University Hill Phase II Feasibility Study
September 15, 2009

Prepared for

Syracuse Metropolitan Transportation Council (SMTC)
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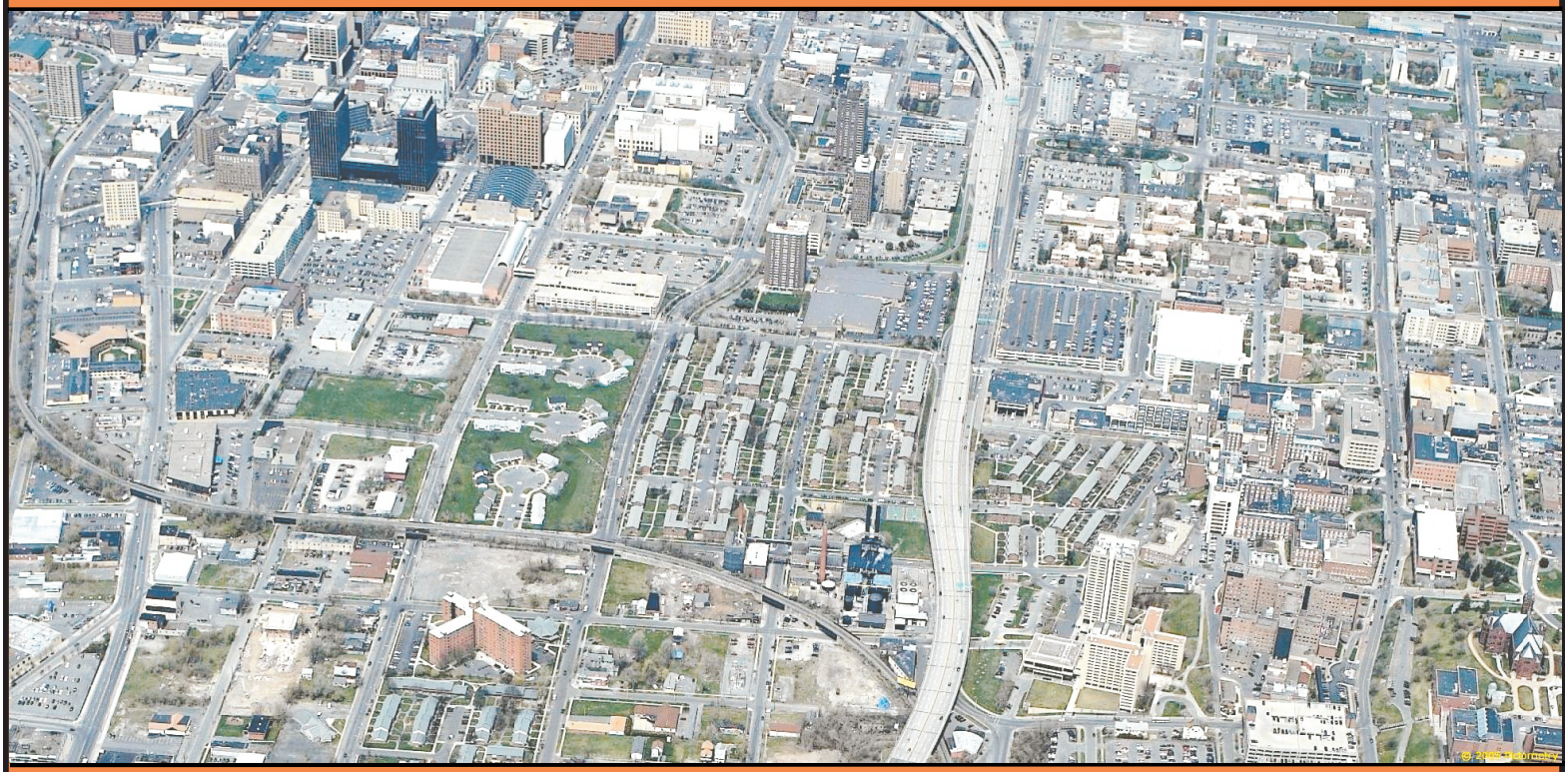

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UNIVERSITY HILL PHASE II FEASIBILITY STUDY

Prepared by

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for

Syracuse Metropolitan Transportation Council

FINAL REPORT
SEPTEMBER 2009

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I. STUDY PURPOSE & SUMMARY

Study Purpose

Fisher Associates (Fisher) in partnership with **Jacobs Edwards & Kelcey (JEK)** and **Alta Planning (Alta)** were commissioned by the **Syracuse Metropolitan Transportation Council (SMTC)** to conduct a mesoscopic feasibility assessment of three transportation recommendations identified in the September 2007 **University Hill Transportation Study (UHTS)**.

The three transportation recommendations being assessed include:

- **One-way to Two-way Street Network Conversion**: Conversion for segments of Adams Street, Harrison Street, Crouse Avenue and University Avenue from one-way to two-way operations**.**
- **Almond Street Narrowing**: Narrowing Almond Street between Adams Street & Harrison Street.
- **Almond Street Roundabouts**: Roundabouts at the Almond Street intersections of Adams Street and Harrison Street.

Study Summary

The three recommended transportation improvements were selected as possible gateway treatments that have been proven successful in enhancing pedestrian, bicyclist and vehicular operations in other urban settings. The UHTS report also identified these recommendations as treatments that would assist with creating connectivity, physically and visually, within the University Hill area and the Syracuse City Center.

The UHTS was conducted as a macroscopic assessment of the daily affects these recommendations may have on the transportation network. This study conducted a more detailed (mesoscopic) assessment for the morning and evening peak commuter hour.

It was concluded that each of the transportation recommendations would significantly decrease the transportation network's vehicular operations with increased congestion/pollution likely. These negative outcomes would be further exacerbated should two of the recommendations be implemented in combination.

However, it is important to note that these recommendations are still potentially viable. The recommendations could be implemented if the study area experiences a significant

decrease in passenger car usage. This could be accomplished through aggressive and concerted efforts that include mixed-use development programs, integrated parking strategies, a prioritized transit network and travel demand techniques. These efforts were identified in conjunction with the three recommendations in the UHTS.

Should it become evident, in the future, that one or more of the assessed recommendations is workable, it is anticipated that certain benefits as stated in this document and the UHTS study may be realized by the non-motorized traveler of pedestrians and bicyclists. Given this study's findings regarding the operations of the transportation network additional evaluations and financial investment analysis should be conducted prior to advancing any of the recommendations. As the SMTC is not an implementing agency, the facility owners' have the final decision to implement the recommendations discussed within this document if considered desirable and practical.

Additionally, the Steering Advisory Committee has emphasized that:

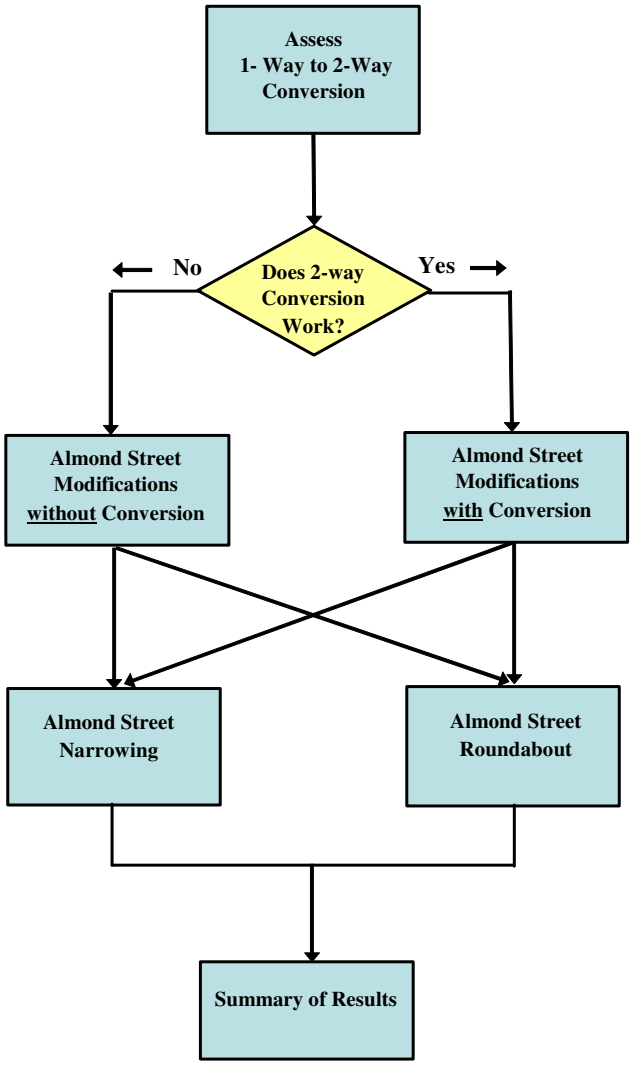
- Connectivity between the University Hill area and the Syracuse City Center is still achievable, on some levels, through the comprehensive use of crosswalks, vegetation and streetscape treatments. These connectivity measures should be considered as new construction projects are planned.
- If a one-way to two-way conversion were to be further considered, a review/update of the Special Events Transportation Plan would be required.
- The findings of this assessment are considered in the future assessments of the I-81 corridor study.

II. STUDY METHODOLOGY

This section of the report will define the approach, assessment tools and measures of operations that were used in this study.

Study Approach

The study includes three separate transportation recommendations; however, the two assessments for the Almond Street modification also included the affects resulting from the one-way to two-way conversion recommendation. To better understand the assessment's analysis structure the following flow diagram was developed.



The assessment analyzed a.m. and p.m. study hours for a design year of 2010 and for a build-out year of 2020.

Assessment Tools

◈ TransCAD Software

TransCAD by Caliper is multifunctional GIS/Transportation planning software that includes a travel demand application that was used in this assessment. SMTC maintains a legacy model that resulted from the UHTS. Using the legacy model as a base, a project specific model was developed for use in this assessment for the conversion of one-way to two-way street operations.

◈ Synchro Software

Synchro software (Synchro) by Trafficware analyzes signal controlled intersections that operate in coordinated or uncoordinated systems, and it has the capability to produce computer simulations of the network being assessed. Results from Synchro are based on procedures and methodologies outlined in the Transportation Research Board's 2000 Highway Capacity Manual (HCM).

Synchro models created by the City of Syracuse were used to assess the conversion of one-way to two-way street operations and the narrowing of Almond Street between Adams Street and Harrison Street.

◈ Vissim Software

Vissim software (Vissim) by PTV America is a traffic analysis and simulation tool for modeling complex or unique traffic operations and circumstances such as roundabouts. Vissim was used in the verification analysis for the Almond Street Roundabouts recommendation.

◈ Federal Highway Administration (FHWA) Reference

FHWA's Roundabouts: an Informational Guide was referenced in this analysis. This reference in conjunction with course work sponsored by the Institute for Transportation Research & Education (ITRE) called Modern Roundabout Design Workshop assisted with the feasibility analysis of the Almond Street Roundabouts recommendation.

Measures of Operations

Two primary measures of operations were used in this study to assess the UHTS recommendations: Level-of-Service (LOS) and volume/capacity (v/c) ratios.

The LOS results in this study were confined to overall intersection operations for signal controlled intersections for the One-way to Two-way Conversion recommendation. For the Almond Street Roundabout recommendation, results were provided in terms of unsignalized LOS by approach since a roundabout approach is controlled by a yield sign.

Level of Service criteria for traffic signals is stated in terms of the average control delay, in seconds, per vehicle, for a 15-minute analysis period. Control or Signal delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The ranges are provided in **Table 1**.

Table 1
Level of Service Definitions
For Signal Controlled Intersections

Level of Service	Delay (Sec. / Veh.)	Qualitative Description
A	< 10.0	Little or No Delay
B	10.1 to 20.0	Minor, Short Delay
C	20.1 to 35.0	Average Delays
D	35.1 to 55.00	Long, but Acceptable Delays
E	55.1 to 80.0	Long, Approaching Unacceptable Delays
F	>80.1	Long, Unacceptable Delays

The LOS for stop controlled (unsignalized) intersections was used to determine the LOS for the roundabout recommendation, which is also defined in terms of delay similar to signal controlled intersections. However, the delay criteria employed is different. The primary reason for this difference is that a signal controlled intersection generally facilitates higher traffic volumes than a stop controlled intersection. The delay threshold for any given LOS is less for a stop controlled intersection than for a signal controlled intersection, with the exception of a LOS of an 'A'. The ranges are provided in **Table 2**.

Table 2

Level of Service Definitions
For Stop Controlled Intersections

Level of Service	Delay (sec. / veh.)
A	< 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.00
E	35.1 to 50.0
F	>50.1

The roundabout analysis used v/c ratios in conjunction with LOS results.

Generally, a roadway lane or intersection movement/approach is at capacity with a v/c ratio of 1.0 or greater. It may still operate acceptably, under ideal conditions, but operations can become unstable should an incident take place such as a minor accident. Typically, a roadway or intersection movement/approach is considered to be approaching an "at capacity" condition with a v/c ratio of 0.8.

To understand the overall affects of the recommendations on the roadway network, three additional measures were reviewed.

- **Queuing:** Stacking of vehicles on an approach and spill-over from adjacent intersections.
- **Vehicle Hours Traveled:** The total vehicle hours expended traveling on the roadway network in a specified area during a specified time period.
- **Carbon Monoxide Emissions:** Resulting from an increase in congestion.

III. ESTABLISHMENT OF STUDY PARAMETERS

This section of the report provides a description of the study limits and transportation characteristics as well as an overview of the calibrations and adjustments that were made to the University Hill Transportation Study's TransCAD model and City of Syracuse's Synchro model.

Study Limits

General study limits are depicted on **Figure 1** and were primarily drawn to account for the full length of Adams Street, Harrison Street, University Avenue and Crouse Avenue where the one-way to two-way street conversions were recommended. Note that Almond Street is located in the center of **Figure 1** east of and adjacent to I-81. **Figure 1** is located at the end of this report.

TransCAD Model Calibrations

A TransCAD model for the University Hill area was created under Phase I of the UHTS and produced results for daily volume conditions. All of the major area developments were accounted for in the TransCAD legacy model created the UHTS. The UHTS daily model was converted to a peak hour model using an a.m. and p.m. assignment module for this assessment.

Synchro Model Calibrations

Overall, the Citywide Synchro model was considered adequate for this mesoscopic assessment; however, minor adjustments were made and discrepancies between field condition geometry and the City model were corrected.

It was recommended that the City's model undergo further calibration and refinement before it is used in design level microscopic (detailed) assessments.

The revised Synchro model was provided to the City of Syracuse.

Existing and Future Traffic Volumes

Existing (2008) one-way peak hour traffic volumes were derived from the Phase II TransCAD model. **Figure 2 & 3** depict 2008 one-way peak hour traffic volumes for a.m. and p.m. peak hours, respectively. These figures are provided at the end of this report.

A review of historical average daily traffic volumes from various New York State jurisdictional roadways surrounding the City of Syracuse were reviewed, and it was determined that traffic volume growth is generally trending flat. However, to account for minor development possibilities and fluctuations in traffic volumes, a straight-line growth rate of ½% per year was applied.

Since the recommendations were deemed "short term" improvements, the estimated time of construction (ETC) is 2010, and the design year (ETC+10) is 2020. This resulted in a 1% traffic volume growth for 2010, and a 6% traffic volume growth for 2020.

Base Conditions Operations

Traffic volumes from TransCAD were applied to the Synchro model resulting in the 2008 Base Condition for this assessment. A review of operational results indicates that majority of the intersections within the study limits operate acceptably, overall, at a LOS *D* or better. Intersections which operate, overall, below LOS *D* include:

- **Adams Street & Almond Street (a.m. & p.m. peak hours)**

- **Madison Street & Onondaga Street (p.m. peak hour)**
  It was noted that the intersection includes a signal phasing scheme that produces a failing condition. This signal phasing scheme was not included in the a.m. and midday time periods, where overall acceptable LOS was identified, and as a result may not be correct.

Figure 4 & 5 depict 2008 one-way peak hour LOS for a.m. and p.m. peak hours, respectively and are located at the end of this report. The capacity analysis files are located in the appendix (A-1).

IV. ONE-WAY TO TWO-WAY CONVERSION RECOMMENDATION

Under this recommendation, the following one-way streets were included.

- **Adams Street**: One-way Eastbound - State Street to Comstock Avenue (Full conversion)
- **Harrison Street**: One-way Westbound - Salina Street to Almond Street
- **University Avenue**: One-way Southbound - Fayette Street to Waverly Avenue
- **Crouse Avenue**: One-way Northbound - Genesee Street to Waverly Avenue

The following diagram depicts the roadways in this assessment.

The traffic flows on the four one-way streets were converted to two-way traffic flows, and twenty critical intersections were selected and analyzed.

One-way to Two-way Traffic Flow Conversion

The TransCAD models for 2008 existing condition's traffic flows were converted to two-way traffic flows and model outputs were refined and calibrated based on study area knowledge. A Cordon Area was established within the study area to validate the converted volumes. A Cordon Area is a boundary used for measuring traffic volumes entering and exiting a network.

A system difference within 2% was maintained for exiting and entering traffic volumes between one-way and two-way converted peak hour volumes with in the Cordon Area. A figure depicting the Cordon Area and entering/exiting traffic volumes is located in the appendix (A-2).

Critical Intersections

The City's Synchro model, within the study limits, included approximately fifty-six intersections, and many are signal controlled. The scope of this study reduced the number of intersections for assessment to twenty critical intersections using the following six criteria.

- Significant increase in traffic volume (~200 vehicle increase) as a result of the one-way to two-way conversion;
- Geometric change as a result of the one-way to two-way conversion;
- Existing 2008 LOS;
- Signal controlled intersection;
- Maintaining a contiguous network between intersections; and
- Input from the Steering Advisory Committee.

The following twenty critical intersections were then assessed for this recommendation:

Harrison Street Intersections	Adams Street Intersections
Montgomery Street	State Street
Salina Street	Townsend Street
Warren Street	McBride Street
State Street	Almond Street
Townsend Street	Sara Loguen Drive
Almond Street	Elizabeth Blackwell Street
Sara Loguen Drive	Irving Avenue
Elizabeth Blackwell Street	Crouse Avenue
Irving Avenue	University Avenue
Crouse Avenue	
University Avenue	

Converted Intersection Volumes

Figure 6 & 7 depict 2008 traffic volumes for a.m. and p.m. peak hours, respectively for the one-way to two-way conversion for the twenty critical intersections. A growth rate of ½% per year was applied to the 2008 converted traffic volumes resulting in one-way and two-way peak hour traffic volumes for 2010 and 2020.

- **Figures 8 & 9** depict 2010 one-way a.m. and p.m. traffic volumes.
- **Figures 10 & 11** depict 2020 one-way a.m. and p.m. traffic volumes.
- **Figures 12 & 13** depict 2010 two-way a.m. and p.m. traffic volumes.
- **Figures 14 & 15** depict 2020 two-way a.m. and p.m. traffic volumes.

Figures 6-15 are located at the end of this report.

Analysis

The analysis results predict that a majority of the critical intersections will operate overall at a LOS 'D' or better under 2010 and 2020 peak hour traffic volume conditions. A LOS 'D' for overall intersection operations is generally the threshold of acceptability in an urban area. The exception, where overall poor LOS is predicted, is summarized in **Table 3**.

Table 3
Level of Service
One-way to Two-way Street Network Conversion

Year / Traffic Flow	Time Period	Intersection	
		Harrison Street & Almond Street	Adams Street & Almond Street
2010 *One-way*	a.m.	C	F
2010 *Two-way*	a.m.	F	D
2010 *One-way*	p.m.	C	F
2010 *Two-way*	p.m.	E	F
2020 *One-way*	a.m.	C	F
2020 *Two-way*	a.m.	F	D
2020 *One-way*	p.m.	D	F
2020 *Two-way*	p.m.	E	F

Level of service for overall intersection operations are depicted on **Figures 16-23** at the end of this report. The capacity analysis files are located in the appendix (A-1).

An arterial analysis was conducted for Adams Street and Harrison Street for 2020 conditions to verify acceptable levels of operations for the overall two-way corridor operations. A review of 2010 conditions was not conducted since the increase in traffic between 2010 and 2020 (approximately 5%) was not considered significant and would provide results leading to similar conclusions.

The arterial analysis generally indicated that significant queuing and congestion along Adams Street was resulting in an unserviceable demand anomaly at many of the Adams Street intersections, which artificially produces good intersection levels of service analysis results. The arterial analysis also indicated that delay/vehicle, vehicle-hours traveled and carbon monoxide emissions were expected to increase. It was noted that the signal system being assessed is maintained through CMAQ funding. For this funding to continue, the system cannot be modified such that it significantly increases overall emissions/pollution.

The arterial analysis for Harrison Street predicted a moderate drop in delay/vehicle with minor increases of vehicle-hours traveled and carbon monoxide emissions remaining level. An arterial analysis summary for 2020 conditions is provided in the appendix (A-3) of this report.

The critical intersections on Crouse Avenue and University Avenue will operate overall at a LOS 'C' or better under 2010 and 2020 peak hour traffic volume conditions after the implementation of the two-way conversion of these streets. Therefore, no arterial analysis was conducted for these streets.

Summary

Traffic volumes served by Adams Street and Harrison Street are estimated to exceed the operational limits associated with a one-way to two-way conversion within the network configuration proposed for this study. And the street conversion, from a traffic volume perspective, indicates a substantial impact on vehicular operations would occur for a one-way to two-way conversion in other network configurations.

Crouse Avenue and University Avenue, from a cursory review, appear feasible for a one-way to two-way conversion within the network configuration proposed for this study. The feasibility of a one-way to two-way conversion of Crouse Avenue and University Avenue in other network configurations would require additional analysis.

The UHTS indicated that two-way streets are more accommodating to pedestrians and provided several example communities where this type of network conversion is or has taken place. The slower travel speeds that would be inherent with the additional vehicular friction associated with two-way street networks, may lend itself to less intimidating environment for pedestrians. However, overly congested conditions resulting in aggressive driving and the

additional number of potential conflict points associated with two-way travel at the intersections, may require further consideration/assessment should this recommendation be progressed in the future.

It was highlight by the Steering Advisory Committee that if a one-way to two-way conversion were to be further considered, a review/update of the Special Events Transportation Plan would be required.

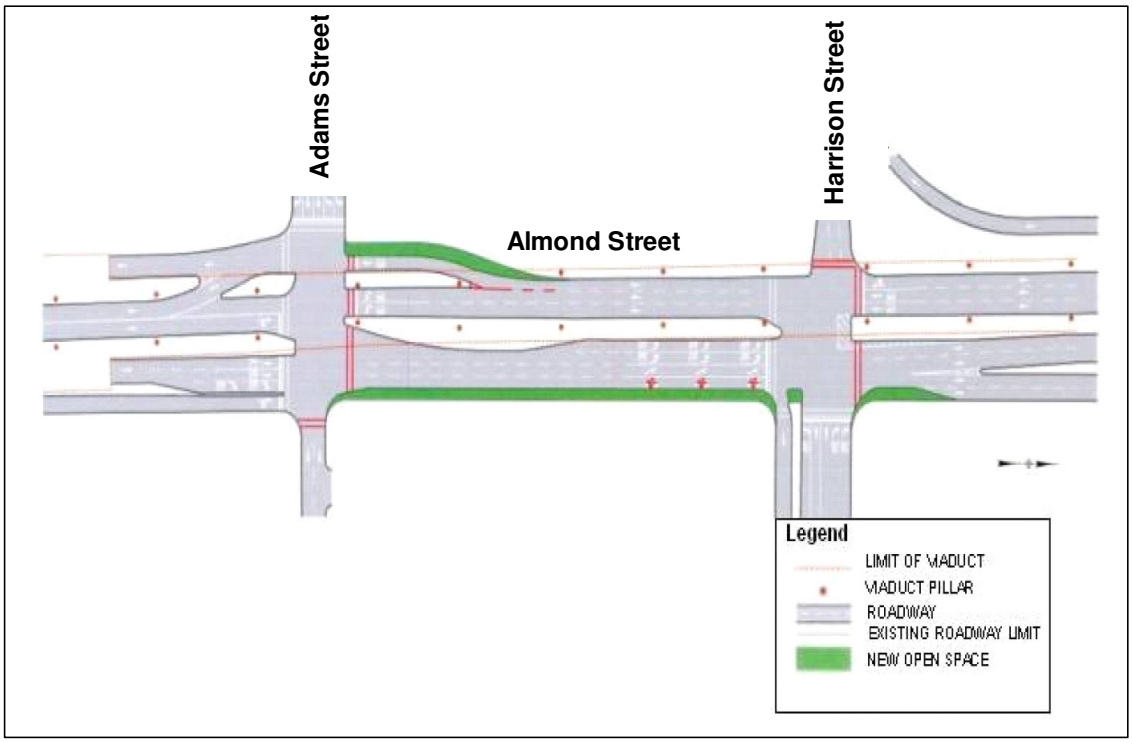
V. ALMOND STREET NARROWING RECOMMENDATION

Almond Street is a major North-South Street that runs under the I-81 viaduct and is located, approximately, in the center of the overall study area. In addition to being a significant local street with six intersecting East-West Streets feeding into the University Hill area, it serves on/off ramps to I-81 running overhead.

For this recommendation the following Almond Street modifications were considered:

- **Narrowing Almond Street by one lane northbound between Adams Street and Harrison Street.**

- **Eliminating one southbound I-81 on-ramp lane at Adams Street.**



Analysis

The assessment conducted for this recommendation focused on the overall intersection operations of Adams Street and Harrison Street with and without the two-way conversion recommendation.

Traffic volumes for 2010 and 2020 are depicted on **Figures 8-15** at the end of this report.

The capacity analysis conducted for the Almond Street intersections of Adams Street and Harrison Streets resulted in the following overall intersection LOS presented in **Table 4**.

Table 4
Level of Service
Almond Street Narrowing

Year / Traffic Flow	Time Period	Intersection	
		Harrison Street & Almond Street	Adams Street & Almond Street
2010 *One-way*	a.m.	C	F
2010 *Two-way*	a.m.	F	F
2010 *One-way*	p.m.	D	F
2010 *Two-way*	p.m.	F	F
2020 *One-way*	a.m.	C	F
2020 *Two-way*	a.m.	F	F
2020 *One-way*	p.m.	E	F
2020 *Two-way*	p.m.	F	F

Existing conditions capacity analysis indicated that the Almond Street/Adams Street intersection was operating under a failing LOS and that LOS translated into this recommendation's assessment.

It is anticipated that the Almond Street/Harrison Street intersection is predicted to degrade to a failing LOS under the two-way conversion scenario; and narrowing Almond Street is expected to compound the operations. The arterial analysis substantiated the predicted poor levels of operations from the capacity analysis. The capacity and arterial analyses are contained in A-1 and A-3, respectively, of the appendix.

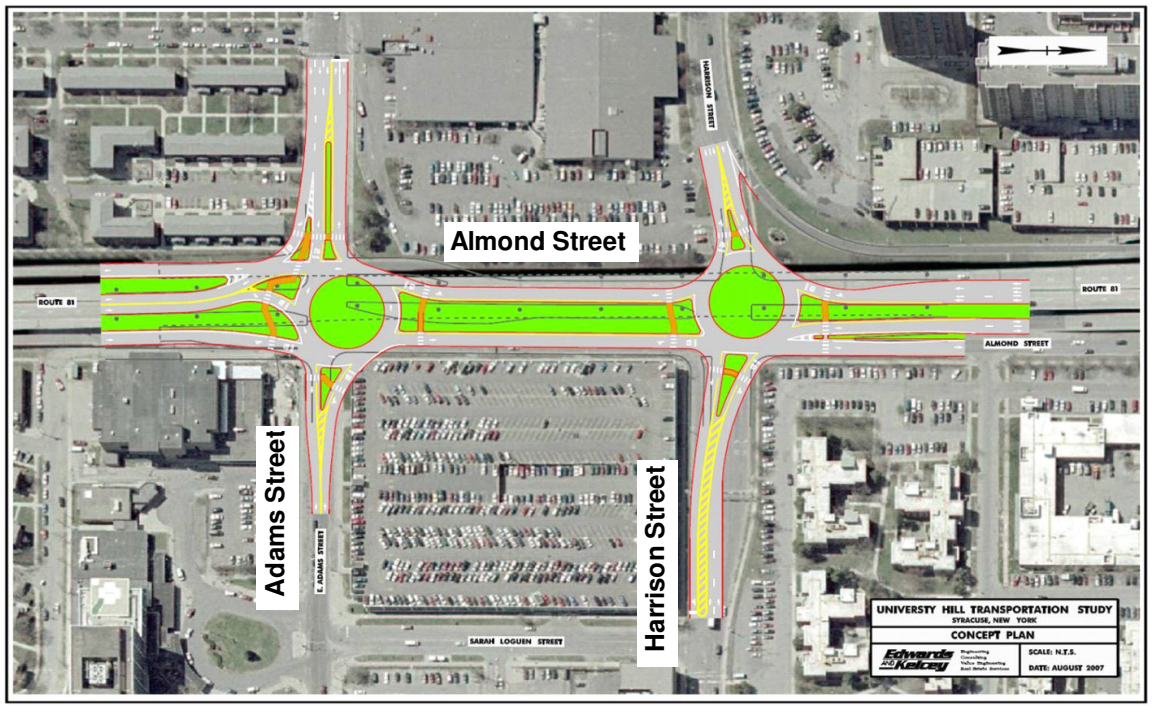
Summary

A narrowed street would reduce pedestrian crossings distances, may provide space for buffering the pedestrians from vehicular travel ways and reduce vehicular travel speeds all of which may improve the pedestrian experience on this street. However, it was concluded that

the Almond Street Narrowing recommendation would not reasonably facilitate the projected traffic volumes, which would result in a level of congestion that may negate the previously stated pedestrian environment improvements.

VI. ALMOND STREET ROUNDABOUT RECOMMENDATION

The third recommendation presented in the UHTS was the implementation of roundabouts at the Almond Street intersections of Harrison Street and Adams Street. The following graphic from the UHTS indicates that a one-lane roundabout configuration at both intersections may have been the preferred alternative. However, given the failing results from the previous "Narrowing" assessment, one-lane and two-lane roundabout alternatives were assessed. For consistency and future "what-if" purposes, one-way and two-way traffic patterns in accordance with the first recommendation were included with this recommendation's assessment.



A two-step analysis approach was conducted for the Almond Street roundabout recommendation. The first step was a **Feasibility Analysis**, which broadly assessed the possibility of one-lane and two-lane roundabouts for each intersection. The second step was a **Verification Analysis** of the roundabout configuration that had the best potential of working. Based on engineering experience, a cursory review of the traffic volumes indicated that roundabouts may not provide acceptable levels of vehicular operations under projected traffic conditions. Therefore, this assessment was initially conducted for existing (2008) p.m. conditions.

Feasibility Analysis

Based on the FHWA roundabout reference discussed earlier, the feasibility analysis has two components: determination of daily service volumes, and intersection approach capacities. All of the roundabout assessment calculations, graphs and figures that were used are included in the appendix (A-4). Conversion of standard intersection turning volumes to roundabout entry and circulatory intersection volumes are depicted on **Figures 24 & 25** for base (2008) p.m. conditions and are located at the end of this report.

◈ Daily Service Volumes

An analysis of daily service volumes includes the use of intersection annual average daily traffic (AADT), left turn percentages and minor street volume percentages. **Table 5** presents this information.

Table 5
Roundabout Service Volumes

Intersection	AADT (estimated)	Left Turn Percentage	Minor Street Volume Percentage
ONE-WAY TRAFFIC FLOW			
Almond Street/Harrison Street	51,400	11%	36%
Almond Street/Adams Street	45,240	38%	48%
TWO-WAY TRAFFIC FLOW			
Almond Street/Harrison Street	52,820	15%	42%
Almond Street/Adams Street	44,670	33%	49%

The roundabout service volumes were compared to graphed maximum daily service volumes (A-4) for a four-legged roundabout indicating that:

- One lane roundabouts would have a substantial impact on traffic operations at either intersection.
- A two-lane roundabout would have a substantial impact on traffic operations at the Harrison Street intersection.
- There is a marginal opportunity for a two-lane roundabout providing reasonable levels of operations at Adams Street intersection.

The maximum daily service volume graphs assumed that only 10% of the intersection is making a right turn. However, the intersections in this assessment have right turn percentages that range from 16% to 30%; therefore, both intersections were further evaluated for two-lane roundabouts using approach capacities.

◈ Approach Capacity

Two scenarios were considered for this analysis.

- Two lanes on all intersection approaches.

- One-lane approach with right turn slip ramp on the side streets.
  The one-lane approach with right turn slip ramp on the side streets (Adams & Harrison) was assessed to determine if separating heavy right turn movements from the approach volume would provide a significant benefit.

The measurement for this assessment is the ratio of entry volume (v) to available approach capacity (c) or v/c. Entry volumes (v) are depicted on **Figures 24 & 25** at the end of this report.

Approach capacity (c) is based on the relationship between circulatory volumes within the roundabout and entry volumes on the approach to the roundabout. This relationship (capacity) was determined for each of the intersections' approaches. Note that for the one-lane approach with slip ramp scenario, the capacity of a two lane approach was reduced by 50%, and Synchro was used to determine the capacity of the slip ramps. Detailed calculations are included in the appendix (A-4), and a summary of v/c ratio is contained in **Table 6**.

Table 6
Roundabout Volume to Capacity

Intersection Approach	Two Lane Approach			One Lane Approach with Slip Ramp		
	Entry Volume (veh./hr.)	Approach Capacity (veh./hr.)	V/C Ratio	Entry Volume (veh./hr.)	Approach Capacity (veh./hr.)	V/C Ratio
ONE-WAY TRAFFIC FLOW						
Almond Street/Harrison Street						
Westbound Approach	1,865	875	**2.13**	641	438	**1.46**
Westbound Right Turn Slip Ramp	-	-	-	1,224	250	**4.89**
Northbound Approach	2,154	2,425	**0.88**	2,154	2,425	**0.88**
Southbound Approach	1,121	1,850	0.61	1,121	1,850	0.61
Almond Street/Adams Street						
Eastbound Approach	2,174	1,450	**1.50**	1,600	725	**2.20**
Eastbound Right Turn Slip Ramp	-	-	-	574	552	**1.04**
Northbound Approach	974	950	**1.03**	974	950	**1.03**
Southbound Approach	1,376	2,425	0.57	1,376	2,425	0.57
TWO-WAY TRAFFIC FLOW						
Almond Street/Harrison Street						
Eastbound Approach	795	1,675	0.47	546	838	0.65
Eastbound Right Turn Slip Ramp	-	-	-	249	515	0.48
Westbound Approach	1,440	775	**1.86**	216	388	0.56
Westbound Right Turn Slip Ramp	-	-	-	1,224	242	**5.05**
Northbound Approach	1,919	2,000	**0.96**	1,919	2,000	**0.96**
Southbound Approach	1,128	2,050	0.55	1,128	2,050	0.55
Almond Street/Adams Street						
Eastbound Approach	1,458	1,375	**1.06**	884	688	**1.28**
Eastbound Right Turn Slip Ramp	-	-	-	574	494	**1.16**
Westbound Approach	727	1,175	0.62	473	588	**0.80**
Westbound Right Turn Slip Ramp	-	-	-	254	311	**0.82**
Northbound Approach	1,027	1,500	0.68	1,027	1,500	0.68
Southbound Approach	1,255	2,025	0.62	1,255	2,025	0.62

A review of the analysis results provided the following conclusions:

- Both study intersections have v/c ratios significantly higher than 1.0, indicating oversaturated conditions, which will result in a failing level of operation.

- The addition of a right turn slip ramp does not improve operations.

- Of the assessments conducted, there is a low probability that a two-lane roundabout with two-way traffic flow conditions may provide marginally acceptable levels of operations.

Verification Analysis

It is noted that of the recommendations assessed in this study, the roundabout recommendation was popular with the stakeholders involved in the UHTS. Additionally, the feasibility analysis does not take into account the affects from adjacent intersections. Therefore, a verification assessment was conducted using Vissim software for two-way traffic flow with the intersections having two lane approaches, which as noted above was the scenario with the best opportunity to provide acceptable levels of operations.

The Vissim simulation produced volume, delay, and queue data that was used to evaluate the operation of the proposed roundabouts. Table 7 summarizes the roundabout measures of performance. The data in Table 7 was confined to model's study limits, which included the immediately adjacent intersections. Video clips of the Vissim model are in the appendix (A-4).

Table 7
Roundabout Level of Service & Queue Length
Two-way traffic flow & two lane intersection approaches

Almond Street Intersections	Approach	Operations		Queue Length (Feet)	
		Delay	LOS	Average	Maximum
Harrison Street	Eastbound	15	C	44	392
	Westbound	**239**	**F**	**776**	**808**
	Northbound	12	B	32	495
	Southbound	5	A	6	186
Adams Street	Eastbound	**117**	**F**	**715**	**775**
	Westbound	**36**	**E**	185	**968**
	Northbound	22	C	103	557
	Southbound	13	B	29	362

Based on the Vissim assessment, it is predicted that the eastbound approach to the Almond Street/Adams Street intersection and the westbound approach to the Almond Street/Harrison Street intersection would fail and that these approaches would experience significant delays and queues due to a lack of gaps created by high circulating volumes within the roundabouts at these approaches. This will in turn cause the entire roundabout to operate poorly.

It was concluded that verification assessment substantiated the results from the feasibility assessment.

The following additional qualitative findings were noted:

- The predicted poor levels of operations were for 2008 conditions, which would indicate that the intersections would have no reserve capacity for projected 2010 and 2020 traffic volume conditions.

- Queue lengths may be longer and delays higher as a result of the compounding effect associated with the operations of Harrison Street and Adams Street as a whole.

- The assessment assumed 4-legged intersections with simplified approach geometries. The recommendation provided in the UHTS shows the northbound approach at Adams Street/Almond Street to be much more complex and non-standard in an attempt to accommodate the I-81 ramp. This unique approach geometry may result in driver/ pedestrian confusion and additional safety concerns, as well as impact approach operations beyond what was assessed in this study.

- It is anticipated that some of the properties adjacent to the roundabout would be impacted by the construction of these roundabouts, and a detailed engineered layout would be necessary to understand the extent of these impacts.

Summary

It is anticipated that an enhanced pedestrian environment may result from the installation of roundabouts at the assessed Almond Street intersection. This is accomplished through the potential narrowing /reconfiguration of the street and the construction of splitter islands that are intrinsic to roundabouts doubling as pedestrian refuge areas on the intersection approaches. However, considering the assessment's findings, it is concluded that the implementation of roundabouts at the Almond Street/Adams Street and Almond Street/Harrison Street intersections would not provide a reasonable level of operation for the projected traffic volumes, which could result in a level of congestion that negates the benefits for the pedestrians.

VII. ASSESSMENT CONCLUSIONS

The assessment concluded that each of the three transportation recommendations would significantly decrease vehicular operations and increase congestion/pollution, which would be further exacerbated should two of the recommendations be implemented in combination.

However, it is important to note that these recommendations are potentially viable should the study area experience a decrease in passenger car usage, through concerted mixed-use development programs, integrated parking strategies, a prioritized transit network and travel demand techniques that were identified in conjunction with these recommendations in the UHTS.

Should it become evident, in the future, that one or more of the assessed recommendations is workable, it is anticipated that certain benefits as stated in this document and the UHTS study may be realized by the non-motorized traveler of pedestrians and bicyclists. Given this study's findings regarding the operations of the transportation network additional detailed evaluations and financial investment analysis should be conducted prior to advancing any of the recommendations. As the SMTC is not an implementing agency, the facility owners' have the final decision to implement the recommendations discussed within this document if considered desirable and practical.

Additionally, the Steering Advisory Committee has emphasized that:

- Connectivity between the University Hill area and the Syracuse City Center is still achievable, on some levels, through the comprehensive use of crosswalks, vegetation and streetscape treatments. These connectivity measures should be considered as new construction projects are planned.
- If a one-way to two-way conversion were to be further considered, a review/update of the Special Events Transportation Plan would be required.
- The findings of this assessment are considered in the future assessments of the I-81 corridor study.

VIII. FIGURES

- **Figure 1** – Study Limits
- **Figures 2 & 3** – Existing Conditions a.m. and p.m. traffic volumes
- **Figures 4 & 5** - Existing Conditions a.m. and p.m. LOS
- **Figures 6 & 7** – 2008 two-way a.m. and p.m. traffic volumes
- **Figures 8 & 9** - 2010 one-way a.m. and p.m. traffic volumes
- **Figures 10 & 11** - 2020 one-way a.m. and p.m. traffic volumes
- **Figures 12 & 13** - 2010 two-way a.m. and p.m. traffic volumes
- **Figures 14 & 15** - 2020 two-way a.m. and p.m. traffic volumes
- **Figures 16 & 17** - 2010 one-way a.m. and p.m. LOS
- **Figures 18 & 19** - 2020 one-way a.m. and p.m. LOS
- **Figures 20 & 21** - 2010 two-way a.m. and p.m. LOS
- **Figures 22 & 23** - 2020 two-way a.m. and p.m. LOS
- **Figure 24** – 2008 one-way Almond Street Roundabout traffic volumes
- **Figure 25** – 2008 two-way Almond Street Roundabout traffic volumes