM	2	0	1	1	4	7	252	8	0	267	**6**	0	2	2	10	**11**	250	9	0	270	551
Total Volume	4	0	2	5	11	23	1093	30	1	1147	16	2	7	6	31	35	991	37	1	1064	2253
% App. Total	36.4	0	18.2	45.5		2	95.3	2.6	0.1		51.6	6.5	22.6	19.4		3.3	93.1	3.5	0.1		
PHF	.500	.000	.500	.625	.688	.821	.936	.833	.250	.937	.667	.500	.438	.750	.705	.795	.938	.661	.250	.924	.953

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle - Maumee, OH 43537
Phone: (419) 891-2222

File Name : Smith Ave & Tuscarawas (SR 172)
Site Code : 00000000
Start Date : 5/17/2011
Page No : 4

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ID: 5543 Community: Canton County: Stark
Tuscarawas W Between Whipple Ave & Raff Ave
AADT
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35000
30000
25000
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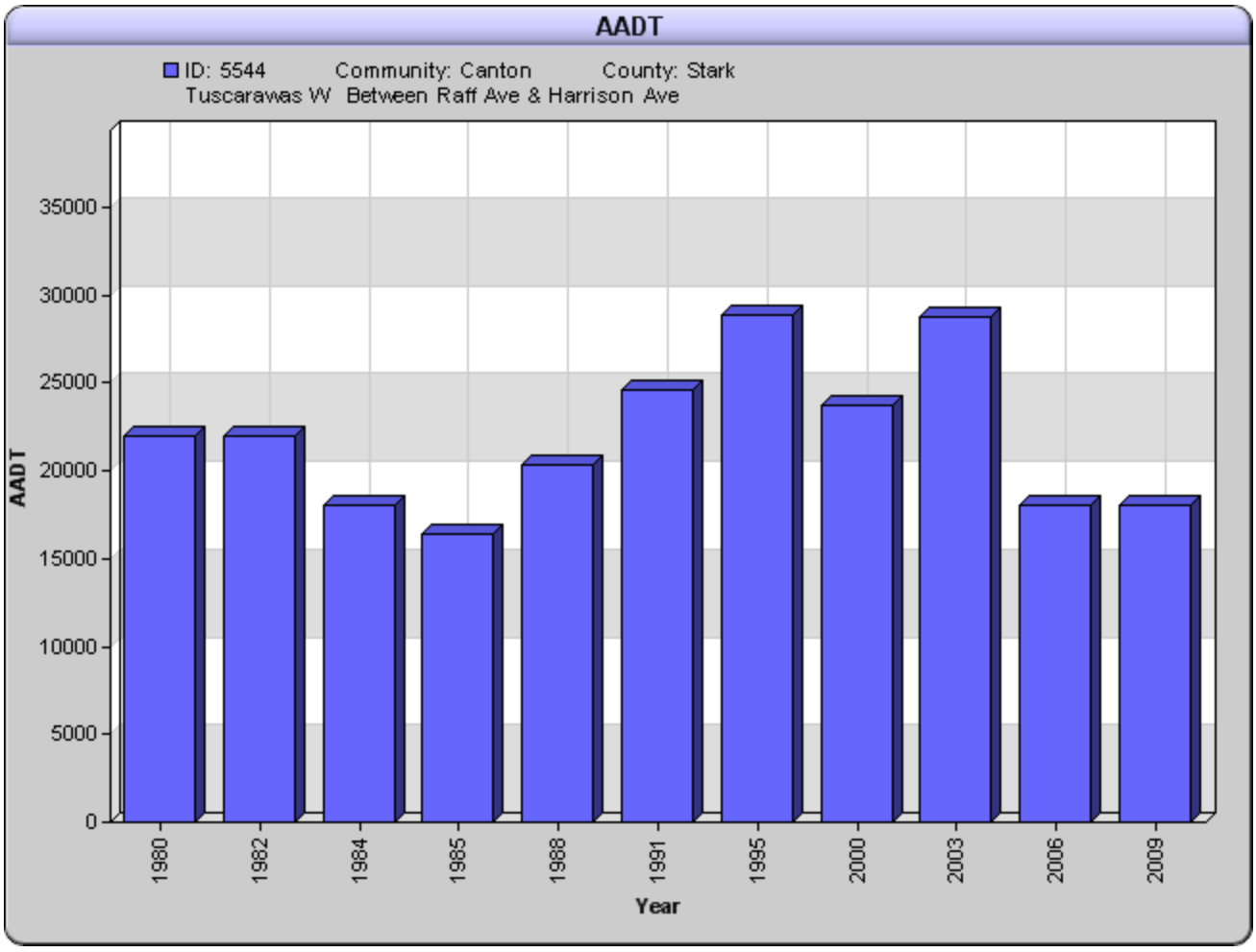
Year


AADT
ID: 5544 Community: Canton County: Stark
Tuscarawas W Between Raff Ave & Harrison Ave
AADT
35000
30000
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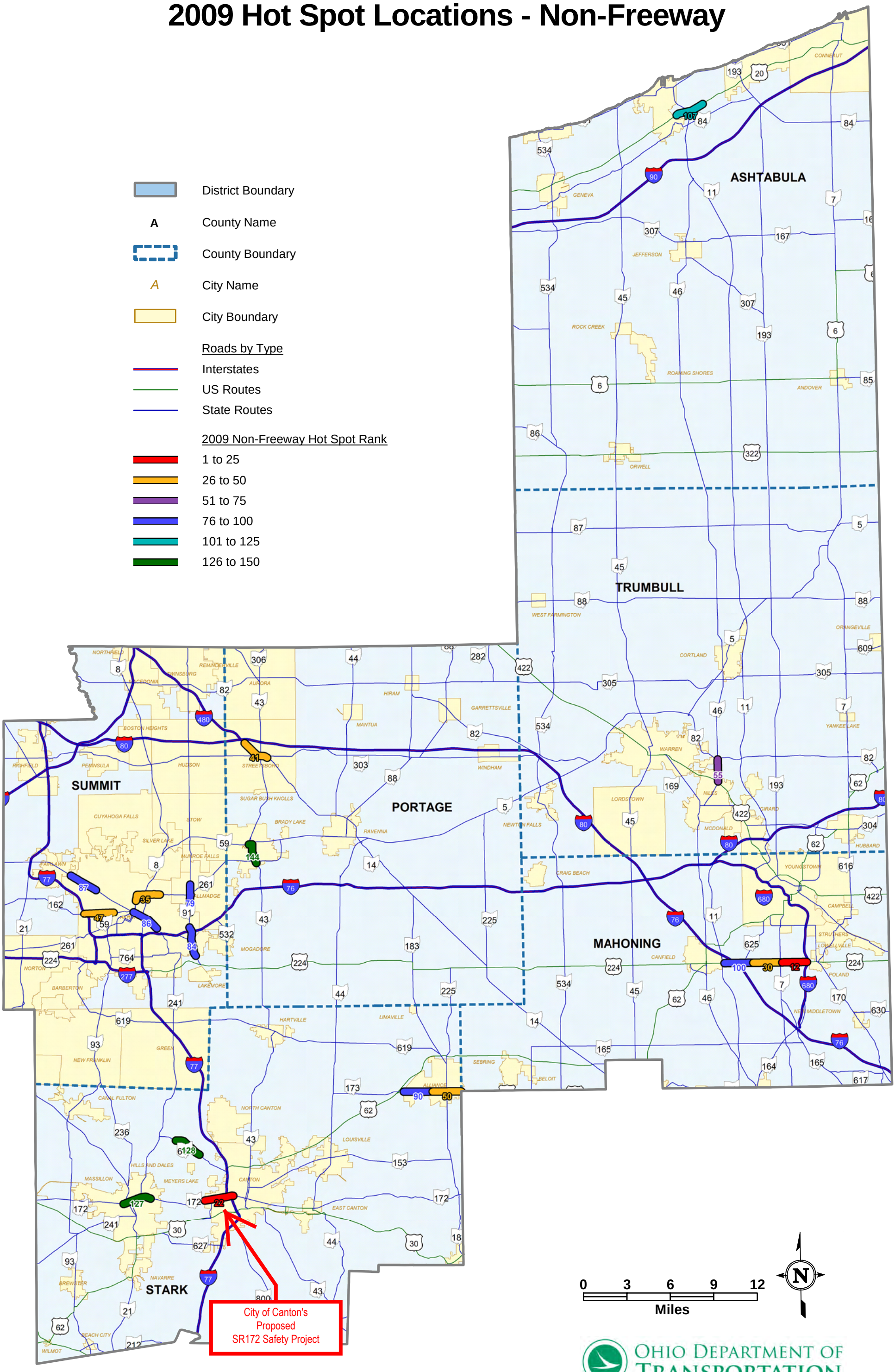
1980
1982
1984
1985
1988
1991
1995
2000
2003
2006
2009
Year

2009 STARK COUNTY 6
AVERAGE 24-HR TRAFFIC VOLUME

	SECT. BEGINS	TRAFFIC SECTION	SECT. LENGTH	PASS & A COM'L	B & C COM'L	TOTAL VEH.
		SR-171				
U	00.00	SR 183 (MAIN ST.) IN WAYNESBURG	.36	3610	270	3880
U	00.36	LISBON ST. ENTER ROSS RD.	.19	2280	170	2450
	00.55	E. CORP. WAYNESBURG	.45	2280	170	2450
	01.00	EQUALS STA. 0.00 IN CARROLL CO.	.00			
		SR-172				
	00.00	WAYNE CO. LINE	2.41	3720	390	4110
	02.41	SR 93	1.54	5620	400	6020
U	03.95	W. CORP. MASSILLON	2.16	9950	700	10650
U	06.11	MAIN AVE.	.16	18090	1270	19360
U	06.27	SR 21 EXPRESSWAY	.37	18090	1270	19360
U	06.64	SR 241 (ERIE ST.)	.75	15800	1110	16910
U	07.39	SR 241 (WALES RD.)	.31	18590	1310	19900
U	07.70	16TH. ST. S.E.	.42	14590	1030	15620
U	08.12	TREMONT AVE. S.E. (CONSTRUCTION)	.71	20910	1470	22380
	08.83	E. CORP. MASSILLON (CONSTRUCTION)	3.08	20910	1470	22380
U	11.91	W. CORP. CANTON (WHIPPLE AVE.) (CONS)	.50	18710	1310	20020
U	12.41	SR 297 (RAFF AVE.) (CONSTRUCTION)	1.10	15860	1120	16980
U	13.51	IR 77	.48	12850	900	13750
U	13.99	3RD. ST.	.77	11190	790	11980
U	14.76	SR 43 DA (WALNUT AVE.)	.10	8700	600	9300
U	14.86	SR 43 (CHERRY AVE.)	.69	6420	440	6860
U	15.55	3RD. ST.	.50	5030	130	5160
U	16.05	BELDEN AVE.	1.56	4840	160	5000
	17.61	US 30	1.90	SEE PREFERRED ROUTE		
U	19.51	US 30 (CEDAR ST.) IN EAST CANTON	.08	6130	460	6590
U	19.59	SR 44 (WOOD ST.)	.58	4180	310	4490
	20.17	E. CORP. EAST CANTON	.56	4180	310	4490
	20.73	T-176 (MIDAY AVE.)	6.86	2810	240	3050
	27.59	ATR # 67	2.47	2810	240	3050
	30.06	SR 183	.26	2720	200	2920
	30.32	EQUALS STA. 0.00 IN COLUMBIANA CO.	.00			
		SR-173				
	00.00	SR 44	1.85	3890	120	4010
	01.85	C-67A (COLUMBUS RD.)	2.64	5380	170	5550
	04.49	US 62 TEMP	.11	5380	170	5550
	04.60	US 62	4.28	SEE PREFERRED ROUTE		
	08.88	EQUALS STA. 0.00 IN COLUMBIANA CO.	.00			

District 4
2009 Hot Spot Locations - Non-Freeway



Stark County Area Transportation Study (SCATS)
2009 High Crash Intersections Listing

Street		Intersecting Street	Crashes by year 2007	2008	2009	3 Year Totals Crashes	Injury	Fatal	Avg Daily Traffic	Severity Index	Crash Rate per Million Vehicles	SCATS Hazard Rating	Jurisdiction
12th St N		Market Ave N	24	18	19	61	28	0	25,615	1.92	2.17	56.51	Canton
US 62		Harmont Ave/Lesh St	22	18	24	64	19	1	31,905	1.77	1.83	45.97	Canton
Central Plaza	#3	Tuscarawas St	17	18	15	50	16	0	23,650	1.64	1.93	35.16	Canton
13/12th St		I-77 Ramps TM Hospital	21	12	13	46	14	0	20,200	1.61	2.08	34.18	Canton
Cleveland Ave		Wright St	3	15	9	27	16	0	10,000	2.19	2.46	32.31	County
30th St NE		Harrisburg Ave	11	8	9	28	9	1	11,345	2.04	2.25	28.53	County
Dueber Ave SW		Navarre Rd	9	9	4	22	12	0	9,400	2.09	2.14	21.83	Canton
Everhard Rd		Whipple Ave	22	17	16	55	17	0	46,500	1.62	1.08	21.35	County
Harrison Ave	#9	Tuscarawas St W	21	12	10	43	10	0	26,430	1.47	1.48	20.79	Canton
I-77		Belden Village & Whipple	13	15	18	46	18	0	40,850	1.78	1.03	18.73	ODOT
SR619		McCallum Ave	8	3	2	13	8	0	4,210	2.23	2.82	18.16	ODOT
Harmont Ave NE		Mahoning Ave	12	9	10	31	11	0	19,105	1.71	1.48	17.44	Canton
US 62		Regent Ave	10	12	14	36	7	1	30,200	1.69	1.09	14.75	ODOT
Clarendon Ave		Navarre Rd	5	5	5	15	7	0	6,000	1.93	2.28	14.70	Canton
13th St NW		Harrison Ave	20	7	6	33	10	0	24,530	1.61	1.23	14.46	Canton
US 30 EB Ramps		Raff Ave	5	11	4	20	8	0	10,550	1.80	1.73	13.84	ODOT
SR687		Everhard Rd	10	18	16	44	11	0	42,740	1.50	0.94	13.78	ODOT
30th St N		Market Ave N SR 43	11	11	9	31	15	0	28,730	1.97	0.98	13.35	Canton
Raff Ave SR791	#19	Tuscarawas St W	8	12	13	33	9	0	26,335	1.55	1.14	12.96	Canton
Dressler Rd		Everhard Rd	11	19	12	42	11	0	42,700	1.52	0.90	12.77	County
US 62		Middlebranch & Harrisburg	13	13	17	43	10	0	43,135	1.47	0.91	12.74	ODOT
Andrews St		Market Ave	3	7	3	13	8	0	6,200	2.23	1.91	12.33	Lake Twp
SR 21 Ramps NB		Erie St	8	6	6	20	5	0	9,900	1.50	1.84	12.29	Massillon
Erie St		Lincoln Way SR172	6	8	14	28	11	0	23,820	1.79	1.07	11.92	Massillon
Elgin Ave		I-77 NB Offramp& Tuscarawas	10	10	8	28	5	0	18,250	1.36	1.40	11.82	Canton
SR172	#26	Whipple Ave	16	12	12	40	6	0	36,030	1.30	1.01	11.71	ODOT

Source: Stark County Crash Report (2009) by SCATS

LOCATION ROUTE	LOGPT	DIR	MUNI/TWP (M/T-) NAME	REFERENCE TYPE	CROSS ROUTE NUMBER	LOGPT	REFERENCE POINT DESCRIPTION		STLOG	LATITUDE	LONGITUDE
SR 0172R	10.490	1 E	T-PERRY	INTERSECTION -I	TR 01409	00.000	T01409 ROXBURY	AVL	011.061	40.792548	-81.452929
SR 0172R	10.560	1 E	T-PERRY	INTERSECTION -I	TR 01410	00.000	T01410 PERSHING	AVL	011.131	40.792320	-81.451618
SR 0172R	10.630	1 E	T-PERRY	INTERSECTION -I	TR 01406	00.000	T01406 EDGEWATER	AVL	011.201	40.792242	-81.450347
SR 0172R	10.730	1 E	T-PERRY	INTERSECTION -I	TR 01469	00.340	T01469 SIPPO	AVR	011.301	40.792230	-81.448410
SR 0172R	10.820	1 E	T-PERRY	INTERSECTION -I	CR 00225		C00225 PERRY	DR	011.391	40.792429	-81.446761
SR 0172R	10.860	1 E	T-PERRY	INTERSECTION -I	CR 00225		C00225 DELAWARE	AVR	011.431	40.792572	-81.446031
SR 0172R	10.930	1 E	T-PERRY	INTERSECTION -I	TR 01463		T01463 BROOKLYN	AVR	011.501	40.792852	-81.444747
SR 0172R	10.980	1 E	T-PERRY	INTERSECTION -I	TR 01443		T01443 SARATOGA	AV	011.551	40.793051	-81.443820
SR 0172R	10.980	1 E	T-PERRY	MILEPOST -M			MILE POST = 011		011.551	40.793051	-81.443820
SR 0172R	11.080	1 E	T-PERRY	INTERSECTION -I	TR 01461		T01461 BORDNER	AVR	011.651	40.793445	-81.441978
SR 0172R	11.200	1 E	T-PERRY	INTERSECTION -I	TR 01449	00.000	T01449 ANNA	AVL	011.771	40.793904	-81.439841
SR 0172R	11.270	1 E	T-PERRY	INTERSECTION -I	TR 01451		T01451 MT MARIE	DRL	011.841	40.794196	-81.438483
SR 0172R	11.350	1 E	T-PERRY	INTERSECTION -I	CR 00224		C00224 WOODLAWN	AVL	011.921	40.794513	-81.437012
SR 0172R	11.490	1 E	T-PERRY	INTERSECTION -I			MILES	AV	012.061	40.795011	-81.434409
SR 0172R	11.650	1 E	T-PERRY	INTERSECTION -I	TR 01121		T01121 MANOR	AV	012.221	40.795577	-81.431444
SR 0172R	11.790	1 E	T-PERRY	INTERSECTION -I			AMBROSE	AVL	012.361	40.796012	-81.428825
SR 0172R	11.790	2 E	T-PERRY	INTERSECTION -I			DELVERNE	AVR	012.361	40.796012	-81.428825
SR 0172R	11.910	1 E	M-CANTON	CORP LIMIT -C			ENTER CANTON		012.481	40.796314	-81.426561
SR 0172R	11.910	1 E	M-CANTON	INTERSECTION -I	CR 00214		C00214 WHIPPLE Begin Project	AV	012.481	40.796314	-81.426561
SR 0172R	11.910	2 E	M-CANTON	INTERSECTION -I	SR 00297R	02.530	S00297R		012.481	40.796314	-81.426561
SR 0172R	12.140	1 E	M-CANTON	INTERSECTION -I	MR 00931		M00931 VALLEYVIEW	AVL	012.711	40.796842	-81.422211
SR 0172R	12.210	1 E	M-CANTON	INTERSECTION -I	MR 00758		M00758 POPLAR	AV	012.781	40.796943	-81.420884
SR 0172R	12.280	1 E	M-CANTON	INTERSECTION -I	MR 00364		M00364 AULTMAN	AVL	012.851	40.797078	-81.419561
SR 0172R	12.340	1 E	M-CANTON	INTERSECTION -I	MR 00586		M00586 HARTER	AVL	012.911	40.797194	-81.418422
SR 0172R	12.410	1 E	M-CANTON	INTERSECTION -I	SR 00297R	02.030	S00297R		012.981	40.797330	-81.417091
SR 0172R	12.480	1 E	M-CANTON	INTERSECTION -I	MR 00702		M00702 MONTROSE	AVL	013.051	40.797539	-81.415745
SR 0172R	12.540	1 E	M-CANTON	INTERSECTION -I	MR 00660		M00660 LINWOOD	AV	013.111	40.797714	-81.414605
SR 0172R	12.600	1 E	M-CANTON	INTERSECTION -I	MR 00379		M00379 BELLFLOWER	AV	013.171	40.797860	-81.413409
SR 0172R	12.650	1 E	M-CANTON	INTERSECTION -I	MR 00800		M00800 ROSLYN	AV	013.221	40.797974	-81.412478
SR 0172R	12.720	1 E	M-CANTON	INTERSECTION -I	MR 00832		M00832 SHADYSIDE	AV	013.291	40.798140	-81.411117
SR 0172R	12.750	1 E	M-CANTON	INTERSECTION -I	MR 00421		M00421 CLAREMONT	AV	013.321	40.798211	-81.410535
SR 0172R	12.780	1 E	M-CANTON	INTERSECTION -I	MR 00679		M00679 MARYLAND	AVR	013.351	40.798278	-81.409956
SR 0172R	12.790	1 E	M-CANTON	INTERSECTION -I	MR 00520		M00520 FLORAL	AVL	013.361	40.798298	-81.409765
SR 0172R	12.830	1 E	M-CANTON	INTERSECTION -I	MR 00507		M00507 FAWCETT	COL	013.401	40.798380	-81.408994
SR 0172R	12.870	1 E	M-CANTON	INTERSECTION -I	MR 00626		M00626 INGRAM	AV	013.441	40.798462	-81.408219
SR 0172R	12.910	1 E	M-CANTON	INTERSECTION -I	MR 00967		M00967 WERTZ	AVL	013.481	40.798545	-81.407444
SR 0172R	12.940	1 E	M-CANTON	INTERSECTION -I	MR 00504		M00504 EXETER	AV	013.511	40.798607	-81.406862
SR 0172R	12.950	1 E	M-CANTON	INTERSECTION -I	MR 00641		M00641 KENSINGTON	COL	013.521	40.798627	-81.406667
SR 0172R	13.000	1 E	M-CANTON	INTERSECTION -I	MR 00403		M00403 BROAD	AV	013.571	40.798735	-81.405651
SR 0172R	13.070	1 E	M-CANTON	INTERSECTION -I	MR 00450		M00450 DARTMOUTH	AV	013.641	40.798885	-81.404338
SR 0172R	13.090	1 E	M-CANTON	INTERSECTION -I	MR 00422		M00422 CLARENDON	AV	013.661	40.798934	-81.403945
SR 0172R	13.150	1 E	M-CANTON	INTERSECTION -I	MR 00431		M00431 COLUMBUS	AV	013.721	40.799077	-81.402800
SR 0172R	13.170	1 E	M-CANTON	INTERSECTION -I	MR 00376		M00376 BEDFORD	AV	013.741	40.799126	-81.402406
SR 0172R	13.190	1 E	M-CANTON	INTERSECTION -I	MR 00375		M00375 BEDFORD	AV	013.761	40.799174	-81.402017
SR 0172R	13.240	1 E	M-CANTON	INTERSECTION -I	MR 00360		M00360 ARLINGTON	AV	013.811	40.799294	-81.401054
SR 0172R	13.250	1 E	M-CANTON	INTERSECTION -I	MR 00359		M00359 ARLINGTON	AV	013.821	40.799318	-81.400860
SR 0172R	13.270	1 E	M-CANTON	INTERSECTION -I	MR 00771		M00771 RAYMONT	CO	013.841	40.799366	-81.400481
SR 0172R	13.310	1 E	M-CANTON	INTERSECTION -I	MR 00849		M00849 SMITH End Project	AV	013.881	40.799463	-81.399704
SR 0172R	13.360	1 E	M-CANTON	INTERSECTION -I	RA 76037		R76037 RAMP TO IR00077R	L	013.931	40.799589	-81.398739
SR 0172R	13.370	1 E	M-CANTON	INTERSECTION -I	MR 00469		M00469 DRYDEN	AV	013.941	40.799621	-81.398535
SR 0172R	13.410	1 E	M-CANTON	INTERSECTION -I	MR 00585		M00585 HARRISON	AV	013.981	40.799733	-81.397671
SR 0172R	13.460	1 E	M-CANTON	INTERSECTION -I	MR 00569		M00569 GREENFIELD	AV	014.031	40.799868	-81.396699

LOCATION ROUTE	LOGPT	DIR	MUNI/TWP (M/T-) NAME	REFERENCE TYPE	CROSS ROUTE NUMBER	LOGPT	REFERENCE POINT DESCRIPTION		STLOG	LATITUDE	LONGITUDE
SR 0172R	13.510	1 E	M-CANTON	UNDERPASS -U	IR 00077R	10.490	I00077R		014.081	40.800030	-81.395684
SR 0172R	13.560	1 E	M-CANTON	INTERSECTION -I	RA 76038		R76038 RAMP TO IR00077R	L	014.131	40.800148	-81.394939
SR 0172R	13.590	1 E	M-CANTON	INTERSECTION -I	CR 00579		C00579 LAWN	AVL	014.161	40.800225	-81.394427
SR 0172R	13.610	1 E	M-CANTON	INTERSECTION -I	CR 00619		C00619 LINCOLN	AVL	014.181	40.800280	-81.394079
SR 0172R	13.630	1 E	M-CANTON	INTERSECTION -I	MR 00470		M00470 DUEBER	AV	014.201	40.800333	-81.393732
SR 0172R	13.650	1 E	M-CANTON	INTERSECTION -I	MR 00640		M00640 KENNET	CO	014.221	40.800382	-81.393394
SR 0172R	13.710	1 E	M-CANTON	INTERSECTION -I	MR 00596		M00596 HAZLETT	AV	014.281	40.800547	-81.392365
SR 0172R	13.740	1 E	M-CANTON	INTERSECTION -I	MR 00979		M00979 WOLF	CO	014.311	40.800620	-81.391846
SR 0172R	13.780	1 E	M-CANTON	INTERSECTION -I	RA 76035		R76035 RAMP TO IR00077R	R	014.351	40.800710	-81.391158
SR 0172R	13.790	1 E	M-CANTON	INTERSECTION -I	RA 76034		R76034 RAMP FROM IR00077R	R	014.361	40.800710	-81.391078
SR 0172R	13.790	2 E	M-CANTON	INTERSECTION -I			ELGIN	AVL	014.361	40.800710	-81.391078
SR 0172R	13.800	1 E	M-CANTON	BRIDGE -G			BRIDGE		014.371	40.800713	-81.390882
SR 0172R	13.820	1 E	M-CANTON	INTERSECTION -I	MR 00954E		M00954E WASHINGTON	BO	014.391	40.800719	-81.390490
SR 0172R	13.910	1 E	M-CANTON	INTERSECTION -I	MR 00815		M00815 SCHROYER	AV	014.481	40.800732	-81.388759
SR 0172R	13.980	1 E	M-CANTON	RAILRD AT GR -R			WHEELING & LAKE ERIE R W		014.551	40.800710	-81.387350
SR 0172R	13.990	1 E	M-CANTON	INTERSECTION -I	CR 00570		C00570 THIRD	STR	014.561	40.800709	-81.387257
SR 0172R	14.000	1 E	M-CANTON	INTERSECTION -I	CR 00570		C00570 BROWN	STL	014.571	40.800709	-81.387164
SR 0172R	14.030	1 E	M-CANTON	INTERSECTION -I	MR 00667		M00667 LYNCH	STR	014.601	40.800633	-81.386488
SR 0172R	14.110	1 E	M-CANTON	INTERSECTION -I	MR 00417		M00417 CECIL	STR	014.681	40.800400	-81.384692
SR 0172R	14.130	1 E	M-CANTON	INTERSECTION -I	MR 00714		M00714 NEWTON	AVL	014.701	40.800337	-81.384243
SR 0172R	14.150	1 E	M-CANTON	INTERSECTION -I	MR 00714		M00714 NEWTON	AVR	014.721	40.800270	-81.383837
SR 0172R	14.190	1 E	M-CANTON	INTERSECTION -I	CR 00569		C00569 SECOND	STL	014.761	40.800139	-81.383016
SR 0172R	14.210	1 E	M-CANTON	INTERSECTION -I	CR 00569		C00569 SHIELDS	AVR	014.781	40.800060	-81.382668
SR 0172R	14.270	1 E	M-CANTON	INTERSECTION -I	MR 00835		M00835 SHORB	AVR	014.841	40.799823	-81.381628
SR 0172R	14.280	1 E	M-CANTON	INTERSECTION -I	MR 00835		M00835 SHORB	AVL	014.851	40.799783	-81.381455
SR 0172R	14.350	1 E	M-CANTON	INTERSECTION -I	CR 00563		C00563 HIGH	AVL	014.921	40.799513	-81.380248
SR 0172R	14.360	1 E	M-CANTON	INTERSECTION -I	CR 00563		C00563 HIGH	AVR	014.931	40.799478	-81.380075
SR 0172R	14.410	1 E	M-CANTON	INTERSECTION -I	MR 00964		M00964 WELLS	AV	014.981	40.799303	-81.379210
SR 0172R	14.460	1 E	M-CANTON	INTERSECTION -I	CR 00500		C00500 MCKINLEY	AV	015.031	40.799126	-81.378335
SR 0172R	14.510	1 E	M-CANTON	INTERSECTION -I	MR 00456		M00456 DEWALT	AV	015.081	40.798950	-81.377464
SR 0172R	14.570	1 E	M-CANTON	INTERSECTION -I	CR 00066		C00066 CLEVELAND	AV	015.141	40.798739	-81.376417
SR 0172R	14.610	1 E	M-CANTON	INTERSECTION -I	MR 00440		M00440 COURT	AVR	015.181	40.798602	-81.375722
SR 0172R	14.650	1 E	M-CANTON	INTERSECTION -I	CR 00504		C00504 MARKET	AV	015.221	40.798502	-81.375020
SR 0172R	14.660	1 E	M-CANTON	INTERSECTION -I	CR 00504		C00504 MARKET	AV	015.231	40.798477	-81.374844
SR 0172R	14.710	1 E	M-CANTON	INTERSECTION -I	MR 00417T		M00417T PIEDMONT	AV	015.281	40.798251	-81.374006
SR 0172R	14.760	1 E	M-CANTON	INTERSECTION -I	SR 00043D	01.480	S00043D		015.331	40.798076	-81.373129
SR 0172R	14.810	1 E	M-CANTON	INTERSECTION -I	MR 00779		M00779 REX	AV	015.381	40.797895	-81.372244
SR 0172R	14.860	1 E	M-CANTON	INTERSECTION -I	SR 00043R	12.890	S00043R		015.431	40.797740	-81.371347
SR 0172R	14.910	1 E	M-CANTON	INTERSECTION -I	MR 00811		M00811 SAVANNAH	AV	015.481	40.797553	-81.370411
SR 0172R	14.910	2 E	M-CANTON	RAILRD AT GR -R			WHEELING & LAKE ERIE R W		015.481	40.797553	-81.370411
SR 0172R	14.940	1 E	M-CANTON	INTERSECTION -I	MR 00732		M00732 ORCHARD	AVL	015.511	40.797440	-81.369847
SR 0172R	15.020	1 E	M-CANTON	INTERSECTION -I	MR 00851		M00851 SPRING	AV	015.591	40.797130	-81.368349
SR 0172R	15.090	1 E	M-CANTON	INTERSECTION -I	CR 00552		C00552 HERBRUCK	AVL	015.661	40.796844	-81.367037
SR 0172R	15.120	1 E	M-CANTON	INTERSECTION -I	CR 00552		C00552 BEAVER	COL	015.691	40.796727	-81.366470
SR 0172R	15.140	1 E	M-CANTON	INTERSECTION -I	MR 00549		M00549 GIBBS	AVL	015.711	40.796653	-81.366102
SR 0172R	15.160	1 E	M-CANTON	RAILRD AT GR -R			NORFOLK SOUTHERN R R		015.731	40.796578	-81.365734
SR 0172R	15.280	1 E	M-CANTON	INTERSECTION -I	MR 00804		M00804 ROWLAND	AV	015.851	40.796122	-81.363480
SR 0172R	15.300	1 E	M-CANTON	INTERSECTION -I			ARCHER	COL	015.871	40.796046	-81.363101
SR 0172R	15.360	1 E	M-CANTON	INTERSECTION -I	MR 00988		M00988 YOUNG	AV	015.931	40.795818	-81.361975
SR 0172R	15.380	1 E	M-CANTON	INTERSECTION -I	MR 00523		M00523 FLORY	CO	015.951	40.795741	-81.361596
SR 0172R	15.410	1 E	M-CANTON	INTERSECTION -I	MR 00633M		M00633M JANET	CO	015.981	40.795627	-81.361029
SR 0172R	15.440	1 E	M-CANTON	INTERSECTION -I	MR 00636		M00636 JOBE	CO	016.011	40.795514	-81.360473

APPENDIX B

Synchro Model Reports & V/C Ratio Data

Timings
1: Tuscarawas St. W. & Whipple Ave NW

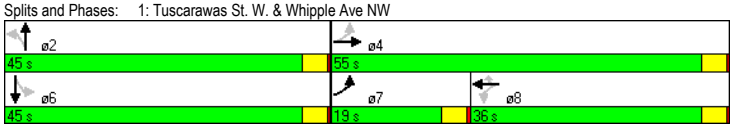
8/30/2011

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	183	574	28	729	181	149	203	186	221
Turn Type	pm+pt		Perm		Perm	Perm		Perm	
Protected Phases	7	4		8			2		6
Permitted Phases	4		8		8	2		6	
Detector Phase	7	4	8	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	19.0	55.0	36.0	36.0	36.0	45.0	45.0	45.0	45.0
Total Split (%)	19.0%	55.0%	36.0%	36.0%	36.0%	45.0%	45.0%	45.0%	45.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag	Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes	Yes				
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	51.0	51.0	32.0	32.0	32.0	41.0	41.0	41.0	41.0
Actuated g/C Ratio	0.51	0.51	0.32	0.32	0.32	0.41	0.41	0.41	0.41
v/c Ratio	0.58	0.43	0.15	0.74	0.31	0.53	0.18	0.47	0.32
Control Delay	22.4	15.9	26.7	35.2	5.1	29.6	17.5	26.0	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.4	15.9	26.7	35.2	5.1	29.6	17.5	26.0	10.5
LOS	C	B	C	D	A	C	B	C	B
Approach Delay		17.3		29.1			22.1		15.2
Approach LOS		B		C			C		B

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 50
Control Type: Pretimed
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 21.5 — Intersection LOS: C
Intersection Capacity Utilization 64.7% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Tuscarawas St. W. & Whipple Ave NW



Phasings
1: Tuscarawas St. W. & Whipple Ave NW

8/30/2011

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Protected Phases	7	4		8			2		6
Permitted Phases	4		8		8	2		6	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	19.0	55.0	36.0	36.0	36.0	45.0	45.0	45.0	45.0
Total Split (%)	19.0%	55.0%	36.0%	36.0%	36.0%	45.0%	45.0%	45.0%	45.0%
Maximum Green (s)	15.0	51.0	32.0	32.0	32.0	41.0	41.0	41.0	41.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag	Lead		Lag	Lag	Lag				
Lead-Lag Optimize?	Yes		Yes	Yes	Yes				
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max
Walk Time (s)		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0	0	0	0	0
90th %ile Green (s)	15.0	51.0	32.0	32.0	32.0	41.0	41.0	41.0	41.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord
70th %ile Green (s)	15.0	51.0	32.0	32.0	32.0	41.0	41.0	41.0	41.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord
50th %ile Green (s)	15.0	51.0	32.0	32.0	32.0	41.0	41.0	41.0	41.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord
30th %ile Green (s)	15.0	51.0	32.0	32.0	32.0	41.0	41.0	41.0	41.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord
10th %ile Green (s)	15.0	51.0	32.0	32.0	32.0	41.0	41.0	41.0	41.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Control Type: Pretimed

Please Note:

A corridor-wide V/C ratio was calculated by averaging the overall HCM v/c ratio of the 8 signalized intersections on the project corridor. **This resulted in a V/C of 0.60 on the overall corridor**. The individual overall intersection V/C ratios are highlighted in yellow throughout this Synchro Model Report.

Queues
1: Tuscarawas St. W. & Whipple Ave NW

8/30/2011

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	203	721	31	810	201	166	265	207	478
v/c Ratio	0.58	0.43	0.15	0.74	0.31	0.53	0.18	0.47	0.32
Control Delay	22.4	15.9	26.7	35.2	5.1	29.6	17.5	26.0	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.4	15.9	26.7	35.2	5.1	29.6	17.5	26.0	10.5
Queue Length 50th (ft)	69	141	14	240	0	78	50	95	51
Queue Length 95th (ft)	129	186	38	312	49	148	77	163	87
Internal Link Dist (ft)		692		1143			437		743
Turn Bay Length (ft)	250		150		195	150		210	
Base Capacity (vph)	349	1666	210	1095	643	316	1433	439	1482
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.43	0.15	0.74	0.31	0.53	0.18	0.47	0.32

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Tuscarawas St. W. & Whipple Ave NW

8/30/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	183	574	75	28	729	181	149	203	35	186	221	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	10	12	10	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.98		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3246		1652	3421	1583	1770	3461		1770	3282	
Flt Permitted	0.14	1.00		0.38	1.00	1.00	0.41	1.00		0.57	1.00	
Satd. Flow (perm)	258	3246		656	3421	1583	770	3461		1070	3282	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	203	638	83	31	810	201	166	226	39	207	246	232
RTOR Reduction (vph)	0	10	0	0	0	137	0	14	0	0	137	0
Lane Group Flow (vph)	203	711	0	31	810	64	166	251	0	207	341	0
Turn Type	pm+pt			Perm		Perm	Perm			Perm		
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	51.0	51.0		32.0	32.0	32.0	41.0	41.0		41.0	41.0	
Effective Green, g (s)	51.0	51.0		32.0	32.0	32.0	41.0	41.0		41.0	41.0	
Actuated g/C Ratio	0.51	0.51		0.32	0.32	0.32	0.41	0.41		0.41	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	350	1655		210	1095	507	316	1419		439	1346	
v/s Ratio Prot	c0.09	0.22			c0.24			0.07			0.10	
v/s Ratio Perm	0.21			0.05		0.04	c0.22			0.19		
v/c Ratio	0.58	0.43		0.15	0.74	0.13	0.53	0.18		0.47	0.25	
Uniform Delay, d1	16.9	15.4		24.3	30.3	24.1	22.2	18.8		21.6	19.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.9	0.8		1.5	4.5	0.5	6.1	0.3		3.6	0.5	
Delay (s)	23.8	16.2		25.7	34.8	24.6	28.3	19.0		25.2	19.9	
Level of Service	C	B		C	C	C	C	B		C	B	
Approach Delay (s)		17.9			32.6			22.6			21.5	
Approach LOS		B			C			C			C	

Intersection Summary				
HCM Average Control Delay	24.3	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	64.7%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

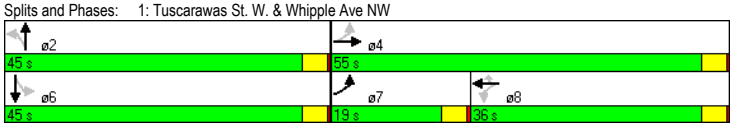
Timing Report, Sorted By Phase
1: Tuscarawas St. W. & Whipple Ave NW

8/30/2011

Phase Number	2	4	6	7	8
Movement	NBTL	EBTL	SBTL	EBL	WBTL
Lead/Lag				Lead	Lag
Lead-Lag Optimize				Yes	Yes
Recall Mode	Max	Max	Max	Max	Max
Maximum Split (s)	45	55	45	19	36
Maximum Split (%)	45.0%	55.0%	45.0%	19.0%	36.0%
Minimum Split (s)	20	20	20	8	20
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4	4
Vehicle Extension (s)	3	3	3	3	3
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	5	5	5		5
Flash Dont Walk (s)	11	11	11		11
Dual Entry	Yes	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	45	0	45	64
End Time (s)	45	0	45	64	0
Yield/Force Off (s)	41	96	41	60	96
Yield/Force Off 170(s)	30	85	30	60	85
Local Start Time (s)	0	45	0	45	64
Local Yield (s)	41	96	41	60	96
Local Yield 170(s)	30	85	30	60	85

Intersection Summary		
Cycle Length	100	
Control Type	Pretimed	
Natural Cycle	50	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green		

Splits and Phases: 1: Tuscarawas St. W. & Whipple Ave NW



HCM Unsignalized Intersection Capacity Analysis
5: Tuscarawas St. W. & SMith

8/30/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	37	991	35	30	1093	23	7	2	16	2	0	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	41	1101	39	33	1214	26	8	2	18	2	0	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)		765										
pX, platoon unblocked				0.75			0.75	0.75	0.75	0.75	0.75	
vC, conflicting volume	1240			1140			1881	2509	570	1946	2516	620
vC1, stage 1 conf vol							1203	1203		1294	1294	
vC2, stage 2 conf vol							678	1307		652	1222	
vCu, unblocked vol	1240			536			1518	2350	0	1603	2359	620
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)							6.5	5.5		6.5	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			96			97	99	98	99	100	99
cM capacity (veh/h)	557			776			230	152	819	157	170	431

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	592	589	641	633	28	7
Volume Left	41	0	33	0	8	2
Volume Right	0	39	0	26	18	4
cSH	557	1700	776	1700	396	273
Volume to Capacity	0.07	0.35	0.04	0.37	0.07	0.02
Queue Length 95th (ft)	6	0	3	0	6	2
Control Delay (s)	2.0	0.0	1.1	0.0	14.8	18.5
Lane LOS	A		A		B	C
Approach Delay (s)	1.0		0.6		14.8	18.5
Approach LOS					B	C

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	65.6%	ICU Level of Service	C	
Analysis Period (min)	15			

Timings
9: Tuscarawas St. W. & Bedford Ave.

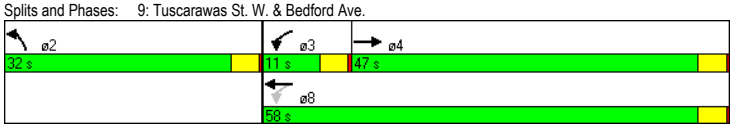
8/30/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	954	83	1036	169
Turn Type		pm+pt		
Protected Phases	4	3	8	2
Permitted Phases		8		
Detector Phase	4	3	8	2
Switch Phase				
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	8.0	23.0	23.0
Total Split (s)	47.0	11.0	58.0	32.0
Total Split (%)	52.2%	12.2%	64.4%	35.6%
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		
Recall Mode	C-Max	None	C-Max	Max
Act Effct Green (s)	45.2	54.0	54.0	28.0
Actuated g/C Ratio	0.50	0.60	0.60	0.31
v/c Ratio	0.66	0.36	0.54	0.54
Control Delay	20.6	11.7	11.9	26.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	20.6	11.7	11.9	26.8
LOS	C	B	B	C
Approach Delay	20.6		11.9	26.8
Approach LOS	C		B	C

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 69 (77%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 17.3 — Intersection LOS: B
Intersection Capacity Utilization 58.7% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 9: Tuscarawas St. W. & Bedford Ave.



Phasings
9: Tuscarawas St. W. & Bedford Ave.

8/30/2011

Lane Group	EBT	WBL	WBT	NBL
Protected Phases	4	3	8	2
Permitted Phases		8		
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	8.0	23.0	23.0
Total Split (s)	47.0	11.0	58.0	32.0
Total Split (%)	52.2%	12.2%	64.4%	35.6%
Maximum Green (s)	43.0	7.0	54.0	28.0
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0
Recall Mode	C-Max	None	C-Max	Max
Walk Time (s)	5.0		5.0	5.0
Flash Dont Walk (s)	8.0		14.0	14.0
Pedestrian Calls (#/hr)	0		0	0
90th %ile Green (s)	43.0	7.0	54.0	28.0
90th %ile Term Code	Coord	Max	Coord	MaxR
70th %ile Green (s)	43.0	7.0	54.0	28.0
70th %ile Term Code	Coord	Max	Coord	MaxR
50th %ile Green (s)	43.0	7.0	54.0	28.0
50th %ile Term Code	Coord	Max	Coord	MaxR
30th %ile Green (s)	43.2	6.8	54.0	28.0
30th %ile Term Code	Coord	Gap	Coord	MaxR
10th %ile Green (s)	54.0	0.0	54.0	28.0
10th %ile Term Code	Coord	Skip	Coord	MaxR

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 69 (77%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Control Type: Actuated-Coordinated

Queues
9: Tuscarawas St. W. & Bedford Ave. 8/30/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Group Flow (vph)	1133	92	1151	301
v/c Ratio	0.66	0.36	0.54	0.54
Control Delay	20.6	11.7	11.9	26.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	20.6	11.7	11.9	26.8
Queue Length 50th (ft)	351	20	187	124
Queue Length 95th (ft)	421	40	240	206
Internal Link Dist (ft)	840		685	953
Turn Bay Length (ft)		50		
Base Capacity (vph)	1708	259	2123	558
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.66	0.36	0.54	0.54

Intersection Summary

HCM Signalized Intersection Capacity Analysis
9: Tuscarawas St. W. & Bedford Ave. 8/30/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	954	66	83	1036	169	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	12	12	12
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	0.95	1.00	
Frt	0.99		1.00	1.00	0.95	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	3388		1711	3539	1715	
Flt Permitted	1.00		0.13	1.00	0.97	
Satd. Flow (perm)	3388		241	3539	1715	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1060	73	92	1151	188	113
RTOR Reduction (vph)	6	0	0	0	24	0
Lane Group Flow (vph)	1127	0	92	1151	277	0
Turn Type			pm+pt			
Protected Phases	4		3	8	2	
Permitted Phases			8			
Actuated Green, G (s)	44.4		54.0	54.0	28.0	
Effective Green, g (s)	44.4		54.0	54.0	28.0	
Actuated g/C Ratio	0.49		0.60	0.60	0.31	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1671		236	2123	534	
v/s Ratio Prot	c0.33		0.02	c0.33	c0.16	
v/s Ratio Perm			0.21			
v/c Ratio	0.67		0.39	0.54	0.52	
Uniform Delay, d1	17.3		11.2	10.7	25.5	
Progression Factor	1.07		1.00	1.00	1.00	
Incremental Delay, d2	2.1		1.1	1.0	3.6	
Delay (s)	20.6		12.2	11.7	29.0	
Level of Service	C		B	B	C	
Approach Delay (s)	20.6			11.7	29.0	
Approach LOS	C			B	C	

Intersection Summary				
HCM Average Control Delay	17.4	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.62			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	58.7%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

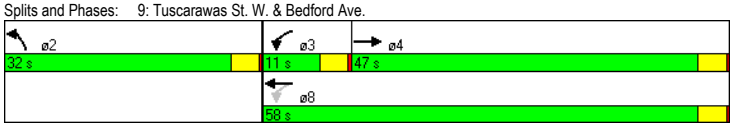
Timing Report, Sorted By Phase
9: Tuscarawas St. W. & Bedford Ave.

8/30/2011

Phase Number	2	3	4	8
Movement	NBL	WBL	EBT	WBTL
Lead/Lag		Lead	Lag	
Lead-Lag Optimize		Yes	Yes	
Recall Mode	Max	None	C-Max	C-Max
Maximum Split (s)	32	11	47	58
Maximum Split (%)	35.6%	12.2%	52.2%	64.4%
Minimum Split (s)	23	8	20	23
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5		5	5
Flash Dont Walk (s)	14		8	14
Dual Entry	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	26	58	69	58
End Time (s)	58	69	26	26
Yield/Force Off (s)	54	65	22	22
Yield/Force Off 170(s)	40	65	14	8
Local Start Time (s)	47	79	0	79
Local Yield (s)	75	86	43	43
Local Yield 170(s)	61	86	35	29

Intersection Summary		
Cycle Length		90
Control Type	Actuated-Coordinated	
Natural Cycle		60
Offset: 69 (77%), Referenced to phase 4:EBT and 8:WBTL, Start of Green		

Splits and Phases: 9: Tuscarawas St. W. & Bedford Ave.



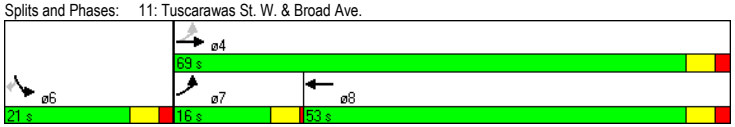
Timings
11: Tuscarawas St. W. & Broad Ave.

8/30/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	114	895	1029	81	114
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4				6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	4.0	1.0	1.0	1.0	1.0
Minimum Split (s)	8.0	8.0	8.0	8.0	8.0
Total Split (s)	16.0	69.0	53.0	21.0	21.0
Total Split (%)	17.8%	76.7%	58.9%	23.3%	23.3%
Yellow Time (s)	3.5	3.6	3.6	3.6	3.6
All-Red Time (s)	0.5	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.6	5.6	5.6	5.6
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	Max	Max
Act Effct Green (s)	65.0	63.4	51.9	15.4	15.4
Actuated g/C Ratio	0.72	0.70	0.58	0.17	0.17
v/c Ratio	0.41	0.40	0.63	0.30	0.34
Control Delay	13.2	10.4	7.6	35.7	9.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	10.4	7.6	35.7	9.0
LOS	B	B	A	D	A
Approach Delay		10.7	7.6	20.0	
Approach LOS		B	A	C	

Intersection Summary		
Cycle Length: 90		
Actuated Cycle Length: 90		
Offset: 74 (82%), Referenced to phase 4:EBTL and 8:WBT, Start of Green		
Natural Cycle: 50		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.63		
Intersection Signal Delay: 10.0	Intersection LOS: A	
Intersection Capacity Utilization 54.4%	ICU Level of Service A	
Analysis Period (min) 15		

Splits and Phases: 11: Tuscarawas St. W. & Broad Ave.



Phasings
11: Tuscarawas St. W. & Broad Ave.

8/30/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Protected Phases	7	4	8	6	
Permitted Phases	4				6
Minimum Initial (s)	4.0	1.0	1.0	1.0	1.0
Minimum Split (s)	8.0	8.0	8.0	8.0	8.0
Total Split (s)	16.0	69.0	53.0	21.0	21.0
Total Split (%)	17.8%	76.7%	58.9%	23.3%	23.3%
Maximum Green (s)	12.0	63.4	47.4	15.4	15.4
Yellow Time (s)	3.5	3.6	3.6	3.6	3.6
All-Red Time (s)	0.5	2.0	2.0	2.0	2.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Vehicle Extension (s)	3.0	3.0	5.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	C-Max	C-Max	Max	Max
Walk Time (s)		5.0	5.0	5.0	5.0
Flash Dont Walk (s)		10.0	14.0	14.0	14.0
Pedestrian Calls (#/hr)		0	0	0	0
90th %ile Green (s)	9.1	63.4	50.3	15.4	15.4
90th %ile Term Code	Gap	Coord	Coord	Ped	Ped
70th %ile Green (s)	8.1	63.4	51.3	15.4	15.4
70th %ile Term Code	Gap	Coord	Coord	Ped	Ped
50th %ile Green (s)	7.5	63.4	51.9	15.4	15.4
50th %ile Term Code	Gap	Coord	Coord	Ped	Ped
30th %ile Green (s)	6.8	63.4	52.6	15.4	15.4
30th %ile Term Code	Gap	Coord	Coord	Ped	Ped
10th %ile Green (s)	6.0	63.4	53.4	15.4	15.4
10th %ile Term Code	Gap	Coord	Coord	Ped	Ped

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 74 (82%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Control Type: Actuated-Coordinated

Queues
11: Tuscarawas St. W. & Broad Ave.

8/30/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	127	994	1229	90	127
v/c Ratio	0.41	0.40	0.63	0.30	0.34
Control Delay	13.2	10.4	7.6	35.7	9.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	10.4	7.6	35.7	9.0
Queue Length 50th (ft)	37	161	83	45	0
Queue Length 95th (ft)	66	224	100	90	47
Internal Link Dist (ft)		504	840	1069	
Turn Bay Length (ft)	70			80	
Base Capacity (vph)	384	2493	1959	303	376
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.33	0.40	0.63	0.30	0.34

Intersection Summary

HCM Signalized Intersection Capacity Analysis
11: Tuscarawas St. W. & Broad Ave.

8/30/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	114	895	1029	77	81	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	12	12	12
Total Lost time (s)	4.0	5.6	5.6		5.6	5.6
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1711	3539	3385		1770	1583
Flt Permitted	0.15	1.00	1.00		0.95	1.00
Satd. Flow (perm)	265	3539	3385		1770	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	127	994	1143	86	90	127
RTOR Reduction (vph)	0	0	6	0	0	105
Lane Group Flow (vph)	127	994	1223	0	90	22
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4					6
Actuated Green, G (s)	63.4	63.4	51.9		15.4	15.4
Effective Green, g (s)	63.4	63.4	51.9		15.4	15.4
Actuated g/C Ratio	0.70	0.70	0.58		0.17	0.17
Clearance Time (s)	4.0	5.6	5.6		5.6	5.6
Vehicle Extension (s)	3.0	3.0	5.0		3.0	3.0
Lane Grp Cap (vph)	307	2493	1952		303	271
v/s Ratio Prot	0.03	c0.28	c0.36		c0.05	
v/s Ratio Perm	0.26					0.01
v/c Ratio	0.41	0.40	0.63		0.30	0.08
Uniform Delay, d1	7.4	5.5	12.6		32.6	31.3
Progression Factor	2.47	1.78	0.49		1.00	1.00
Incremental Delay, d2	0.9	0.5	1.3		2.5	0.6
Delay (s)	19.1	10.2	7.4		35.1	31.9
Level of Service	B	B	A		D	C
Approach Delay (s)		11.2	7.4		33.2	
Approach LOS		B	A		C	

Intersection Summary				
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.8
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Timing Report, Sorted By Phase
11: Tuscarawas St. W. & Broad Ave.

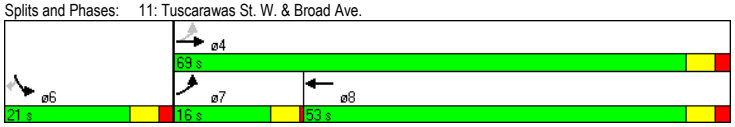
8/30/2011

Phase Number	4	6	7	8
Movement	EBTL	SBL	EBL	WBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize			Yes	Yes
Recall Mode	C-Max	Max	None	C-Max
Maximum Split (s)	69	21	16	53
Maximum Split (%)	76.7%	23.3%	17.8%	58.9%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.6	3.6	3.5	3.6
All-Red Time (s)	2	2	0.5	2
Minimum Initial (s)	1	1	4	1
Vehicle Extension (s)	3	3	3	5
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5		5
Flash Dont Walk (s)	10	14		14
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	58	37	58	74
End Time (s)	37	58	74	37
Yield/Force Off (s)	31.4	52.4	70	31.4
Yield/Force Off 170(s)	21.4	38.4	70	17.4
Local Start Time (s)	74	53	74	0
Local Yield (s)	47.4	68.4	86	47.4
Local Yield 170(s)	37.4	54.4	86	33.4

Intersection Summary		
Cycle Length		90
Control Type	Actuated-Coordinated	
Natural Cycle		50

Offset: 74 (82%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Splits and Phases: 11: Tuscarawas St. W. & Broad Ave.



Timings
13: Tuscarawas St. W. & Wertz Ave.

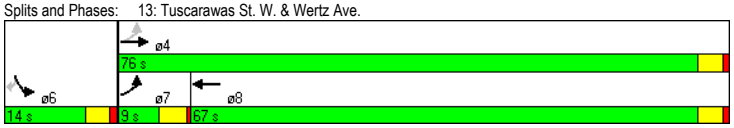
8/30/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	132	828	1040	98	158
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4				6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	4.0	1.0	1.0	4.0	4.0
Minimum Split (s)	8.0	20.0	20.0	10.0	10.0
Total Split (s)	9.0	76.0	67.0	14.0	14.0
Total Split (%)	10.0%	84.4%	74.4%	15.6%	15.6%
Yellow Time (s)	3.5	3.0	3.0	3.0	3.0
All-Red Time (s)	0.5	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	Max	Max
Act Effct Green (s)	72.0	72.0	63.0	10.0	10.0
Actuated g/C Ratio	0.80	0.80	0.70	0.11	0.11
v/c Ratio	0.46	0.32	0.53	0.55	0.53
Control Delay	13.4	1.5	3.3	49.4	12.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.4	1.5	3.3	49.4	12.5
LOS	B	A	A	D	B
Approach Delay		3.2	3.3	26.6	
Approach LOS		A	A	C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 60 (67%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.55
Intersection Signal Delay: 5.8 Intersection LOS: A
Intersection Capacity Utilization 54.4% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 13: Tuscarawas St. W. & Wertz Ave.



Phasings
13: Tuscarawas St. W. & Wertz Ave.

8/30/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Protected Phases	7	4	8	6	
Permitted Phases	4				6
Minimum Initial (s)	4.0	1.0	1.0	4.0	4.0
Minimum Split (s)	8.0	20.0	20.0	10.0	10.0
Total Split (s)	9.0	76.0	67.0	14.0	14.0
Total Split (%)	10.0%	84.4%	74.4%	15.6%	15.6%
Maximum Green (s)	5.0	72.0	63.0	10.0	10.0
Yellow Time (s)	3.5	3.0	3.0	3.0	3.0
All-Red Time (s)	0.5	1.0	1.0	1.0	1.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Vehicle Extension (s)	3.0	5.0	5.0	5.0	5.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	C-Max	C-Max	Max	Max
Walk Time (s)		0.0	7.0	7.0	7.0
Flash Dont Walk (s)		0.0	11.0	14.0	14.0
Pedestrian Calls (#/hr)		0	0	0	0
90th %ile Green (s)	5.0	72.0	63.0	10.0	10.0
90th %ile Term Code	Max	Coord	Coord	Ped	Ped
70th %ile Green (s)	5.0	72.0	63.0	10.0	10.0
70th %ile Term Code	Max	Coord	Coord	Ped	Ped
50th %ile Green (s)	5.0	72.0	63.0	10.0	10.0
50th %ile Term Code	Max	Coord	Coord	Ped	Ped
30th %ile Green (s)	5.0	72.0	63.0	10.0	10.0
30th %ile Term Code	Max	Coord	Coord	Ped	Ped
10th %ile Green (s)	5.0	72.0	63.0	10.0	10.0
10th %ile Term Code	Max	Coord	Coord	Ped	Ped

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 60 (67%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Control Type: Actuated-Coordinated

Queues
13: Tuscarawas St. W. & Wertz Ave.

8/30/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	147	920	1258	109	176
v/c Ratio	0.46	0.32	0.53	0.55	0.53
Control Delay	13.4	1.5	3.3	49.4	12.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.4	1.5	3.3	49.4	12.5
Queue Length 50th (ft)	23	9	45	60	0
Queue Length 95th (ft)	m70	m65	66	113	59
Internal Link Dist (ft)		600	504	1209	
Turn Bay Length (ft)	50			70	
Base Capacity (vph)	323	2831	2373	197	332
Starvation Cap Reductn	0	0	41	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.46	0.32	0.54	0.55	0.53

Intersection Summary
m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
13: Tuscarawas St. W. & Wertz Ave.

8/30/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	132	828	1040	92	98	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	12	11	12	12	12
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1711	3539	3380		1770	1583
Flt Permitted	0.17	1.00	1.00		0.95	1.00
Satd. Flow (perm)	305	3539	3380		1770	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	147	920	1156	102	109	176
RTOR Reduction (vph)	0	0	7	0	0	156
Lane Group Flow (vph)	147	920	1251	0	109	20
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4					6
Actuated Green, G (s)	72.0	72.0	63.0		10.0	10.0
Effective Green, g (s)	72.0	72.0	63.0		10.0	10.0
Actuated g/C Ratio	0.80	0.80	0.70		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	5.0	5.0		5.0	5.0
Lane Grp Cap (vph)	322	2831	2366		197	176
v/s Ratio Prot	c0.03	0.26	c0.37		c0.06	
v/s Ratio Perm	0.34					0.01
v/c Ratio	0.46	0.32	0.53		0.55	0.11
Uniform Delay, d1	4.1	2.4	6.4		37.9	36.0
Progression Factor	4.59	0.51	0.40		1.00	1.00
Incremental Delay, d2	0.9	0.3	0.7		10.7	1.3
Delay (s)	20.0	1.5	3.3		48.6	37.3
Level of Service	B	A	A		D	D
Approach Delay (s)		4.1	3.3		41.6	
Approach LOS		A	A		D	

Intersection Summary				
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

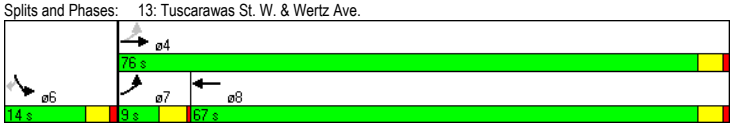
c Critical Lane Group

Timing Report, Sorted By Phase
13: Tuscarawas St. W. & Wertz Ave. 8/30/2011

Phase Number	4	6	7	8
Movement	EBTL	SBL	EBL	WBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize			Yes	Yes
Recall Mode	C-Max	Max	None	C-Max
Maximum Split (s)	76	14	9	67
Maximum Split (%)	84.4%	15.6%	10.0%	74.4%
Minimum Split (s)	20	10	8	20
Yellow Time (s)	3	3	3.5	3
All-Red Time (s)	1	1	0.5	1
Minimum Initial (s)	1	4	4	1
Vehicle Extension (s)	5	5	3	5
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	0	7		7
Flash Dont Walk (s)	0	14		11
Dual Entry	Yes	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	51	37	51	60
End Time (s)	37	51	60	37
Yield/Force Off (s)	33	47	56	33
Yield/Force Off 170(s)	33	33	56	22
Local Start Time (s)	81	67	81	0
Local Yield (s)	63	77	86	63
Local Yield 170(s)	63	63	86	52

Intersection Summary		
Cycle Length		90
Control Type	Actuated-Coordinated	
Natural Cycle		45
Offset: 60 (67%), Referenced to phase 4:EBTL and 8:WBT, Start of Green		

Splits and Phases: 13: Tuscarawas St. W. & Wertz Ave.

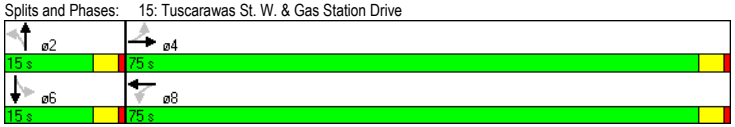


Timings
15: Tuscarawas St. W. & Gas Station Drive 8/30/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	1	881	339	892	84	32	22	16
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	1.0	1.0	1.0	1.0	4.0	4.0	4.0	4.0
Minimum Split (s)	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0
Total Split (s)	75.0	75.0	75.0	75.0	15.0	15.0	15.0	15.0
Total Split (%)	83.3%	83.3%	83.3%	83.3%	16.7%	16.7%	16.7%	16.7%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	71.0	71.0	71.0	71.0		11.0		11.0
Actuated g/C Ratio	0.79	0.79	0.79	0.79		0.12		0.12
v/c Ratio	0.00	0.39	0.99	0.39		1.04		0.29
Control Delay	4.0	14.1	55.6	1.9		107.7		40.0
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	4.0	14.1	55.6	1.9		107.7		40.0
LOS	A	B	E	A		F		D
Approach Delay		14.1		16.5		107.7		40.1
Approach LOS		B		B		F		D

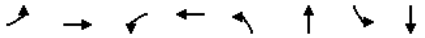
Intersection Summary		
Cycle Length: 90		
Actuated Cycle Length: 90		
Offset: 84 (93%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green		
Natural Cycle: 90		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 1.04		
Intersection Signal Delay: 23.7	Intersection LOS: C	
Intersection Capacity Utilization 67.2%	ICU Level of Service C	
Analysis Period (min) 15		

Splits and Phases: 15: Tuscarawas St. W. & Gas Station Drive



Phasings
15: Tuscarawas St. W. & Gas Station Drive

8/30/2011



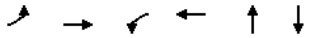
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Minimum Initial (s)	1.0	1.0	1.0	1.0	4.0	4.0	4.0	4.0
Minimum Split (s)	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0
Total Split (s)	75.0	75.0	75.0	75.0	15.0	15.0	15.0	15.0
Total Split (%)	83.3%	83.3%	83.3%	83.3%	16.7%	16.7%	16.7%	16.7%
Maximum Green (s)	71.0	71.0	71.0	71.0	11.0	11.0	11.0	11.0
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag								
Lead-Lag Optimize?								
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None	None	None
Walk Time (s)	5.0	5.0	0.0	0.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	7.0	7.0	0.0	0.0	14.0	14.0	0.0	0.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0
90th %ile Green (s)	71.0	71.0	71.0	71.0	11.0	11.0	11.0	11.0
90th %ile Term Code	Coord	Coord	Coord	Coord	Max	Max	Max	Max
70th %ile Green (s)	71.0	71.0	71.0	71.0	11.0	11.0	11.0	11.0
70th %ile Term Code	Coord	Coord	Coord	Coord	Max	Max	Max	Max
50th %ile Green (s)	71.0	71.0	71.0	71.0	11.0	11.0	11.0	11.0
50th %ile Term Code	Coord	Coord	Coord	Coord	Max	Max	Hold	Hold
30th %ile Green (s)	71.0	71.0	71.0	71.0	11.0	11.0	11.0	11.0
30th %ile Term Code	Coord	Coord	Coord	Coord	Max	Max	Hold	Hold
10th %ile Green (s)	71.0	71.0	71.0	71.0	11.0	11.0	11.0	11.0
10th %ile Term Code	Coord	Coord	Coord	Coord	Max	Max	Hold	Hold

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 84 (93%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Control Type: Actuated-Coordinated

Queues
15: Tuscarawas St. W. & Gas Station Drive

8/30/2011



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	1	1010	377	1012	226	44
v/c Ratio	0.00	0.39	0.99	0.39	1.04	0.29
Control Delay	4.0	14.1	55.6	1.9	107.7	40.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.0	14.1	55.6	1.9	107.7	40.0
Queue Length 50th (ft)	0	294	232	44	~122	22
Queue Length 95th (ft)	m1	340	#411	57	#266	55
Internal Link Dist (ft)		824		600	1120	136
Turn Bay Length (ft)	60		80			
Base Capacity (vph)	379	2596	381	2600	217	154
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.39	0.99	0.39	1.04	0.29

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
15: Tuscarawas St. W. & Gas Station Drive / Maryland Ave.

8/30/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	881	28	339	892	19	84	32	87	22	16	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	10	12	11	10	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	1.00		1.00	1.00			0.94			0.99	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.97	
Satd. Flow (prot)	1711	3288		1711	3293			1719			1802	
Flt Permitted	0.27	1.00		0.27	1.00			0.87			0.67	
Satd. Flow (perm)	481	3288		482	3293			1533			1241	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1	979	31	377	991	21	93	36	97	24	18	2
RTOR Reduction (vph)	0	3	0	0	2	0	0	30	0	0	2	0
Lane Group Flow (vph)	1	1007	0	377	1010	0	0	196	0	0	42	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	71.0	71.0		71.0	71.0			11.0			11.0	
Effective Green, g (s)	71.0	71.0		71.0	71.0			11.0			11.0	
Actuated g/C Ratio	0.79	0.79		0.79	0.79			0.12			0.12	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Grp Cap (vph)	379	2594		380	2598			187			152	
v/s Ratio Prot		0.31			0.31							
v/s Ratio Perm	0.00			c0.78				c0.13			0.03	
v/c Ratio	0.00	0.39		0.99	0.39			1.05			0.28	
Uniform Delay, d1	2.0	2.9		9.2	2.9			39.5			35.9	
Progression Factor	1.93	4.73		1.17	0.52			1.00			1.00	
Incremental Delay, d2	0.0	0.4		41.2	0.4			79.3			2.1	
Delay (s)	3.9	14.1		52.1	1.9			118.8			38.0	
Level of Service	A	B		D	A			F			D	
Approach Delay (s)		14.1			15.5			118.8			38.0	
Approach LOS		B			B			F			D	

Intersection Summary				
HCM Average Control Delay	24.1	HCM Level of Service	C	
HCM Volume to Capacity ratio	1.00			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	67.2%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

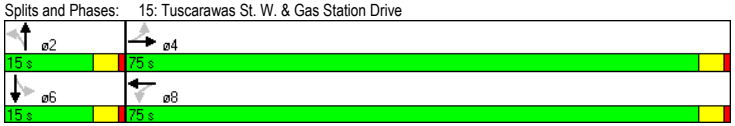
Timing Report, Sorted By Phase
15: Tuscarawas St. W. & Gas Station Drive

8/30/2011

Phase Number	2	4	6	8
Movement	NBTL	EBTL	SBTL	WBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	None	C-Max	None	C-Max
Maximum Split (s)	15	75	15	75
Maximum Split (%)	16.7%	83.3%	16.7%	83.3%
Minimum Split (s)	10	5	10	5
Yellow Time (s)	3	3	3	3
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	4	1	4	1
Vehicle Extension (s)	5	5	5	5
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5	5	0
Flash Dont Walk (s)	14	7	0	0
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	69	84	69	84
End Time (s)	84	69	84	69
Yield/Force Off (s)	80	65	80	65
Yield/Force Off 170(s)	66	58	80	65
Local Start Time (s)	75	0	75	0
Local Yield (s)	86	71	86	71
Local Yield 170(s)	72	64	86	71

Intersection Summary		
Cycle Length	90	
Control Type	Actuated-Coordinated	
Natural Cycle	90	
Offset: 84 (93%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green		

Splits and Phases: 15: Tuscarawas St. W. & Gas Station Drive



Timings
18: Tuscarawas St. W. & Bellflower Ave.

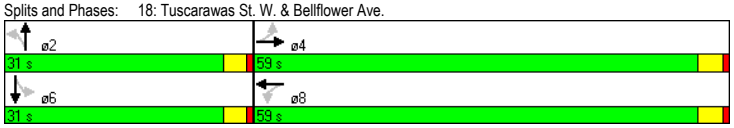
8/30/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	66	786	13	1067	66	18	4	7
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	2.0	2.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	6.0	6.0	20.0	20.0	30.0	30.0	10.0	10.0
Total Split (s)	59.0	59.0	59.0	59.0	31.0	31.0	31.0	31.0
Total Split (%)	65.6%	65.6%	65.6%	65.6%	34.4%	34.4%	34.4%	34.4%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	47.4	47.4	47.4	47.4		34.6		34.6
Actuated g/C Ratio	0.53	0.53	0.53	0.53		0.38		0.38
v/c Ratio	0.55	0.51	0.06	0.69		0.18		0.03
Control Delay	47.4	31.3	12.8	26.3		20.4		16.3
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	47.4	31.3	12.8	26.3		20.4		16.3
LOS	D	C	B	C		C		B
Approach Delay		32.6		26.1		20.4		16.3
Approach LOS		C		C		C		B

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 20 (22%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 28.5 Intersection LOS: C
Intersection Capacity Utilization 55.6% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 18: Tuscarawas St. W. & Bellflower Ave.



Phasings
18: Tuscarawas St. W. & Bellflower Ave.

8/30/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Minimum Initial (s)	2.0	2.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	6.0	6.0	20.0	20.0	30.0	30.0	10.0	10.0
Total Split (s)	59.0	59.0	59.0	59.0	31.0	31.0	31.0	31.0
Total Split (%)	65.6%	65.6%	65.6%	65.6%	34.4%	34.4%	34.4%	34.4%
Maximum Green (s)	55.0	55.0	55.0	55.0	27.0	27.0	27.0	27.0
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag								
Lead-Lag Optimize?								
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	17.0	17.0	11.0	11.0	12.0	12.0	12.0	12.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0
90th %ile Green (s)	55.0	55.0	55.0	55.0	27.0	27.0	27.0	27.0
90th %ile Term Code	Hold	Hold	Max	Max	Coord	Coord	Coord	Coord
70th %ile Green (s)	51.7	51.7	51.7	51.7	30.3	30.3	30.3	30.3
70th %ile Term Code	Hold	Hold	Gap	Gap	Coord	Coord	Coord	Coord
50th %ile Green (s)	48.2	48.2	48.2	48.2	33.8	33.8	33.8	33.8
50th %ile Term Code	Hold	Hold	Gap	Gap	Coord	Coord	Coord	Coord
30th %ile Green (s)	44.2	44.2	44.2	44.2	37.8	37.8	37.8	37.8
30th %ile Term Code	Hold	Hold	Gap	Gap	Coord	Coord	Coord	Coord
10th %ile Green (s)	37.8	37.8	37.8	37.8	44.2	44.2	44.2	44.2
10th %ile Term Code	Hold	Hold	Gap	Gap	Coord	Coord	Coord	Coord

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 20 (22%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Control Type: Actuated-Coordinated

Queues
18: Tuscarawas St. W. & Bellflower Ave.

8/30/2011

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	73	892	14	1203	106	19
v/c Ratio	0.55	0.51	0.06	0.69	0.18	0.03
Control Delay	47.4	31.3	12.8	26.3	20.4	16.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.4	31.3	12.8	26.3	20.4	16.3
Queue Length 50th (ft)	42	272	6	350	37	4
Queue Length 95th (ft)	m65	316	m11	m354	83	21
Internal Link Dist (ft)		963		824	1032	942
Turn Bay Length (ft)	90		70			
Base Capacity (vph)	154	2014	270	2016	582	665
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.44	0.05	0.60	0.18	0.03

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
18: Tuscarawas St. W. & Bellflower Ave.

8/30/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	786	17	13	1067	15	66	18	12	4	7	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	10	12	11	10	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	1.00		1.00	1.00			0.98			0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.99	
Satd. Flow (prot)	1711	3293		1711	3296			1771			1752	
Flt Permitted	0.14	1.00		0.24	1.00			0.82			0.97	
Satd. Flow (perm)	251	3293		441	3296			1501			1716	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	73	873	19	14	1186	17	73	20	13	4	8	7
RTOR Reduction (vph)	0	2	0	0	1	0	0	5	0	0	4	0
Lane Group Flow (vph)	73	890	0	14	1202	0	0	101	0	0	15	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	47.4	47.4		47.4	47.4			34.6			34.6	
Effective Green, g (s)	47.4	47.4		47.4	47.4			34.6			34.6	
Actuated g/C Ratio	0.53	0.53		0.53	0.53			0.38			0.38	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Grp Cap (vph)	132	1734		232	1736			577			660	
v/s Ratio Prot		0.27			c0.36							
v/s Ratio Perm	0.29			0.03				c0.07			0.01	
v/c Ratio	0.55	0.51		0.06	0.69			0.18			0.02	
Uniform Delay, d1	14.2	13.8		10.4	15.9			18.3			17.2	
Progression Factor	2.40	2.29		1.47	1.57			1.00			1.00	
Incremental Delay, d2	6.8	0.4		0.2	1.4			0.7			0.1	
Delay (s)	40.9	32.1		15.6	26.4			18.9			17.3	
Level of Service	D	C		B	C			B			B	
Approach Delay (s)		32.8			26.2			18.9			17.3	
Approach LOS		C			C			B			B	

Intersection Summary

HCM Average Control Delay	28.6	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.47			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	55.6%	ICU Level of Service	B	
Analysis Period (min)	15			

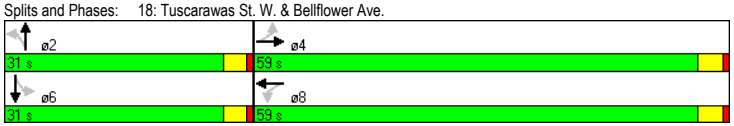
c Critical Lane Group

Timing Report, Sorted By Phase
18: Tuscarawas St. W. & Bellflower Ave. 8/30/2011

Phase Number	2	4	6	8
Movement	NBTL	EBTL	SBTL	WBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	31	59	31	59
Maximum Split (%)	34.4%	65.6%	34.4%	65.6%
Minimum Split (s)	30	6	10	20
Yellow Time (s)	3	3	3	3
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	4	2	4	4
Vehicle Extension (s)	5	5	5	5
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)	5	5	5	5
Flash Dont Walk (s)	12	17	12	11
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	20	51	20	51
End Time (s)	51	20	51	20
Yield/Force Off (s)	47	16	47	16
Yield/Force Off 170(s)	35	89	35	5
Local Start Time (s)	0	31	0	31
Local Yield (s)	27	86	27	86
Local Yield 170(s)	15	69	15	75

Intersection Summary		
Cycle Length		90
Control Type	Actuated-Coordinated	
Natural Cycle		60
Offset: 20 (22%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green		

Splits and Phases: 18: Tuscarawas St. W. & Bellflower Ave.

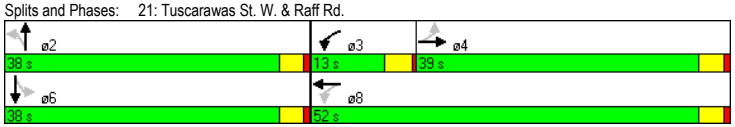


Timings
21: Tuscarawas St. W. & Raff Rd. 8/30/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	2	699	96	933	225	47	7	32
Turn Type	Perm		pm+pt		Perm		Perm	
Protected Phases		4	3	8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	3	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0
Minimum Split (s)	10.0	10.0	6.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	39.0	39.0	13.0	52.0	38.0	38.0	38.0	38.0
Total Split (%)	43.3%	43.3%	14.4%	57.8%	42.2%	42.2%	42.2%	42.2%
Yellow Time (s)	3.0	3.0	3.5	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lead					
Lead-Lag Optimize?	Yes	Yes	Yes					
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	35.0	35.0	48.0	48.0	34.0	34.0	34.0	34.0
Actuated g/C Ratio	0.39	0.39	0.53	0.53	0.38	0.38	0.38	0.38
v/c Ratio	0.01	0.69	0.36	0.60	0.49	0.24	0.02	0.07
Control Delay	9.5	21.8	7.1	4.8	25.4	7.7	17.9	14.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.5	21.8	7.1	4.8	25.4	7.7	17.9	14.8
LOS	A	C	A	A	C	A	B	B
Approach Delay		21.8		5.0		18.2		15.2
Approach LOS		C		A		B		B

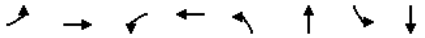
Intersection Summary		
Cycle Length: 90		
Actuated Cycle Length: 90		
Offset: 84 (93%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green		
Natural Cycle: 40		
Control Type: Pretimed		
Maximum v/c Ratio: 0.69		
Intersection Signal Delay: 13.3	Intersection LOS: B	
Intersection Capacity Utilization 58.6%	ICU Level of Service B	
Analysis Period (min) 15		

Splits and Phases: 21: Tuscarawas St. W. & Raff Rd.



Phasings
21: Tuscarawas St. W. & Raff Rd.

8/30/2011



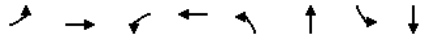
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Protected Phases		4	3	8		2		6
Permitted Phases	4		8		2		6	
Minimum Initial (s)	1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0
Minimum Split (s)	10.0	10.0	6.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	39.0	39.0	13.0	52.0	38.0	38.0	38.0	38.0
Total Split (%)	43.3%	43.3%	14.4%	57.8%	42.2%	42.2%	42.2%	42.2%
Maximum Green (s)	35.0	35.0	9.0	48.0	34.0	34.0	34.0	34.0
Yellow Time (s)	3.0	3.0	3.5	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lead					
Lead-Lag Optimize?	Yes	Yes	Yes					
Vehicle Extension (s)	5.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Walk Time (s)	0.0	0.0		0.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	0.0	0.0		16.0	7.0	7.0	12.0	12.0
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0
90th %ile Green (s)	35.0	35.0	9.0	48.0	34.0	34.0	34.0	34.0
90th %ile Term Code	Coord	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR
70th %ile Green (s)	35.0	35.0	9.0	48.0	34.0	34.0	34.0	34.0
70th %ile Term Code	Coord	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR
50th %ile Green (s)	35.0	35.0	9.0	48.0	34.0	34.0	34.0	34.0
50th %ile Term Code	Coord	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR
30th %ile Green (s)	35.0	35.0	9.0	48.0	34.0	34.0	34.0	34.0
30th %ile Term Code	Coord	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR
10th %ile Green (s)	35.0	35.0	9.0	48.0	34.0	34.0	34.0	34.0
10th %ile Term Code	Coord	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 84 (93%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Control Type: Pretimed

Queues
21: Tuscarawas St. W. & Raff Rd.

8/30/2011



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	2	877	107	1048	250	172	8	48
v/c Ratio	0.01	0.69	0.36	0.60	0.49	0.24	0.02	0.07
Control Delay	9.5	21.8	7.1	4.8	25.4	7.7	17.9	14.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.5	21.8	7.1	4.8	25.4	7.7	17.9	14.8
Queue Length 50th (ft)	0	238	4	20	107	19	3	13
Queue Length 95th (ft)	m1	317	m18	67	179	60	12	35
Internal Link Dist (ft)		1313		963		1045		1181
Turn Bay Length (ft)	70		130				90	
Base Capacity (vph)	183	1274	301	1759	511	704	431	684
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.69	0.36	0.60	0.49	0.24	0.02	0.07

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
21: Tuscarawas St. W. & Raff Rd.

8/30/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	699	90	96	933	10	225	47	108	7	32	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	10	12	11	10	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.90		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3247		1711	3298		1770	1668		1770	1793	
Flt Permitted	0.26	1.00		0.17	1.00		0.73	1.00		0.61	1.00	
Satd. Flow (perm)	470	3247		299	3298		1352	1668		1140	1793	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	2	777	100	107	1037	11	250	52	120	8	36	12
RTOR Reduction (vph)	0	11	0	0	1	0	0	75	0	0	7	0
Lane Group Flow (vph)	2	866	0	107	1047	0	250	97	0	8	41	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	35.0	35.0		48.0	48.0		34.0	34.0		34.0	34.0	
Effective Green, g (s)	35.0	35.0		48.0	48.0		34.0	34.0		34.0	34.0	
Actuated g/C Ratio	0.39	0.39		0.53	0.53		0.38	0.38		0.38	0.38	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	183	1263		301	1759		511	630		431	677	
v/s Ratio Prot		c0.27		0.04	c0.32			0.06			0.02	
v/s Ratio Perm	0.00			0.15			c0.18			0.01		
v/c Ratio	0.01	0.69		0.36	0.60		0.49	0.15		0.02	0.06	
Uniform Delay, d1	16.9	22.9		12.9	14.4		21.4	18.5		17.5	17.8	
Progression Factor	0.54	0.83		0.41	0.24		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	2.7		2.7	1.2		3.3	0.5		0.1	0.2	
Delay (s)	9.2	21.9		8.0	4.7		24.7	19.0		17.6	18.0	
Level of Service	A	C		A	A		C	B		B	B	
Approach Delay (s)		21.8			5.0			22.4			17.9	
Approach LOS		C			A			C			B	

Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

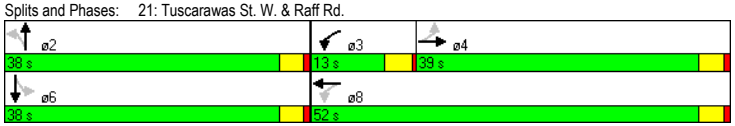
Timing Report, Sorted By Phase
21: Tuscarawas St. W. & Raff Rd.

8/30/2011

Phase Number	2	3	4	6	8
Movement	NBTL	WBL	EBTL	SBTL	WBTL
Lead/Lag		Lead	Lag		
Lead-Lag Optimize		Yes	Yes		
Recall Mode	Max	Max	Max	Max	Max
Maximum Split (s)	38	13	39	38	52
Maximum Split (%)	42.2%	14.4%	43.3%	42.2%	57.8%
Minimum Split (s)	10	6	10	10	10
Yellow Time (s)	3	3.5	3	3	3
All-Red Time (s)	1	0.5	1	1	1
Minimum Initial (s)	1	2	1	1	1
Vehicle Extension (s)	5	3	5	5	5
Minimum Gap (s)	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0
Walk Time (s)	5		0	5	0
Flash Dont Walk (s)	7		0	12	16
Dual Entry	Yes	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	33	71	84	33	71
End Time (s)	71	84	33	71	33
Yield/Force Off (s)	67	80	29	67	29
Yield/Force Off 170(s)	60	80	29	55	13
Local Start Time (s)	39	77	0	39	77
Local Yield (s)	73	86	35	73	35
Local Yield 170(s)	66	86	35	61	19

Intersection Summary	
Cycle Length	90
Control Type	Pretimed
Natural Cycle	40
Offset: 84 (93%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green	

Splits and Phases: 21: Tuscarawas St. W. & Raff Rd.



Timings
24: Tuscarawas St. W. & Valleyview Ave.

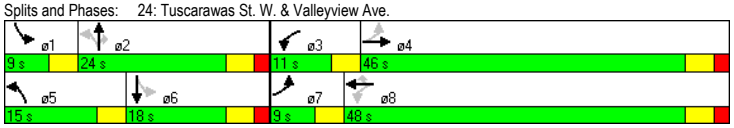
8/30/2011

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Volume (vph)	37	669	101	817	97	135	55	78	92	44
Turn Type	pm+pt		pm+pt		Perm	pm+pt		Perm	pm+pt	
Protected Phases	7	4	3	8		5	2		1	6
Permitted Phases	4		8		8	2		2	6	
Detector Phase	7	4	3	8	8	5	2	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	1.0	2.4	1.0	1.0	4.0	4.0	4.0	2.4	4.0
Minimum Split (s)	9.0	6.6	6.0	10.0	10.0	9.0	10.0	10.0	6.0	10.0
Total Split (s)	9.0	46.0	11.0	48.0	48.0	15.0	24.0	24.0	9.0	18.0
Total Split (%)	10.0%	51.1%	12.2%	53.3%	53.3%	16.7%	26.7%	26.7%	10.0%	20.0%
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.6	5.6	3.6	5.6	5.6	3.6	5.6	5.6	3.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	C-Max	None	None	None	None	None
Act Effct Green (s)	54.9	48.2	58.0	51.4	51.4	23.7	14.5	14.5	15.5	10.0
Actuated g/C Ratio	0.61	0.54	0.64	0.57	0.57	0.26	0.16	0.16	0.17	0.11
v/c Ratio	0.11	0.50	0.29	0.48	0.11	0.44	0.20	0.27	0.40	0.40
Control Delay	8.1	16.4	11.3	20.2	10.6	29.0	32.6	9.3	29.6	27.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.1	16.4	11.3	20.2	10.6	29.0	32.6	9.3	29.6	27.6
LOS	A	B	B	C	B	C	C	A	C	C
Approach Delay		16.0		18.4			24.0			28.7
Approach LOS		B		B			C			C

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 46 (51%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.50
Intersection Signal Delay: 19.0 Intersection LOS: B
Intersection Capacity Utilization 54.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 24: Tuscarawas St. W. & Valleyview Ave.



Phasings
24: Tuscarawas St. W. & Valleyview Ave.

8/30/2011

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Protected Phases	7	4	3	8		5	2		1	6
Permitted Phases	4		8		8	2		2	6	
Minimum Initial (s)	4.0	1.0	2.4	1.0	1.0	4.0	4.0	4.0	2.4	4.0
Minimum Split (s)	9.0	6.6	6.0	10.0	10.0	9.0	10.0	10.0	6.0	10.0
Total Split (s)	9.0	46.0	11.0	48.0	48.0	15.0	24.0	24.0	9.0	18.0
Total Split (%)	10.0%	51.1%	12.2%	53.3%	53.3%	16.7%	26.7%	26.7%	10.0%	20.0%
Maximum Green (s)	5.4	40.4	7.4	42.4	42.4	11.4	18.4	18.4	5.4	12.4
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	0.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	5.0	3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	C-Max	None	C-Max	C-Max	None	None	None	None	None
Walk Time (s)		0.0		5.0	5.0		0.0	0.0		5.0
Flash Dont Walk (s)		0.0		15.0	15.0		0.0	0.0		11.0
Pedestrian Calls (#/hr)		0		0	0		0	0		0
90th %ile Green (s)	5.4	40.4	7.4	42.4	42.4	11.4	18.4	18.4	5.4	12.4
90th %ile Term Code	Max	Coord	Max	Coord	Coord	Max	Hold	Hold	Max	Max
70th %ile Green (s)	6.2	40.4	8.2	42.4	42.4	11.4	17.6	17.6	5.4	11.6
70th %ile Term Code	Max	Coord	Max	Coord	Coord	Max	Hold	Hold	Max	Gap
50th %ile Green (s)	6.3	42.4	7.8	43.9	43.9	11.4	16.0	16.0	5.4	10.0
50th %ile Term Code	Gap	Coord	Gap	Coord	Coord	Max	Hold	Hold	Max	Gap
30th %ile Green (s)	0.0	46.3	6.9	56.8	56.8	10.0	13.0	13.0	5.4	8.4
30th %ile Term Code	Skip	Coord	Gap	Coord	Coord	Gap	Hold	Hold	Max	Gap
10th %ile Green (s)	0.0	71.3	0.0	71.3	71.3	9.5	7.5	7.5	0.0	0.0
10th %ile Term Code	Skip	Coord	Skip	Coord	Coord	Hold	Hold	Hold	Skip	Skip

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 46 (51%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Control Type: Actuated-Coordinated

Queues
24: Tuscarawas St. W. & Valleyview Ave.

8/30/2011

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	41	879	112	908	108	150	61	87	102	91
v/c Ratio	0.11	0.50	0.29	0.48	0.11	0.44	0.20	0.27	0.40	0.40
Control Delay	8.1	16.4	11.3	20.2	10.6	29.0	32.6	9.3	29.6	27.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.1	16.4	11.3	20.2	10.6	29.0	32.6	9.3	29.6	27.6
Queue Length 50th (ft)	8	176	39	244	28	65	30	0	43	27
Queue Length 95th (ft)	22	246	m75	306	m65	110	63	38	79	71
Internal Link Dist (ft)		1143		1313			358			317
Turn Bay Length (ft)	220		180		100				130	
Base Capacity (vph)	374	1741	391	1885	940	353	381	393	256	273
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.50	0.29	0.48	0.11	0.42	0.16	0.22	0.40	0.33

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
24: Tuscarawas St. W. & Valleyview Ave.

8/30/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	669	122	101	817	97	135	55	78	92	44	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	10	12	11	10	12	12	12	12	12	12	12
Total Lost time (s)	3.6	5.6		3.6	5.6	5.6	3.6	5.6	5.6	3.6	5.6	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1711	3227		1711	3303	1583	1770	1863	1583	1770	1734	
Flt Permitted	0.27	1.00		0.24	1.00	1.00	0.49	1.00	1.00	0.72	1.00	
Satd. Flow (perm)	482	3227		439	3303	1583	913	1863	1583	1336	1734	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	41	743	136	112	908	108	150	61	87	102	49	42
RTOR Reduction (vph)	0	15	0	0	0	39	0	0	73	0	36	0
Lane Group Flow (vph)	41	864	0	112	908	69	150	61	14	102	55	0
Turn Type	pm+pt			pm+pt		Perm	pm+pt		Perm	pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)	49.9	46.3		54.9	48.8	48.8	22.8	14.9	14.9	12.8	8.5	
Effective Green, g (s)	49.9	46.3		54.9	48.8	48.8	22.8	14.9	14.9	12.8	8.5	
Actuated g/C Ratio	0.55	0.51		0.61	0.54	0.54	0.25	0.17	0.17	0.14	0.09	
Clearance Time (s)	3.6	5.6		3.6	5.6	5.6	3.6	5.6	5.6	3.6	5.6	
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	5.0	5.0	3.0	5.0	
Lane Grp Cap (vph)	316	1660		354	1791	858	333	308	262	211	164	
v/s Ratio Prot	0.01	0.27		c0.02	c0.27		c0.05	0.03		0.02	0.03	
v/s Ratio Perm	0.07			0.17		0.04	c0.06		0.01	0.05		
v/c Ratio	0.13	0.52		0.32	0.51	0.08	0.45	0.20	0.05	0.48	0.33	
Uniform Delay, d1	9.4	14.5		8.3	13.0	9.9	27.5	32.4	31.6	35.1	38.1	
Progression Factor	1.00	1.00		1.34	1.39	2.25	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	1.2		0.4	0.9	0.2	1.0	0.7	0.2	1.7	2.5	
Delay (s)	9.6	15.7		11.6	19.0	22.3	28.5	33.1	31.8	36.9	40.6	
Level of Service	A	B		B	B	C	C	C	C	D	D	
Approach Delay (s)		15.4			18.5			30.4			38.6	
Approach LOS		B			B			C			D	

Intersection Summary				
HCM Average Control Delay	20.3	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.46			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.8	
Intersection Capacity Utilization	54.8%	ICU Level of Service	A	
Analysis Period (min)	15			

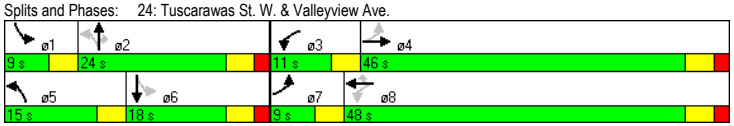
c Critical Lane Group

Timing Report, Sorted By Phase
24: Tuscarawas St. W. & Valleyview Ave. 8/30/2011

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBTL	WBL	EBTL	NBL	SBTL	EBL	WBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	C-Max	None	None	None	C-Max
Maximum Split (s)	9	24	11	46	15	18	9	48
Maximum Split (%)	10.0%	26.7%	12.2%	51.1%	16.7%	20.0%	10.0%	53.3%
Minimum Split (s)	6	10	6	6.6	9	10	9	10
Yellow Time (s)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
All-Red Time (s)	0	2	0	2	0	2	0	2
Minimum Initial (s)	2.4	4	2.4	1	4	4	4	1
Vehicle Extension (s)	3	5	3	5	3	5	3	5
Minimum Gap (s)	3	3	3	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0	0	0
Walk Time (s)		0		0		5		5
Flash Dont Walk (s)		0		0		11		15
Dual Entry	No	Yes	No	Yes	No	Yes	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	2	11	35	46	2	17	35	44
End Time (s)	11	35	46	2	17	35	44	2
Yield/Force Off (s)	7.4	29.4	42.4	86.4	13.4	29.4	40.4	86.4
Yield/Force Off 170(s)	7.4	29.4	42.4	86.4	13.4	18.4	40.4	71.4
Local Start Time (s)	46	55	79	0	46	61	79	88
Local Yield (s)	51.4	73.4	86.4	40.4	57.4	73.4	84.4	40.4
Local Yield 170(s)	51.4	73.4	86.4	40.4	57.4	62.4	84.4	25.4

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	55
Offset: 46 (51%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green	

Splits and Phases: 24: Tuscarawas St. W. & Valleyview Ave.

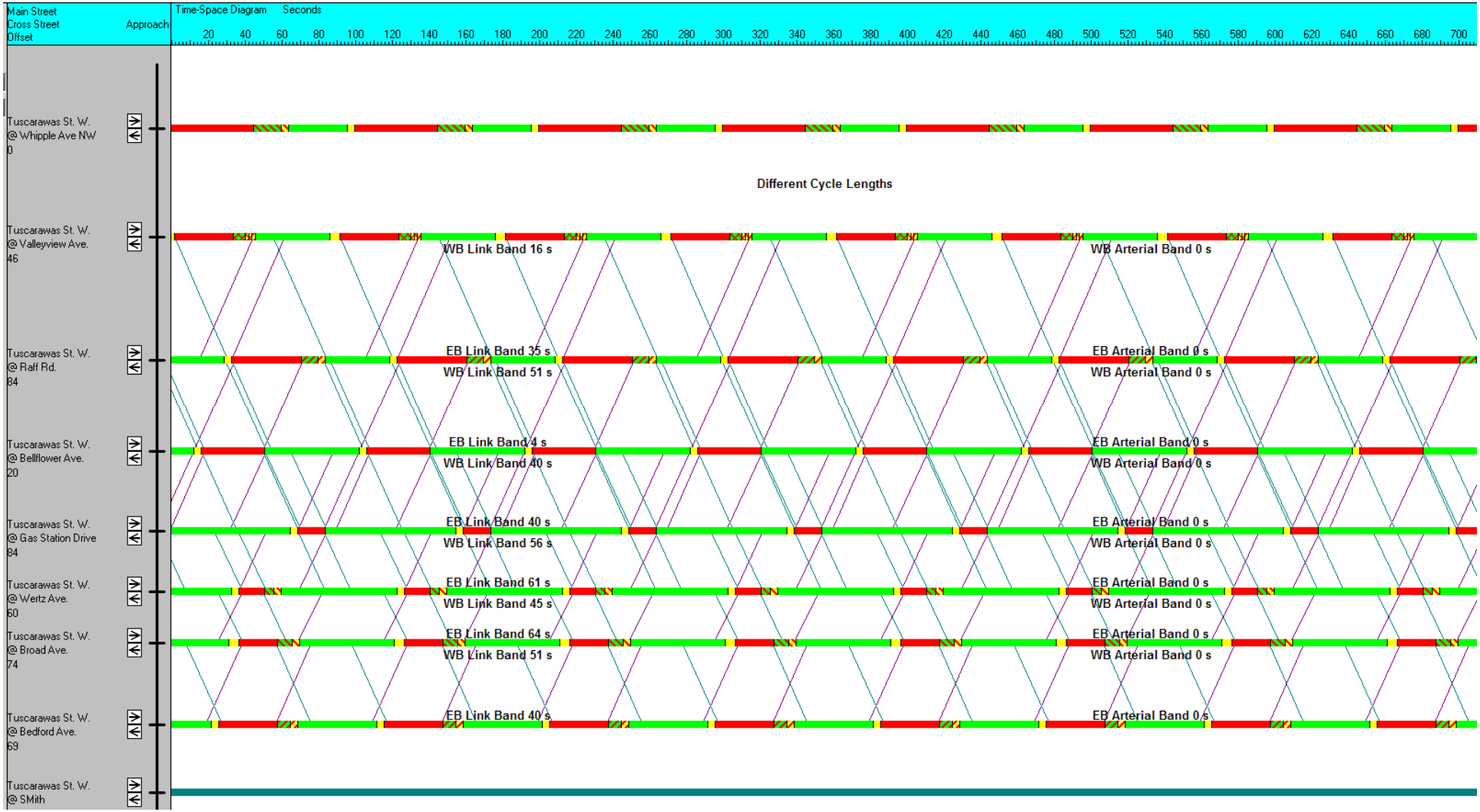


Peak Hour Traffic Volumes (Existing 2011)
Used for Synchro Model

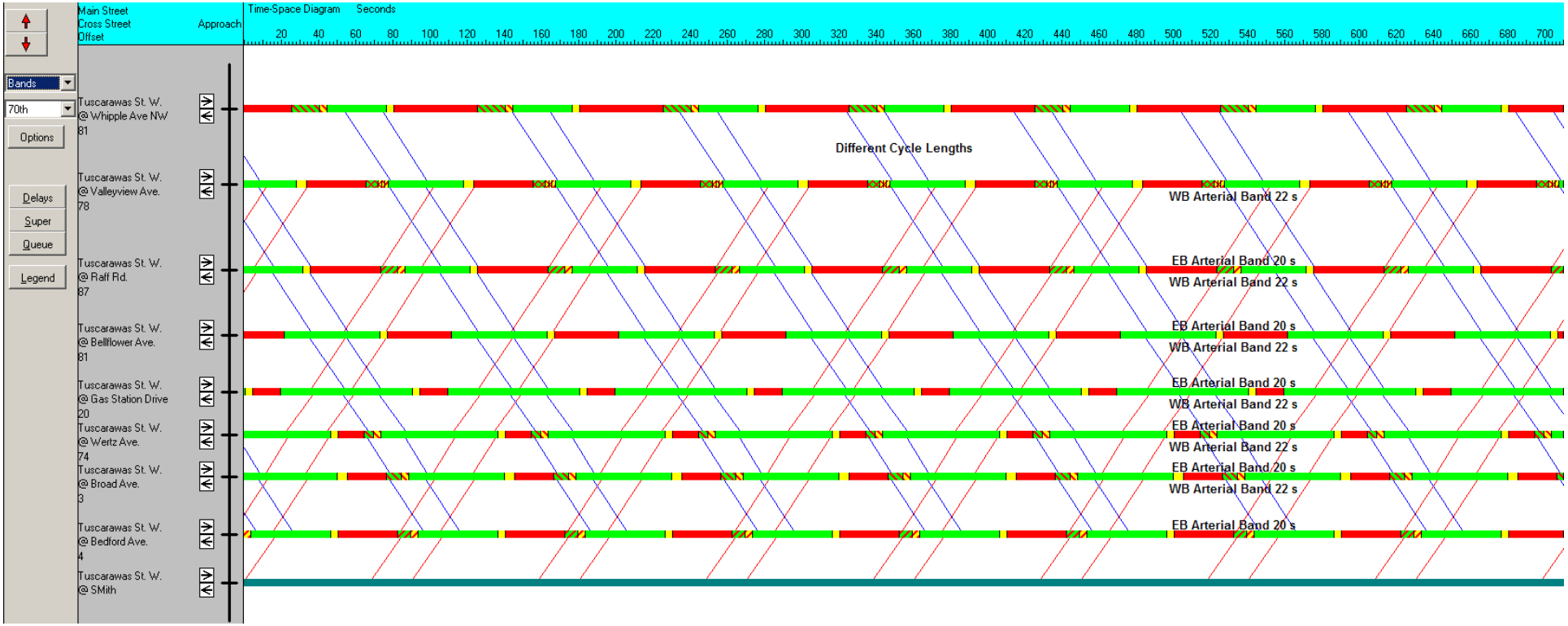
V/C Ratios (Existing 2011) from
Synchro Model

An average of the signalized intersection overall V/C ratios was calculated, which resulted in a corridor average V/C of 0.60

Existing Time-Space Diagram of
Existing (2011) Traffic Progression



Potential Time-Space Progression Improvements
Based on Current Peak Hour Traffic



APPENDIX C

Planning Level Cost Estimates

Cost Estimates, Scope,
and Anticipated Schedule
SR172 Corridor Dartmouth/Broad Realignment Alt (combined as one total project)

The Combined SR172 Full Project Cost Estimate below was Used for Safety Program Funding Application

City of Canton - SR172 (Tusc-West) Safety Improvements - PLANNING LEVEL COST ESTIMATE - 9-7-2011
Combined SR172 Corridor Project & Dartmouth/Broad Realignment Project

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
Project Component				
SR172 Corridor Construction Subtotal				$ 3,311,095
Broad & Dartmouth Realignment Construction Subtotal				$ 413,237
Maintenance of Traffic (% of construction cost)	0.04	LUMP (% of Constr.)	4%	$ 148,973
Construction TOTAL				$3,873,305
Prelim. Eng. Studies, Geotech, NEPA Documents (PDP-Steps 1-3)				$309,864
Environmental Screening				$110,000
Detailed Design				$464,797
ROW Easements & Temporary Work Agreements				$170,000
Prelim. Cost Estimate - TOTAL PROJECT COST:				**$4,927,966**

Costs Used for Safety Application	
$ 3,900,000.00	Construction
$ 310,000.00	PE, NEPA, Geotech.
$ 110,000.00	Env. Screening
$ 470,000.00	Detailed Design
$ 170,000.00	ROW Items
$ 4,960,000.00	**TOTAL**

Anticipated Schedule:	**Anticipated Start & Completion Dates**	**FY (ODOT)**
Project Startup/Prelim. Eng. Studies/Env.Screening/NEPA Docs	Jan 2012 - Apr 2012	**2012**
Detailed Design	May 2012 - Apr 2013	**2012/2013**
R/W & Utilities	Feb 2013 - Aug 2013	**2013/2014**
Construction	Oct 2013 - May 2014	**2014**

Note:
More detailed costs and information is provided on the separated preliminary project cost estimates on the following two pages. These separated costs would be applicable if the project were split into two independent projects. The costs above in the combined overall project represents cost savings on non-construction items such as Preliminary Engineering, NEPA, Environmental Screenings, etc.

Cost Estimates, Scope,
and Anticipated Schedule
SR172 Corridor Improvements

City of Canton - SR172 (Tusc-West) Corridor Safety Improvements - PLANNING LEVEL COST ESTIMATE - 9-7-2011					
ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	
Individual Cost Items					
Underdrains (Whipple to Raff)	5400	LF	12	$	64,800
Storm Water Catch Basins (Whipple to Raff)	30	EACH	1500	$	45,000
Combination Curb and Gutter, Type 2 (Whipple to Raff - Total Both Sides)	5400	LF	25	$	135,000
Signs (Urban Area)	1.4	Per Mile	165000	$	231,000
Overhead Lane Use Sign Structure	8	EACH	12000	$	96,000
Pavement Markings (edge line)	1.4	Per Mile	3000	$	4,200
Pavement Markings (lane line)	1.4	Per Mile	2000	$	2,800
Pavement Markings (center line)	1.4	Per Mile	4000	$	5,600
Crosswalk Pavement Markings	1750	LF	6	$	10,500
Signal Removal	7	EACH	10000	$	70,000
Traffic Signal Full Upgrade (decorative poles assumed)	7	EACH	210000	$	1,470,000
Walk Removed	2240	SF	2	$	4,480
New Sidewalk (8' Wide)	22640	SF	4	$	90,560
Concrete Traffic Islands	44	SY	40	$	1,760
Curb Ramps	45	EACH	500	$	22,500
Concrete Median (6' Wide)	2700	SY	35	$	94,500
Solar Powered LED School Flashers	2	EACH	4000	$	8,000
Pavement removal (full depth)	1840	SY	8	$	14,720
Construction Contingency Factor	% of Construction Costs		25%	$	592,855
ODOT Infl. Factor (Midpoint Constr. Jan 2014)	% Added to Costs		11.7%	$	346,820
Construction Subtotal				$	3,311,095
Maintenance of Traffic (% of construction cost)	0.05	LUMP (% of Constr.)	5%	$	165,555
Construction TOTAL					$3,476,650
Prelim. Eng. Studies, Geotech, NEPA Documents (PDP-Steps 1-3)					$278,132
Environmental Screening					$90,000
Detailed Design					$417,198
ROW Easements & Temporary Work Agreements					$50,000
Prelim. Cost Estimate - TOTAL PROJECT COST:					**$4,311,980**

Used for Safety Application	
$ 3,500,000.00	Construction
$ 280,000.00	PE, NEPA, Geotech.
$ 90,000.00	Env. Screening
$ 420,000.00	Detailed Design
$ 50,000.00	ROW Items
$ 4,340,000.00	**TOTAL**

Anticipated Schedule:	**Anticipated Start & Completion Dates**	**FY (ODOT)**
Project Startup/Prelim. Eng. Studies/Env.Screening/NEPA Docs	Jan 2012 - Apr 2012	**2012**
Detailed Design	May 2012 - Apr 2013	**2012/2013**
R/W & Utilities	Feb 2013 - Aug 2013	**2013/2014**
Construction	Oct 2013 - May 2014	**2014**

Cost Estimates, Scope,
and Anticipated Schedule
Dartmouth/Broad Realignment Alternative (estimated as separate project)

City of Canton - Broad Avenue & Dartmouth Avenue Re-Alignment - PLANNING LEVEL COST ESTIMATE - 9-7-2011				
ITEM	QUANTITY	UNIT	UNIT COST	TOTAL
Individual Cost Items				
Excavation	10000	CY	10	$ 100,000.00
Underdrains	830	LF	12	$ 9,960.00
Storm Water Catch Basins	8	EACH	1500	$ 12,000.00
Combination Curb and Gutter, Type 2 (total reflects both sides)	830	LF	25	$ 20,750.00
Overhead Lane Use Sign Structure (NB Approach on Dartmouth)	1	EACH	12000	$ 12,000.00
Signs (Urban Area)	0.08	Per Mile	165000	$ 13,200.00
Pavement Markings (edge line)	0.08	Per Mile	3000	$ 240.00
Pavement Markings (lane line)	0.08	Per Mile	2000	$ 160.00
Pavement Markings (center line)	0.08	Per Mile	4000	$ 320.00
Crosswalk Pavement Markings	62	LF	6	$ 372.00
New Pavement 2-Lane Roadway (Urban)	0.2	Per Lane Mile	315000	$ 63,000.00
Walk Removed	3700	SF	2	$ 7,400.00
New Sidewalk (8' Wide)	6640	SF	4	$ 26,560.00
Commercial Bldg Demolition (Large Bldg.)	1	EACH	30000	$ 30,000.00
Construction Contingency Factor	% of Construction Costs		25%	$ 73,990.50
ODOT Infl. Factor (Midpoint Constr. Jan 2014)	% Added to Costs		11.7%	$ 43,284.44
Construction Subtotal				$413,237
Maintenance of Traffic (% of construction cost)	0.03	LUMP (% of Constr.)	3%	$ 12,397
Construction TOTAL				$425,634
Prelim. Eng. Studies, Geotech, NEPA Documents (PDP-Steps 1-3)				$34,051
Environmental Screening				$20,000
Detailed Design				$51,076
ROW Easements & Temporary Work Agreements[1]				$120,000
Prelim. Cost Estimate - TOTAL PROJECT COST:				**$650,761**

Used for Safety Application	
$ 426,000.00	Construction
$ 35,000.00	NEPA & PDP 1-3
$ 20,000.00	Env. Screening
$ 52,000.00	Detailed Design
$ 120,000.00	ROW Items
$ 653,000.00	**TOTAL**

Anticipated Schedule:	**Anticipated Start & Completion Dates**	**FY (ODOT)**
Project Startup/Prelim. Eng. Studies/Env.Screening/NEPA Docs	Jan 2012 - Apr 2012	**2012**
Detailed Design	May 2012 - Apr 2013	**2012/2013**
R/W & Utilities	Feb 2013 - Aug 2013	**2013/2014**
Construction	Oct 2013 - May 2014	**2014**

[1] The ROW cost may potentially be donated by the property owner per past verbal correspondence between the City and Hospital.
Current Dartmouth could be possibly vacated and ownership transferred depending on deed.

SECTION 4

ECONOMIC ANALYSES

7.0 RATE OF RETURN

The rate of return represents the benefits expected to be obtained by an improvement and is a measure of expected "yield" or effective return of the safety countermeasures. The rate of return economic analyses for the *SR172 (Tuscarawas Street West) Safety Study* was separated into two separate evaluations since the project includes a potential major re-alignment of two offset intersections involving Broad Avenue and Dartmouth Avenue. This re-alignment was evaluated separately since it would require input from key stakeholders such as Aultman Hospital as it would require significant Right-of-Way (ROW) to accomplish and vacating/removal of the old alignment of Dartmouth Avenue. This project should ideally be considered as part of the safety countermeasures being recommended for the corridor, however it could be separated out if it appears in the more detailed preliminary engineering/design phase of the project that such a re-alignment is not feasible or if it would require a longer timeframe given the amounts of ROW needed to accomplish the project. The *Table 7.1* below summarizes these two recommended long term improvements. The results of the rate of return analyses are shown on two worksheets as presented in *Figure 7.1*.

Table 7.1 Rate of Return Economic Analyses of Recommended Improvements

Improvement Scenario	Rate of Return Results	Comments
Recommended Long Term Improvements	+37.67%	Reflects all applicable crashes on SR172 Corridor.
Re-Alignment of Broad Avenue / Dartmouth Avenue Intersections	+25.14%	Reflects only those crashes associated with the intersections of Broad and Dartmouth and the small section between these two offset intersections, which are intersection related crashes given the short distance between the two intersections.

The rate of return results as displayed in the table above represent the economic benefit of the proposed improvements and the return on investment associated with the costs of those improvements and the likelihood the proposed improvements would have on reducing the types of crashes occurring. Such reductions in crash types would thereby reduce the financial costs associated with the severity & types of crashes. The higher the percent of the rate of return indicates the proposed improvements more effectively address the types of crashes occurring.

The results of the rate of return analyses as shown above reflect the benefits of the proposed improvements for the SR172 corridor and their likelihood of reducing crashes. Given these results, both the Recommended Long Term Improvements and the Re-Alignment Improvement will be submitted to the ODOT Safety Program for a funding request as one project initially to be studied for further detail during the Preliminary Engineering and Design Phases. During these phases, it will be determined if the projects should be separated based on criteria such as costs; time frames associated with ROW acquisitions; local funding commitments, safety program funding availability, and SCATS funding availability. Whether or not the projects are combined or separated, the ROR Analyses supports either scenario as they both provide positive benefits on the investments.

The City of Canton intends to also apply to SCATS (local MPO) for potential funding for improving the corridor. Possible additional funding sources from SCATS include CMAQ funds, Transportation Enhancement funds and TIP funds.

Figure 7.1 Rate of Return Analyses Recommended Long Term Improvements

RATE OF RETURN - ECONOMIC ANALYSIS WORKSHEET

Cells in Yellow Require User Input

Ohio Department of Transportation
Office of Systems Planning and Program Management

County	STA	Main Roadway	0172	Begin SLM	11.79	End SLM 13.41
		Intersecting Roadway	Corridor from Whipple Ave. to Smith Ave.			
Prepared by	D4	Date	9/8/2011	Crash BDate	20080101	Crash EDate 20101231

Year	TIME OF DAY						ROADWAY CONDITION						CRASH TYPE																			
	DAY		DAWN/DUSK		DARK		DRY		WET		SNOW / ICE		REAR END		LEFT		RIGHT		ANGLE		HEAD ON		SS PASS		FIXED OBJ		RAN OFF RD		PEDESTRIAN		OTHER		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	72	20	8	0	22	8	77	17	20	8	6	3	53	6	9	6	0	0	25	8	1	0	9	1	2	1	0	0	0	2	4	4	103	28
2009	67	30	6	1	12	8	60	30	20	9	5	1	41	15	4	6	0	0	16	9	1	0	12	3	1	3	0	0	0	1	10	3	85	40
2010	69	21	4	2	21	9	65	24	14	5	16	3	36	16	5	2	0	0	25	9	0	0	16	1	5	0	0	0	0	4	8	0	95	32
TOTAL	139	50	14	1	34	16	137	47	40	17	11	4	94	21	13	12	0	0	41	17	2	0	21	4	3	4	0	0	0	3	14	7	188	68
AVG.	46.3	16.7	4.7	0.3	11.3	5.3	45.7	15.7	13.3	5.7	3.7	1.3	31.3	7.0	4.3	4.0	0.0	0.0	13.7	5.7	0.7	0.0	7.0	1.3	1.0	1.3	0.0	0.0	0.0	1.0	4.7	2.3	62.7	22.7

--The "TOTAL" and "AVERAGE" row formulas are set to only use 2007-2009 crash data. If the crash data is not for these three years, the formulas must be modified by the user to calculate the associated year data.

RECOMMENDED IMPROVEMENTS		CRASH TYPE	PDO CRASHES							INJ. - FAT. CRASHES						
	Select Countermeasures		R1	R2	R3	R4	RT	AVG PDO	EST. RED.	R1	R2	R3	R4	RT	AVG INJ-FAT	EST. RED.
R1	25 Revise signal timing	LEFT	0.1	0.4	0.27		0.606	4.33	2.63	0.1	0.4	0.27		0.606	4.00	2.42
R2	12 Prohibit turn	RIGHT	0.1	0.4	0.27		0.606	0.00	0.00	0.1	0.4	0.27		0.606	0.00	0.00
R3	23 Reconstruct existing signal - major	ANGLE	0.1	0.4	0.27		0.606	13.67	8.28	0.1	0.4	0.27		0.606	5.67	3.43
R4	26 Add pedestrian heads	REAR END	0.1	0.4	0.27		0.606	31.33	18.98	0.1	0.4	0.27		0.606	7.00	4.24
		HEAD ON	0.1	0.4	0.27		0.606	0.67	0.40	0.1	0.4	0.27		0.606	0.00	0.00
		SS PASS	0.1	0.4	0.27		0.606	7.00	4.24	0.1	0.4	0.27		0.606	1.33	0.81
		FIXED OBJ	0.1	0.4	0.27		0.606	1.00	0.61	0.1	0.4	0.27		0.606	1.33	0.81
		RAN OFF RD	0.1	0.4	0.27		0.606	0.00	0.00	0.1	0.4	0.27		0.606	0.00	0.00
		OTHER	0.1	0.4	0.27		0.606	4.67	2.83	0.1	0.4	0.27		0.606	2.33	1.41
		NIGHT					0	11.33	0.00					0	5.33	0.00
		WET					0	13.33	0.00					0	5.67	0.00
		PEDESTRIAN				0.5	0.5	0.00	0.00				0.5	0.5	1.00	0.50
								ESTIMATED PDO CRASH REDUCTION =	37.96					ESTIMATED INJ. - FAT. CRASH REDUCTION =		13.63

ADT Factor

Project Service Life	20 years						
Present ADT (PADT)	25330 veh / day	Average ADT =	(PADT + FADT)/2 =	(25330	+ 27860	) =	26595
Future ADT (FADT)	27860 veh / day	ADT Factor =	Average ADT / PADT =	26595	/ 25330	=	1.05

Average Annual Benefits

Select Facility Type Below: Cities and Incorporated Villages

Annual PDO Benefits = Estimated PDO Crash Reduction * Avg PDO Cost	=	37.96	*	$ 9,253.52	=	$ 351,295.81
Annual INJ.-FAT. Benefits = Estimated INJ.-FAT. Crash Reduction * Avg INJ.-FAT. Cost	=	13.63	*	$ 78,992.88	=	$ 1,076,330.68
Total Benefits					=	$ 1,427,626.49
AverageAnnual Benefits = Total Benefits * ADT Factor	=	1.05	*	$ 1,427,626.49	=	**$ 1,498,923.27**

Rate of Return

Total Safety Project Cost (Design, Right-of-Way, and Construction)	$3,970,000	Design (PE)	$420,000	Rate of Return	37.67%
Annual Maintenance and Energy Costs	$1,000	Right-of-Way	$50,000		
Salvage Value	$1,000	Construction	$3,500,000		

See Text Box Below for Additional Details on Project Costs for ODOT Safety Projects

Figure 7.2 Rate of Return Analyses Re-Alignment of Broad Ave./Dartmouth Ave. Intersections

RATE OF RETURN - ECONOMIC ANALYSIS WORKSHEET

Cells in Yellow Require User Input

Ohio Department of Transportation
Office of Systems Planning and Program Management

County	STA	Main Roadway	0172	Begin SLM	12.97	End SLM 13.08
		Intersecting Roadway	Broad Ave. & Dartmouth Ave. Realignment			
Prepared by	D4	Date	9/8/2011	Crash BDate	20080101	Crash EDate 20101231

Year	TIME OF DAY						ROADWAY CONDITION						CRASH TYPE																			
	DAY		DAWN/DUSK		DARK		DRY		WET		SNOW / ICE		REAR END		LEFT		RIGHT		ANGLE		HEAD ON		SS PASS		FIXED OBJ		RAN OFF RD		PEDESTRIAN		OTHER		TOTAL	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	10	5	1	0	2	1	7	3	5	2	1	1	6	2	2	2	0	0	4	1	0	0	0	0	1	0	0	0	0	1	0	0	13	6
2009	11	1	1	0	0	1	8	2	4	0	0	0	5	1	1	0	0	0	2	1	0	0	2	0	1	0	0	0	0	0	1	0	12	2
2010	6	2	1	0	5	0	6	1	3	0	3	1	2	2	1	0	0	0	7	0	0	0	2	0	0	0	0	0	0	0	0	0	12	2
TOTAL	21	6	2	0	2	2	15	5	9	2	1	1	11	3	3	2	0	0	6	2	0	0	2	0	2	0	0	0	0	1	1	0	25	8
AVG.	7.0	2.0	0.7	0.0	0.7	0.7	5.0	1.7	3.0	0.7	0.3	0.3	3.7	1.0	1.0	0.7	0.0	0.0	2.0	0.7	0.0	0.0	0.7	0.0	0.7	0.0	0.0	0.0	0.0	0.3	0.3	0.0	8.3	2.7

--The "TOTAL" and "AVERAGE" row formulas are set to only use 2007-2009 crash data. If the crash data is not for these three years, the formulas must be modified by the user to calculate the associated year data.

RECOMMENDED IMPROVEMENTS

Select Countermeasures

R1	25 Revise signal timing
R2	51 Relocate intersection
R3	23 Reconstruct existing signal - major
R4	26 Add pedestrian heads

CRASH TYPE	PDO CRASHES R1	R2	R3	R4	RT	AVG PDO	EST. RED.	INJ. - FAT. CRASHES R1	R2	R3	R4	RT	AVG INJ-FAT	EST. RED.
LEFT	0.1	0.25	0.27		0.507	1.00	0.51	0.1	0.25	0.27		0.507	0.67	0.34
RIGHT	0.1	0.25	0.27		0.507	0.00	0.00	0.1	0.25	0.27		0.507	0.00	0.00
ANGLE	0.1	0.25	0.27		0.507	2.00	1.01	0.1	0.25	0.27		0.507	0.67	0.34
REAR END	0.1	0.25	0.27		0.507	3.67	1.86	0.1	0.25	0.27		0.507	1.00	0.51
HEAD ON	0.1	0.25	0.27		0.507	0.00	0.00	0.1	0.25	0.27		0.507	0.00	0.00
SS PASS	0.1	0.25	0.27		0.507	0.67	0.34	0.1	0.25	0.27		0.507	0.00	0.00
FIXED OBJ	0.1	0.25	0.27		0.507	0.67	0.34	0.1	0.25	0.27		0.507	0.00	0.00
RAN OFF RD	0.1	0.25	0.27		0.507	0.00	0.00	0.1	0.25	0.27		0.507	0.00	0.00
OTHER	0.1	0.25	0.27		0.507	0.33	0.17	0.1	0.25	0.27		0.507	0.00	0.00
NIGHT					0	0.67	0.00					0	0.67	0.00
WET					0	3.00	0.00					0	0.67	0.00
PEDESTRIAN				0.5	0.5	0.00	0.00				0.5	0.5	0.33	0.17
ESTIMATED PDO CRASH REDUCTION =							4.23	ESTIMATED INJ. - FAT. CRASH REDUCTION =						1.35

ADT Factor

Project Service Life	20 years	Average ADT =	(PADT + FADT)/2 =	(25330	+ 27860	) = 26595
Present ADT (PADT)	25330 veh / day	ADT Factor =	Average ADT / PADT =	26595	/ 25330	= 1.05
Future ADT (FADT)	27860 veh / day					

Average Annual Benefits

Select Facility Type Below: Cities and Incorporated Villages

Annual PDO Benefits = Estimated PDO Crash Reduction * Avg PDO Cost	=	4.23	*	$ 9,253.52	=	$ 39,115.41
Annual INJ.-FAT. Benefits = Estimated INJ.-FAT. Crash Reduction * Avg INJ.-FAT. Cost	=	1.35	*	$ 78,992.88	=	$ 106,660.14
Total Benefits					=	$ 145,775.55
AverageAnnual Benefits = Total Benefits * ADT Factor	=	1.05	*	$ 145,775.55	=	**$ 153,055.70**

Rate of Return

Total Safety Project Cost (Design, Right-of-Way, and Construction)	$598,000	Design (PE)	$52,000
Annual Maintenance and Energy Costs	$1,000	Right-of-Way	$120,000
Salvage Value	$1,000	Construction	$426,000

See Text Box Below for Additional Details on Project Costs for ODOT Safety Projects

Rate of Return 25.14%

SECTION 5

SUPPLEMENTAL DATA

Location	Location Type	Facility Type	Begin Log	End Log	Length	Fatal Crashes	Injury Crashes	PDO Crashes	Total Crashes	Fatalities	Incapacitating Injuries	# of Years	ADT (Or Intersection Entering Volume)	Truck ADT	V/C
STA-0172R	Section	Urban Non-Freeway	11.79	13.41	1.62	0	100	283	383	0	10	3	25,330	1,520	0.6

Year	2009
HSP Rank	
Hot Spot Rank	
Congestion Rank	

Rate of Return: 37.67%

High Risk Rural Road Calculation: 22.26

(Fatalities & Incapacitating Injuries per 100 MVMT or Entering Vehicles)

Functional Class : Urban Principal Arterial

(Must be Rural Major Collector, Minor Collector, or Rural Local Road for HRRR Funding)

Safety Project Scoring

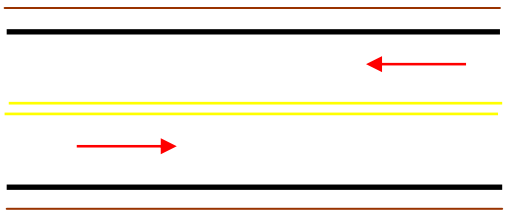
Crash Frequency (10)		Crash Density (10)		Crash Rate (10)		RSI (15)		EPDO Rate (5)		% Trucks (5)		Rate of Return (5)		V/C Ratio (5)	
Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
		236.4	10	8.52	10	27,440	7	22.57	3	6.00%	1	37.67%	5	0.60	1

Total Score =	37

Click to Clear Data

Section Crash Rate Analysis Tool

County:	STA
Route:	TR1999
BLog:	11.79
ELog:	13.41
Crash Year Data:	2008-2010



Average Daily Traffic (ADT)

Enter Number of Crashes on Section:	383
Enter Number of Years for Crash Data:	3
Enter Average Daily Traffic on Section (ADT):	25,330
Enter Length of Section in Miles	1.62
Number of Days in Year:	365

Crash Rate per Million Vehicle Miles Traveled (MVMT): **8.52**

Select Location Type: Urban Non-Freeway

Show RSI Formula

RSI Value = 27,440

2009 Relative Severity Index

User Override	Auto Fill	Crash Type Severity Calc	Crash Type #	Crash Type	Rural Non-Freeway	Urban Non-Freeway	Freeway
	0	$0	0	Not stated	$22,633	$28,107	$16,378
	2	$94,785	1	Head on	$152,458	$47,392	$146,089
	167	$4,217,959	2	Rear end	$23,343	$25,257	$28,600
	15	$344,923	3	Backing	$26,005	$22,995	$22,926
	2	$70,746	4	Sideswipe - meeting	$60,806	$35,373	$84,066
	42	$1,043,784	5	Sideswipe - passing	$29,542	$24,852	$30,884
	92	$2,617,699	6	Angle	$41,755	$28,453	$37,050
	6	$127,935	7	Parked Vehicle	$22,390	$21,323	$32,323
	7	$447,094	8	Pedestrian	$132,045	$63,871	$241,488
	0	$0	9	Animal	$16,988	$15,554	$16,025
	0	$0	10	Train	$77,049	$25,068	$0
	1	$44,535	11	Pedalcycles	$65,914	$44,535	$29,590
	0	$0	12	Other non-vehicle	$47,344	$0	$35,934
	12	$315,679	13	Fixed object	$30,903	$26,307	$24,020
	0	$0	14	Other object	$20,525	$22,881	$15,691
	0	$0	15	Falling from or in vehicle	$0	$0	$0
	0	$0	16	Overturning	$61,830	$54,819	$49,769
	5	$128,409	17	Other non-collision	$20,150	$25,682	$20,854
	32	$1,056,150	18	Left Turn	$43,898	$33,005	$40,629
0	383	$10,509,697					

Select Appropriate "Location Type" and Modify the "User Override" Cells in Yellow if Necessary

Below is a summary of the count data sources used to calculate an average ADT for the SR172 corridor. More detailed count data is available in *Appendix A* of the Safety Study (see Section 3 of this funding application package).

SR172 (Tuscarawas St. West)
Calculation of Corridor Average ADT for Safety Study

Roadway	From	To	ADT	Data Year	Source
SR172 (Tuscarawas St. West)	Whipple Ave.	SR297 (Raff Ave.)	20,020	2009	ODOT - Traffic Survey Report (2009)
SR172 (Tuscarawas St. West)	SR297 (Raff Ave.)	Interstate 77	16,980	2009	ODOT - Traffic Survey Report (2009)
SR172 (Tuscarawas St. West)	Bellflower Ave.	Maryland Ave.	26,800	2011	City of Canton Loop System Count (May 2011)
SR172 (Tuscarawas St. West)	Bedford Ave.	Smith Ave.	27,200	2011	City of Canton Loop System Count (May 2011)
SR172 (Tuscarawas St. West)	Whipple Ave.	SR297 (Raff Ave.)	21,230	2009	SCATS - Online Traffic Counts (2009)
SR172 (Tuscarawas St. West)	SR297 (Raff Ave.)	Harrison Ave.	18,010	2009	SCATS - Online Traffic Counts (2009)
SR172 (Tuscarawas St. West)	Whipple Ave.	SR297 (Raff Ave.)	23,570	2003	ODOT - Traffic Survey Report (2009)
SR172 (Tuscarawas St. West)	SR297 (Raff Ave.)	Interstate 77	28,750	2003	ODOT - Traffic Survey Report (2009)
SR172 (Tuscarawas St. West)	Whipple Ave.	Canton Centre Dr.	22,500	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Canton Center Dr.	Valleyview Ave.	23,610	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Valleyview Ave.	Poplar Ave.	24,080	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Harter Ave.	SR297 (Raff Ave.)	25,450	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	SR297 (Raff Ave.)	Montrose Ave.	24,070	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Linwood Ave.	Bellflower Ave.	25,260	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Bellflower Ave.	Roslyn Ave.	24,640	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Claremont Ave.	Maryland Ave.	24,520	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Maryland Ave.	Fawcett Ct.	29,090	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Ingram Ave.	Wertz Ave.	28,030	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Wertz Ave.	Exeter Ave.	26,730	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Exeter Ave.	Broad Ave.	27,950	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Broad Ave.	Dartmouth Ave.	27,040	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Broad Ave.	Dartmouth Ave.	26,580	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Dartmouth Ave.	Clarendon Ave.	28,560	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Columbus Ave.	Bedford Ave. SW	28,900	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Bedford Ave. SW	Bedford Ave. NW	28,250	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Raymont Ct.	Smith Ave.	28,140	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	Smith Ave.	Harrison Ave.	27,990	2011	Peak Hr Turn Count projected to ADT using 0.077 k-factor
SR172 (Tuscarawas St. West)	**Whipple Ave.**	**Smith Ave.**	**25,331**	**Average of All ADT's**	**Average of all available ADT Data and Sources**

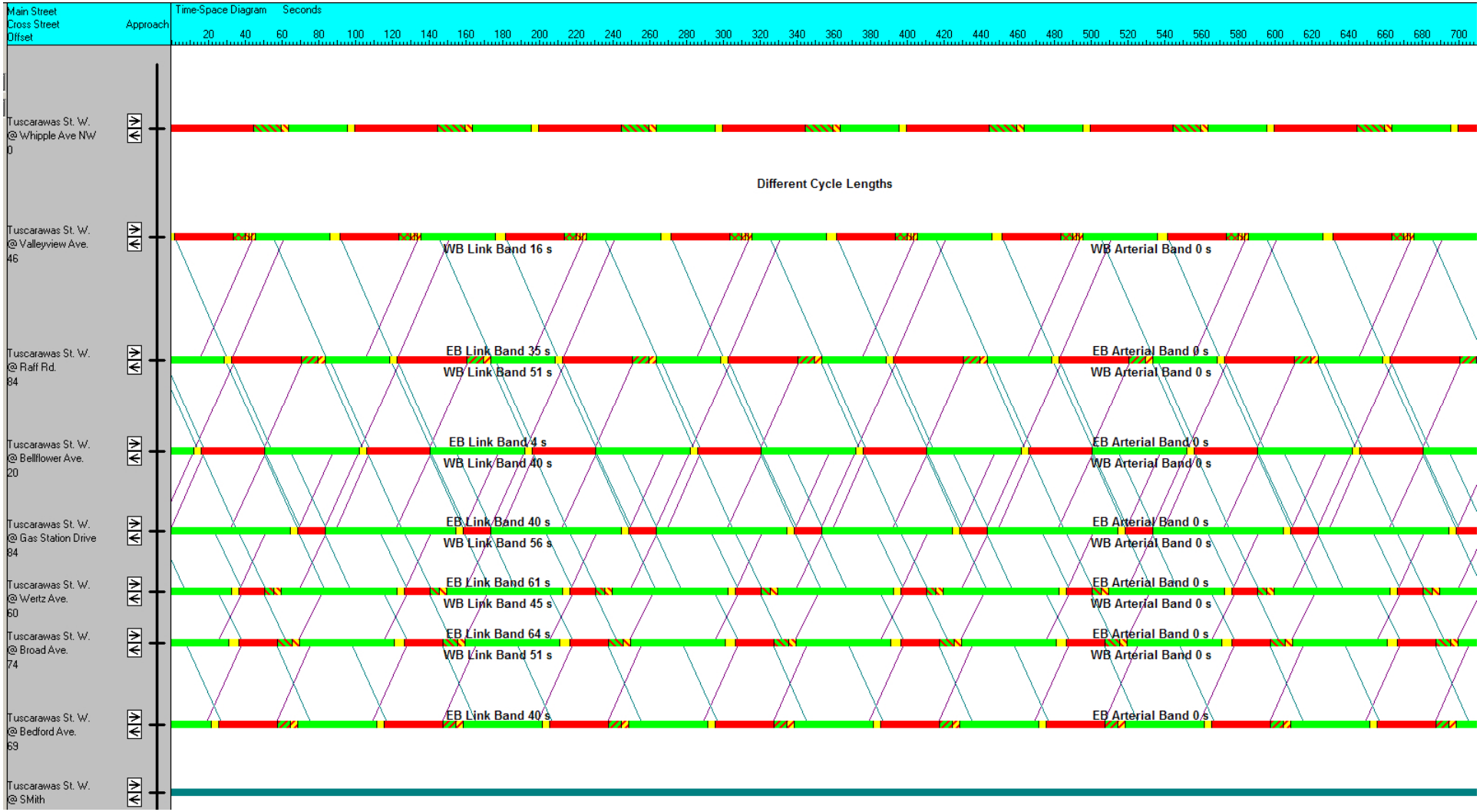
Current ADT Used forSafety Study Analyses:	**25,330**
Future ADT Used forSafety Study Analyses: (0.5% Growth Rate over 20 yrs.)	**27,860**

Peak Hour Traffic Volumes (Existing 2011)
Used for Synchro Model

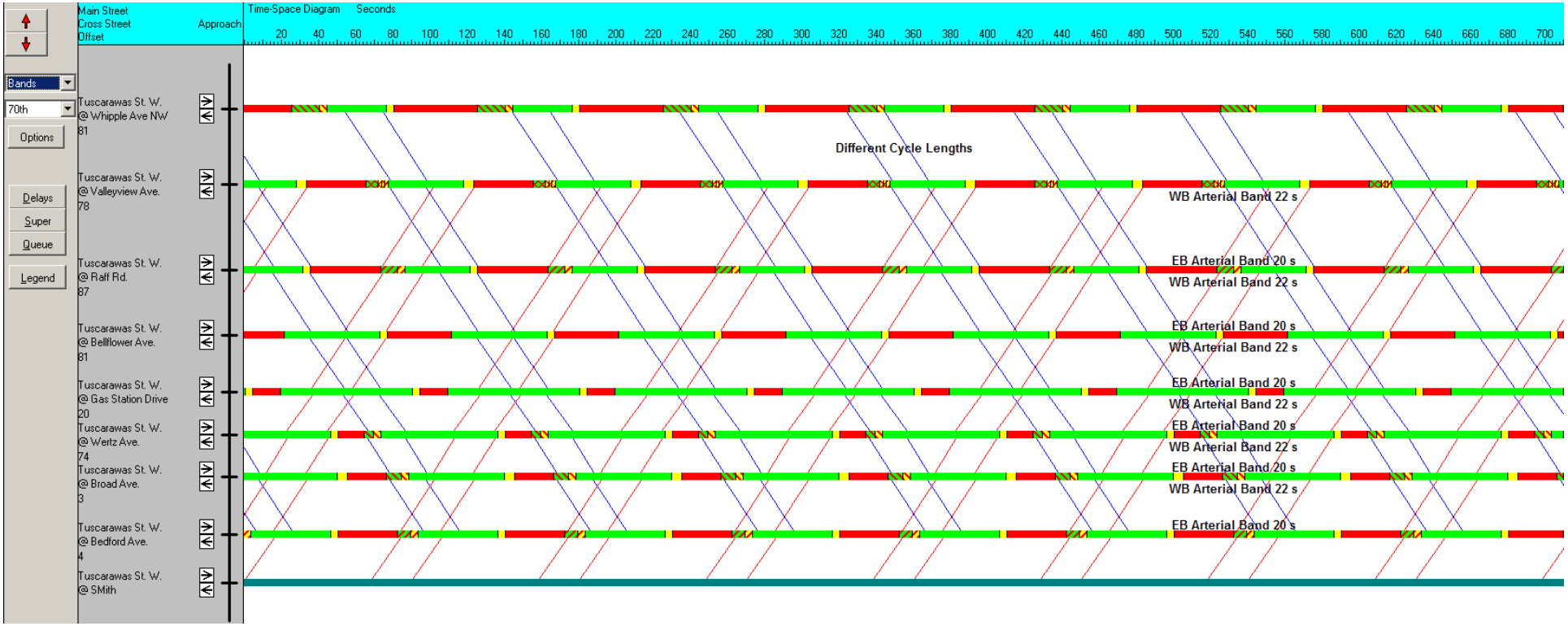
V/C Ratios (Existing 2011) from
Synchro Model

An average of the signalized intersection overall V/C ratios was calculated, which resulted in a corridor average V/C of 0.60

Existing Time-Space Diagram of
Existing (2011) Traffic Progression



Potential Time-Space Progression Improvements
Based on Current Peak Hour Traffic



Stark County Area Transportation Study (SCATS)
2009 High Crash Intersections Listing

Street		Intersecting Street	Crashes by year			3 Year Totals			Avg Daily Traffic	Severity Index	Crash Rate per Million Vehicles	SCATS Hazard Rating	Jurisdiction
			2007	2008	2009	Crashes	Injury	Fatal					
12th St N		Market Ave N	24	18	19	61	28	0	25,615	1.92	2.17	56.51	Canton
US 62		Harmont Ave/Lesh St	22	18	24	64	19	1	31,905	1.77	1.83	45.97	Canton
Central Plaza	#3	Tuscarawas St	17	18	15	50	16	0	23,650	1.64	1.93	35.16	Canton
13/12th St		I-77 Ramps TM Hospital	21	12	13	46	14	0	20,200	1.61	2.08	34.18	Canton
Cleveland Ave		Wright St	3	15	9	27	16	0	10,000	2.19	2.46	32.31	County
30th St NE		Harrisburg Ave	11	8	9	28	9	1	11,345	2.04	2.25	28.53	County
Dueber Ave SW		Navarre Rd	9	9	4	22	12	0	9,400	2.09	2.14	21.83	Canton
Everhard Rd		Whipple Ave	22	17	16	55	17	0	46,500	1.62	1.08	21.35	County
Harrison Ave	#9	Tuscarawas St W	21	12	10	43	10	0	26,430	1.47	1.48	20.79	Canton
I-77		Belden Village & Whipple	13	15	18	46	18	0	40,850	1.78	1.03	18.73	ODOT
SR619		McCallum Ave	8	3	2	13	8	0	4,210	2.23	2.82	18.16	ODOT
Harmont Ave NE		Mahoning Ave	12	9	10	31	11	0	19,105	1.71	1.48	17.44	Canton
US 62		Regent Ave	10	12	14	36	7	1	30,200	1.69	1.09	14.75	ODOT
Clarendon Ave		Navarre Rd	5	5	5	15	7	0	6,000	1.93	2.28	14.70	Canton
13th St NW		Harrison Ave	20	7	6	33	10	0	24,530	1.61	1.23	14.46	Canton
US 30 EB Ramps		Raff Ave	5	11	4	20	8	0	10,550	1.80	1.73	13.84	ODOT
SR687		Everhard Rd	10	18	16	44	11	0	42,740	1.50	0.94	13.78	ODOT
30th St N		Market Ave N SR 43	11	11	9	31	15	0	28,730	1.97	0.98	13.35	Canton
Raff Ave SR791	#19	Tuscarawas St W	8	12	13	33	9	0	26,335	1.55	1.14	12.96	Canton
Dressler Rd		Everhard Rd	11	19	12	42	11	0	42,700	1.52	0.90	12.77	County
US 62		Middlebranch & Harrisburg	13	13	17	43	10	0	43,135	1.47	0.91	12.74	ODOT
Andrews St		Market Ave	3	7	3	13	8	0	6,200	2.23	1.91	12.33	Lake Twp
SR 21 Ramps NB		Erie St	8	6	6	20	5	0	9,900	1.50	1.84	12.29	Massillon
Erie St		Lincoln Way SR172	6	8	14	28	11	0	23,820	1.79	1.07	11.92	Massillon
Elgin Ave		I-77 NB Offramp& Tuscarawas	10	10	8	28	5	0	18,250	1.36	1.40	11.82	Canton
SR172	#26	Whipple Ave	16	12	12	40	6	0	36,030	1.30	1.01	11.71	ODOT

Source: Stark County Crash Report (2009) by SCATS

District 4
2009 Hot Spot Locations - Non-Freeway

District Boundary

A County Name

County Boundary

A City Name

City Boundary

Roads by Type

Interstates

US Routes

State Routes

2009 Non-Freeway Hot Spot Rank

1 to 25

26 to 50

51 to 75

76 to 100

101 to 125

126 to 150

ASHTABULA

TRUMBULL

MAHONING

PORTAGE

SUMMIT

STARK

City of Canton's
Proposed
SR172 Safety Project

0 3 6 9 12
Miles

N

OHIO DEPARTMENT OF TRANSPORTATION