

INNER LOOP SCOPING REPORT ATTACHMENTS

- A. Go/No Go Traffic Assessment
- B. Safety Considerations, Accident History and Analysis
- C. I-490 Ramp Evaluation and Analysis
- D. Main Street Alternatives
- E. Minimum Lane Requirements
- F. Hazardous Waste
- G. Endangered Species
- H. Probable Cost and Benefit/Cost Assessment
- I. Memorandum of Understanding - Draft

D. Main Street Alternatives

Memo

DRAFT



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To:	Jim Hofmann Rochester, NY	From:	Paula Benway Rochester, New York
File:	Inner Loop 192500170	Date:	August 19, 2009

Raising the Eastern Portion of the Inner Loop East Main Street/University Avenue Alternatives

INTRODUCTION

Previous studies on raising the Eastern Portion of the Inner Loop completed for the City of Rochester identified the following objectives:

- To create a properly scaled transportation facility that will improve the physical and visual sense of connection between the neighborhoods adjacent to the Inner Loop and the downtown area.
- To develop a transportation facility that is visually attractive and promotes pedestrian access to and from downtown.
- To improve mobility and maintain vehicular access in and around the City of Rochester (i.e. GTC Long Range Plan)
- To create concept alternatives that are consistent with the Vision of Rochester for the 21st Century as documented in the Renaissance 2010 Comprehensive Plan.
- To develop alternatives that will enhance neighborhood and downtown development, thus supporting economic revitalization of the area.
- To minimize social, environmental and economic impacts to the City and the adjacent neighborhoods.

These objectives are still valid today and used to evaluate various alternatives including those for the East Main Street/University Avenue area.

FEASIBLE ALTERNATIVES SUMMARY

Raising the eastern portion of the Inner Loop through the East Main Street/University Avenue area has two inevitable outcomes:

- Inner Loop through traffic will add approximately 600-700 vehicles per hour through this complex four-intersection juncture.
- South Union Street will become a two-way road; increasing traffic and turning movements at various intersections.

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These two factors alone may create additional operational complexities at this four-intersection juncture that may result in impacts to adjacent properties. As part of the Go/No Go decision, preliminary analysis identified two (2) traditional intersection alternatives that maintained levels of operation; however, would require notable widening on the existing Inner Loop / East Main Street ramps and the section of University Avenue between East Main Street and South Union Street. While this widening is needed to accommodate the at-grade Inner Loop, the widening in and of itself resulted in less than desirable conditions:

- Limited intersection spacing causing queuing and driver confusion does not address the current safety concerns.
- Pedestrian/bicycle access along East Main Street would be affected.
- Traffic operations – volume to capacity ratios, lane utilization factors and storage still a concern.

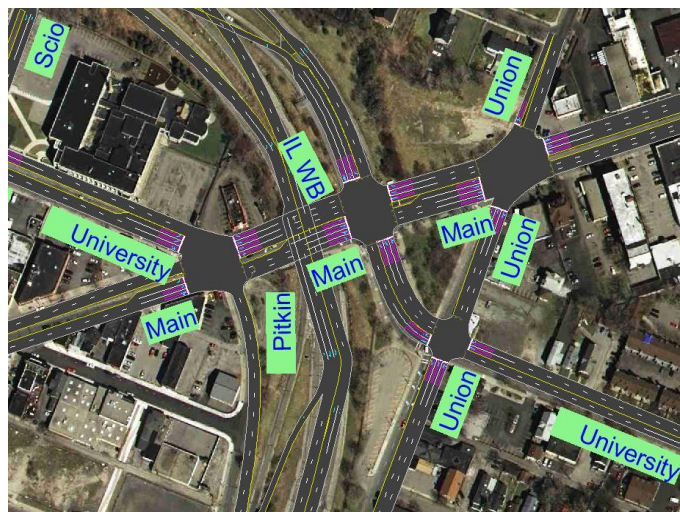
A subsequent review of other alternatives developed by the Advisory Committee members was undertaken. In addition, input from the involved agencies related to signal operations (lost time, lane utilization, and heavy vehicle factors) have been adjusted to better reflect current operations. Each alternative assessed for the East Main Street/University Avenue juncture have:

- Varying degrees of impact to adjacent properties or neighborhoods (ROW, parcel access, increased volumes, etc.)
- Additional travel lanes will increase pedestrian exposure and conflicts.
- Physical constraints in intersection spacing remain (without considerable impacts to adjacent properties).

Of the dozen alternatives considered and evaluated, three 'feasible' options should be considered further. These are as follow:

Option 1 (no change at Main Street) or Existing Conditions –

This option is the no-build or null scenario for this comparison. This option is the baseline comparison scenario using the year 2035 traffic volumes with no geometric changes along the East Main Street corridor and University Avenue area. The East Main Street / University Avenue area is a complex juncture of East Main Street, University Avenue (east and west ends), Inner Loop Ramps, North Union Street, South Union Street, and Pitkin Street. These streets all merge and form four (4) closely spaced, traffic signal controlled intersections. These four intersections are currently operating with one master controller to address

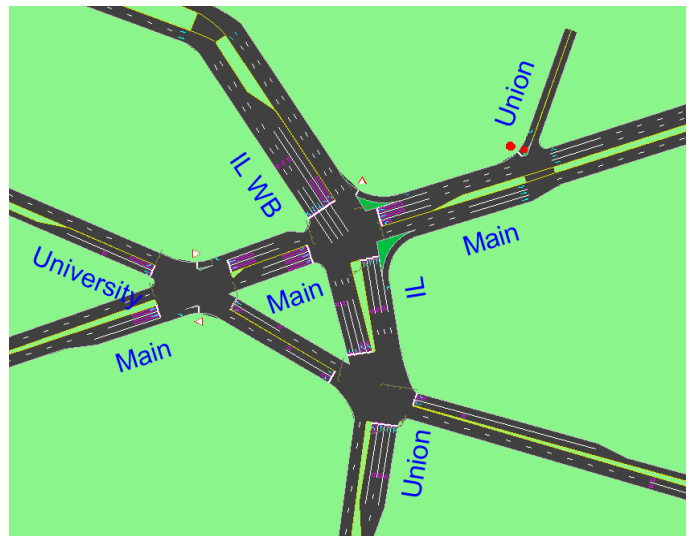


These four intersections are currently operating with one master controller to address

progression and minimize queuing. The stretch of East Main Street is seven (7) lanes wide with left turn and right turn lanes at each intersection. All four intersections are projected to continue operating at overall Level “D” or better with no movements falling below level “E” by the year 2035 (design year) with one exception. This exception is at the intersection of East Main Street and North Union Street; the westbound approach during the evening peak hour is shown to operate at Level of Service F with queuing in excess of 600 feet and a high volume to capacity ratio. In fact, the four intersections are shown to have a volume to capacity ratio of 1.14 or over capacity conditions during peak intervals. In addition, there are safety concerns related to the limited storage between intersections that are causing driver confusion and impromptu lane changes that result in crashes. The physical constraints at this juncture do not provide adequate decision making distances, causing confusion, and abnormal lane utilization.

Option 4A (w/o North Union) –

This option brings the Inner Loop up to grade at the current intersection locations. The introduction of reconnecting University Avenue remains; however, the North and South Union connection is severed. Overall acceptable levels of operation can be achieved with a traditional intersection design if various additional travel lanes are provided.



This option has the following to offer:

- Additional auxiliary/through lanes at Inner Loop/University Ave intersection;
- Eliminates one traffic signal controlled intersection at North Union Street, providing notable delay reductions to over 2,300 vehicles per hour;
- Eliminates one eastbound through travel lane on East Main Street;
- 50% reduction in queuing (PM Peak) on the westbound East Main Street approach to the Inner Loop ramps;
- Eliminates Pitkin Street approach;
- Reduces number of travel lanes on University Avenue (west end);
- Reconnects the University Avenue corridor;
- Provides channelized right turn flows;
- Simplifies intersection geometry and number of driver decision points. This option addresses some of the current safety concerns (driver confusion, lane changes, rear-ending, etc.)
- Increases crossing distances for pedestrian traffic at the Inner Loop ramps.
- Improves volume to capacity ratios during the critical evening peak hour.

Option 4B (w/o North Union) – MCDOT Traffic Signal Modifications – This option assumes all the geometric characteristics (with one exception) of Option 4A with signal

modifications presented by Monroe County Department of Transportation. This option includes operating the three major intersections on three separate traffic signal controllers versus the current one-master controller. This option allows for better optimization of intersection operations and reduction in travel lanes needed versus Option 4A.

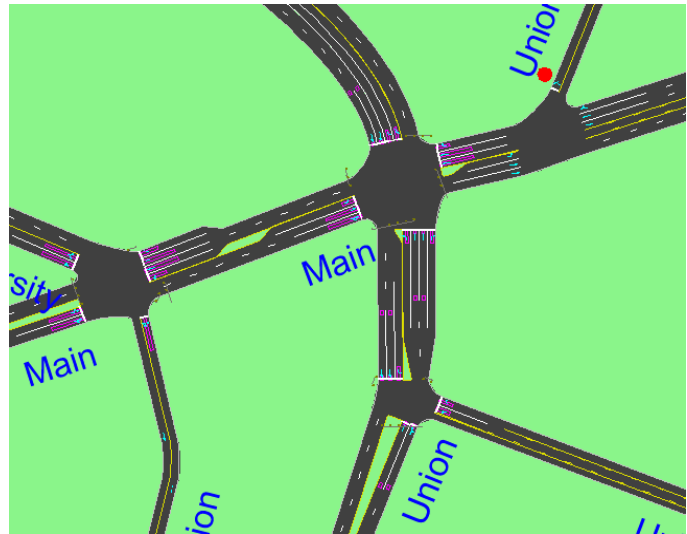
This option has the following to offer:

- Additional auxiliary/through lanes at Inner Loop/University Ave intersection;
- Eliminates one traffic signal at North Union Street, providing notable delay reductions to over 2,300 vehicles per hour;
- 50% reduction in queuing (PM Peak) on the westbound East Main Street approach to the Inner Loop ramps;
- Eliminates one eastbound through travel lane on East Main Street;
- Eliminates Pitkin Street approach;
- Reduces number of travel lanes on University (west end);
- Reconnects the University Avenue corridor;
- Requires widening of University Avenue at South Union to provide a westbound left turn lane. This widening will impact properties at the north and south corners of the intersection.
- Provides channelized right turn flows;
- Simplifies intersection geometry and number of driver decision points. This option addresses some of the current safety concerns;
- Improves volume to capacity ratios during the critical evening peak hour.

Option 5 – T-University Avenue – This option notably simplifies the area and signal operations by eliminating the traffic signal at North Union St, aligning South Union with the East Main Street Inner Loop ramps and realigning University Avenue to form a T-intersection with South Union Street.

This option has the following to offer:

- Additional through lanes at Inner Loop/University Ave intersection;
- Eliminates a traffic signal at North Union Street, providing notable delay reductions to over 2,300 vehicles per hour;
- 50% reduction in queuing (PM Peak) on the westbound East Main Street approach to the Inner Loop ramps;
- Traffic signal at University/Pitkin/Main Street maybe replaced by a roundabout;
- Eliminates one eastbound through travel lane on East Main Street;
- Converts Pitkin Street to two-way operation;



- Reduces number of travel lanes on University Avenue (west end);
- Allows for better transition to the proposed University Avenue 3-lane section (east end);
- Simplifies intersection geometry and number of driver decision points. This option better addresses current safety concerns (driver confusion, lane changes, rear-ending, etc.);
- Improves volume to capacity ratios during the critical evening peak hour.

Level of Service analysis comparison for each of the feasible alternatives identified is shown in the table below. Overall intersection operations can be maintained or improved with these 'Feasible' alternatives.

Overall, these feasible alternatives present varying degrees of impact to adjacent neighbors, traffic operations and circulation in the immediate area. However, these impacts are minimized with these four options (versus other alternatives considered) and overall traffic operations can be maintained or in most cases improved. Option 5 provides the greatest benefits by addressing capacity while minimizing current safety patterns.

Considering this refined analysis, feasible alternatives to raise the Inner Loop through East Main Street do exist and should be further considered.

The extended list of alternatives assessed and how they compare to the challenges outlined above are documented in the next section.

Table 1 - Level of Service and Queue Length Comparison

Intersection	Approach & Movement	2035 Projected Traffic							
		AM Peak				PM Peak			
		Option 1 (Exist Geom)	Option 4A (No Union)	MCDOT Option	Option 5 (T-University)	Option 1 (Exist Geom)	Option 4A (No Union)	MCDOT Option	Option 5 (T-University)
University Avenue & Union Street	NB LT	C (120')	C (78')	D (95')		D (219')	C (129')	D(145')	
	NB THRU/RT	B (80')	C (170')	D(242')	D (232')	D (163')	D (239')	D (286')	D (234')
	NB RT			A (36')				A (39')	
	SB LT		C (87')	B (80')	A (11')		C (81')	B (109')	A (82')
	SB THRU/RT		C (110')	B (113')	A (4')		C (81')	A (95')	A (57')
	EB THRU	A (40')	C (93')	C (75')		A (91')	C (106')	C (72')	
	EB RT		A (67')	A (28')			A (18')	A (12')	
	WB LT			C (75')	C (26')			D (83')	D (16')
	WB LT/TH/RT	A (30')	C (234')	C (191')		A (90')	C (139')	C (101')	
	WB RT		C (274')	A 97')	B (415')		B (178')	B (214')	B (202')
OVERALL	A (0.89)	C (0.91)	C (0.72)	B (0.71)	B (1.14)	C (0.87)	C (0.72)	B (0.85)	
Main Street & Union Street	NB LT	D (12')	Un Signalized - LOS A	Un Signalized - LOS A	Un Signalized - LOS A	D (9')	Un Signalized - LOS A	Un Signalized - LOS A	Un Signalized - LOS A
	NB THRU/RT	C (83')				D (142')			
	SB LT/RT	B (71')				B (54')			
	EB LT	A (13')				A (7')			
	EB THRU	A (46')				A (35')			
	WB THRU	C (339')				F (>633')			
	WB RT								
	OVERALL	B				D			
Main Street & Inner Loop Ramps	NB LT	D (262')			D (153')	D (289')			D (115')
	NB THRU	C (234')	C (108')	D (186')	D (250')	D (235')	C (144')	D (220')	D (218')
	NB RT		A (39')	B (45')	A (45')		A (0')	C (120')	C (180')
	SB LT	E (>393')	D (241')	D (253')	C (201')	D (326')	D (209')	D (223')	C (186')
	SB THRU/RT	D (326')	D (288')	B (225')	D (421')	D (268')	D (247')	B (218')	D (370')
	EB LT	C (11')	C (10')	C (11')	C (7')	B (10')	B (12')	B (11')	B (12')
	EB THRU	C (85')	C (75')	C (93')	C (141')	C (109')	C (113')	B (141')	C (269')
	EB RT	A (65')				A (65')			
	WB LT		D (153')	D (167')			E (127')	D (126')	
	WB THRU*	B (430')	C (279')	D (305')	E (397')	B (681')	C (223')	C (213')	C (234')
WB RT*	B (462')	B (205')	B (263')	B (185')	A (637')	A (23')	B (309')	B (182')	
OVERALL	C (0.89)	C (0.91)	C (0.83)	D (0.93)	C (1.14)	C (0.87)	C (0.84)	C (0.85)	
Main Street & University Avenue/Pitkin Street	NB LT		D (144')	C (139')			D (228')	B (115')	
	NB LT/TH/RT		D (84')	C (115')	C (70')		C (63')	C (44')	C (88')
	SB LT	D (109')	D (152')	B (88')		C (110')	D (226')	B (136')	
	SB LT/THRU/R	D (48')	C (90')	B (70')	C (132')	C (40')	D (75')	B (49')	B (96')
	EB LT	C (11')				C (26')			
	EB LT/TH/RT			B (52')	A (42')			C (181')	B (154')
	EB THRU	C (139')	B (55')			C (266')	B (93')		
	EB RT		A (9')				A (2')		
	WB LT	A (30')			A (0')	A (24')			B (67')
	WB THRU	A (45')	A (27')	B (40')	A (0')	A (34')	A (5')	A (7')	A (25')
WB RT	A (0')	A (0')	A (0')	A (0')	A (0')	A (0')	A (0')	A (4')	
OVERALL	B (0.89)	B (0.91)	B (0.45)	A (0.38)	B (1.14)	C (0.87)	C (0.90)	B (0.51)	

* WB LOS/Queue includes queue at Main/N. Union too

Improvement over Option 1 - Existing Geometry

Slight degradation over Option 1

Notable degradation in LOS or Queue over Option 1

C (0.90) Overall intersection Level of Serve + volume/capcity ratio

Note: Analysis has been updated to address State and County comments related to lost time and heavy vehicle adjustments.

OTHER ALTERNATIVES CONSIDERED

Various alternatives were developed and reviewed for feasibility in addressing the study goals, capacity and safety needs along the East Main Street area. The following alternatives were considered to have notable impacts on the community, adjacent properties or not physically feasible producing less desirable conditions. Some of the pros and cons of each alternative is shown along with a concept diagram.

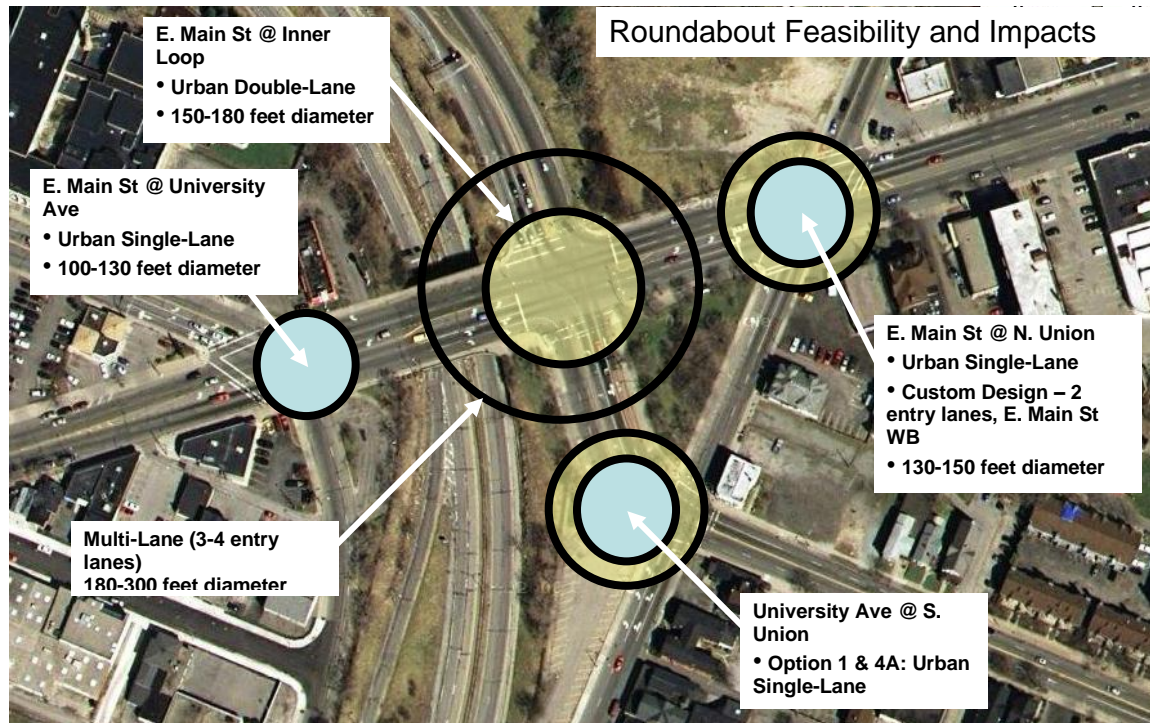
Roundabout Alternatives

Based on the FHWA's Roundabouts: An Informational Guide, there are several basic planning thresholds to test the applicability of roundabouts at the East Main Street intersection alternatives. These thresholds can be summarized as follows:

- **Urban Single Lane Roundabout** - 100-130 feet inscribed circle diameter; 20 mph, typically can process 25,000 vehicles/day; and the maximum entering/circulating flow of 2,000 vehicles per hour.
- **Urban Double Lane Roundabout** – 150-180 feet inscribed circle diameter; 25 mph, typically can process up to 50,000 vehicles/day with a maximum entering/circulating flow of 4,000 vehicles per hour.
- **Urban Multilane Roundabouts (3-4 entry lanes)** - can range up to 300 feet inscribed diameter and serve 55,000-80,000 vehicles per day. Multilane roundabouts are not recommended without significant evaluation due to safety concerns.
- **Roundabout Spacing** – should accommodate 95% queue on entry approach, 100-150 feet (Single Lane) or 300-500 feet (Multi Lane) for installation of destination signing and advanced warning signs.

Existing Intersections - Quick Roundabout assessment was completed with the 2035 traffic volumes projected at the four-signalized intersections at this juncture for Options 1, 2 and 4A. Reviewing entry volumes and circulating flows indicate that a “Single-Lane” roundabout will not accommodate projected traffic volumes at the East Main Street intersection at the Inner Loop ramps under any of the options identified at this time. A double-lane roundabout would be necessary at this intersection. A double-lane roundabout may also be needed at the University Avenue at South Union intersection under Option 2. Intersection spacing requirements for adequate advanced warning signs and destination signs would be limited.

For display purposes only, the figure below shows what a single lane and double lane roundabout outline would be at each of the four intersections. The double-lane roundabouts would have significant impacts on adjacent properties along East Main Street at University Avenue and at South Union Street. Transitions required between roundabouts would be unlikely. Consideration for only one roundabout, for example at East Main at Inner Loop Ramps, could be considered; however, traffic signals at nearby intersections would be impacted by queuing and insufficient storage.



Reunion Circle Concept & Revised Concept – these options look at a significant size roundabout or traffic circle with all roadways converging at one location. This option has various challenges:

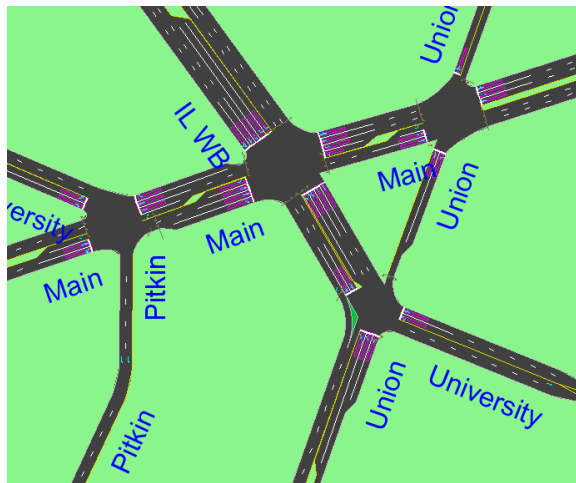
- Entry volumes exceed 4,600 vehicles per hour which exceeds the hourly service volume for a double lane roundabout; a multi-lane (3-4 entry lane) roundabout would be potentially needed. FHWA does not recommend roundabouts with more than two lanes as the safety benefits can noticeably decrease due to the higher volumes, higher design speeds and driver confusion.
- Major neighborhood impacts
- Minimizes developable land in the vicinity
- Creates a significant pedestrian and bicycle barrier as the distance traveled to cross the roundabout is significant as compared to a traditional intersection.

The installation of roundabouts at the major intersections may not be a feasible option due to intersection spacing and volume of traffic to be served per hour expected at the East Main Street intersections. Roundabouts should be considered at other locations throughout the project including East Avenue, Broad Street, Monroe Avenue and at new locations and junctures.



Other Traditional Intersection Concepts

Option 2 – Inner Loop Raised – This option brings the Inner Loop up to grade at the current intersection locations. The North and South Union connection remains, with South Union Street converted to provide two-way traffic. Overall acceptable levels of operation can be achieved with a traditional intersection design if various additional travel lanes are provided as shown below.



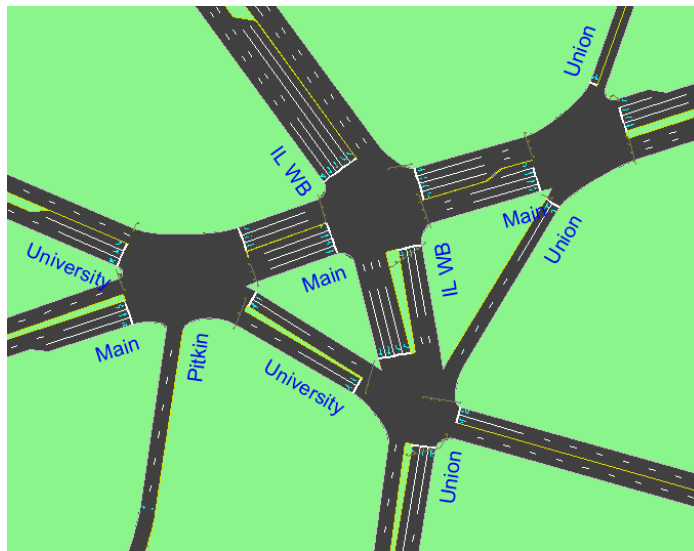
This option has the following to offer:

- Requires additional auxiliary/through lanes on the Inner Loop/University Avenue intersection;
- Maintains four closely spaced traffic signal controlled intersections;
- Does not address current intersection safety concerns (driver confusion, lane changes, rear-ending, etc.)
- Increases the number of travel lanes a pedestrian has to cross;

- Intersection levels of service will operate with sensitive volume/capacity ratios making the intersection prone to routine cycle failures.

Option 4 – Inner Loop Raised – This option brings the Inner Loop up to grade at the current intersection locations. The existing North and South Union connection remains. This option also introduces the re-connection of University Avenue. Overall acceptable levels of operation can be achieved with a traditional intersection design if various additional travel lanes are provided as shown below. This option has the following to offer:

- Requires additional auxiliary/through lanes on the Inner Loop/University Avenue intersection;
- Increases the number of travel lanes a pedestrian has to cross;
- Maintains four closely spaced traffic signal controlled intersections;
- Does not address current intersection safety concerns (driver confusion, lane changes, rear-ending, etc.)
- Intersection levels of service will operate at sensitive volume/capacity ratios making the intersection prone to routine cycle failures.



Charrette Concept Plan – This option reconnects University Avenue and eliminates the ability of University Avenue traffic to access the Inner Loop at E. Main Street by diverting it to the Scio Street interchange. Figure below shows the concept plan developed. Traffic counts were obtained at the Scio Street interchange and capacity analysis was conducted.

This option has the following to offer:

- Maintains four closely spaced traffic signal controlled intersections.
- Requires a double left turn lane on Scio Street northbound at the Inner Loop interchange; this will require widening the bridge over the Inner Loop and the approaches to the bridge.
- Impacts the Scio Street corridor due to the widening necessary.

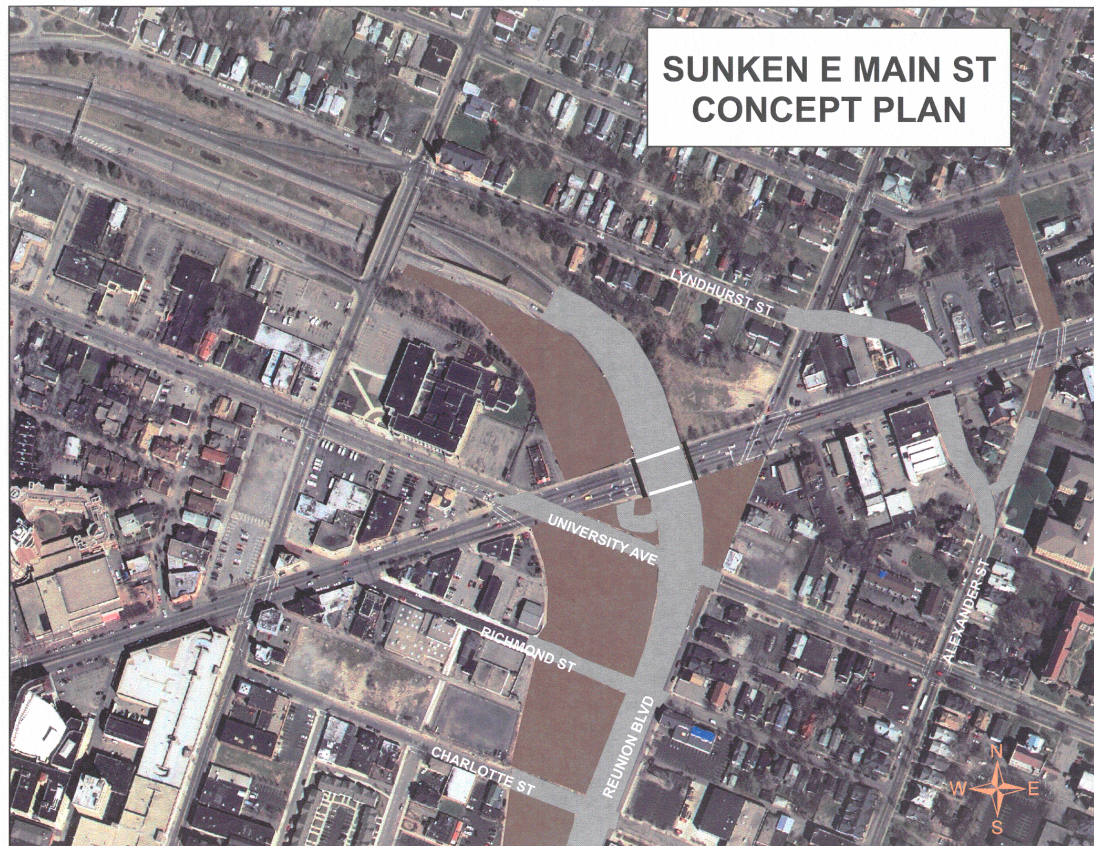
- University Avenue (west end) near the school will need widening.
- Forces high volumes in front of the School on University Avenue.
- No notable intersection improvements along East Main Street intersections.
- Some University Avenue traffic may still use the East Main Street Inner Loop intersection and cause backups and gridlock.



Sunken East Main Street Concept - This option's intent is to separate the heavier traffic volumes on East Main Street by dropping it below grade while leaving University Avenue and the Inner Loop at grade.

This option as shown below has the following to offer:

- Eliminates three (3) traffic signal controlled intersections along East Main Street;
- Eliminates direct access to/from the Inner Loop at East Main Street; ramp shown is not feasible.
- Inner Loop access would be at University Avenue.
- University Avenue at East Main Street would also be grade separated due to proximity to Inner Loop.
- Dropping East Main Street below grade would require retaining walls from approximately Richmond Street to Alexander Street.
- Reconnection of North Union and Lyndhurst Street to East Main Street would have notable impacts on businesses and residential properties.
- Significant access impacts to adjacent properties would result.



Scio Street Inner Loop Terminus – This option terminates the Inner Loop at the Scio Street interchange with access to and from Lyndhurst Street. This option also reconnects University Avenue and North/South Union.

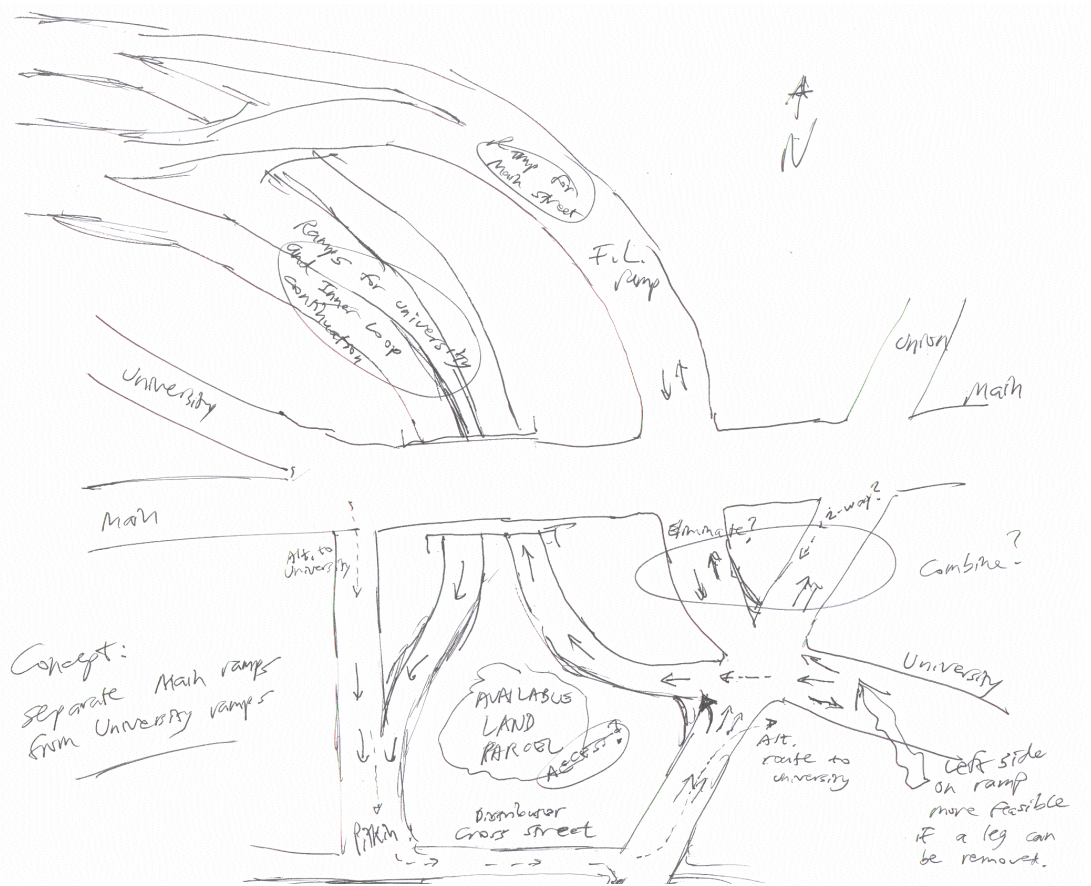
This option has the following to offer:

- Provides the greatest amount of developable land;
- Reconnects University Avenue;
- Connects Reunion Boulevard with North Union Street
- Eliminates one (1) traffic signal controlled intersection along East Main Street;
- Eliminates direct access to/from the Inner Loop at East Main Street;
- Significant impacts to residential properties along Lyndhurst Street;
- Significant impacts on Scio Street;
- Significant impacts on Alexander Street/East Main Street area;
- Three major intersections of East Main Street with University, North Union and University Avenue will operate with failing conditions;
- New high volume intersection of Lyndhurst Street at North Union Street is too close to East Main Street.



University Avenue Inner Loop Interchange Concept – This option provides a direct connection to the Inner Loop from University Avenue by providing separate ramps to East Main Street (existing) and the new ramps to University Avenue. This option has the following to offer:

- University Avenue WB on ramp to Inner Loop is not feasible due to the significant grade differential.
- Eliminates one (1) traffic signal controlled intersection at East Main Street and North Union Street;
- Eliminates the Reunion Blvd and North Union connection;
- Uses Pitkin Street as a new service off-ramp for Inner Loop EB traffic.



Reunion Square Concept – This option terminates the Inner Loop at a roundabout at Richmond Street; relocates the existing Inner Loop ramps east; and reconnects University Avenue. This option has the following to offer:

- Maintains East Main Street grade-separated;
- Increases the distance between East Main Street intersection with elimination of the existing center signal at the Inner Loop ramps;
- Requires a new bridge to reconnect University Avenue;



STANTEC CONSULTING SERVICES INC.

Paula Benway
Associate, Transportation
Paula.Benway@stantec.com