CUY-90-14.90

PID 77332/85531

APPENDIX LD-09

Design Exceptions
(Contract Document)

State of Ohio
Department of Transportation
Jolene M. Molitoris, Director

Innerbelt Bridge
Construction Contract Group 1 (CCG1)

Revision Date: December 11, 2009

U.S. Department
of Transportation
Federal Highway Administration

Ohio Division

200 North High Street
Room 328
Columbus, Ohio 43215
614-280-6896
614-280-6876 Fax
Ohio.FHWA@fhwa.dot.gov

December 11, 2009

Director Jolene M. Molitoris
Ohio Department of Transportation
1980 West Broad Street
Columbus, OH 43223

In Reply, Refer To:
HEO-OH

Subject: Cleveland Innerbelt Project
CUY – 71/90 – 16.79/14.90, PID: 77510
Design Exceptions CCG1

Dear Director Molitoris:

The Federal Highway Administration (FWHA) has completed its review of the design exception submissions for the Cleveland Innerbelt Project, CUY – 71/90 – 16.79/14.90, PID: 77510 as electronically submitted by the Ohio Department of Transportation (ODOT) November 24, 2009. The design exception submissions provide for the management project design features that do not conform to the minimum controlling criteria, in accordance with 23 CFR 625. Proposed is the following:

1. Design Exception Shoulder Width

   Controlling Criteria: Shoulder Width (I-71 Median south of I-71/I-90 split)
   - Existing: 7' (6' where luminary and sign supports bump out the median barrier)
   - Standard: 12'
   - Proposed: 7' (6' where luminary and sign supports bump out the median barrier)

2. Design Exception Ontario Ramp Horizontal Alignment

   Controlling Criteria: Horizontal Alignment (Ontario Street On-Ramp to WB I-90)
   - Standard: 30 mph horizontal curve
   - Proposed: 20 mph horizontal curve

3. Design Exception E9th Ramp Horizontal and Vertical Alignment Shoulder Width

   Controlling Criteria: Horizontal Alignment (East 9th Street On-Ramp to WB-90
   - Standard: 30 mph horizontal curve
   - Proposed: 20 mph horizontal curve

Controlling Criteria: Vertical Alignment (Ontario Street on-Ramp to WB I-90)

- Standard: 30 mph vertical curve
- Proposed: 25 mph sag vertical curve

Based upon due consideration of all project conditions including, but not limited to, service and safety benefits, dollars to be invested, compatibility with adjacent sections of the roadway, expected useful life of investment, traffic demands, environmental factors, etc… FHWA agrees with ODOT that the project conditions warrant exception to the minimum controlling design criteria. The above listed exceptions/proposed designs are thus approved for implementation in association with the systematic advancement of the Cleveland Innerbelt Project, CUY – 71/90 – 16.79/14.90, PID: 77510, provided that: 1) Mitigation measures as outlined within the exception documentation are implemented, and; 2) The documented conditions which support each exception remain valid. ODOT shall consult with FHWA regarding any substantive changes to any of the documented exception warranting conditions.

Any questions regarding the FHWA approval of the above listed exceptions/proposed designs may be brought to the attention of Mr. Michael B. Armstrong, Civil Engineer (Highway), at (614) 280-6896 or by e-mail ohio.fhwa@dot.gov.

Sincerely,

Herman Rodrigo

For: Laura S. Leffler,
Division Administrator

Ecc:
Michael.Armstrong@dot.gov
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Dirk.Gross@dot.state.oh.us
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Project E-File:
CUY – 71/90 – 16.79/14.90, PID: 77510

E-Document File Name:
2009 12 11 Cleveland Innerbelt Design Exceptions CCG1 APP (MBA)

INFORMATION FOR EXCEPTION TO THE MINIMUM DESIGN STANDARDS

PROJECT: CLEVELAND INNERBELT PROJECT

P.I.D. 77510

I-90 FUNCTIONAL CLASSIFICATION: URBAN INTERSTATE

(SHOULDER WIDTH)

Introduction

The Cleveland Innerbelt is a high capacity, limited-access interstate highway extending from Cleveland's Tremont neighborhood on the West Side of the Cuyahoga River, across the Cuyahoga Valley, around the southern and eastern edges of downtown to the City's lakefront district at Burke Lakefront Airport. The Innerbelt includes portions of I-71 and I-90, and connects to I-77, I-490, SR 2, and SR 176.

The Innerbelt Freeway provides access to and mobility through the City of Cleveland. Downtown Cleveland depends on the Innerbelt Freeway's ability to collect and distribute traffic between the radial freeway system of I-90, I-490, I-71, SR 176, and I- 77 and the local street system. During the morning peak period, the Innerbelt Freeway functions to collect traffic from the system of radial freeways and distribute that traffic to the local street system. During the evening peak period, the Innerbelt Freeway functions to collect traffic from the local street system and distribute that traffic to the system of radial freeways. The Innerbelt Freeway also moves traffic between each of the radial freeways, thus allowing through traffic to bypass the local street system.

The Innerbelt is an important segment of the federally designated interstate highway system that crisscrosses the United States to provide efficient movement of industrial goods and to link major metropolitan centers. The Innerbelt is designated as Interstate 90 (I-90) and serves as the northern terminus for two others, Interstate 71 (I-71) and Interstate 77 (I-77).

The design of the Innerbelt Freeway predates the development of modern standards for the design of freeways. In particular, three types of design deficiencies — improper reduction in the basic number of lanes; inadequate ramp configuration and spacing; and inadequate curve radius — have the most direct and adverse impacts on the operational performance and safety of the Innerbelt Freeway.

The existing and future conditions for the Innebelt were examined, a purpose and need for the project was developed, alternatives were developed, analyzed and refined and a final NEPA screening of these alternatives resulted in a Preferred Alternative being selected for implementation. Based on the Implementation Plan developed for the project the estimated total construction cost for the overall project is $2.65 billion (year of expenditure dollars) and will be implemented between 2010 and 2027. For further information on this process, please refer to the following project documents:

- Cleveland Innerbelt Existing and Future Conditions Report (E&F)
- Cleveland Innerbelt Purpose and Need (P&N)
- Cleveland Innerbelt Conceptual Alternatives Study (CAS)
- Cleveland Innerbelt Interchange Justification Study (IJS)
- Cleveland Innerbelt Draft Environmental Impact Statement (DEIS)

- Cleveland Innerbelt Final Environmental Impact Statement (FEIS)
- Cleveland Innerbelt Record of Decision (ROD)

The first construction contract, Construction Contract Group 1 (CCG1), to implement the NEPA decisions outlined in the FEIS will consist of the roadway segment comprised of mainline WB I-90 from approximately East 9th Street on the north to the southern termini of the overall project at the I-71/I-90/I-490 system interchange for a mainline distance of approximately 1.4 miles. CCG1 includes a new WB Central Viaduct Bridge and the following ramp connections: East 9th Street on-ramp, Ontario Street on-ramp and Abbey Avenue off-ramp. CCG1 has an estimated construction cost of $476 million (2012$).

1.) EXISTING FACILITY:

I-90 across the Central Viaduct Bridge has a current (2008) ADT of 119,000 vehicles per day with 6% truck traffic and a legal speed of 50-mph. Existing WB I-90 on the Central Viaduct Bridge consists of 4 twelve foot lanes with median shoulders that vary from 1’6” to 3’6” and outside shoulders that vary from 1’0” to 3’3”.

South of the Central Viaduct Bridge, the outside lane (number 4 lane) drops to WB I-90, the two inside lanes (number 1 and 2 lanes) continue onto SB I-71 and the number 3 lane is a decision lane (see Existing Conditions – Shoulder Width Figure). After transitioning from the shoulders provided on the Central Viaduct Bridge, but before the off-ramp to WB I-90, the existing outside shoulder increases to 12’ and the median shoulder is 7’ wide. However, the median shoulder narrows to 6’ wide whenever luminary or sign supports cause the median barrier to bump out. After the diverge of the WB I-90 ramp, the right (outside) shoulder on this ramp is transitioned down to 10’ and the left (inside) shoulder is 4’. In addition, after the diverge of the WB I-90 ramp, the outside shoulder of I-71 is 9’ and the median shoulder continues as 7’ wide, narrowing to 6’ whenever luminary or sign supports cause the median barrier to bump out. The median shoulder is 7’ or less in width southbound on I-71 from the WB I-90 diverge to past Fulton Road (which represents the extent of available project mapping).

2.) PROPOSED FACILITY:

Proposed Design

I-90 across the new WB Central Viaduct Bridge has a projected (2035) ADT of 71,000 vehicles per day with 6% truck traffic and a legal speed of 55-mph. Proposed WB I-90 on the Central Viaduct Bridge consists of 5 twelve foot lanes with twelve foot median and outside shoulders. For the improvements shown, the roadway pavement and bridge decks will be either rehabilitated or replaced to improve the physical condition of this segment of the Innerbelt in accordance with the Purpose and Need established for this project. Further, the reconfiguration of the number of mainline freeway lanes and geometry of interchanges will address the operation, safety and access components of the P&N.

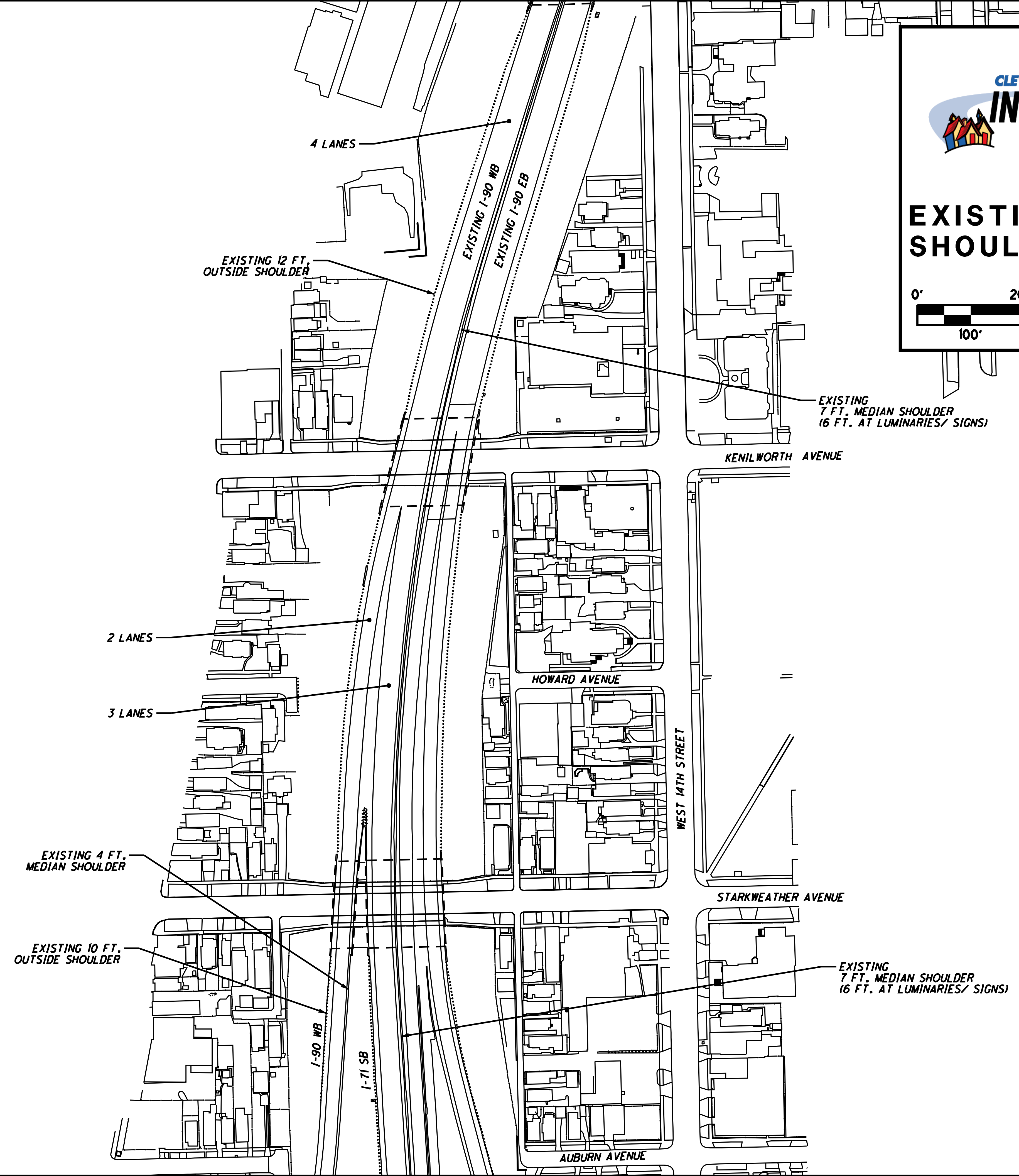
South of the new WB I-90 bridge, the two outside lanes (number 4 and 5 lanes) will drop to WB I-90 and the three inside lanes (number 1, 2 and 3 lanes) will continue onto SB I-71. The 12’ median and outside shoulders will be continued from the south end of the new bridge to approximately the location of the proposed gore for the exit ramp to WB I-90 (see Contract Group 1 – Shoulder Width Design Exception Figure). After the diverge of the WB I-90 ramp, the left (outside) shoulder of the ramp tapers down to the required 10’ and matches into the existing 10’ outside shoulder. Past the gore the right (inside) shoulder of the ramp is developed as 4’, which also matches into the existing inside shoulder. In addition, after the diverge of the WB I-90 ramp, the outside shoulder of I-71 is proposed as a

EXISTING CONDITIONS - SHOULDER WIDTH

0' 200'

100'

NOVEMBER 19, 2009



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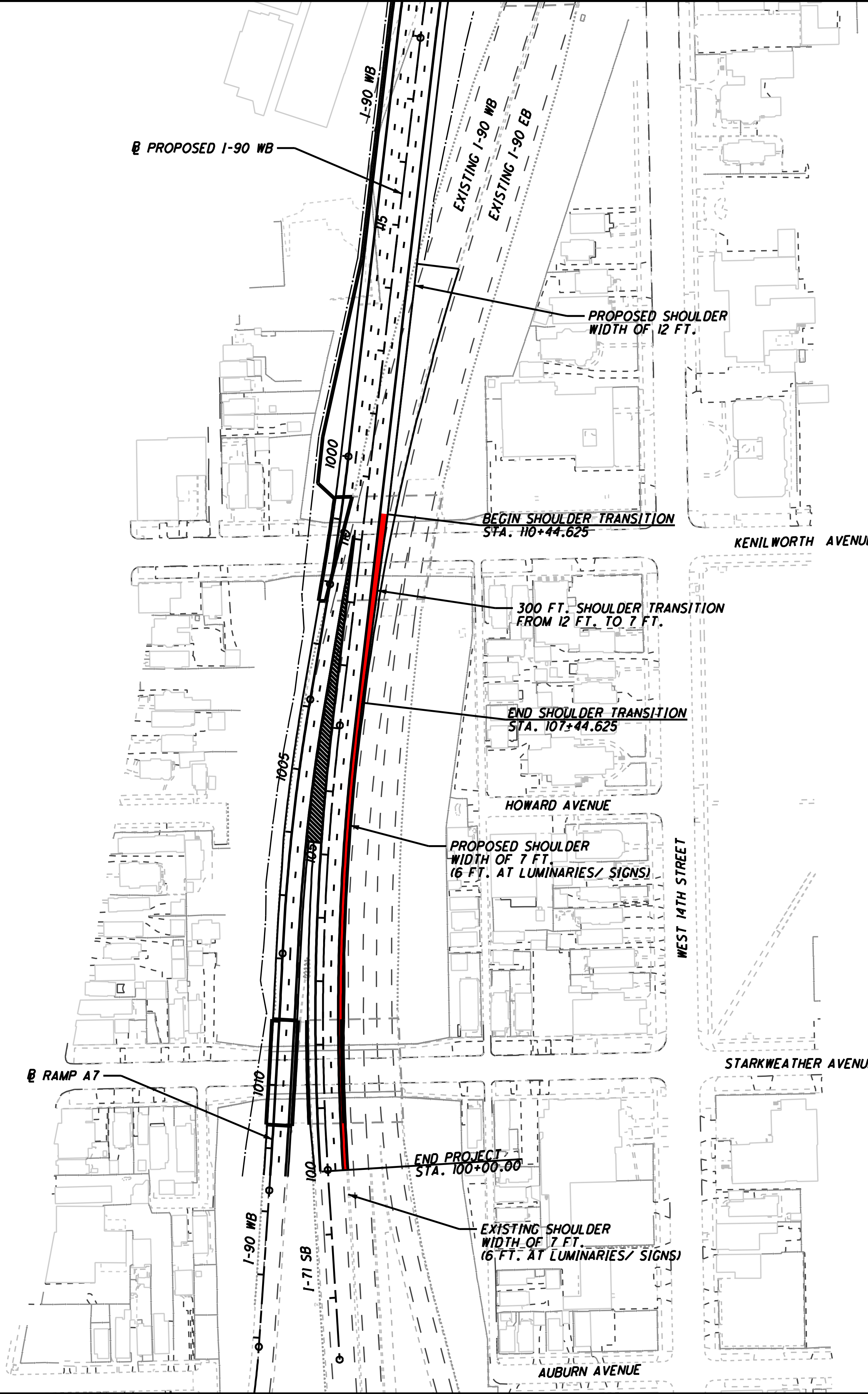
CLEVELAND INNERBELT PLAN
OHIO DEPARTMENT OF TRANSPORTATION

CONTRACT GROUP 1 - SHOULDER WIDTH DESIGN EXCEPTION

0' 100' 200'

NOVEMBER 19, 2009



NOTE: AREAS OF DEFICIENT SHOULDER WIDTH SHOWN IN RED.

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12’ shoulder until Sta. 100+75.847. Then, the outside shoulder transitions from the proposed 12’ shoulder to the existing 9’ shoulder between Sta. 100+75.847 to Sta. 100+00. Past the gore, the median shoulder on I-71 begins to transition from the proposed 12’ shoulder to the existing shoulder width of 7’ (6’ at locations where luminary or sign supports bump out the center median) over a distance of 300 feet from Sta. 107+44.625 to 110+44.625. Then, it maintains the existing median shoulder width for the last 744.625 ft. of the proposed work from Sta. 107+44.625 to 100+00.00. The median shoulders on southbound I-71 are substandard from Sta. 100+00.00 to 110+44.625.

Design Philosophy

During the NEPA process, it was agreed that no shoulder widening would be provided south of the I-71 bridge over I-490. In Section 4.0 Preferred Alternative of the FEIS, it was identified that I-71 would not have full shoulders provided. This decision was spelled out in greater detail in Section 3.4 Feasible Alternatives of the DEIS. Which stated that “Approaching the project terminus on the west end of the I-90 portion of the Innerbelt Corridor on the western end of the Innerbelt Bridge (west bank of the Cuyahoga River), the shoulder width provided tapers from the required 12 feet to the existing width of 7-feet. This transition to the existing shoulder width is necessary to minimize the right-of-way impacts in the Tremont neighborhood and to tie into the existing alignment in a logical manner. It is not possible to provide widened shoulders across the I-71 bridge over I-90/I-490 without complete reconstruction of the entire system interchange due to clearance requirements. As such, this also facilitates a smoother transition to the I-90 ramps located in the I-71/I-90/I-490 system interchange.” Further, based on the analyses done as part of the NEPA process it has been determined that a major reconstruction of I-71 will not be done. For further graphics and information regarding the Preferred Alternative, please refer to the DEIS Exhibit A, Alternative A, Figures A9 and A10; IJS Section 1.2.1; and IJS Figure 4.

There has been no substantive changes to the design in this area between the Step 6 Engineering, which was incorporated into the IJS, FEIS and DEIS, and the Preliminary Engineering (a refinement of this Step 6 Engineering) that will be used to support the Design Build effort for Construction Contract Group 1, which includes this roadway segment. However, a change in stationing was undertaken as part of the refinement of the Preferred Engineering, which results in the station ranges reported in the IJS regarding the limits of the design exception and those contained herein to differ slightly. None of these refinements to the Step 6 Engineering that was show in the FEIS, DEIS and IJS as Alternative A or the Preferred Alternative that are reflected in the CCG1 Preliminary Engineering, change the validity of the results and recommendations outlined in those documents.

3.) CONTROLLING CRITERIA:

Lane Width	______	Grades	______
Shoulder Width	X	SSD	______
Bridge Width	______	Cross Slopes	______
Structural Capacity	______	Superelevation (Transition)	______
Graded Shoulder	______		
Horizontal Alignment	______	Horizontal Clearance	______
Vertical Alignment	______	Vertical Clearance	______

4.) DETAILED ANALYSIS

A.) Description of Deviation:

The functional class of I-71 (Urban Interstate), and the fact that the projected truck traffic exceeds 250 DDHV, requires a minimum shoulder width of 12-feet on the median side of the roadway, per Figure 301-4, Note D, of the ODOT Location and Design Manual, Volume 1. The existing median shoulder width from Kenilworth Avenue to the southern terminus of the project is 7' (6' where luminary and sign supports bump out the median barrier). Over this same section, the proposed design utilizes a median shoulder width of 7' (6' where luminary and sign supports bump out the median barrier) in order to match into the existing shoulder width, as, based on the NEPA analysis, no major reconstruction of I-71 will be done.

B.) Accident Data:

The area impacted by the proposed shoulder width deficiency is represented by the section of mainline freeway between mile marker 170.82 and 171.16. This area was examined for crash exposure for a three year period (2006-2008), which shows a total of 44 crashes in this segment during that period (see Table 1 below for summary). Only the crashes caused by southbound vehicles traveling in the three left-most lanes were included in the analysis, as these were the only vehicles that had potential to be involved in crashes that may have been impacted by the existing shoulder width deficiency.

Table 1: Crash Data for Shoulder Width Deficiency Area

ACCTYPE	ACCSEV	ACCYEAR
Rear End	Injury	2006
Sideswipe Passing	PDO	2006
Fixed Object	Injury	2006
Sideswipe Passing	PDO	2006
Rear End	Injury	2006
Rear End	Injury	2006
Fixed Object	Unknown	2006
Sideswipe Passing	PDO	2006
Fixed Object	Injury	2006
Fixed Object	PDO	2006
Rear End	PDO	2007
Parked Car	PDO	2007
Fixed Object	PDO	2007
Rear End	Injury	2007
Fixed Object	Injury	2007
Rear End	PDO	2007
Fixed Object	PDO	2007
Rear End	PDO	2007
Fixed Object	PDO	2007
Rear End	PDO	2007
Rear End	PDO	2007
Sideswipe Passing	PDO	2007
Sideswipe Passing	PDO	2007
Rear End	PDO	2007
Sideswipe Passing	Injury	2007
Fixed Object	PDO	2007

Rear End	PDO	2007
Rear End	Injury	2007
Rear End	PDO	2008
Rear End	PDO	2008
Rear End	Injury	2008
Rear End	PDO	2008
Fixed Object	PDO	2008
Rear End	Injury	2008
Sideswipe Passing	Injury	2008
Sideswipe Passing	PDO	2008
Sideswipe Passing	Injury	2008
Fixed Object	PDO	2008
Sideswipe Passing	Injury	2008
Rear End	Injury	2008
Fixed Object	PDO	2008
Rear End	PDO	2008
Sideswipe Passing	Injury	2008
Fixed Object	PDO	2008

<u>2006</u>

- 10 total crashes; 5 involving injury
- 3 rear-end; 4 fixed-object; 3 sideswipe
- Two of the crashes involved standing water in the roadway

<u>2007</u>

- 18 total crashes; 4 involving injury
- 9 rear-end; 5 fixed-object; 3 sideswipe
- Five of the crashes involved drivers hitting snow, ice, or other debris in the roadway or shoulder. One of these crashes involved a driver striking a disabled vehicle in the left shoulder.

<u>2008</u>

- 16 total crashes; 7 involving injury
- 7 rear-end; 4 fixed-object; 5 sideswipe
- Three crashes involved ice in the roadway

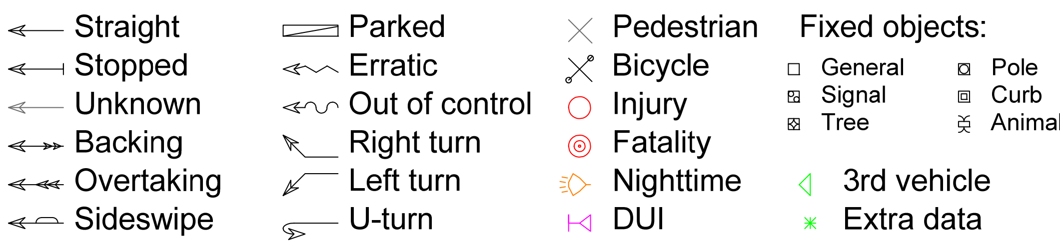
These crashes were examined with respect to the following variables (see Traffic Accident Analysis summaries): year, time of day, roadway conditions, crash severity, crash type, day of week, hour of day and month of year. Further, all crashes were plotted on a collision diagram (see Collision Diagram and Collision Diagram Legend and Label Definition) to clearly show the location of each incident.

Most of these were rear-end (19 of 44 crashes or 43%) or sideswipe crashes (11 of 44 or 25%) caused by the recurring congestion along this section of the freeway. These congestion related crashes represent 30 of the 44 crashes (68%) that occurred along this roadway segment. This is supported by the narratives from the OH-1's which indicate that the contributing factors in most of these crashes are congestion-related – either following too close or changing lanes. For two of the years examined, there was a slight increase in crashes during the PM peak period, which corresponds with the time of day when this section of roadway typically experiences severe congestion. There were slightly more crashes reported during periods of wet pavement conditions, which fits well with the trend for most of these crashes to be rear end crashes.

All other crashes involved drivers hitting the center concrete median or other fixed objects in the roadway. A contributing factor in the remaining 13 fixed object crashes,

Collision Diagram Legend and Label Definition

Symbols



LABEL = MM/DD/YYYY-HHMI-LI-RC-S-99999999999

LI = Light Codes:

CODE	NUMBER	DESCRIPT
DA	1	Daylight
DW	2	Dawn
DU	3	Dusk
DL	4	Dark - Lighted Roadway
DN	5	Dark - Roadway Not Lighted
DU	6	Dark - Unknown Roadway Lighting
GL	7	Glare
OT	8	Other
UK	9	Unknown

RC = Road Condition Codes:

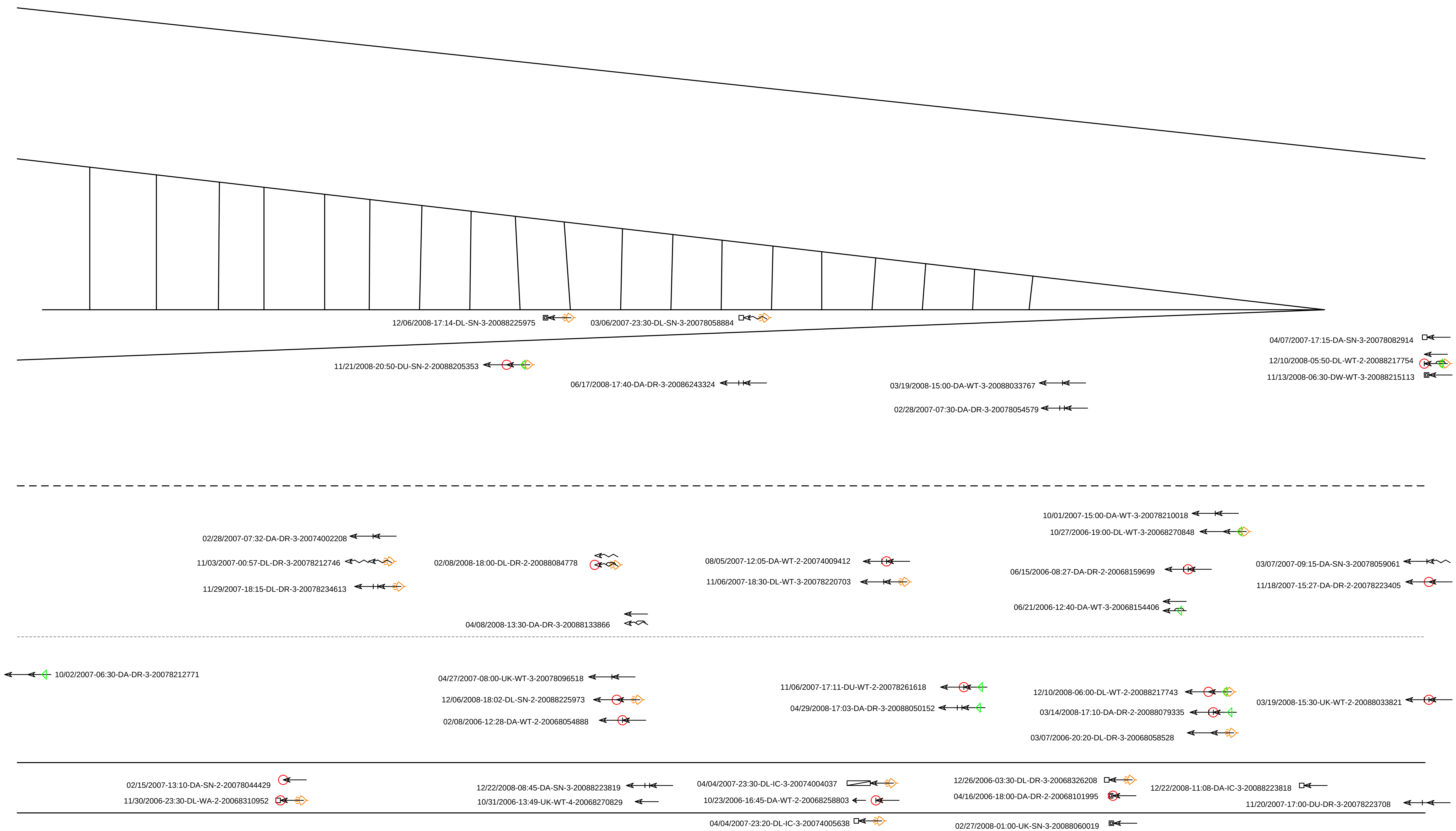
CODE	NUMBER	DESCRIPT
DR	1	Dry
WT	2	Wet
SN	3	Snow
IC	4	Ice
MD	5	Sand, Mud, Dirt, Oil, Gravel
WA	6	Water (Standing, Moving)
SL	7	Slush
DB	8	Debris
RT	9	Rut, Holes, Bumps, Uneven Pavement
OT	10	Other
UK	11	Unknown

S = Crash Severity

CODE	NUMBER	DESCRIPT
1	1	Fatal Crash
2	2	Injury Crash
3	3	Property Damage Crash
4	4	Propertyy Damage Unknown/Other Crash

Project: Burgess And Niple I-90 Corridor Southbound
PID: 10130
Roadway: I-90 Southbound Log Mileage 170.82 to 171.16

I-90 Southbound Log Mileage 170.82 to 171.16



Prepared By: TSASS Inc.
Prepared Date: November 3rd, 2009
Prepared For: Burgess and Niple
Start Date: January 1st 2006
End Date: December 31st 2008

TRAFFIC ACCIDENT ANALYSIS
I-90 Southbound Log Mileage 170.82 to 171.16

County CUY | Main Roadway #### | Begin SLM 14.000 | End SLM 21.000

Project: I-90 Southbound Log M | Intersecting Roadway 90 Southbound Log Mileage 170.82 to 171.16 | *Crash Data last Updated:* *5/10/2009*

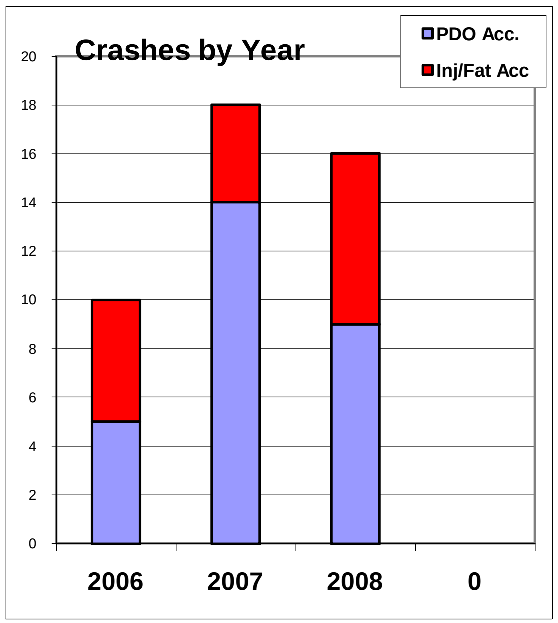
Prepared by TSASS-BATCH | Date 04-NOV-09 | Prepared for: Burgess and Niple - Franklin County Engi | *Estimated Percent of 2008 data =* *87*

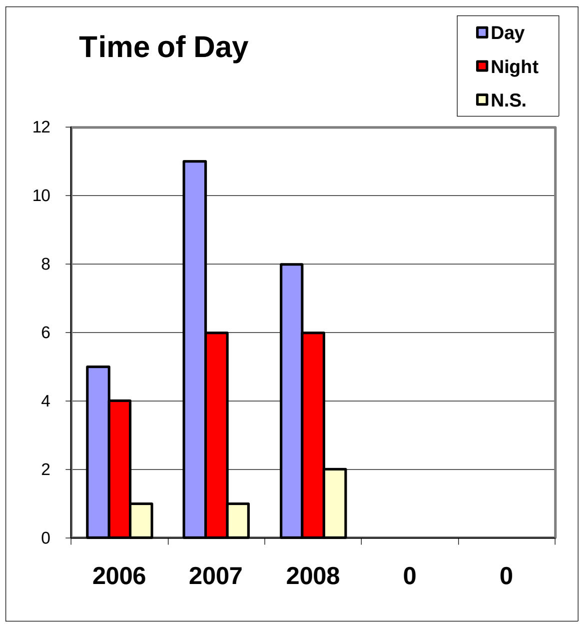
TSASS Study-ID:	10130
SEGID	INTERSID
1	0

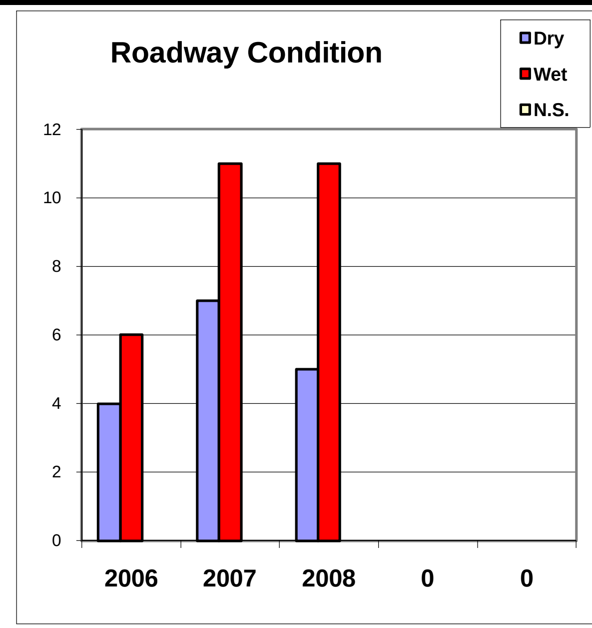
9788

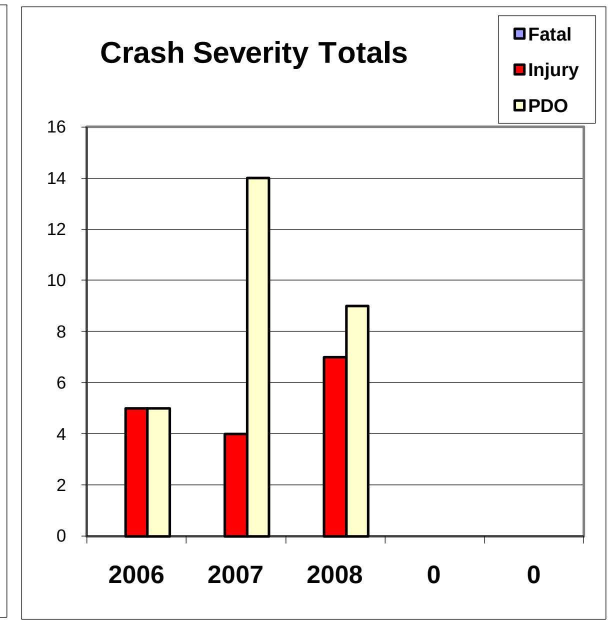
YEAR	LIGHTING CONDITION						ROADWAY CONDITION						CRASH TYPE					
	Day		Night		N.S.		Dry		Wet		N.S.		L.T.		R.T.		Angle	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2006	1	4	3	1	1	0	2	2	3	3	0	0	0	0	0	0	0	0
2007	7	4	6	0	1	0	6	1	8	3	0	0	0	0	0	0	0	0
2008	7	1	1	5	1	1	3	2	6	5	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	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	**15**	**9**	**10**	**6**	**3**	**1**	**11**	**5**	**17**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total	**24**		**16**		**4**		**16**		**28**		**0**		**0**		**0**		**0**	

YEAR	CRASH TYPE																			
	Rear-end		Head On		S.S. Same		S.S. Oppos		F.O.		Backing		Ran Off Road		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
2006	0	3	0	0	3	0	0	0	2	2	0	0	2	1	0	0	0	0	5	5
2007	7	2	0	0	1	1	0	0	3	0	1	0	2	1	0	0	2	1	14	4
2008	4	3	0	0	1	4	0	0	4	0	0	0	0	0	0	0	0	0	9	7
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	0	0	0	0	0	0	0	0
Subtotal	**11**	**8**	**0**	**0**	**5**	**5**	**0**	**0**	**9**	**2**	**1**	**0**	**4**	**2**	**0**	0	**2**	**1**	**28**	**16**
Total	**19**		**0**		**10**		**0**		**11**		**1**		**6**		**0**		**3**		**44**	









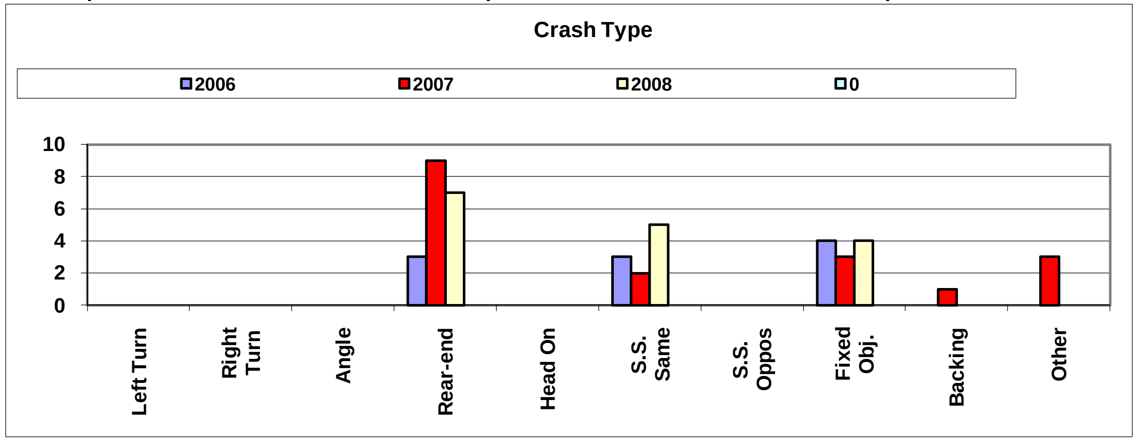
Source: Traffic Safety Analysis Systems & Services - Ohio Safety Information System - Data represents most current data available as of date of preparation. Subject to change due to late crash data submissions by police agencies and / or additional improved crash location information. The Ohio Safety Information System (OSIS) is a proprietary safety database containing Ohio traffic crash and related safety information. Available on line at: osis.tsass.com

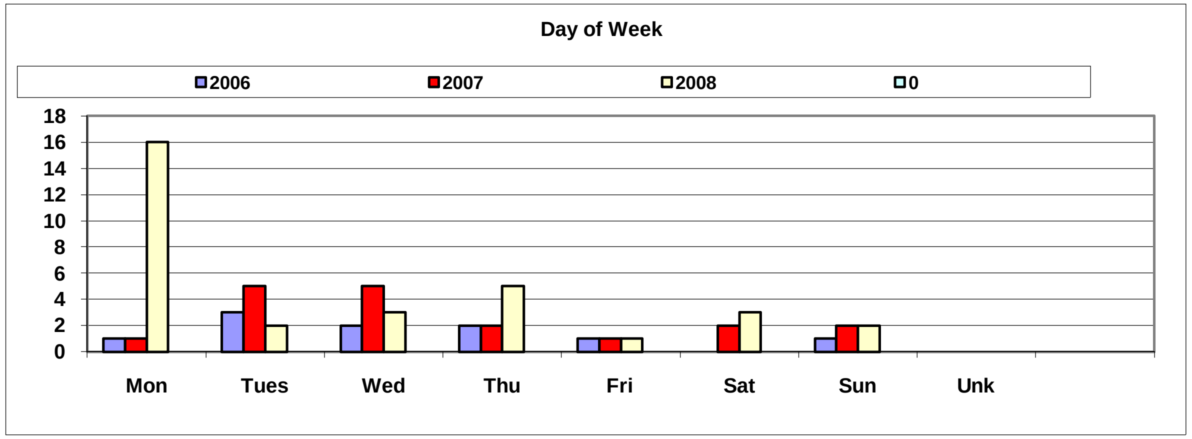
TRAFFIC ACCIDENT ANALYSIS
I-90 Southbound Log Mileage 170.82 to 171.16

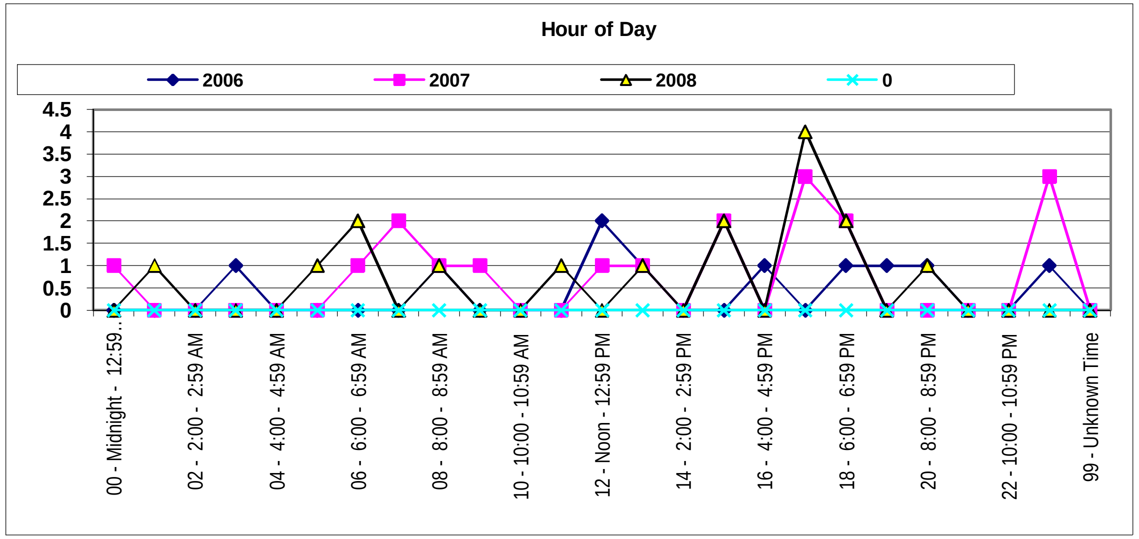
County	CUY	Main Roadway	####	Begin SLM	14.000	End SLM	21.000
Project:	I-90 Southbound Log M	Intersecting Roadway	90 Southbound Log Mileage 170.82 to 171.16	*Crash Data last Updated:*	*5/10/2009*		
Prepared by	TSASS-BATCH	Date	04-NOV-09	Prepared for:	Burgess and Niple - Franklin County Engi	*Estimated Percent of 2008 data =*	*87*

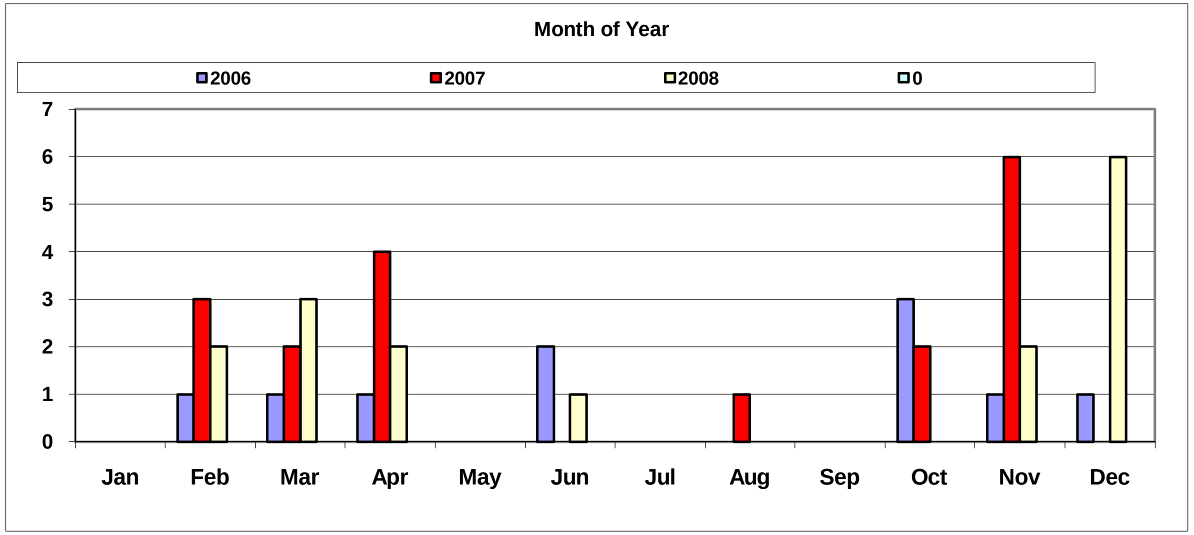
TSASS Study-ID:	10130
SEGID	**INTERSID**
1	0

9788









Source: Traffic Safety Analysis Systems & Services - Ohio Safety Information System - Data represents most current data available as of date of preparation. Subject to change due to late crash data submissions by police agencies and / or additional improved crash location information. The Ohio Safety Information System (OSIS) is a proprietary safety database containing Ohio traffic crash and related safety information. Available on line at: osis.tsass.com

may have been the narrow shoulder width along this section of the freeway. Among these are a crash that involved a disabled vehicle in the shoulder and crashes involving snow and ice located in the shoulder area.

These trends agree with the crash analyses previously documented in the *Existing and Future Conditions Report* (Section 4.4 Crash Analysis), *Purpose and Need* (Section 3.4 Safety), *Conceptual Alternatives Report* (Section 3.3.2 Safety) and *Draft Environmental Impact Statement* (Section 2.2.3 Innerbelt Freeway Safety).

C.) Future Traffic Safety:

Because the proposed shoulder width is no different than the existing, the future shoulder-related crash rate along this section is expected to be no worse than the existing. However, because the changes in capacity along this section of the Innerbelt will effectively provide another lane of traffic approaching the diverge of WB I-90 and SB I-71, it is anticipated that the congestion related crashes at this location will drop. Since rear end and sideswipe crashes caused by reoccurring congestion made up the majority (68%) of crashes at this location, it can be assumed that this capacity change will have a large positive impact on safety. Further, the physical condition of the pavement in this section will be rehabilitated or replaced, resulting in a better riding surface, which combined with the capacity improvements should help mitigate the large number of wet pavement crashes. As such, it is anticipated that overall safety along this segment of roadway will improve as a result of this project.

The design and operational deficiencies that are retained in the CCG1 Preliminary Engineering, which is a refinement of the Step 6 Engineering that was utilized to develop the selected Preferred Alternative (Alternative A) as part of the NEPA process, are minor, localized in nature and in all cases provide for a build condition that is substantially better than that of the existing condition.

D.) Impact on Adjacent Property:

In order for the proposed alignment to meet the design criteria established for shoulder width, the width of WB I-90 would need to be increased. This increase in overall width of the alignment would have the following impacts:

- The widening of the existing structure carrying I-71 over Starkweather Avenue and the replacement of the structure carrying the I-90 ramp over Starkweather Avenue. In order to widen the structure carrying I-71 over Starkweather Avenue, the structure carrying the I-90 ramp over Starkweather would need to be relocated and reconstructed to the west of its current location. The approximate cost of this bridge would be $2.1 million ($2009).
- The additional widening of the existing structure carrying I-90 over Kenilworth Avenue. The approximate cost of this additional widening would be $0.2 million ($2009).
- The transition to the existing shoulder width is necessary to minimize the right-of-way impacts in the Tremont neighborhood and to tie into the existing alignment in a logical manner. If 12’ median shoulders are provided from Sta. 100+00.00 to 110+44.625, this will not be possible.
- In the future, is not possible to provide widened shoulders across the I-71 bridge over I-90/I-490 without complete reconstruction of the entire system interchange. The existing interchange is a four level interchange, with the I-90/I-490 alignment on level 1, EB I-90 to EB I-90 ramp and WB I-490 to SB I-71 ramp on level 2, NB I-71 to WB I-90 on level 3 and I-71 on level 4. Widening the I-71 bridge on level 4, would result in clearance deficiencies on the NB I-71 to WB I-90 ramp on level

3. However, in order to correct these clearance deficiencies, other existing deficiencies within the interchange would also need to be addressed. This cascade effect would require the entire system interchange to be addressed. Further, because of the close spacing of this system interchange to local interchanges on I-90, work on this system interchange would also cascade westbound on I-90. This is one of the primary reasons that the I-71/I-90/I-490 ramp was selected as an intermediate termini for the Innerbelt Project (see DEIS Section 1.1.1 Study Area Description). As such, provision of a 12’ median shoulder would be inconsistent with the identified logical termini of the project.

- Based on the analyses done as part of the NEPA process (see DEIS Section 3.4.2.4 Southern Innerbelt) it has been determined that a major reconstruction of I-71 will not be done. The existing median shoulder on SB I-71 is 7’ or less from the diverge of WB I-90 south to the Fulton Road interchange. As such, provision of a 12’ median shoulder from Sta. 100+00.00 to 110+44.625 would be inconsistent with a logical transition to the existing median shoulder and would be inconsistent with the decisions documented in the IJS, DEIS, FEIS and ROD.

E.) Proposed Mitigation:

Other than shoulder rumble strips and barrier reflectors, there will be no mitigative measures for the deviation to the standards includes as part of this project.

F.) Support for Deviation:

There are several factors that support this shoulder width deviation:

- This design deficiency is minor and localized in nature. The overall changes to the design and operational characteristics of the corridor in all cases provides for a build condition that is substantially better than the existing/no build condition. The safety analysis performed in support of this deviation show that safety in this segment of the corridor will increase with the build alternative.
- This deviation is located near the southern end of the project where the proposed design matches back into the existing. Based on the analysis done as part of the NEPA process it has been determined that no major reconstruction to I-71 will be undertaken. Since providing for 12’ median shoulders on I-71 would require the reconstruction of the I-71/I-90/I-490 system interchange and would encounter additional complexities in the vicinity of the SR-176 system interchange (see DEIS Section 3.4.2.4 Southern Innerbelt), it was determined that this would not be prudent.
- Since there will be no major reconstruction of the I-71 corridor, the logical location to transition from the 12’ median shoulder provided on the I-90 alignment to the existing 7’ (6’ at luminary and sign supports) median shoulders on the I-71 alignment is just past the diverge of the WB I-90 ramp.
- Providing 12’ median shoulders past the diverge of the WB I-90 ramp to the termini of the projects would result in only 685’ of additional full median shoulders past the gore. This would necessitate the replacement of the I-90 ramp structure over Starkweather, the widening of the I-71 bridge over Starkweather and the widening of the I-90 bridge over Kennilworth for a cost of $2.3 million ($2009).
- A full 12’ outside shoulder is provided for this three lane roadway section.
- This design does not preclude future work that may be done on I-90 west of this location or I-490 east of this location.
- The proposed design balances the physical condition, operational performance, safety, access and community needs with the design requirements as documented in the IJS, FEIS/Section 4(f) Evaluation and ROD.

- The geometrics (inclusive) of the CCG1 Preliminary Engineering, which is a refinement of the Step 6 Engineering shown in the NEPA documentation as Alternative A, meet or exceed the enumerated geometric criteria, Interstate system mainline and ramp layouts, local street system layouts and intersection layouts, lane and turn lane dimensions and assessed operational characteristics as documented within the IJS, FEIS/Section 4(f) Evaluation, and ROD.

5.) SUMMARY:

As described above, the proposed design for the median shoulder does not meet the required minimum shoulder width of 12' based on a projected truck volume that will exceed 250 DDHV and per Figure 301-4, Note D, of the ODOT Location and Design Manual, Volume 1. The existing median shoulder width on I-71 is 7' (6' where luminary and sign supports bump out the median barrier). Redesigning the median shoulder to meet the 12' requirement would be inconsistent with the decisions that were documented in the IJS, FEIS/Section 4(f) and ROD. Since there will be no major reconstruction of I-71, the most logical place to transition from the 12' median shoulder provided on the I-90 alignment to the existing 7' (6' at luminary and sign supports) on the I-71 alignment is just past the diverge of the WB I-90 system ramp. This design deficiency is minor and localized in nature and, in all cases, the build condition provides for substantially better physical condition, operational performance and safety than the existing/no build condition.

Engineers Seal:

STATE OF OHIO
PAUL W.
DOROTHY
E-63443
REGISTERED
PROFESSIONAL ENGINEER

Signed: ______________

Date: 22 NOV 2009

INFORMATION FOR EXCEPTION TO THE MINIMUM DESIGN STANDARDS

PROJECT: CLEVELAND INNERBELT PROJECT

P.I.D. 77510

I-90 FUNCTIONAL CLASSIFICATION: URBAN INTERSTATE

(ONTARIO STREET ON-RAMP TO WB I-90)

Introduction

The Cleveland Innerbelt is a high capacity, limited-access interstate highway extending from Cleveland's Tremont neighborhood on the West Side of the Cuyahoga River, across the Cuyahoga Valley, around the southern and eastern edges of downtown to the City's lakefront district at Burke Lakefront Airport. The Innerbelt includes portions of I-71 and I-90, and connects to I-77, I-490, SR 2, and SR 176.

The Innerbelt Freeway provides access to and mobility through the City of Cleveland. Downtown Cleveland depends on the Innerbelt Freeway's ability to collect and distribute traffic between the radial freeway system of I-90, I-490, I-71, SR 176, and I- 77 and the local street system. During the morning peak period, the Innerbelt Freeway functions to collect traffic from the system of radial freeways and distribute that traffic to the local street system. During the evening peak period, the Innerbelt Freeway functions to collect traffic from the local street system and distribute that traffic to the system of radial freeways. The Innerbelt Freeway also moves traffic between each of the radial freeways, thus allowing through traffic to bypass the local street system.

The Innerbelt is an important segment of the federally designated interstate highway system that crisscrosses the United States to provide efficient movement of industrial goods and to link major metropolitan centers. The Innerbelt is designated as Interstate 90 (I-90) and serves as the northern terminus for two others, Interstate 71 (I-71) and Interstate 77 (I-77).

The design of the Innerbelt Freeway predates the development of modern standards for the design of freeways. In particular, three types of design deficiencies — improper reduction in the basic number of lanes; inadequate ramp configuration and spacing; and inadequate curve radius — have the most direct and adverse impacts on the operational performance and safety of the Innerbelt Freeway.

The existing and future conditions for the Innebelt were examined, a purpose and need for the project was developed, alternatives were developed, analyzed and refined and a final NEPA screening of these alternatives resulted in a Preferred Alternative being selected for implementation. Based on the Implementation Plan developed for the project the estimated total construction cost for the overall project is $2.65 billion (year of expenditure dollars) and will be implemented between 2010 and 2027. For further information on this process, please refer to the following project documents:

- Cleveland Innerbelt Existing and Future Conditions Report (E&F)
- Cleveland Innerbelt Purpose and Need (P&N)
- Cleveland Innerbelt Conceptual Alternatives Study (CAS)
- Cleveland Innerbelt Interchange Justification Study (IJS)
- Cleveland Innerbelt Draft Environmental Impact Statement (DEIS)

- Cleveland Innerbelt Final Environmental Impact Statement (FEIS)
- Cleveland Innerbelt Record of Decision (ROD)

The first construction contract, Construction Contract Group 1 (CCG1), to implement the NEPA decisions outlined in the FEIS will consist of the roadway segment comprised of mainline WB I-90 from approximately East 9th Street on the north to the southern termini of the overall project at the I-71/I-90/I-490 system interchange for a mainline distance of approximately 1.4 miles. CCG1 includes a new WB Central Viaduct Bridge and the following ramp connections: East 9th Street on-ramp, Ontario Street on-ramp and Abbey Avenue off-ramp. CCG1 has an estimated construction cost of $476 million (2012$).

1.) EXISTING FACILITY:

I-90 across the Central Viaduct Bridge has a current (2008) ADT of 119,000 vehicles per day with 6% truck traffic and a legal speed of 50 mph. The existing Ontario Street on-ramp to WB I-90 (see Existing Conditions – Ontario Street On-ramp to WB I-90) has an existing (2006) ADT of 5,836. Existing WB I-90 in the vicinity of the Ontario Street on-ramp carries three twelve foot lanes. The single lane Ontario Street on-ramp then enters as an add lane forming the fourth twelve foot lane across the Central Viaduct Bridge. The existing shoulders are deficient with inside shoulders that vary from 1’6” to 3’6” and outside shoulders that vary from 1’0” to 3’3”.

2.) PROPOSED FACILITY:

Proposed Design

I-90 across the new WB Central Viaduct Bridge has a projected (2035) ADT of 71,000 vehicles per day with 6% truck traffic and a legal speed of 55 mph. The proposed Ontario Street on-ramp to WB I-90 (see Contract Group 1 – Ontario Street On-ramp to WB I-90 Design Exception) has a projected (2035) ADT of 9,900 vehicles per day. Proposed WB I-90 in the vicinity of the Ontario Street on-ramp will carry four twelve foot lanes. The dual lane Ontario Street on-ramp will taper to a single lane and then enter as an add lane forming the fifth twelve foot lane across the new WB Central Viaduct Bridge. Twelve foot inside and outside shoulders will be provided on the mainline, while on the ramp a 6 ft. right shoulder and 3 ft. left shoulder (4 ft. when barrier is present) is provided.

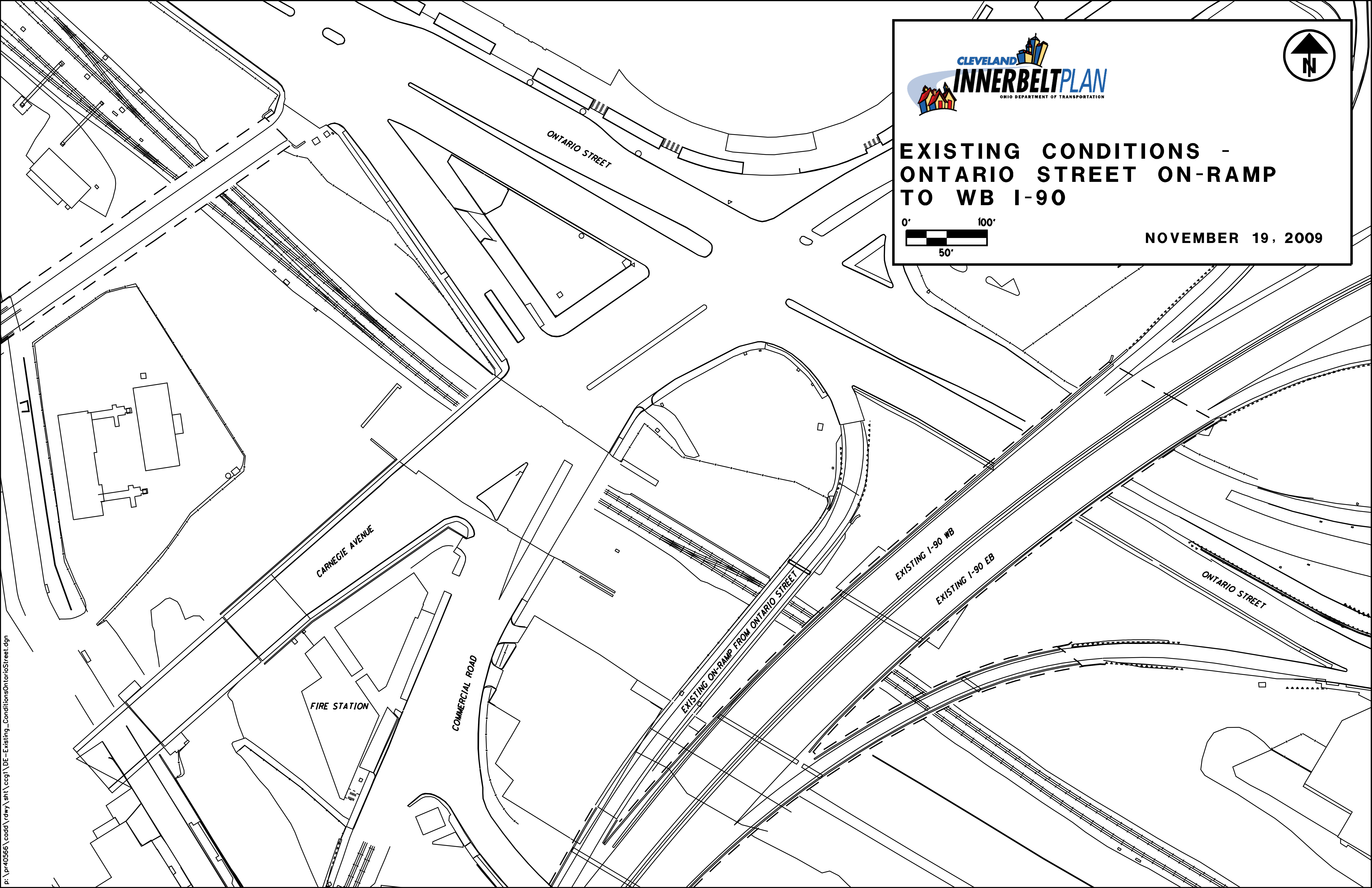
The proposed Ontario Street on-ramp to WB I-90 begins as the southeastern leg of the Carnegie Avenue/Ontario Street intersection. Four lanes approach the Carnegie Avenue intersection eastbound along Ontario. A fifth lane is then added to the outside. Just before the intersection, the outer two lanes are separated from the main intersection area by a splitter island. Traffic entering these outer two lanes can either enter the on-ramp to WB I-90 or turn to the right onto Carnegie from the outer lane only. The on-ramp curves away from the Ontario Street alignment in a dual 18 ft. lane configuration through a 39º45’00” curve with a superelevation rate of 0.053 which provides a design speed of 20mph and a sag vertical curve with a design speed of 30mph (K=37). The two lanes then taper to a single 16 ft. lane over 600 ft.

The Ontario Street on-ramp to WB I-90 provides 2,620 ft. of acceleration length between the PT of the initial 20 mph horizontal curve and the point where the lane has narrowed to 12 ft. in width. In AASHTO’s *A Policy on the Geometric Design of Highways and Streets* it states that “The geometrics of a ramp proper should be such that motorists may attain a speed that is within 5 mph of the operating speed of the freeway by the time they reach the point where the left edge of the ramp joins the traveled way of the freeway. For consistency of

CLEVELAND INNERBELT PLAN
OHIO DEPARTMENT OF TRANSPORTATION

EXISTING CONDITIONS - ONTARIO STREET ON-RAMP TO WB I-90

NOVEMBER 19, 2009



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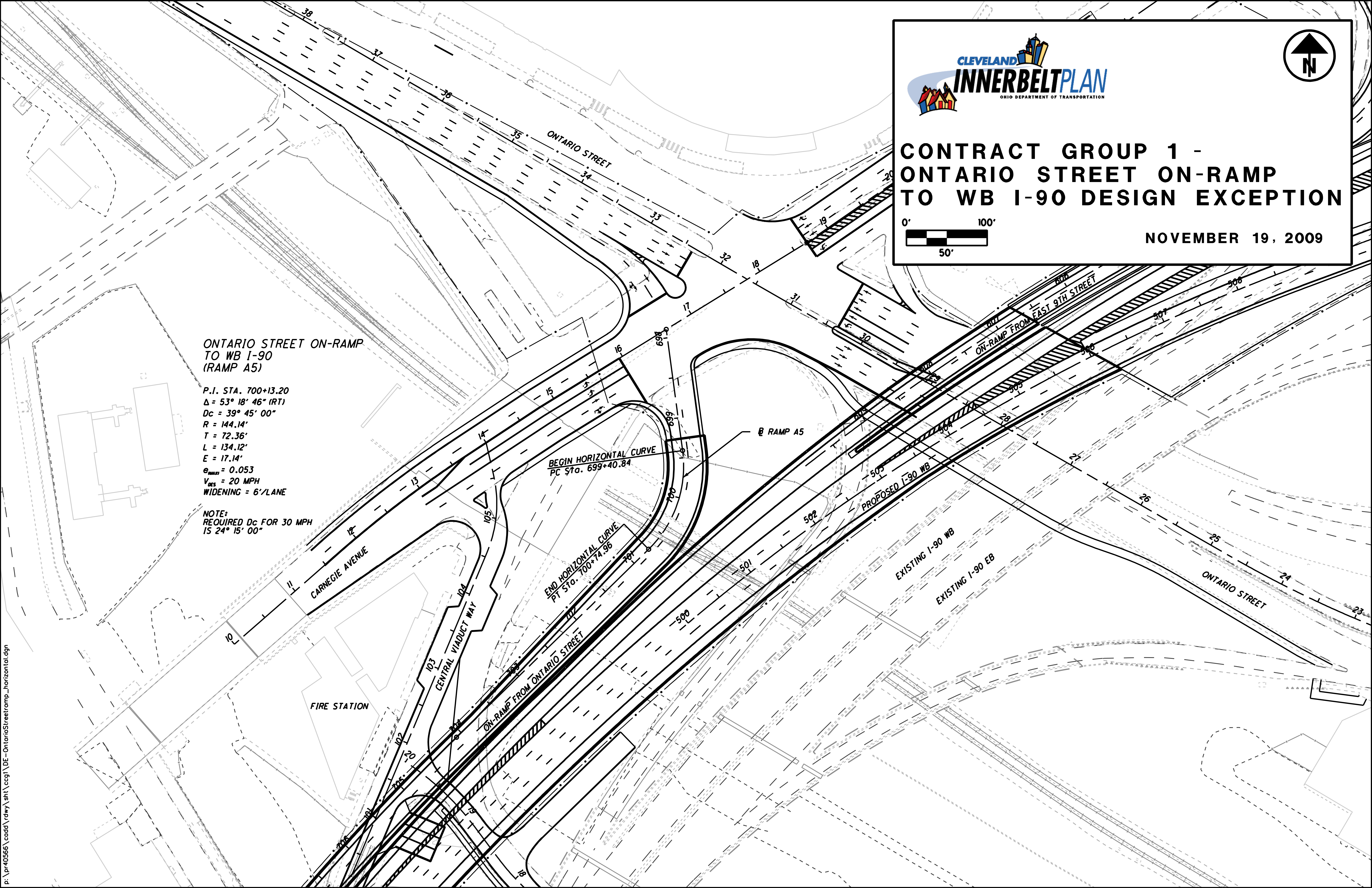
CLEVELAND INNERBELT PLAN
OHIO DEPARTMENT OF TRANSPORTATION

CONTRACT GROUP 1 - ONTARIO STREET ON-RAMP TO WB I-90 DESIGN EXCEPTION

NOVEMBER 19, 2009



application, this point of convergence of the left edge of the ramp and the right edge of the through lane may be assumed to occur where the right edge of the ramp traveled way is 12 ft. from the right edge of the through lane of the freeway." Based on Exhibit 10-70, the minimum acceleration length needed for a mainline design speed of 60 mph is 1,100 ft. However, "where grades are present on ramps, speed-change lengths should be adjusted in accordance with Exhibit 10-71." The grade on the first 875 ft. of this ramp is +4.99% after which the grade drops to +0.60 for the remainder of the ramp. Being overly conservative and assuming the grade of the ramp to be 5%-6% upgrade for the entire ramp results in a factor of 1.7 from the table. Multiplying 1,100 ft. by 1.7 results in a grade adjusted acceleration distance of 1,870 ft. As such, even with this conservative approach to determining needed acceleration length, this ramp design provides an additional 750 ft. of acceleration length over what is required. In addition, the Ontario Street ramp is an add lane to I-90 further mitigating concerns over acceleration length provided.

Design Philosophy

This proposed design for the East 9th Street on-ramp to WB I-90 was selected as the best balance between design, operation, safety, driver expectation and community impacts. Other alternatives were considered and rejected as not achieving this balance. A brief description of the other alternatives considered is presented below.

In order for the proposed alignment to meet the design criteria established for curve radius, either the location of the proposed ramp would need to change or the location of I-90 would need to change. During initial development of this alternative which is documented in the Conceptual Alternatives Study, major changes to this area were considered and rejected first.

- Change Alignment of I-90: This approach is not feasible for several reasons. First, moving the alignment of I-90 to the southwest to allow greater room to develop the ramp curve radius in question would create design problems for the multitude of other ramps that interact with the I-90 and I-77 alignments within the Central Interchange area. Second, moving the alignment of I-90 to the southeast would create extensive constructability and Maintenance of Traffic and Access (MOTAA) issues associated with the interaction between the existing alignment of I-90 and a realigned future I-90 alignment. These constructability and MOTAA issues would result in substantial increases in cost, delay in construction and reduction of access during construction. These impacts do not justify correcting this design deviation.
- Change the location of the ramp: There are a limited number of ways in which the location of the ramp could be changed.
    - The Carnegie Avenue and Ontario Street intersection could be moved to the northwest approximately 130 ft. There are two options to accomplish this. The first would require severing the through connectivity of Carnegie Avenue, which is a major arterial serving both the Cleveland Central Business District and surrounding neighborhoods. The second would require taking Progressive Field, which was constructed in 1994 at a cost of $175 million, to reestablish the Carnegie alignment.
    - The ramp could be elevated on a fly-over, which would begin on the southbound approach to the Carnegie Avenue and Ontario Street intersection at approximately the location of Eagle Avenue. This fly-over ramp would then cross over the eastbound approach to the intersection on an elevated structure before entering mainline westbound I-90. This alternative was examined as part of the Assessment of Feasible Alternatives and strongly rejected by the community.

Once major changes to the ramp configuration had been examined and rejected, the design process focused on improving the existing design approach. Based on design guidance given in AASHTO's A Policy on Design Standards Interstate System (January 2005) "Access Control…should extend beyond the ramp terminal at least 100 ft in urban areas." Because sufficient space was not available to meet this criteria and have the ramp perpetuate the existing condition of the ramp beginning just south of the intersection on the Ontario Street leg, other configurations for this ramp were examined (see *DEIS* Section 3.4.2.3 Central Interchange/Central Viaduct). A single intersection concept was developed that separated the ramp traffic from the local traffic within the intersection by creating a fifth leg to the intersection – the Interstate on-ramp. The majority of traffic accessing this ramp comes from SB Ontario Street. To further reinforce this separation of traffic, a splitter island was developed for the SB approach to the intersection that physically separates Interstate ramp traffic from local through traffic. However, due to the restricted space available between the intersection and mainline WB I-90, a 20 mph horizontal and 30 mph vertical curve begin the ramp. However, the guidance given by a combination of FHWA's *Mitigation Strategies for Design Exceptions* and AASHTO's *A Policy on Geometric Design of Highways and Streets*, requires a minimum design speed for these curve elements of 30 mph. The proposed design's deviation from this horizontal curve requirement requires a design exception. This geometry sets the ramps approach to the mainline freeway.

A second approach was considered that looked at what it would take to meet the 30 mph design requirements for the initial horizontal curve that begins the geometry of this ramp. It is possible to fit a 30 mph horizontal (degree of curvature 24º45'00"). However, there is not sufficient room to provide for adequate superelevation transition. Under this configuration, it is necessary to provide full superelevation of 0.06 for at least 1/3 of the horizontal curve length. Also, 1/3 of the superelevation run-off needs to be provided on the curve side of the point of tangency (PT). This results in only 96.15 ft. available to rotate from a superelevation of 0.0151 to the required 0.06. The resulting equivalent maximum relative slope (G-value) is 89. From ODOT L&D Volume 1 202-4E, the required G-value for 30 mph is 152 and the lowest provided design G-value for 20 mph is 135. As such, it can be concluded that the design speed for this superelevation transition would we substantially less than the 20 mph provided by the proposed design. In addition, it would not be possible for this design approach to meet required superelevation position as outlined in Section 202.4.6 Superelevation Position in ODOT's *Location and Design Manual Volume 1*. Based on this guidance, a design exception is required if the following is not provided: "the transition shall be placed so that 50 percent to 70 percent of the maximum superelevation rate is outside the curve limits (PC, PT)." As such, a design exception would be required for superelevation to account for this deviation. However, if this were done, the imbalance between the design speed for the superelevation transition and the horizontal/vertical design would be unacceptable. The visual cues given to drivers by the horizontal/vertical design would encourage them to drive the ramp at 30 mph, which would be inconsistent with the provided superelevation transition rate of substantially less than 20 mph and would result in a safety hazard.

All efforts were made to develop a proposed design that achieved the best balance between the competing design elements, operational needs, safety, access, driver expectancy and community preferences. When these two alternative approaches are examined with these measures of effectiveness in mind, the proposed design is superior. The alternative configuration that was not selected violates driver expectation regarding the superelevation transition and the large deviation between the horizontal/vertical design speed and superelevation design speed represents a safety hazard. However, the proposed design provides expected superelevation transition, provides a balanced design speed across all roadway elements in the initial curve and provides adequate distance (as per the *Ohio*

Manual of Uniform Traffic Control Devices) to provide warning signs for the curve design speed deficiency.

This design exception was not called out in the *Interchange Justification Study (IJS) Section 1.2.1 Design Exceptions* as a potential design exception. The IJS has been incorporated in its entirety into the Final Environmental Impact Statement (FEIS). In July 2007, FHWA released *Mitigation Strategies for Design Exceptions (FHWA-SA-07-011).* The changes to the design exception process represented in this new publication were incorporated into ODOT policy gradually over the course of 2008. The *Mitigation Strategies for Design Exceptions* document specifically calls out that "Not meeting the lower (50 percent) range per Exhibit 10-56 requires a design exception per FHWA policy." Bases on Exhibit 10-56 in AASHTO's *A Policy on Geometric Design of Highways and Streets (2004)* and a highway design speed of 60 mph, the lower range (50%) ramp design speed is 30 mph, which requires a design exception for this location. However, the Step 6 Engineering for this project was also completed during 2008. As part of the development of the Step 6 Engineering, the list of potential design exceptions (not including this design exception) that was presented along with the Step 6 Engineering in the IJS and, by way of reference, in the FEIS was prepared. During further verification of the Step 6 Engineering in preparation of a Preliminary Engineering package for use by a Design Build Team for the construction of Contract Group 1 (which includes this roadway segment) a review of all roadway elements revealed that this segment would now need to be processed as a design exception.

There has been no substantive changes to the design in this area between the Step 6 Engineering, which was incorporated into the IJS, FEIS and DEIS, and the Preliminary Engineering (a refinement of this Step 6 Engineering) that will be used to support the Design Build effort for Construction Contract Group 1, which includes this roadway segment. However, there were several slight revisions to the geometry of this ramp that were undertaken as part of the refinements made to the design as part of the development of the CCG1 Preliminary Engineering. The refinements to the horizontal design include:

- The intersection skew angle for the Ontario on-ramp to WB I-90 has been changed from 20 degrees to 25 degrees to provide better constructability of the lower portion of the ramp and simplified the geometrics of the ramp. This change in intersection skew angle still meets all applicable design standards.
- The PC for the first horizontal curve on the Ontario on-ramp to WB I-90 was pushed 50 ft. further from the intersection. This change was made in conjunction with the skew angle change. This did not change any other characteristics of the horizontal curve (e.g. radius, design speed).
- The overall geometrics of the ramp were simplified from what was shown in the Step 6 Engineering. In the Step 6 Engineering, the ramp geometry from the intersection to the mainline consisted of: a 20 degree skew, 102 ft. tangent, 20 mph horizontal curve to the right, 43 ft. tangent, 40 mph horizontal curve to the left, 333 ft. tangent, 50 mph compound curve to the left, 200 ft. spiral onto the mainline. In the simplified geometrics for the Preliminary Engineering, the ramp geometry from the intersection to the mainline consists of: a 25 degree skew, 151 ft. tangent, 20 mph horizontal curve to the right, 333 ft. tangent, 45 mph/60 mph compound curve to the left, 200 ft. spiral onto the mainline.

The refinements to the vertical design include:

- To improve drainage for the ramp, the manner in which the beginning of the ramp interacts with Carnegie was changed to permit continuous use of the Carnegie curb and gutter system as the primary collection for drainage at this point. To accomplish this, a grade break was introduced at the edge of pavement with the Carnegie alignment. In the Step 6 Engineering this grade break was from -1.6% to -1.05% (grade break of 0.55%). In the Preliminary Engineering this grade break is now from -

0.8% to +0.7 (grade break of 1.5%). This grade break meets all applicable standards.
- Minor adjustments were made to the remainder of the vertical design to account for this change in grade break at the intersection.

None of these refinements to the Step 6 Engineering that was show in the FEIS, DEIS and IJS as Alternative A or the Preferred Alternative that are reflected in the CCG1 Preliminary Engineering, change the validity of the results and recommendations outlined in those documents. In fact, these refinements have only served to further improve and optimize the design.

3.) CONTROLLING CRITERIA:

Lane Width	______	Grades	______
Shoulder Width	______	SSD	______
Bridge Width	______	Cross Slopes	______
Structural Capacity	______	Superelevation (Transition)	______
Graded Shoulder	______		
Horizontal Alignment	**X**	Horizontal Clearance	______
Vertical Alignment	______	Vertical Clearance	______

4.) DETAILED ANALYSIS

A.) Description of Deviation:

Mitigation Strategies for Design Exceptions (FHWA-SA-07-011) states that “Not meeting the lower (50 percent) range per Exhibit 10-56 requires a design exception per FHWA policy.” Bases on Exhibit 10-56 in *AASHTO Geometric Design of Highways and Streets (2004)* and a highway design speed of 60 mph, the lower range (50%) ramp design speed is 30 mph, which requires a design exception for this location. For a 30 mph design curve, the minimum degree of curve that can be used as set forth by Figure 202-10 of the ODOT Location and Design Manual, Volume 1 is 24º45’00”. The design speed of 30 mph would require a superelevation of 0.06. The proposed design utilizes a degree of curve of 39º45’00” on the first curve away from the intersection with Carnegie Avenue along the ramp. The proposed 39º45’00” curve with a superelevation rate of 0.053 provides a design speed of 20 mph.

B.) Accident Data:

The 3-year crash history (2006-2008) for the 400 ft. section of the Ontario Street Entrance Ramp, beginning at Ontario Street and extending through the non-standard segment of the ramp curve, was reviewed to identify crash patterns and contributing factors. The primary purpose of this crash analysis is to isolate the potential impact that perpetuating a horizontal curve deficiency would have on safety at this location. As such, only crashes that occurred in the roadway segment where the curve geometry may have been a proximate cause of the crash were considered. Crashes that occur outside of this selected segment should not have been impacted by the curve deficiencies. The crash history shows a total of six crashes from 2006 to 2008 – one in 2006, four in 2007, and one in 2008 (see Table 1 below for summary).

Table 1: Crash Data for Ontario Street On-Ramp to I-90

ACCYEAR	ACCSEV	ACCTYPE
2008	Unknown	Rear end
2007	PDO	Rear end
2007	PDO	Rear end
2007	PDO	Rear end
2006	PDO	Rear end
2007	PDO	Sideswipe Passing

These crashes were examined with respect to the following variables (see Traffic Accident Analysis summaries): year, time of day, roadway conditions, crash severity, crash type, day of week, hour of day and month of year. Further, all crashes were plotted on a collision diagram (see Collision Diagram and Collision Diagram Legend and Label Definition) to clearly show the location of each incident.

None of the crashes involved injury. Of the six crashes identified at this location, there was one sideswipe and five rear-end accidents. The sideswipe passing crash occurs at the beginning of the ramp and, since this is a single lane ramp, can be attributed to driver error. One of the rear end crashes occurred past the horizontal curve and in the PM peak and, thus, can be attributed to recurring congestion at this location. The remaining four rear end crashes occurred on the Ontario Street ramp prior to the horizontal curve.

Three of the crashes occurred under dry pavement conditions and three of the crashes occurred under wet pavement conditions. In addition, 1 of the crashes occurred between 1am and 3am, 1 occurred between 2pm and 3pm and the other 4 occurred between 3pm and 7pm. Of the four rear end crashes that occurred on the Ontario Street ramp, 2 of those crashes occurred between 3pm and 7pm. This ramp typically incurs severe congestion during the PM peak period. As such, the most probable cause of these 2 crashes is the recurring congestion at this location.

The crash type that would be expected if there was an existing safety problem related to the horizontal and vertical curve geometry of the initial curve of this ramp would be ran-off-road. There were no “ran-off-road” type crashes during the study period. Further, of the four rear end crashes that occurred in the portion of the curve where a possible cause for the crash would be the lead driver slowing for the curve, two occurred during the recurring congestion of the PM peak period. As such, during the study period, there are only two crashes identified where the proximate cause of the crash may be curve geometry.

These trends agree with the crash analyses previously documented in the *Existing and Future Conditions Report* (Section 4.4 Crash Analysis), *Purpose and Need* (Section 3.4 Safety), *Conceptual Alternatives Report* (Section 3.3.2 Safety) and *Draft Environmental Impact Statement* (Section 2.2.3 Innerbelt Freeway Safety).

In addition, a *Road Safety Audit for the East 9th Street and Carnegie Avenue Intersection* was performed under the direction of NOACA with input from FHWA, ODOT District 12 and city of Cleveland Division of Traffic Engineering in November 2008. While this audit was not for the Ontario Street and Carnegie Avenue intersection, these sites are very similar in nature. This audit examined vehicular movement, pedestrian

Collision Diagram Legend and Label Definition

Symbols

Straight	Parked	Pedestrian	Fixed objects:
Stopped	Erratic	Bicycle	General, Pole
Unknown	Out of control	Injury	Signal, Curb
Backing	Right turn	Fatality	Tree, Animal
Overtaking	Left turn	Nighttime	3rd vehicle
Sideswipe	U-turn	DUI	Extra data

LABEL = MM/DD/YYYY-HHMI-LI-RC-S-99999999999

LI = Light Codes:

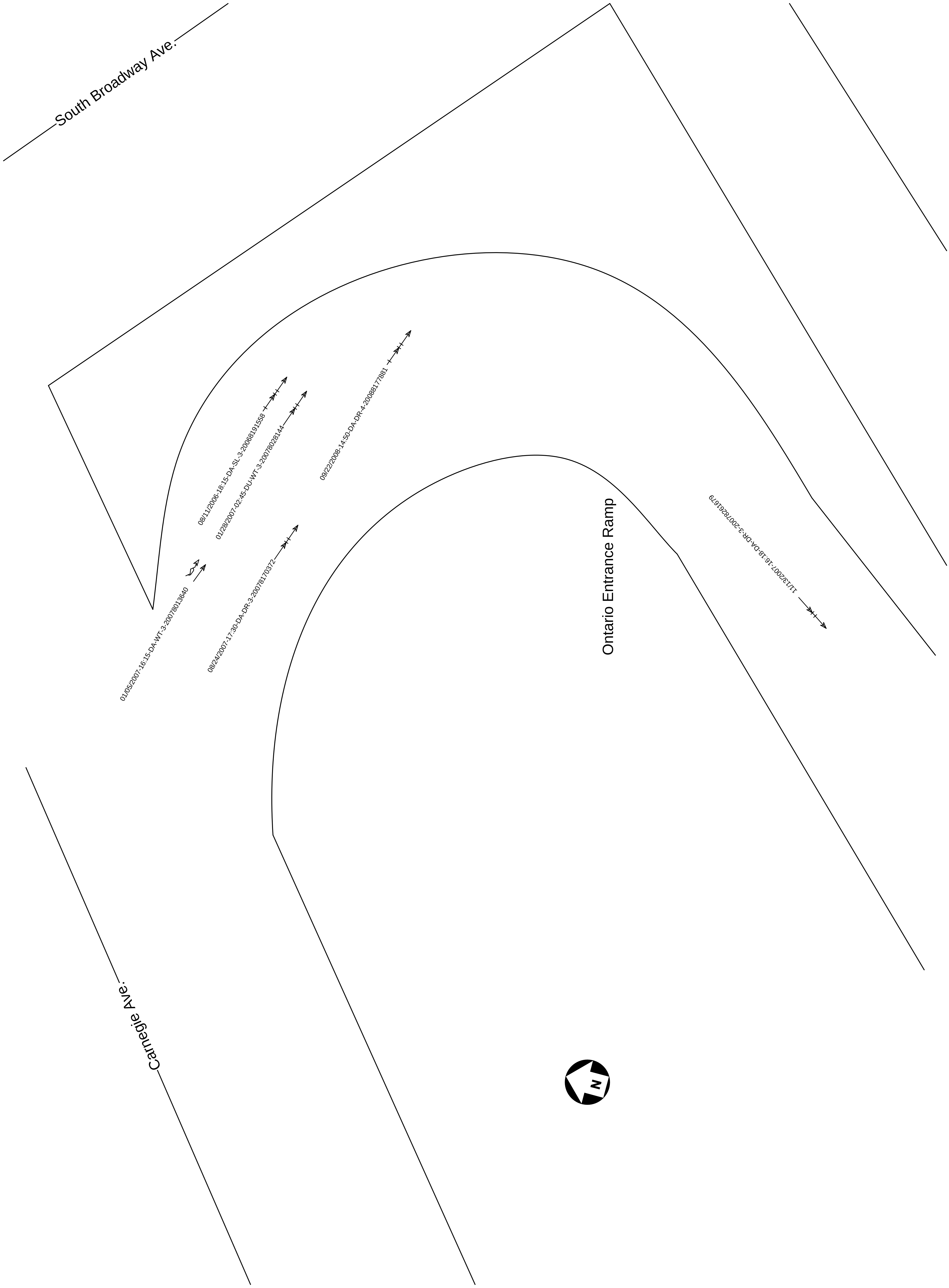
CODE	NUMBER	DESCRIPT
DA	1	Daylight
DW	2	Dawn
DU	3	Dusk
DL	4	Dark - Lighted Roadway
DN	5	Dark - Roadway Not Lighted
DU	6	Dark - Unknown Roadway Lighting
GL	7	Glare
OT	8	Other
UK	9	Unknown

RC = Road Condition Codes:

CODE	NUMBER	DESCRIPT
DR	1	Dry
WT	2	Wet
SN	3	Snow
IC	4	Ice
MD	5	Sand, Mud, Dirt, Oil, Gravel
WA	6	Water (Standing, Moving)
SL	7	Slush
DB	8	Debris
RT	9	Rut, Holes, Bumps, Uneven Pavement
OT	10	Other
UK	11	Unknown

S = Crash Severity

CODE	NUMBER	DESCRIPT
1	1	Fatal Crash
2	2	Injury Crash
3	3	Property Damage Crash
4	4	Propertyy Damage Unknown/Other Crash



Onterio Ramp to I-90

Project: Burgess And Niple Onterio Ramp to I-90
PID: 10130
Roadway: Onterio Ramp to I-90

Prepared By: TSASS Inc.
Prepared Date: November 3rd, 2009
Prepared For: Burgess and Niple
Start Date: January 1st 2006
End Date: December 31st 2008

TRAFFIC ACCIDENT ANALYSIS
Onterio Ramp to I-90

County: CUY | Main Roadway: #### | Begin SLM: -0.010 | End SLM: 0.152

Project: Onterio Ramp to I-90 | Intersecting Roadway: terio Ramp to I-90 | *Crash Data last Updated: 5/10/2009*

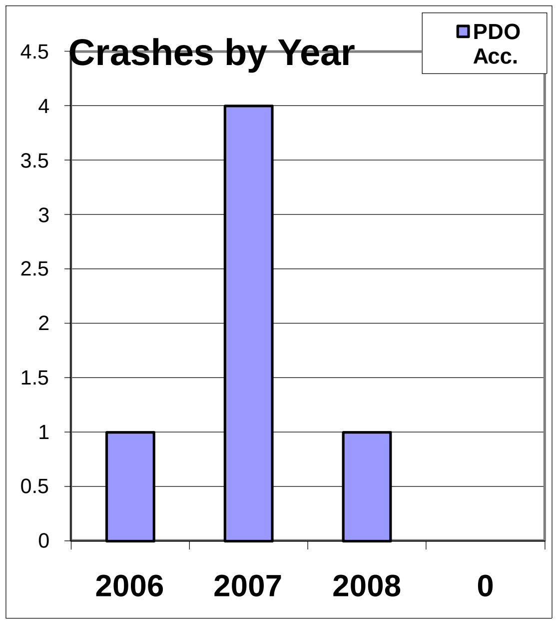
Prepared by: TSASS-BATCH | Date: 04-NOV-09 | Prepared for: Burgess and Niple - Franklin County Engi | *Estimated Percent of 2008 data = 87*

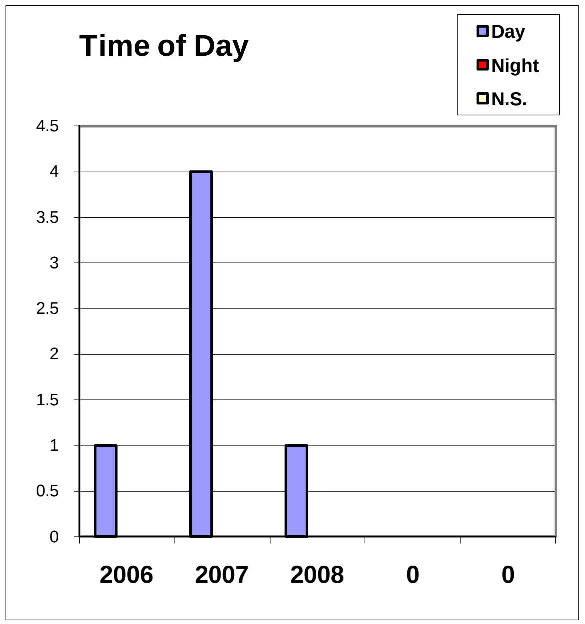
TSASS Study-ID:	10131
SEGID	INTERSID
1	0

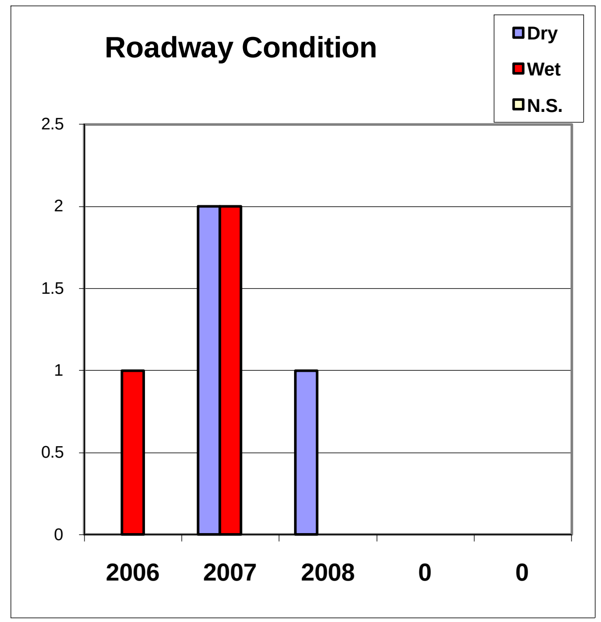
9789

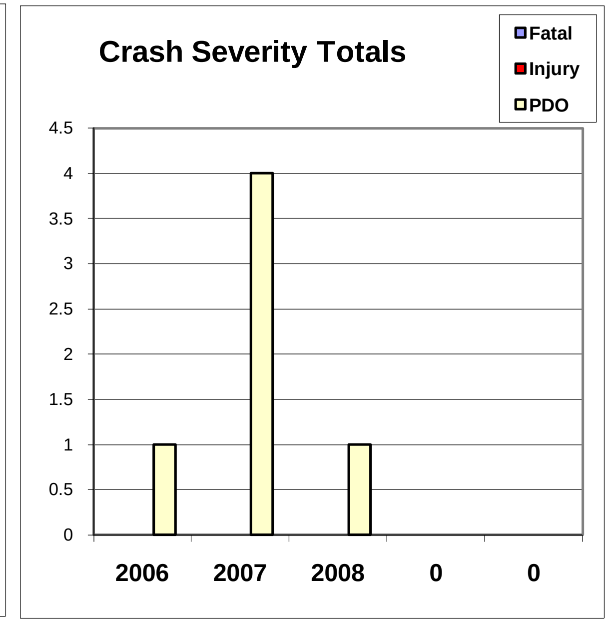
YEAR	LIGHTING CONDITION						ROADWAY CONDITION					
	Day		Night		N.S.		Dry		Wet		N.S.	
	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F	PDO	I/F
2006	1	0	0	0	0	0	0	0	1	0	0	0
2007	4	0	0	0	0	0	2	0	2	0	0	0
2008	1	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	**6**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**3**	**0**	**0**	**0**
Total	**6**		**0**		**0**		**3**		**3**		**0**	

YEAR	CRASH TYPE																											
	L.T.		R.T.		Angle		Rear-end		Head On		S.S. Same		S.S. Oppos		F.O.		Backing		Ran Off Road		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		
2006	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		
2007	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0		
2008	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Subtotal	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**		
Total	**0**		**0**		**0**		**5**		**0**		**1**		**0**		**0**		**0**		**0**		**0**		**0**		**6**			







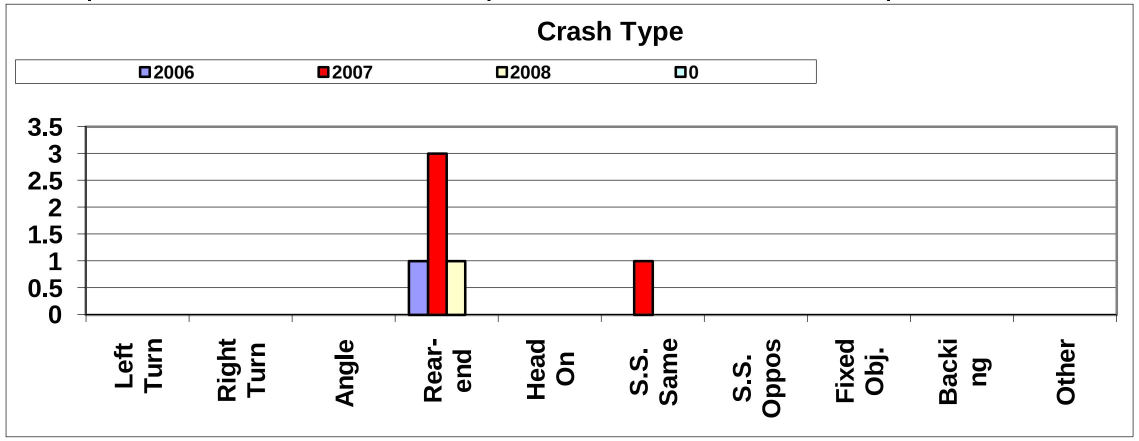


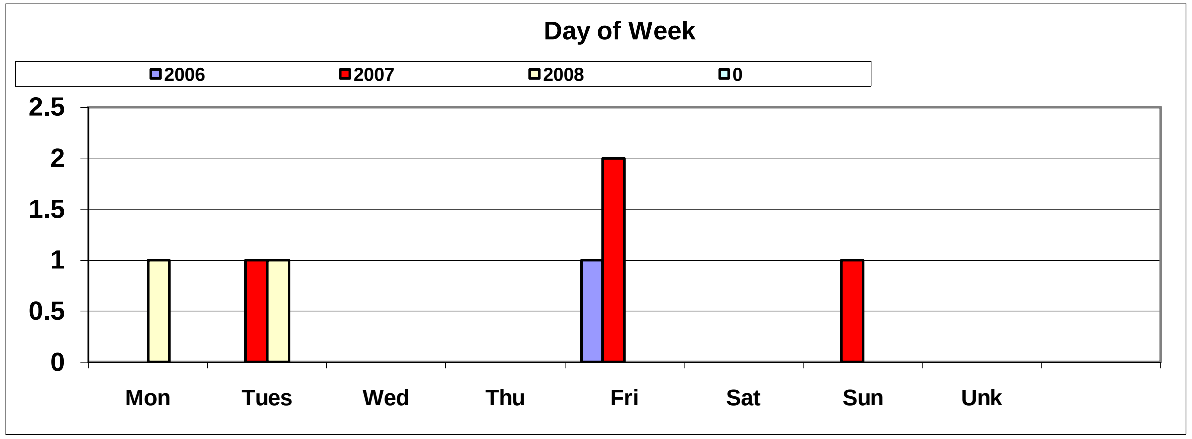
Source: Traffic Safety Analysis Systems & Services - Ohio Safety Information System - Data represents most current data available as of date of preparation. Subject to change due to late crash data submissions by police agencies and / or additional improved crash location information. The Ohio Safety Information System (OSIS) is a proprietary safety database containing Ohio traffic crash and related safety information. Available on line at: osis.tsass.com

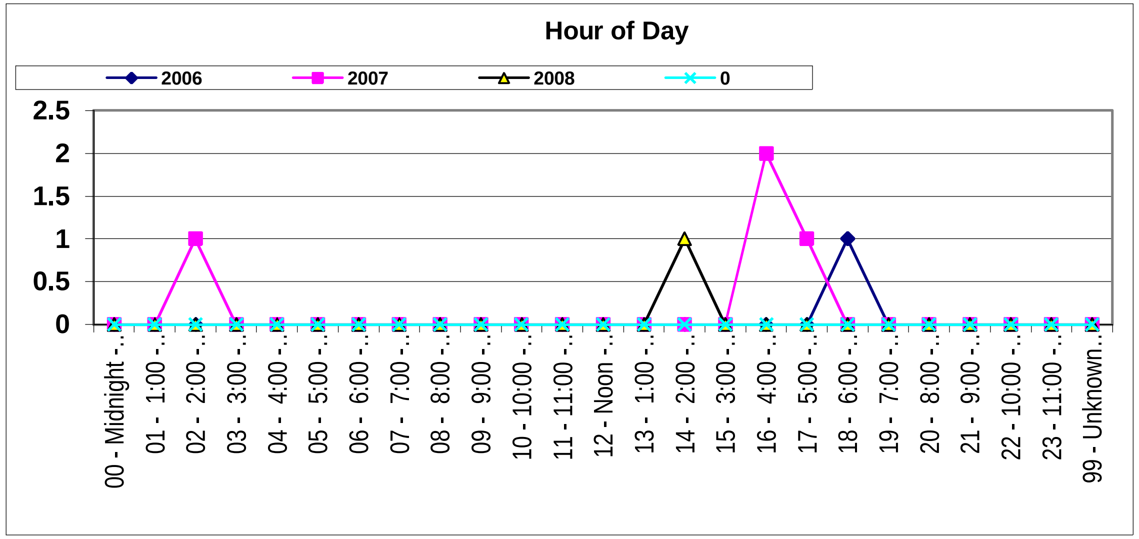
TRAFFIC ACCIDENT ANALYSIS
Onterio Ramp to I-90

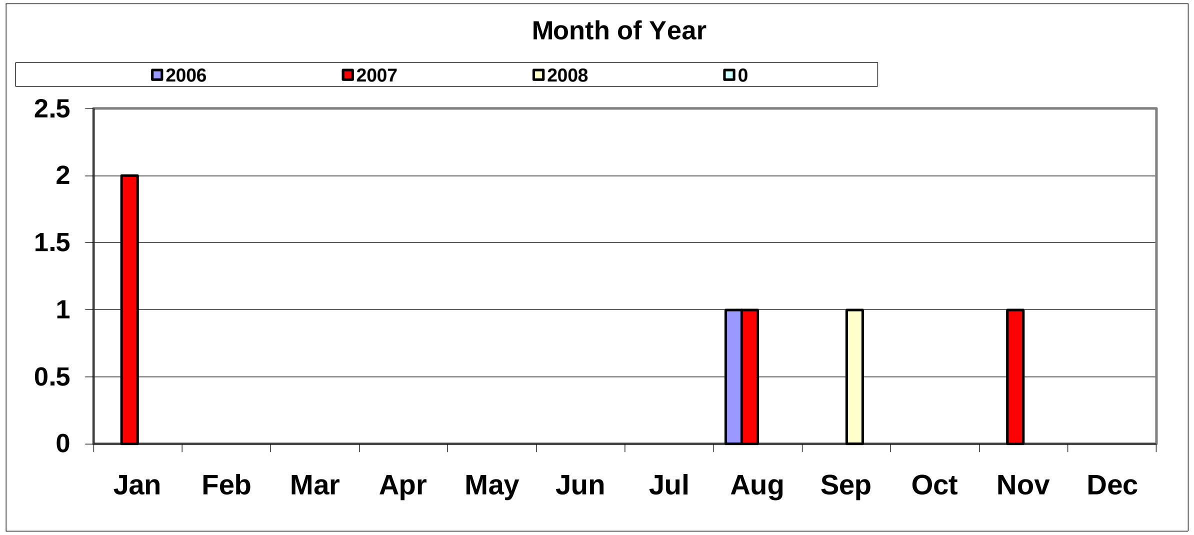
County	CUY	Main Roadway	####		Begin SLM	-0.010	End SLM	0.152	TSASS Study-ID: 10131
Project:	Onterio Ramp to I-90	Intersecting Roadway	terio Ramp to I-90		*Crash Data last Updated:*	*5/10/2009*		SEGID	INTERSID
Prepared by	TSASS-BATCH	Date	04-NOV-09	Prepared for: Burgess and Niple - Franklin County Engi	*Estimated Percent of 2008 data =*	*87*		1	0

9789









Source: Traffic Safety Analysis Systems & Services - Ohio Safety Information System - Data represents most current data available as of date of preparation. Subject to change due to late crash data submissions by police agencies and / or additional improved crash location information. The Ohio Safety Information System (OSIS) is a proprietary safety database containing Ohio traffic crash and related safety information. Available on line at: osis.tsass.com

movement and intersection operation at this location. Of the recommendations made by the Audit, one deals directly with the configuration of the East 9th Street on-ramp to WB I-90. This recommendation is to "address the conflict at the ramps to I-90 and I-77 south of Carnegie Avenue by installing repeated advance directional information to emphasize lane assignment, including advanced lane assignment overhead signs, upgraded pavement markings, ground-mounted sign at the gore area and mountable raised island separation to define the ramps' entrances." As part of the proposed design, the Ontario/Carnegie intersection will be reconfigured. As part of this reconfiguration, the Ontario Street on-ramp to WB I-90 will be reconfigured to act as a fifth leg of the intersection. The majority of the traffic utilizing this ramp comes from the SB Ontario approach to the intersection. To further facilitate clear wayfinding, a splitter island has been proposed for the SB approach to the intersection to separate ramp traffic from through traffic and direct that ramp traffic to the ramp leg of the intersection. As such, the proposed design supports the recommendations made by this Audit.

C.) Future Traffic Safety:

The crash analysis for this roadway segment shows that, at most, only two of the rear end crashes could potentially have a proximate cause associated with the curvature of the ramp. It is anticipated that the future crash rate along this section to be no worse than the existing due to the proposed horizontal curvature. However, due to the changes in capacity along this section of Innerbelt, it is anticipated that congestion related crashes at this location will drop. Since the majority of the crashes (67%) at this location were associated with reoccurring congestion, it can be assumed that this change in capacity will have a large impact on improving safety. As such, it is anticipated that the overall safety along this segment of roadway will improve as a result of this project.

The design and operational deficiencies that are retained in the CCG1 Preliminary Engineering, which is a refinement of the Step 6 Engineering that was utilized to develop the selected Preferred Alternative (Alternative A) as part of the NEPA process, are minor, localized in nature and in all cases provide for a build condition that is substantially better than that of the existing condition.

D.) Impact on Adjacent Property:

The alternatives considered and their potential impact on adjacent properties has been outlined in the Design Philosophy section above. As shown in that documentation, in order for the proposed alignment to meet the design criteria established for curve radius, either the location of the proposed ramp would need to change, the location of I-90 would need to change, or the design of the ramp would need to change. These alternate approaches were considered and rejected in favor of the proposed design. The proposed design supports the decisions reached and documented in the IJS, FEIS/Section 4(f) Evaluation and ROD.

E.) Proposed Mitigation:

There will be no mitigative measures for the deviation to the standards included as part of this project other than the provision of additional signing warning of the curve's design speed which may improve driver expectation.

F.) Support for Deviations:

There are several factors that support this horizontal and vertical curve deviation:

- This design deficiency is minor and localized in nature. The overall changes to the design and operational characteristics of the corridor in all cases provides for a build condition that is substantially better than the existing/no build condition. The safety analysis performed in support of this deviation show that safety in this segment of the corridor will increase with the build alternative.
- This deviation is located near an intersection. As such, the operating speeds along this ramp at the location of the initial curve should closely match the design speed.
- The proposed design balances the physical condition, operational performance, safety, access and community needs with the design requirements as documented in the IJS, FEIS/Section 4(f) Evaluation and ROD.
- The geometrics (inclusive) of the CCG1 Preliminary Engineering, which is a refinement of the Step 6 Engineering shown in the NEPA documentation as Alternative A, meet or exceed the enumerated geometric criteria, Interstate system mainline and ramp layouts, local street system layouts and intersection layouts, lane and turn lane dimensions and assessed operational characteristics as documented within the IJS, FEIS/Section 4(f) Evaluation, and ROD.

5.) SUMMARY:

As described above, the proposed design for the Ontario Street on-ramp to westbound I-90 does not meet the lower range value for Ramp Design Speed as set forth by Figure 503-1 of the ODOT Location and Design Manual Volume 1. For a mainline I-90 design speed of 60 mph, the lower range design speed for the ramp would be 30 mph. However, the proposed design only provides for a 20 mph horizontal curve. The proposed design achieves the best balance of the physical condition, operational performance, safety, access and community needs with the design requirements. The proposed 20 mph curve is similar to the existing condition at this location. Existing crash history for this location shows that the existing geometry does not have a substantial safety impact. As such, it is assumed that the proposed 20 mph curve would also have minimal safety impacts. This design deficiency is minor and localized in nature and, in all cases, the build condition provides for substantially better physical condition, operational performance and safety than the existing/no build condition.

Engineers Seal:

STATE OF OHIO
PAUL W.
DOROTHY
E-63443
REGISTERED
PROFESSIONAL ENGINEER

Signed:

Date: 22 NOV 2009

INFORMATION FOR EXCEPTION TO THE MINIMUM DESIGN STANDARDS

PROJECT: CLEVELAND INNERBELT PROJECT

P.I.D. 77510

I-90 FUNCTIONAL CLASSIFICATION: URBAN INTERSTATE

(EAST 9TH STREET ON-RAMP TO WB I-90)

Introduction

The Cleveland Innerbelt is a high capacity, limited-access interstate highway extending from Cleveland's Tremont neighborhood on the West Side of the Cuyahoga River, across the Cuyahoga Valley, around the southern and eastern edges of downtown to the City's lakefront district at Burke Lakefront Airport. The Innerbelt includes portions of I-71 and I-90, and connects to I-77, I-490, SR 2, and SR 176.

The Innerbelt Freeway provides access to and mobility through the City of Cleveland. Downtown Cleveland depends on the Innerbelt Freeway's ability to collect and distribute traffic between the radial freeway system of I-90, I-490, I-71, SR 176, and I- 77 and the local street system. During the morning peak period, the Innerbelt Freeway functions to collect traffic from the system of radial freeways and distribute that traffic to the local street system. During the evening peak period, the Innerbelt Freeway functions to collect traffic from the local street system and distribute that traffic to the system of radial freeways. The Innerbelt Freeway also moves traffic between each of the radial freeways, thus allowing through traffic to bypass the local street system.

The Innerbelt is an important segment of the federally designated interstate highway system that crisscrosses the United States to provide efficient movement of industrial goods and to link major metropolitan centers. The Innerbelt is designated as Interstate 90 (I-90) and serves as the northern terminus for two others, Interstate 71 (I-71) and Interstate 77 (I-77).

The design of the Innerbelt Freeway predates the development of modern standards for the design of freeways. In particular, three types of design deficiencies — improper reduction in the basic number of lanes; inadequate ramp configuration and spacing; and inadequate curve radius — have the most direct and adverse impacts on the operational performance and safety of the Innerbelt Freeway.

The existing and future conditions for the Innebelt were examined, a purpose and need for the project was developed, alternatives were developed, analyzed and refined and a final NEPA screening of these alternatives resulted in a Preferred Alternative being selected for implementation. Based on the Implementation Plan developed for the project the estimated total construction cost for the overall project is $2.65 billion (year of expenditure dollars) and will be implemented between 2010 and 2027. For further information on this process, please refer to the following project documents:

- Cleveland Innerbelt Existing and Future Conditions Report (E&F)
- Cleveland Innerbelt Purpose and Need (P&N)
- Cleveland Innerbelt Conceptual Alternatives Study (CAS)
- Cleveland Innerbelt Interchange Justification Study (IJS)
- Cleveland Innerbelt Draft Environmental Impact Statement (DEIS)

- Cleveland Innerbelt Final Environmental Impact Statement (FEIS)
- Cleveland Innerbelt Record of Decision (ROD)

The first construction contract, Construction Contract Group 1 (CCG1), to implement the NEPA decisions outlined in the FEIS will consist of the roadway segment comprised of mainline WB I-90 from approximately East 9^{th} Street on the north to the southern termini of the overall project at the I-71/I-90/I-490 system interchange for a mainline distance of approximately 1.4 miles. CCG1 includes a new WB Central Viaduct Bridge and the following ramp connections: East 9^{th} Street on-ramp, Ontario Street on-ramp and Abbey Avenue off-ramp. CCG1 has an estimated construction cost of $476 million (2012$).

1.) EXISTING FACILITY:

I-90 across the Central Viaduct Bridge has a current (2008) ADT of 119,000 vehicles per day with 6% truck traffic and a legal speed of 50 mph. The existing East 9^{th} Street on-ramp to WB I-90 (see Existing Conditions – East 9^{th} Street On-ramp to WB I-90) has a current (2006) ADT of 7,245. Existing WB I-90 in the vicinity of the East 9^{th} Street on-ramp carries three twelve foot lanes. The single lane East 9^{th} Street on-ramp then enters as a merge lane followed by the Ontario Street on-ramp as an add lane which forms the fourth twelve foot lane across the Central Viaduct Bridge. The existing shoulders are deficient with inside shoulders that vary from 1’6” to 3’6” and outside shoulders that vary from 1’0” to 3’3”.

2.) PROPOSED FACILITY:

Proposed Design

I-90 across the new WB Central Viaduct Bridge has a projected (2035) ADT of 71,000 vehicles per day with 6% truck traffic and a legal speed of 55 mph. The proposed East 9^{th} Street on-ramp to WB I-90 (see Contract Group 1 – East 9^{th} Street On-ramp to WB I-90 Design Exception) has a projected (2035) ADT of 7,000 vehicles per day. Proposed WB I-90 in the vicinity of the East 9^{th} Street on-ramp will carry four twelve foot lanes. The dual lane East 9^{th} Street ramp will taper to a single lane and enter WB I-90 as a merge lane, then the Ontario Street on-ramp will enter as an add lane forming the fifth twelve foot lane across the Central Viaduct Bridge. Twelve foot inside and outside shoulders will be provided on the mainline, while on the ramp a 6 ft. right shoulder and 3 ft. left shoulder (4 ft. when barrier is present) is provided.

The proposed East 9^{th} Street on-ramp to WB I-90 begins 128.1 ft. south east of the Carnegie Avenue/East 9^{th} Street intersection. Three lanes travel southeast out of this intersection, with the two outside lanes dropping to the on-ramp and the inside lane continuing southeast to an intersection with the Orange Avenue/Ontario Avenue corridor. The on-ramp curves away from the East 9^{th} Street alignment in a dual 18 ft. lane configuration through a 49º23’34” curve with a superelevation rate of 0.057 which provides a design speed of 20-mph and a sag vertical curve with a design speed of 25mph (K=26). The two lanes then taper to a single 16 ft. lane over 600 ft.

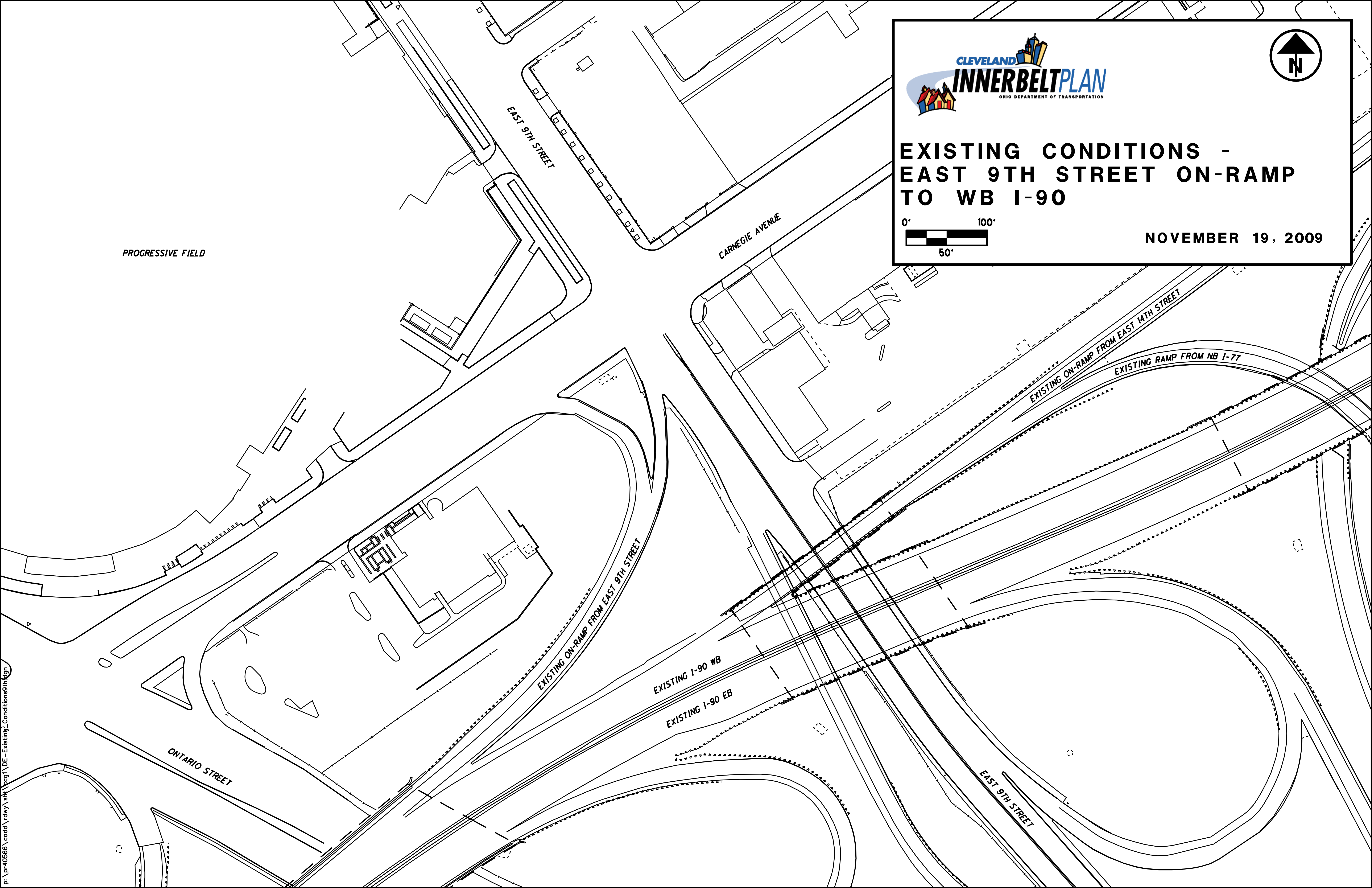
The East 9^{th} Street on-ramp to WB I-90 provides 1,900 ft. of acceleration length between the PT of the initial 20 mph horizontal curve and the point where the lane has narrowed to 12 ft. in width. In AASHTO’s *A Policy on the Geometric Design of Highways and Streets* it states that “The geometrics of a ramp proper should be such that motorists may attain a speed that is within 5 mph of the operating speed of the freeway by the time they reach the point where the left edge of the ramp joins the traveled way of the freeway. For consistency of application, this point of convergence of the left edge of the ramp and the right edge of the through lane may be assumed to occur where the right edge of the ramp traveled way is 12

CLEVELAND INNERBELTPLAN
OHIO DEPARTMENT OF TRANSPORTATION

EXISTING CONDITIONS - EAST 9TH STREET ON-RAMP TO WB I-90

0' 100'
50'

NOVEMBER 19, 2009



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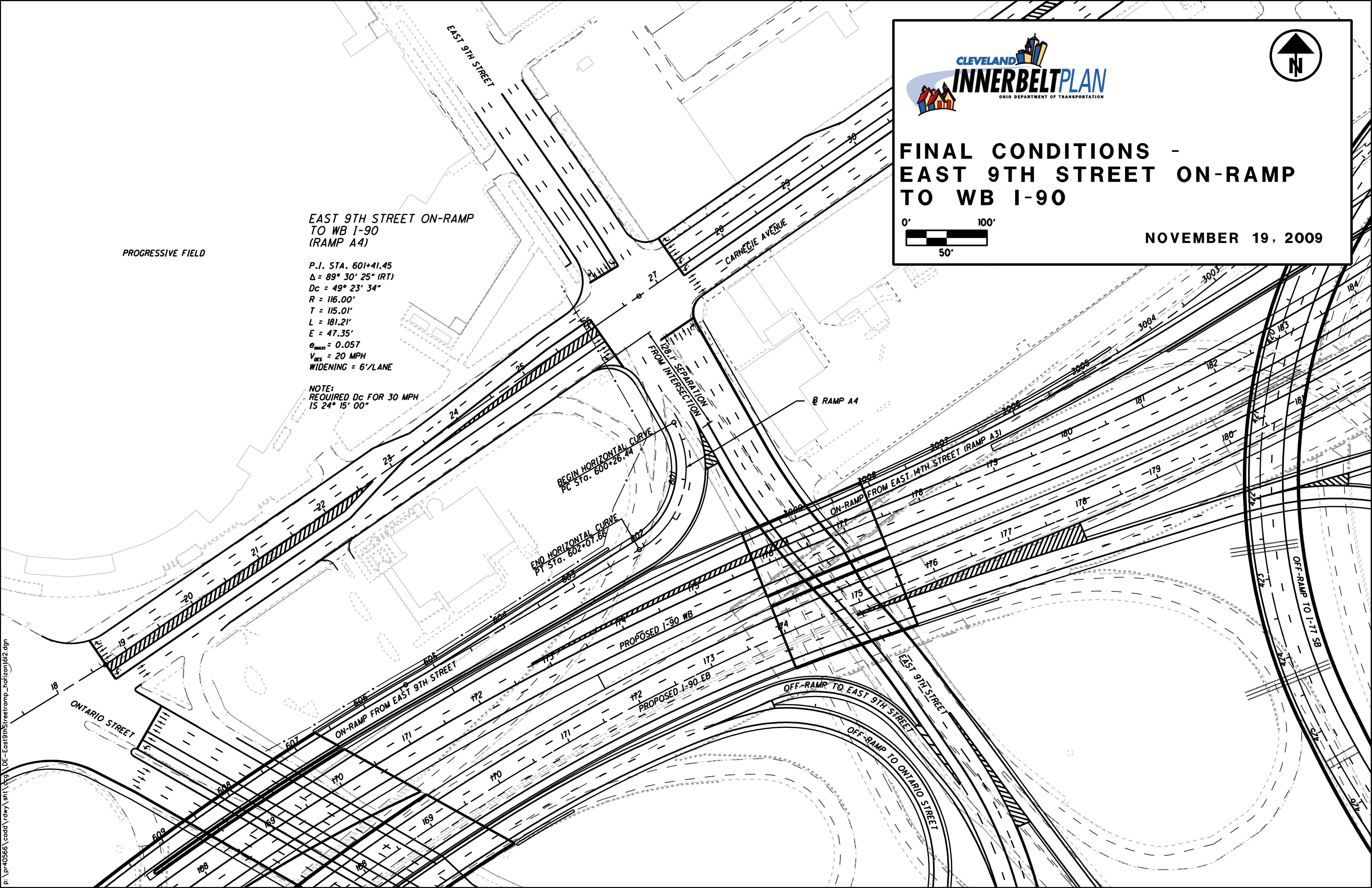
FINAL CONDITIONS - EAST 9TH STREET ON-RAMP TO WB I-90

NOVEMBER 19, 2009

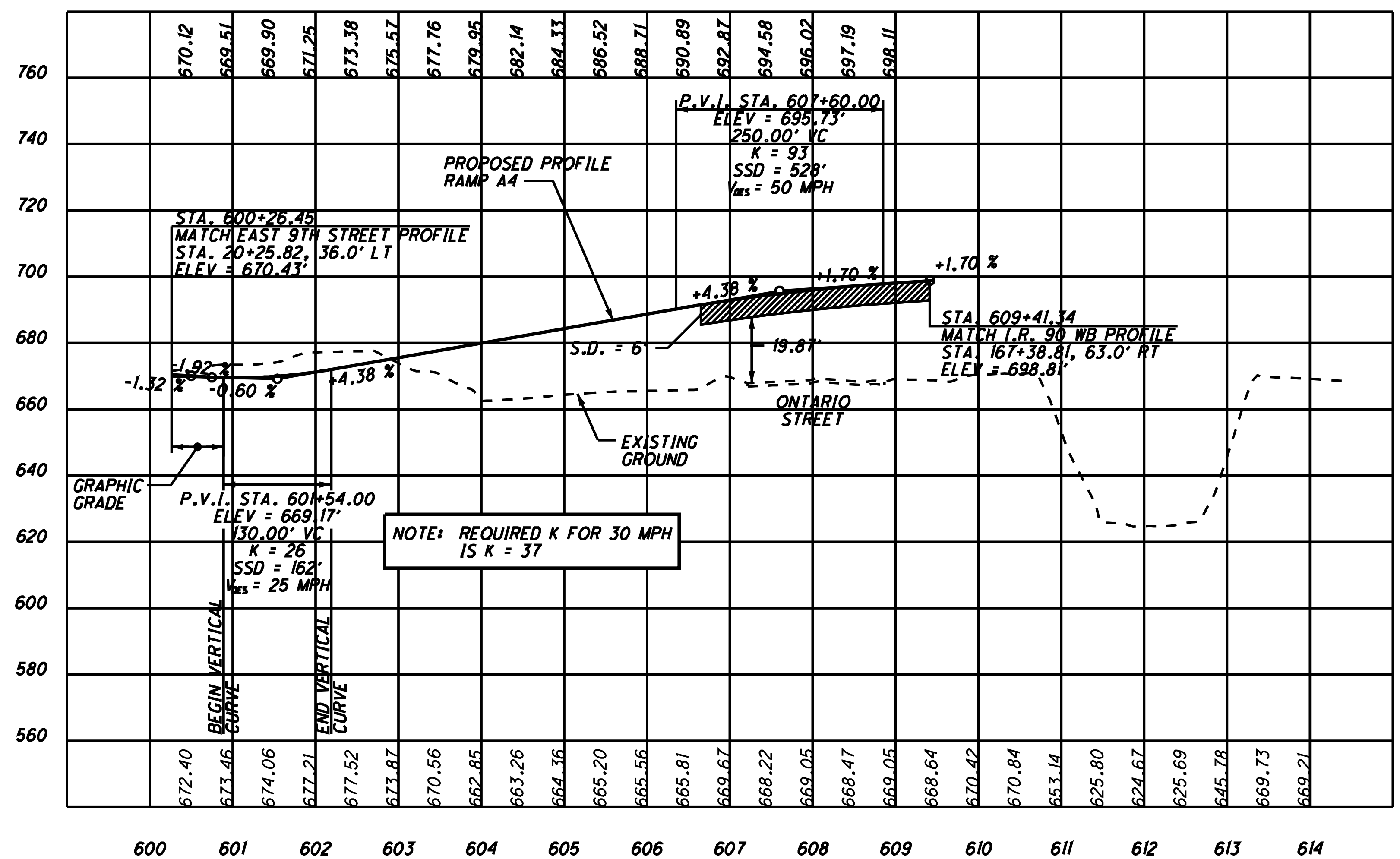


CONTRACT GROUP 1 - EAST 9TH STREET ON-RAMP TO WB I-90 DESIGN EXCEPTION

0' 100'
50'

NOVEMBER 19, 2009

EAST 9TH STREET ON-RAMP TO WB I-90 (RAMP A4)



p:\pr40566\cadd\rdwy\sht\ccg1\DE-East9thStreetramp_vertical.dgn ft. from the right edge of the through lane of the freeway." Based on Exhibit 10-70, the minimum acceleration length needed for a mainline design speed of 60 mph is 1,100 ft. However, "where grades are present on ramps, speed-change lengths should be adjusted in accordance with Exhibit 10-71." The grade on much of this ramp is +4.38%, so the factor derived from the table is 1.4. Multiplying 1,100 ft. by 1.4 results in a grade adjusted acceleration distance of 1,540 ft. As such, this ramp design provides an additional 360 ft. of acceleration length over what is required.

Design Philosophy

This proposed design for the East 9th Street on-ramp to WB I-90 was selected as the best balance between design, operation, safety, driver expectation and community impacts. Other alternatives were considered and rejected as not achieving this balance. A brief description of the other alternatives considered is presented below.

In order for the proposed alignment to meet the design criteria established for curve radius, either the location of the proposed ramp would need to change or the location of I-90 would need to change. During initial development of this alternative which is documented in the Conceptual Alternatives Study, major changes to this area were considered and rejected first.

- Change Alignment of I-90: This approach is not feasible for several reasons. First, moving the alignment of I-90 to the southwest to allow greater room to develop the ramp curve radius in question would create design problems for the multitude of other ramps that interact with the I-90 and I-77 alignments within the Central Interchange area. Second, moving the alignment of I-90 to the southeast would create extensive constructability and Maintenance of Traffic and Access (MOTAA) issues associated with the interaction between the existing alignment of I-90 and a realigned future I-90 alignment. These constructability and MOTAA issues would result in substantial increases in cost, delay in construction and reduction of access during construction. These impacts do not justify correcting this design deviation.
- Change the location of the ramp: There are a limited number of ways in which the location of the ramp could be changed.
    - The Carnegie Avenue and East 9th Street intersection could be moved to the northwest approximately 130 ft. There are two options to accomplish this. The first would require severing the through connectivity of Carnegie Avenue, which is a major arterial serving both the Cleveland Central Business District and surrounding neighborhoods. The second would require taking Progressive Field, which was constructed in 1994 at a cost of $175 million, to reestablish the Carnegie alignment.
    - The ramp could be elevated on a fly-over, which would begin on the southbound approach to the Carnegie Avenue and East 9th Street intersection. This fly-over ramp would then cross over the eastbound approach to the intersection on an elevated structure before entering mainline westbound I-90. While this alternative has not explicitly been examined as part of the Assessment of Feasible Alternatives, a similar alternative for the Ontario Street to westbound I-90 ramp was examined and strongly rejected by the community.

Once major changes to the ramp configuration had been examined and rejected, two primary design approaches were examined.

The first of these is represented by the proposed design. Based on design guidance given in AASHTO's A Policy on Design Standards Interstate System (January 2005) "Access Control…should extend beyond the ramp terminal at least 100 ft. in urban areas," the beginning point for the ramp was determined. In the final build condition, the

East 9th Street on-ramp is located 104 ft. from the Carnegie/East 9th Street intersection, while in the CCG1 Preliminary Engineering it is located 128.1 ft. from the intersection. Constrained by the 100 ft. separation from the intersection and the location of the mainline, a 20 mph horizontal and 25 mph vertical curve begin the ramp. However, the guidance given by a combination of FHWA's *Mitigation Strategies for Design Exceptions* and AASHTO's *A Policy on Geometric Design of Highways and Streets*, requires a minimum design speed for these curve elements of 30 mph. The proposed design's deviation from this horizontal and vertical curve requirement requires a design exception. This geometry sets the ramps approach to the mainline freeway.

The second approach considered looked at what it would take to meet the 30 mph design requirements for the initial horizontal and vertical curve that begins the geometry of this ramp. By reconfiguring the ramp to provide a 30 mph curve design, without impacting the mainline I-90 alignment, the 100 ft. minimum separation from the intersection cannot be maintained. This would not require a design exception. Under this approach, the ramp essentially becomes another leg of the intersection of East 9th Street and Carnegie Avenue, but cannot be adequately separated from the SB East 9th Street leg of the intersection enough to provide a clear visual cues to drivers. In addition, it would not be possible for this design approach to meet required superelevation position as outlined in Section 202.4.6 Superelevation Position in ODOT's *Location and Design Manual Volume 1*. Based on this guidance, a design exception is required if the following is not provided: "the transition shall be placed so that 50 percent to 70 percent of the maximum superelevation rate is outside the curve limits (PC, PT)." As such, a design exception would be required for superelevation to account for this deviation.

All efforts were made to develop a proposed design that achieved the best balance between the competing design elements, operational needs, safety, access, driver expectancy and community preferences. When these two alternative approaches are examined with these measures of effectiveness in mind, the proposed design is superior. The alternative configuration creates driver confusion by creating an unnecessarily complex intersection and violates driver expectation regarding the superelevation transition. However, the proposed design simplifies the intersection, provides expected superelevation transition and provides adequate distance (as per the *Ohio Manual of Uniform Traffic Control Devices*) to provide warning signs for the curve design speed deficiency.

This design exception was not called out in the *Interchange Justification Study (IJS) Section 1.2.1 Design Exceptions* as a potential design exception. The IJS has been incorporated in its entirety into the Final Environmental Impact Statement (FEIS). In July 2007, FHWA released *Mitigation Strategies for Design Exceptions (FHWA-SA-07-011).* The changes to the design exception process represented in this new publication were incorporated into ODOT policy gradually over the course of 2008. The *Mitigation Strategies for Design Exceptions* document specifically calls out that "Not meeting the lower (50 percent) range per Exhibit 10-56 requires a design exception per FHWA policy." Bases on Exhibit 10-56 in AASHTO's *A Policy on Geometric Design of Highways and Streets (2004)* and a highway design speed of 60 mph, the lower range (50%) ramp design speed is 30 mph, which requires a design exception for this location. However, the Step 6 Engineering for this project was also completed during 2008. As part of the development of the Step 6 Engineering, the list of potential design exceptions (not including this design exception) that was presented along with the Step 6 Engineering in the IJS and, by way of reference, in the FEIS was prepared. During further verification of the Step 6 Engineering in preparation of a Preliminary Engineering package for use by a Design Build Team for the construction of Contract Group 1 (which includes this roadway segment) a review of all roadway elements revealed that this segment would now need to be processed as a design exception.

There has been no substantive changes to the design in this area between the Step 6 Engineering, which was incorporated into the IJS, FEIS and DEIS, and the Preliminary Engineering (a refinement of this Step 6 Engineering) that will be used to support the Design Build effort for Construction Contract Group 1, which includes this roadway segment. However, there were several slight revisions to the geometry of this ramp that were undertaken as part of the refinements made to the design as part of the development of the CCG1 Preliminary Engineering. The refinements to the horizontal design include:

- The overall geometrics of the ramp were refined slightly from what was shown in the Step 6 Engineering. In the Step 6 Engineering, the ramp geometry from the intersection to the mainline consisted of: 20 mph horizontal curve to the right, 215 ft. tangent, 50 mph compound curve to the left, 200 ft. spiral onto the mainline. In the simplified geometrics for the Preliminary Engineering, the ramp geometry from the intersection to the mainline consists of: 20 mph horizontal curve to the right, 335 ft. tangent, 50 mph curve to the left, 200 ft. spiral onto the mainline.

The refinements to the vertical design include:

- Minor adjustments were made to the vertical design to account for the changes made to the horizontal design.

None of these refinements to the Step 6 Engineering that was show in the FEIS, DEIS and IJS as Alternative A or the Preferred Alternative that are reflected in the CCG1 Preliminary Engineering, change the validity of the results and recommendations outlined in those documents. In fact, these refinements have only served to further improve and optimize the design.

3.) CONTROLLING CRITERIA:

Lane Width	______	Grades	______
Shoulder Width	______	SSD	______
Bridge Width	______	Cross Slopes	______
Structural Capacity	______	Superelevation (Transition)	______
Graded Shoulder	______		
Horizontal Alignment	**X**	Horizontal Clearance	______
Vertical Alignment	**X**	Vertical Clearance	______

4.) DETAILED ANALYSIS

A.) Description of Deviation:

Mitigation Strategies for Design Exceptions (FHWA-SA-07-011) states that “Not meeting the lower (50 percent) range per Exhibit 10-56 requires a design exception per FHWA policy.” Bases on Exhibit 10-56 in *AASHTO Geometric Design of Highways and Streets (2004)* and a highway design speed of 60 mph, the lower range (50%) ramp design speed is 30 mph, which requires a design exception for this location. For a 30 mph design curve, the minimum degree of curve that can be used as set forth by Figure 202-10 of the ODOT Location and Design Manual, Volume 1 is 24º45’00”. The design speed of 30 mph would require a superelevation of 0.06. The proposed design utilizes a degree of curve of 49º23’34” on the first curve away from the intersection with Carnegie Avenue along the ramp. In addition, the sag vertical curve design criteria set forth by Figure 203-

6E of the ODOT Location and Design Manual, Volume 1 requires a rate of vertical curvature of 37 (K=37) to accommodate sight distance for a 30 mph design speed. The design utilizes a rate of vertical curvature of 26 (K=26). The proposed 49º23'34" curve with a superelevation rate of 0.057 provides a design speed of 20 mph and the sag vertical curve with a rate of vertical curvature of 26 (K=26) provides a design speed of 25 mph.

B.) Accident Data:

A summary of the crashes occurring during the most recent 3-year period – 2006-2008 – along the initial 400 ft. segment of each ramp beginning at E. 9th Street and at Carnegie Avenue, including the non-standard section, was reviewed to determine the pattern of crashes and their probable causes. The primary purpose of this crash analysis is to isolate the potential impact that perpetuating a horizontal and vertical curve deficiency would have on safety at this location. As such, only crashes that occurred in the roadway segment where the curve geometry may have been a proximate cause of the crash were considered. However, at this location this also includes the segment of the ramp where the merge of two ramps occurs (on-ramp to WB I-90 from East 9th Street and from EB Carnegie Avenue) and, thus, crashes associate with this feature were also included in the analysis. There were a total of six crashes during the 3-year period – three in 2006 and three in 2008 (see Table 1 below for summary).

Table 1: Crash Data for East 9th Street On-Ramp to I-90

ACCYEAR	ACCSEV	ACCTYPE
2006	PDO	Rear end
2006	PDO	Rear end
2006	Injury	Rear end
2008	Injury	Rear end
2008	PDO	Sideswipe Passing
2008	PDO	Rear end

These crashes were examined with respect to the following variables (see Traffic Accident Analysis summaries): year, time of day, roadway conditions, crash severity, crash type, day of week, hour of day and month of year. Further, all crashes were plotted on a collision diagram (see Collision Diagram and Collision Diagram Legend and Label Definition) to clearly show the location of each incident.

Of the six crashes identified at this location, there was one sideswipe and five rear-end accidents. Two of these crashes involved injury. The sideswipe passing crash is clearly attributed to the merge. One of the rear end crashes occurred on the entrance ramp from Carnegie near the beginning of the ramp and, thus, is not associated with the curve geometry. The remaining four rear end crashes occurred on the East 9th Street ramp prior to the merge.

All crashes occurred under dry pavement conditions. In addition, 3 of the crashes occurred between 11am and 1pm and the other 3 occurred between 3pm and 7pm. Of the four rear end crashes that occurred on the East 9th Street ramp, 3 of those crashes occurred between 3pm and 7pm. This ramp typically incurs severe congestion during the PM peak period. As such, the most probable cause of these 3 crashes is the recurring congestion at this location.

The crash type that would be expected if there was an existing safety problem related to the horizontal and vertical curve geometry of the initial curve of this ramp would be ran-off-road. There were no "ran-off-road" type crashes during the study period. Further, the

Collision Diagram Legend and Label Definition

Symbols

Straight	Parked	Pedestrian	Fixed objects:	
Stopped	Erratic	Bicycle	General	Pole
Unknown	Out of control	Injury	Signal	Curb
Backing	Right turn	Fatality	Tree	Animal
Overtaking	Left turn	Nighttime	3rd vehicle	
Sideswipe	U-turn	DUI	Extra data	

LABEL = MM/DD/YYYY-HHMI-LI-RC-S-99999999999

<u>LI = Light Codes:</u>

CODE	NUMBER	DESCRIPT
DA	1	Daylight
DW	2	Dawn
DU	3	Dusk
DL	4	Dark - Lighted Roadway
DN	5	Dark - Roadway Not Lighted
DU	6	Dark - Unknown Roadway Lighting
GL	7	Glare
OT	8	Other
UK	9	Unknown

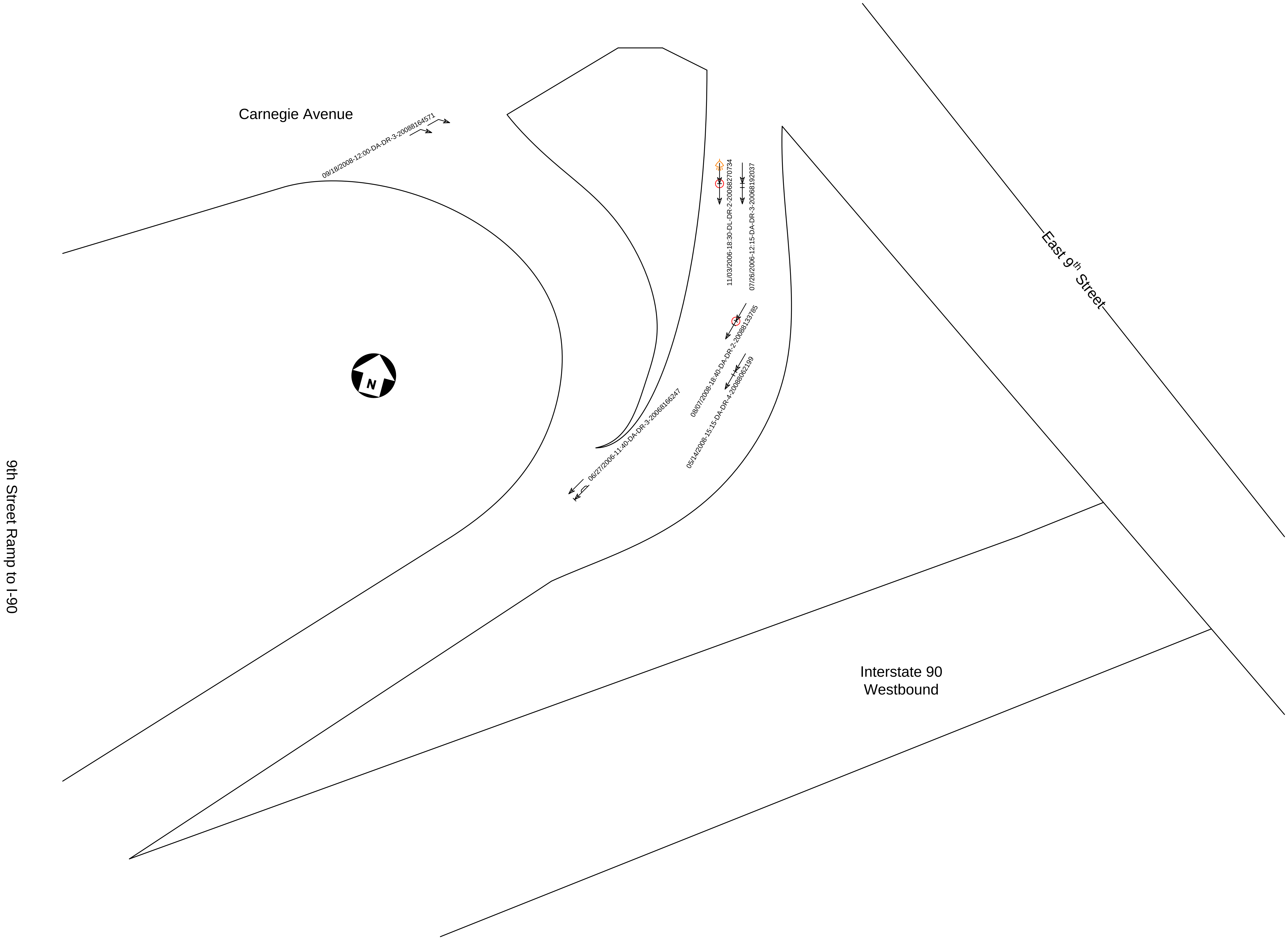
<u>RC = Road Condition Codes:</u>

CODE	NUMBER	DESCRIPT
DR	1	Dry
WT	2	Wet
SN	3	Snow
IC	4	Ice
MD	5	Sand, Mud, Dirt, Oil, Gravel
WA	6	Water (Standing, Moving)
SL	7	Slush
DB	8	Debris
RT	9	Rut, Holes, Bumps, Uneven Pavement
OT	10	Other
UK	11	Unknown

<u>S = Crash Severity</u>

CODE	NUMBER	DESCRIPT
1	1	Fatal Crash
2	2	Injury Crash
3	3	Property Damage Crash
4	4	Propertyy Damage Unknown/Other Crash

Project: Burgess And Niple 9th Street Ramp to I-90
PID: 10132
Roadway: 9th Street Ramp to I-90



Prepared By: TSASS Inc.
Prepared Date: November 3rd, 2009
Prepared For: Burgess and Niple
Start Date: January 1st 2006
End Date: December 31st 2008

TRAFFIC ACCIDENT ANALYSIS
9th Street Ramp to I-90

County: CUY | Main Roadway: #### | Begin SLM: -0.010 | End SLM: 0.313

Project: 9th Street Ramp to I-90 | Intersecting Roadway: h Street Ramp to I-90 | *Crash Data last Updated:* *5/10/2009*

Prepared by: TSASS-BATCH | Date: 04-NOV-09 | Prepared for: Burgess and Niple - Franklin County Engi | *Estimated Percent of 2008 data =* *87*

TSASS Study-ID:	10132
SEGID	**INTERSID**
1	0

9793

YEAR	LIGHTING CONDITION						ROADWAY CONDITION						CRASH TYPE																									
	Day		Night		N.S.		Dry		Wet		N.S.		L.T.		R.T.		Angle		Rear-end		Head On		S.S. Same		S.S. Oppos		F.O.		Backing		Ran Off Road		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	PDO	I/F	PDO	I/F
2006	2	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
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	0	0	0	0
2008	2	1	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
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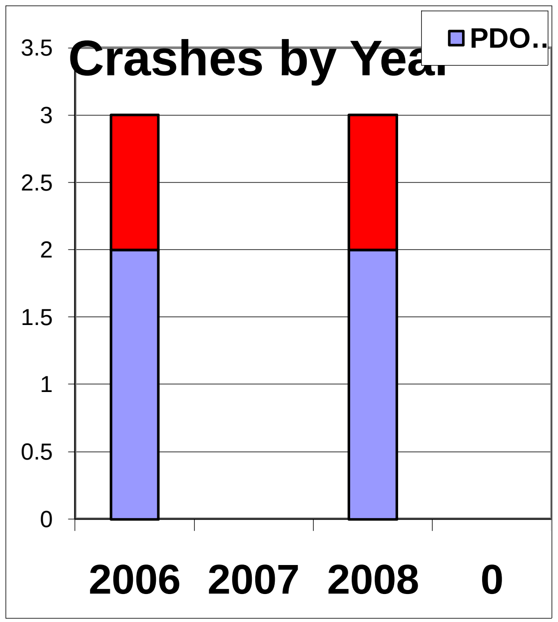
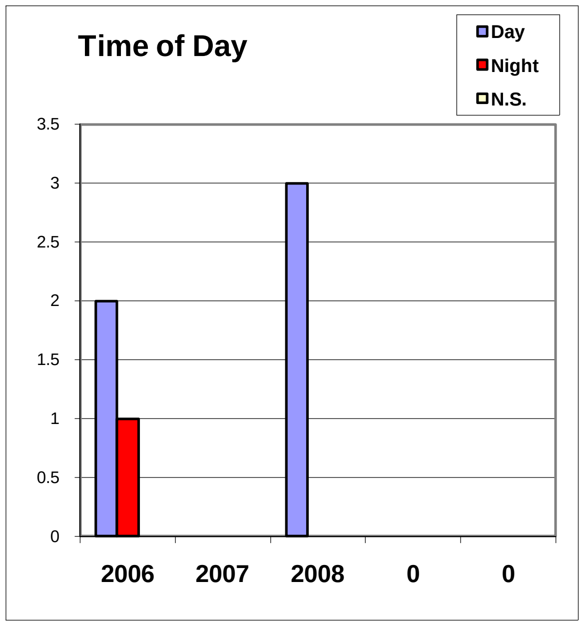
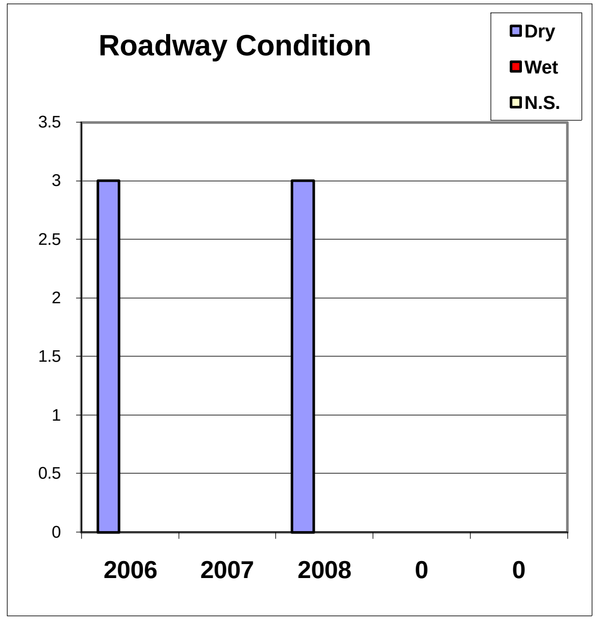
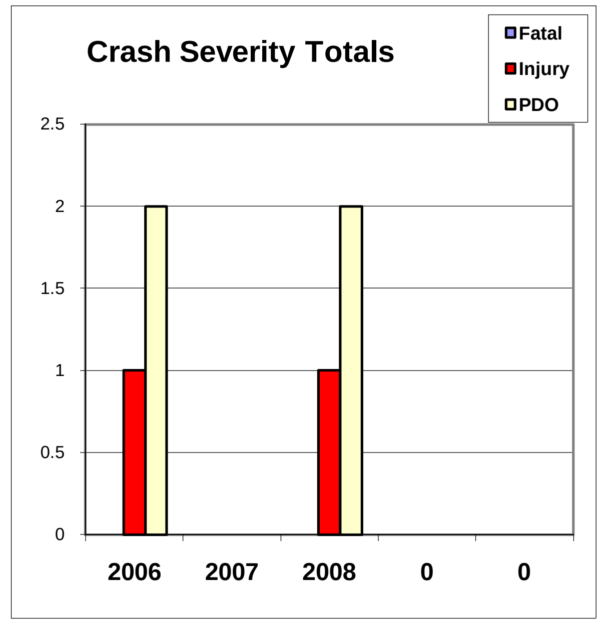
Subtotal	**4**	**1**	**0**	**1**	**0**	**0**	**4**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**2**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	**0**	**0**	**4**	**2**
Total	**5**		**1**		**0**		**6**		**0**		**0**		**0**		**0**		**0**		**5**		**0**		**1**		**0**		**0**		**0**		**0**		**0**		**0**		**6**	









Source: Traffic Safety Analysis Systems & Services - Ohio Safety Information System - Data represents most current data available as of date of preparation. Subject to change due to late crash data submissions by police agencies and / or additional improved crash location information. The Ohio Safety Information System (OSIS) is a proprietary safety database containing Ohio traffic crash and related safety information. Available on line at: osis.tsass.com

TRAFFIC ACCIDENT ANALYSIS
9th Street Ramp to I-90

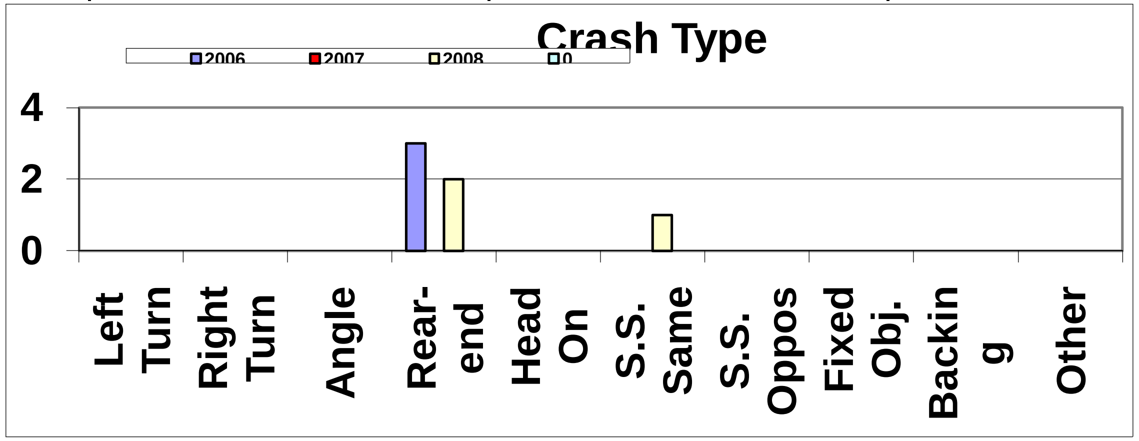
County CUY | Main Roadway #### | Begin SLM -0.010 | End SLM 0.313

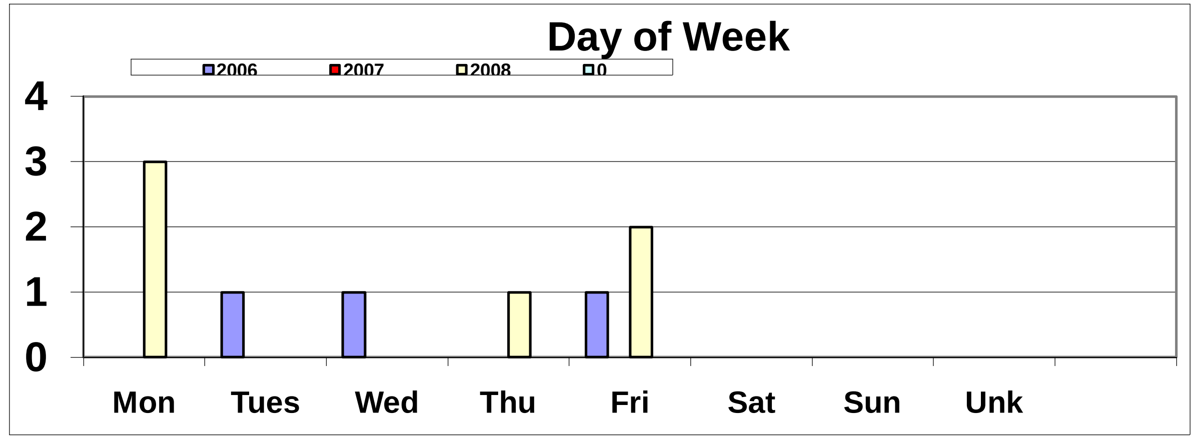
Project: 9th Street Ramp to I-90 | Intersecting Roadway h Street Ramp to I-90 | *Crash Data last Updated: 5/10/2009*

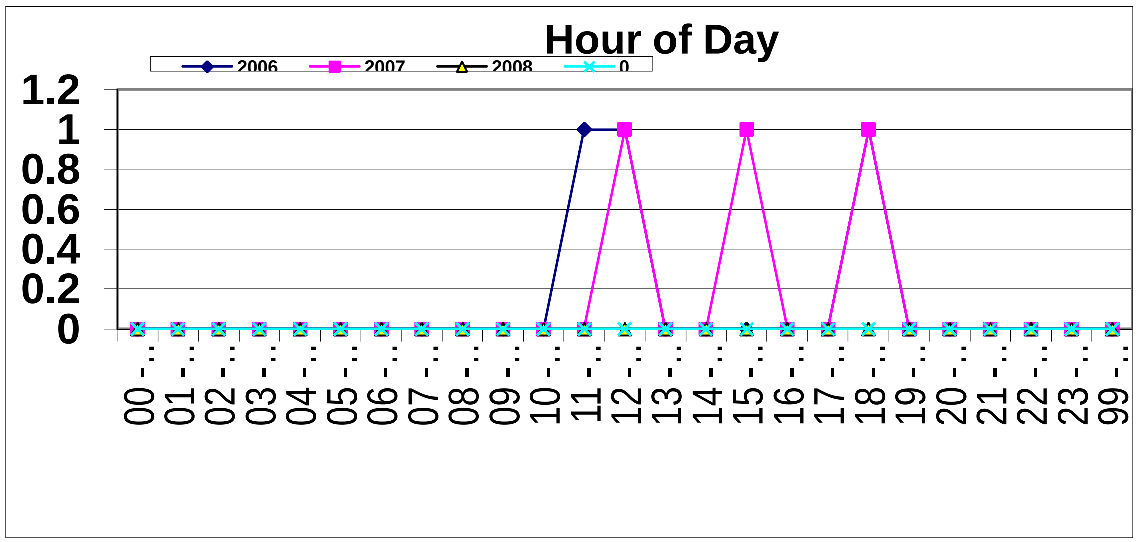
Prepared by TSASS-BATCH | Date 04-NOV-09 | Prepared for: Burgess and Niple - Franklin County Engi | *Estimated Percent of 2008 data = 87*

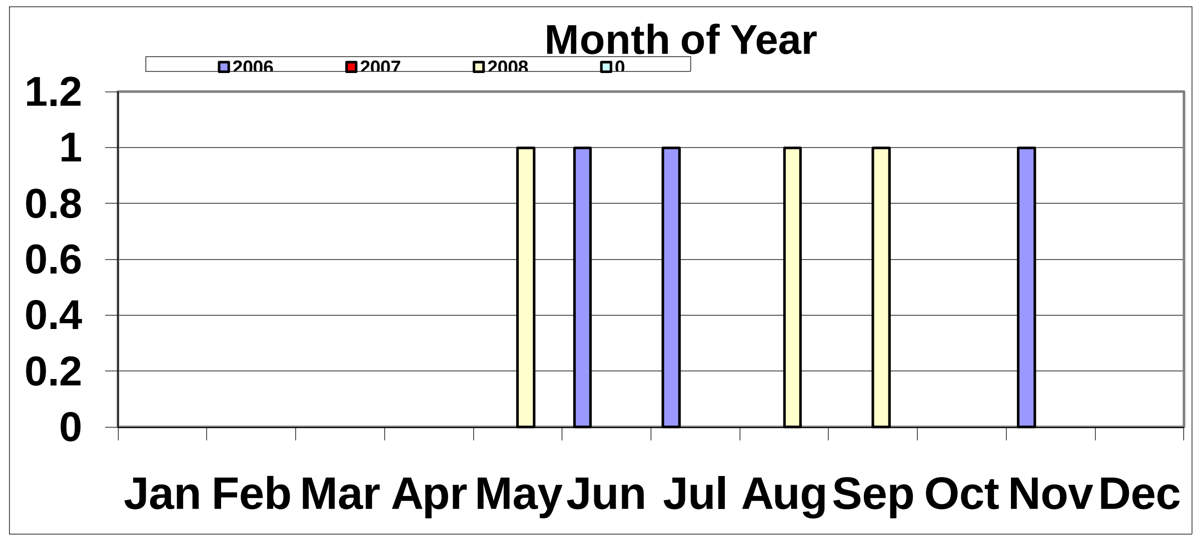
TSASS Study-ID:	10132
SEGID	INTERSID
1	0

9793









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only two rear end crashes that occurred in the portion of the curve where a possible cause for the crash would be the lead driver slowing for the curve both occurred during the recurring congestion of the PM peak period. As such, during the study period, there are not crashes identified where the proximate cause of the crash is curve geometry.

These trends agree with the crash analyses previously documented in the *Existing and Future Conditions Report* (Section 4.4 Crash Analysis), *Purpose and Need* (Section 3.4 Safety), *Conceptual Alternatives Report* (Section 3.3.2 Safety) and *Draft Environmental Impact Statement* (Section 2.2.3 Innerbelt Freeway Safety).

In addition, a *Road Safety Audit for the East 9th Street and Carnegie Avenue Intersection* was performed under the direction of NOACA with input from FHWA, ODOT District 12 and city of Cleveland Division of Traffic Engineering in November 2008. This audit examined vehicular movement, pedestrian movement and intersection operation at this location. Of the recommendations made by the Audit, one deals directly with the configuration of the East 9th Street on-ramp to WB I-90. This recommendation is to "address the conflict at the ramps to I-90 and I-77 south of Carnegie Avenue by installing repeated advance directional information to emphasize lane assignment, including advanced lane assignment overhead signs, upgraded pavement markings, ground-mounted sign at the gore area and mountable raised island separation to define the ramps' entrances." Since this ramp will be reconfigured to eliminate the existing merge from the Carnegie on-ramp to WB I-90 and to eliminate the East 9th Street to SB I-77 ramp (which eliminates the diverge to this ramp) as part of the proposed design, the proposed design supports the recommendations made by this Safety Audit.

C.) Future Traffic Safety:

The crash analysis performed at this location did not identify any crashes during the study period where the proximate cause was the existing curve geometry. Several geometric features of the ramp will be improved over the existing condition:

- The radius of the initial curve of the existing ramp segment from Carnegie Avenue is 92 ft., which will be improved to a radius of 116 ft. for the proposed design.
- The diverge between the East 9th Street on-ramp to WB I-90 and the on-ramp to SB I-77 will be eliminated in the full build configuration.
- The existing merging maneuver occurs along only 233 ft. within the initial curved section of the entrance ramp, while in the proposed design the merge of the two lanes feeding the on-ramp will take place on a tangent section (335 ft.) and 50 mph compound curve.
- Changes in capacity along this section of mainline WB I-90 will reduce congestion at this location, which will help to eliminate crashes caused by recurring congestion. Since the majority of the crashes (50%) at this location were associated with reoccurring congestion, it can be assumed that this change in capacity will have a large impact on improving safety.

As such, it is anticipated that the overall safety along this segment of roadway will improve as a result of this project.

The design and operational deficiencies that are retained in the CCG1 Preliminary Engineering, which is a refinement of the Step 6 Engineering that was utilized to develop the selected Preferred Alternative (Alternative A) as part of the NEPA process, are minor, localized in nature and in all cases provide for a build condition that is substantially better than that of the existing condition.

D.) Impact on Adjacent Property:

The alternatives considered and their potential impact on adjacent properties has been outlined in the Design Philosophy section above. As shown in that documentation, in order for the proposed alignment to meet the design criteria established for curve radius, either the location of the proposed ramp would need to change, the location of I-90 would need to change, or the design of the ramp would need to change. These alternate approaches were considered and rejected in favor of the proposed design. The proposed design supports the decisions reached and documented in the IJS, FEIS/Section 4(f) Evaluation and ROD.

E.) Proposed Mitigation:

There will be no mitigative measures for the deviation to the horizontal alignment standards included as part of this project other than the provision of additional signing warning of the curve's design speed which may improve driver expectation. For the deviation to the vertical alignment standards, fixed-source lighting will be provided within the interchange. As per the American Association of State Highway and Transportation Officials *A Policy on Geometric Design of Highways and Streets,* "In certain cases, ramps may also be designed with shorter sag vertical curves. Fixed-source lighting is desirable in such cases."

F.) Support for Deviations:

There are several factors that support this horizontal and vertical curve deviation:

- This design deficiency is minor and localized in nature. The overall changes to the design and operational characteristics of the corridor in all cases provides for a build condition that is substantially better than the existing/no build condition. The safety analysis performed in support of this deviation show that safety in this segment of the corridor will increase with the build alternative.
- This deviation is located near an intersection. As such, the operating speeds along this ramp at the location of the initial curve should closely match the design speed.
- Fixed-source lighting will illuminate the ramp and the criterion for sag vertical curves is based on headlight sight distance. This fixed-source lighting will mitigate this vertical alignment deficiency.
- The proposed design balances the physical condition, operational performance, safety, access and community needs with the design requirements as documented in the IJS, FEIS/Section 4(f) Evaluation and ROD.
- The geometrics (inclusive) of the CCG1 Preliminary Engineering, which is a refinement of the Step 6 Engineering shown in the NEPA documentation as Alternative A, meet or exceed the enumerated geometric criteria, Interstate system mainline and ramp layouts, local street system layouts and intersection layouts, lane and turn lane dimensions and assessed operational characteristics as documented within the IJS, FEIS/Section 4(f) Evaluation, and ROD.

5.) SUMMARY:

As described above, the proposed design for the East 9th Street on-ramp to westbound I-90 does not meet the lower range value for Ramp Design Speed as set forth by Figure 503-1 of the ODOT Location and Design Manual Volume 1. For a mainline I-90 design speed of 60 mph, the lower range design speed for the ramp would be 30 mph. However, the proposed design only provides for a 20 mph horizontal curve in order to preserve the required 100 foot separation from the Carnegie Avenue and East 9th Street intersection and provides for a corresponding 25 mph sag vertical curve. The proposed design achieves the best balance of the physical condition, operational performance, safety, access and community needs with the design requirements. The proposed 20 mph curve is similar to the existing horizontal condition at this location and the use of fixed-source interchange lighting will mitigate the reduced length of the sag vertical curve. Existing crash history for this location shows that the existing geometry does not have a substantial safety impact. As such, it is assumed that the proposed 20 mph horizontal curve and 25 mph vertical curve would also have minimal safety impacts. This design deficiency is minor and localized in nature and, in all cases, the build condition provides for substantially better physical condition, operational performance and safety than the existing/no build condition.

Engineers Seal:

STATE OF OHIO
PAUL W.
DOROTHY
E-63443
REGISTERED
PROFESSIONAL ENGINEER

Signed: ____________________

Date: 22 NOV 2009