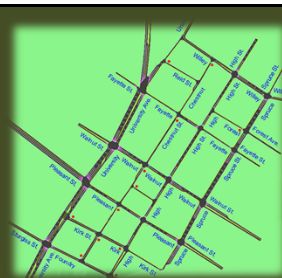
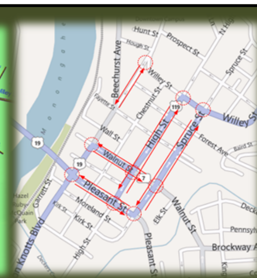




Morgantown Downtown Circulation Study

Presentation on Draft Report

3/20/2014 (updated 3/24/2014)

Andrew P. Nichols, PhD, PE, PTOE
Rahall Transportation Institute

RTI
RAHALL APPALACHIAN TRANSPORTATION INSTITUTE

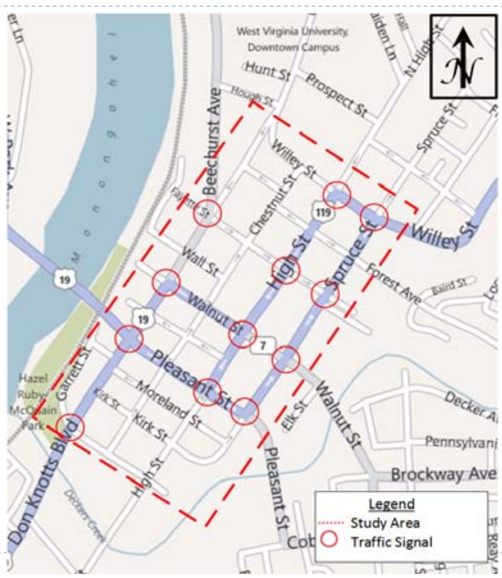
Presentation Overview

- Study Objectives
- Data Collection
- Traffic Modeling
- Performance Measures
- Existing Problem Areas
- Specific Changes Analyzed
- Alternatives Evaluated
- Results
- Summary

Study Objectives

- Quantify the existing level-of-service and other performance measures for motorized vehicles in the downtown Morgantown area
- Obtain input from the public regarding existing problems in the downtown Morgantown area
- Investigate alternatives to improve the circulation of traffic within and through the downtown Morgantown area
- Quantify the level-of-service and other performance measures for each alternative in order to draw comparisons

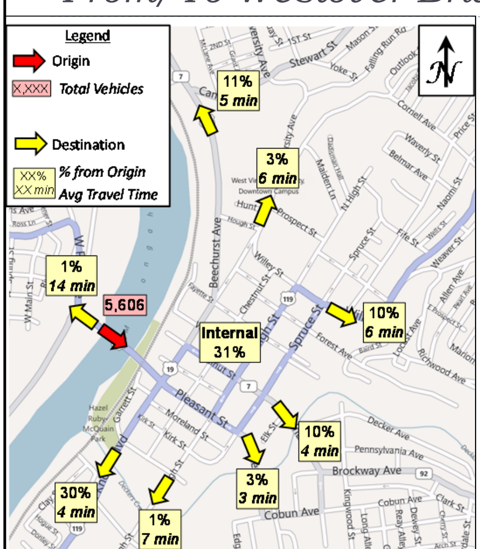
Study Area

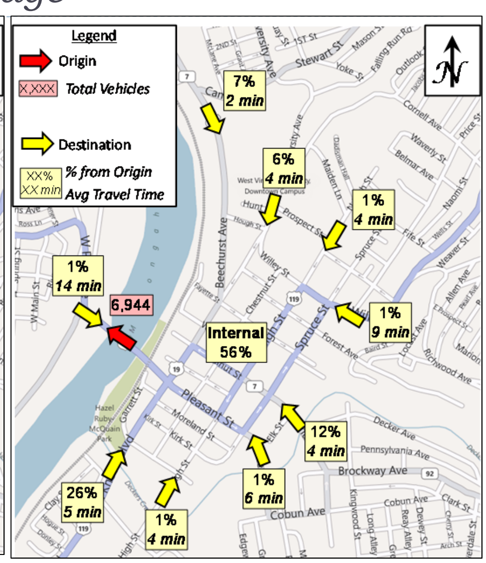


Data Collection
Traffic Flows

- All data collected on Weds 4/13/2011 from 7am-7pm
- Vehicle Counts
  - Turning Movement Counts at 9 Intersections
  - Machine Counts at 5 mid-block locations
- Origin-Destination Flows
  - Used cameras to capture license plates of vehicles entering and exiting study area
  - License plates matched to determine travel time and establish flow patterns

Example Origin-Destination Flow Maps
From/To Westover Bridge





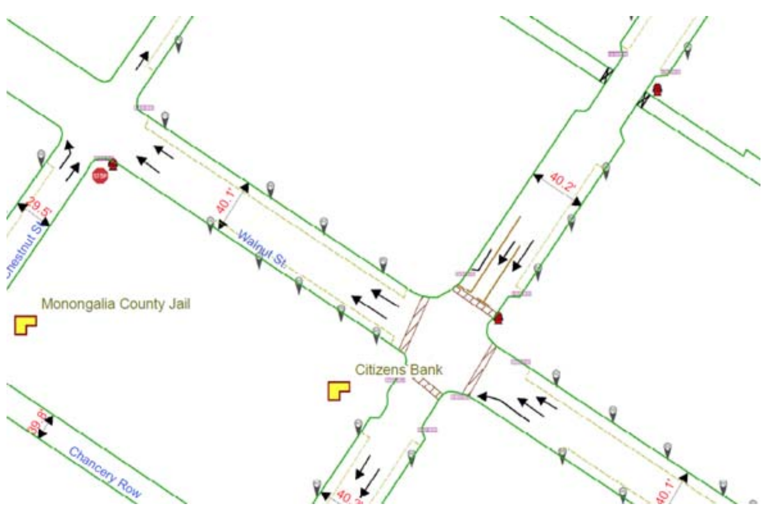
Data Collection
Other Data

- Downtown Geometric Survey
- Downtown Parking Inventory
  - Locations, access points, and number of spaces

Parking Type	Number of Spaces
City-Owned Surface Lots	486
City-Owned Structures	910
WVU Surface Lot	105
Private/Church Lot	997
On-Street Parking	223

- Public Meeting conducted on 10/6/2011
  - Support for one-way to two-way conversion
  - Desire to eliminate heavy truck traffic from downtown area

Downtown Geometric Survey



Downtown Parking Inventory

Section	Spaces
R-East	6
R-West	5
S	3
T-East	2
T-West	2
U-East	3
U-West	2
V	7
W-East	6
W-West	7
X	5
Y	10

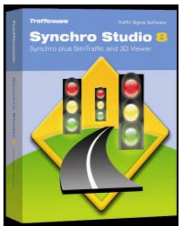
Section	Spaces	Section	Spaces	Section	Spaces
A-East	11	G	5	L-South	8
A-West	11	H-East	8	M-North	9
B	4	H-West	5	M-South	7
C	5	I	2	N	5
D	5	J	5	O-East	4
E	9	K-East	15	O-West	3
F-East	6	K-West	9	P	9
F-West	8	L-North	8	Q	4

Lot	Spaces	Lot	Spaces	Lot	Spaces	Lot	Spaces	Lot	Spaces
1	56	10	13	19	40	28	50	37	41
2	20	11	18	20	30	29	15	38	33
3	60	12	50	21	20	30	68	39	31
4	37	13	35	22	52	31	16	40	36
5	54	14	77	23	42	32	21	41	66
6	25	15	48	24	398	33	72	42	24
7	64	16	36	25	444	34	130	43	40
8	17	17	17	26	23	35	24	44	20
9	22	18	48	27	45	36	20		

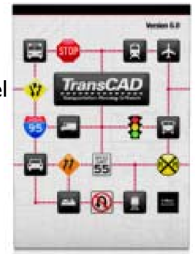
Traffic Modeling

- TransModeler/TransCAD
  - Analysis completed by Burgess & Niple
  - Common software for Planning level analysis
  - Estimate driver's route choice using O-D data
  - Considers the location and size of parking
  - Estimate the change in route choice in response to reconfigurations
- Synchro/SimTraffic
  - Common software for Operations level analysis
  - Accounts for detailed traffic signal operations
  - Produces detailed performance measures

Traffic Modeling



1. Build Base Geometric Model



2. Import Geometric Model
3. Configure "Existing" Volumes
4. Estimate "Existing" O-D flows
5. Assign "Existing" trips to intersections

6. Import "Existing" intersection volumes
7. Optimize signal timings
8. Generate "Existing" performance measures

Repeat Steps 4-8 for each Alternative

Synchro Model for Existing Conditions

Performance Measures

- Control Delay and Level-of-Service (LOS)
  - By movement and overall intersection

Level of Service	Control Delay (sec/veh)
A	$\leq$ 10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

- Volume-to-Capacity Ratios (v/c)
  - By movement and overall intersection
  - Congestion starts to occur at v/c > 0.85
- 95th Percentile Queue Lengths (feet)
  - By movement
  - Queue is only expected to exceed this distance 5% of the time

Existing Problem Areas
Walnut Street @ University Avenue

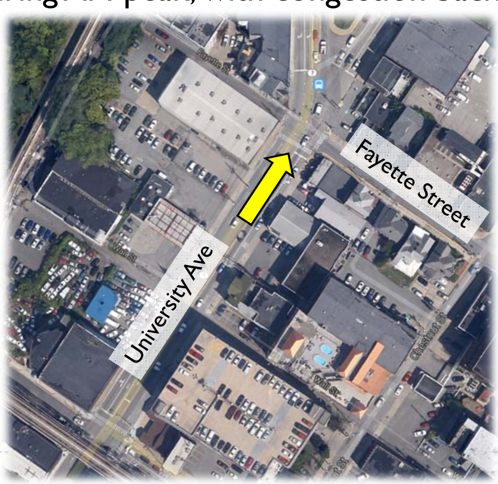
- Queueing on westbound Walnut Street at University Ave
- Worst during PM peak, often queueing to High Street

Existing Problem Areas
Walnut Street @ University Avenue

- 3-lane westbound approach essentially operates as 2 lanes

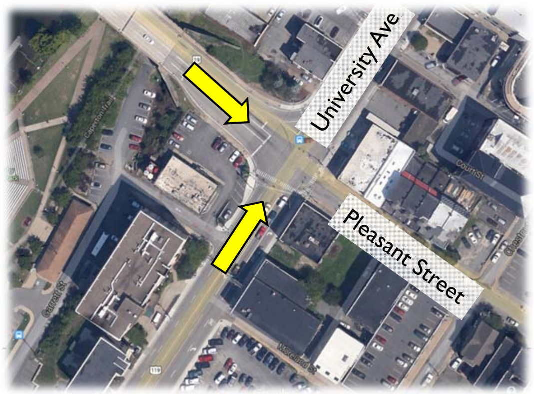
Existing Problem Areas
University Avenue @ Fayette Street

- Queueing on northbound University Avenue
- Worst during AM peak, with congestion back to Pleasant Street



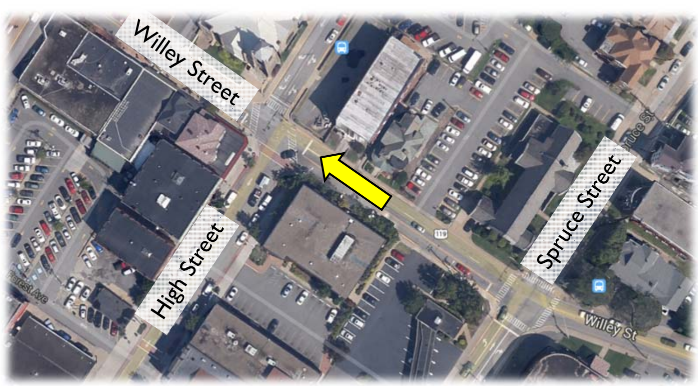
Existing Problem Areas
University Avenue @ Pleasant Street

- Queueing on northbound University Avenue
  - AM peak – thru movement tends to be the worst
  - PM peak – left-turn movement tends to be the worst
- Queueing on eastbound Pleasant Street



Existing Problem Areas
Willey Street @ High Street

- Congestion on westbound Willey St throughout the day
- Eastbound Willey Street gets congested mid-day and PM

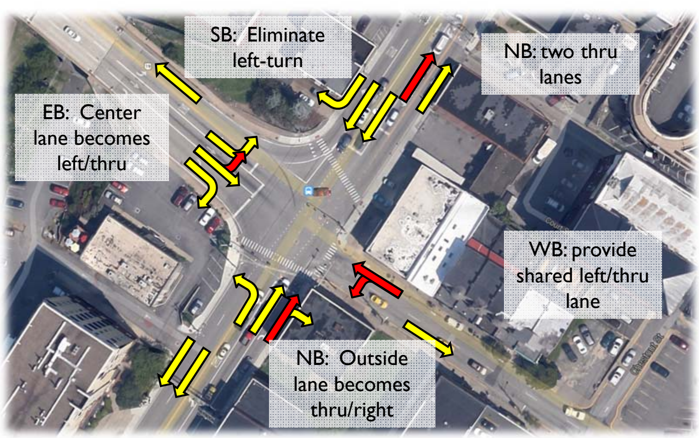


Specific Changes Analyzed
Conversion to Two-Way

- Conversion of the following streets from one-way to two-way flow
  - High Street (south of Willey Street)
  - Spruce Street (south of Willey Street)
    - Allows more direct access to parking from Willey Street
  - Walnut Street
    - Allows more direct access between University Ave and Walnut Street bridge (including heavy vehicles)
  - Pleasant Street
    - Provides another outlet from downtown area to University Avenue

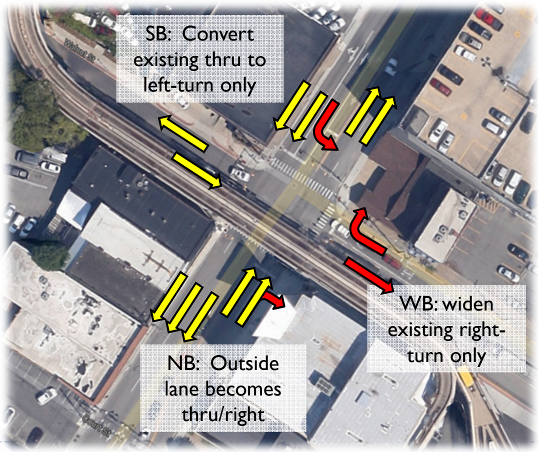
Specific Changes Analyzed
University Ave & Pleasant Street

- Pleasant Street becomes two-way flow
- Eliminate southbound left-turn onto Pleasant



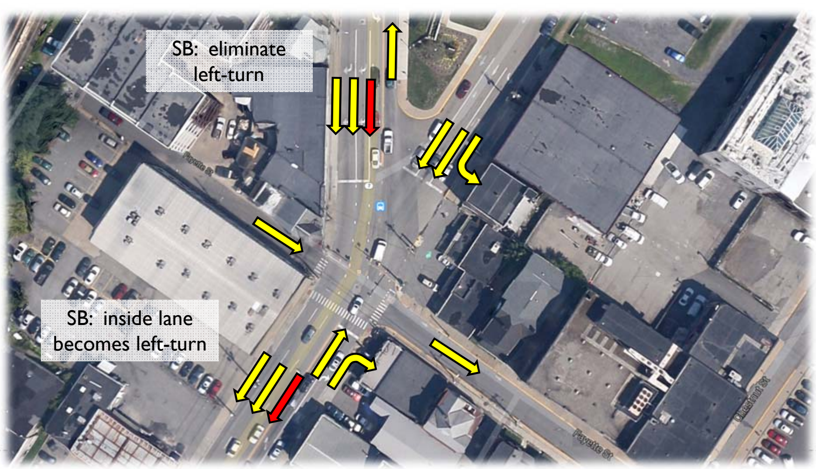
Specific Changes Analyzed
University Ave & Walnut Street

- Walnut Street becomes two-way flow
- East leg can only handle one lane in each direction



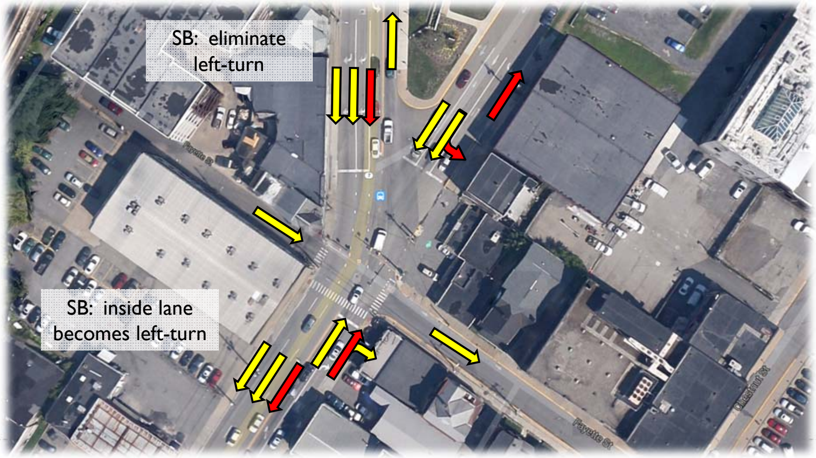
Specific Changes Analyzed
University Ave & Fayette Street

- Eliminate southbound left-turn from Beechurst Avenue
- Accounted for in Alternatives 2 & 3



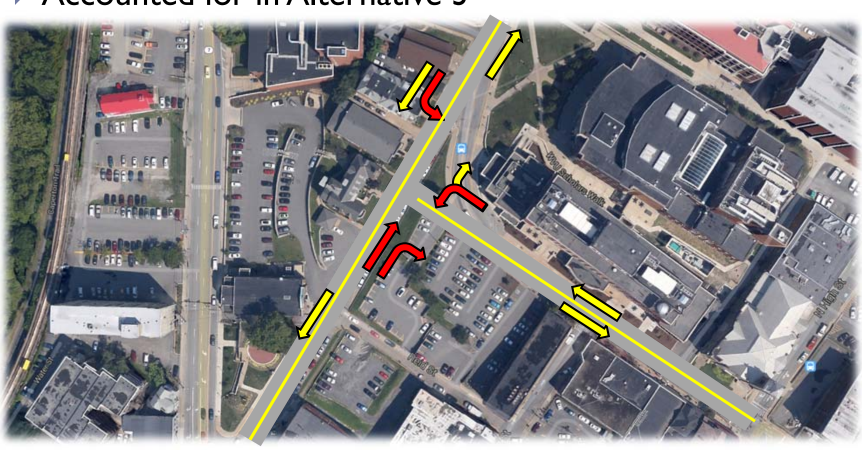
Specific Changes Analyzed
University Ave & Fayette Street

- Convert University Avenue to Two-Way Flow
- Accounted for in Alternative 3



Specific Changes Analyzed
University Ave & Willey Street

- Convert to a 3-way "T" signalized intersection
- Accounted for in Alternative 3



Alternative 1 Overview

- System Modifications
  - Conversion of One-way to Two-way flow on
    - High Street (south of Willey Street)
    - Spruce Street (south of Willey Street)
    - Walnut Street
    - Pleasant Street
  - Assumes "ideal" conditions with left-turn bays at all intersections created by the two-way conversion
  - Elimination of southbound left-turn from University Avenue onto Pleasant Street

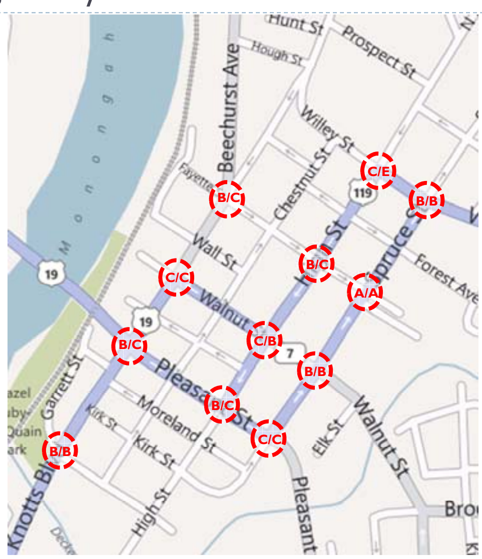
Alternative 2 Overview

- System Modifications (in addition to Alternative 1)
  - Elimination of southbound left-turn onto Fayette Street
  - Elimination of left-turns from Walnut Street onto University
  - Elimination of right-turns from Pleasant Street onto University
  - Elimination of left-turn bay on eastbound Pleasant @ High St.
- Anticipated Impacts
  - Removal of ~33 on-street parking spaces
    - ~ 7 on High Street
    - ~ 26 on Walnut Street
  - Requires right-of-way along east leg of Willey Street for westbound left-turn bay onto Spruce Street

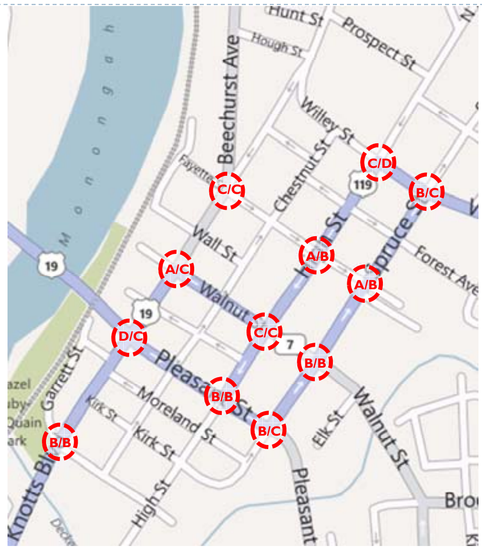
Alternative 3 Overview

- System Modifications (In addition to Alternative 2)
  - Conversion of University Avenue from Willey Street to Fayette Street from one-way to two-way flow
  - Realignment of University Avenue & Willey Street intersection with turn bays along University Avenue and signalization
- Anticipated Impacts (In addition to Alternative 2)
  - Removal of ~11 on-street parking spaces on University Avenue
  - Requires right-of-way in vicinity of Willey Street and University Avenue to realign Willey Street

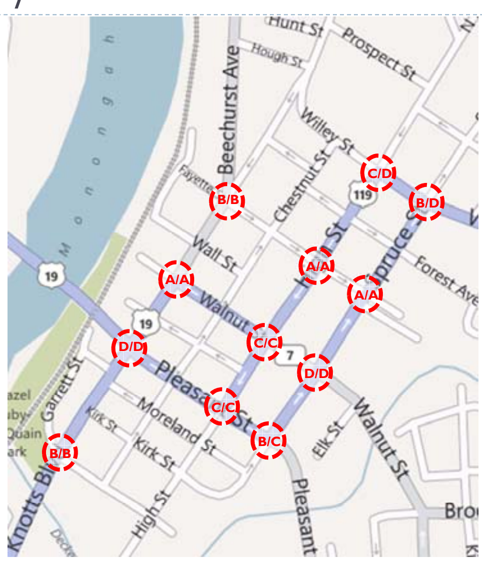
Existing AM/PM Intersection LOS



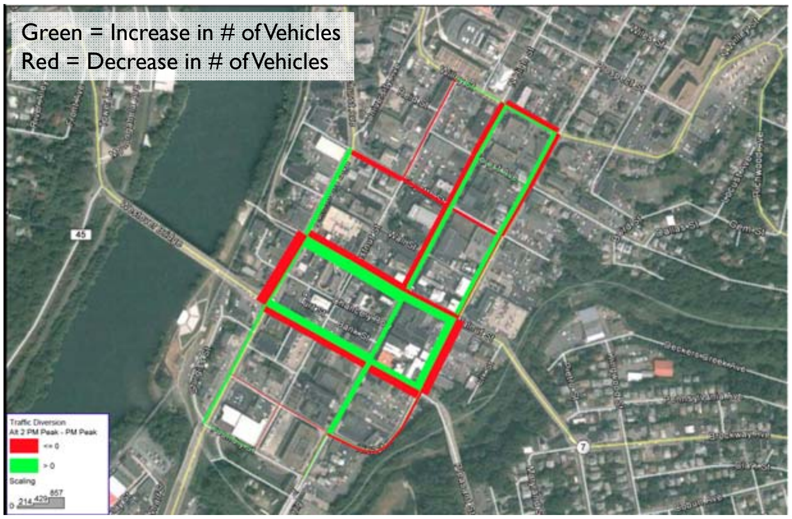
Alt 1 AM/PM Intersection LOS



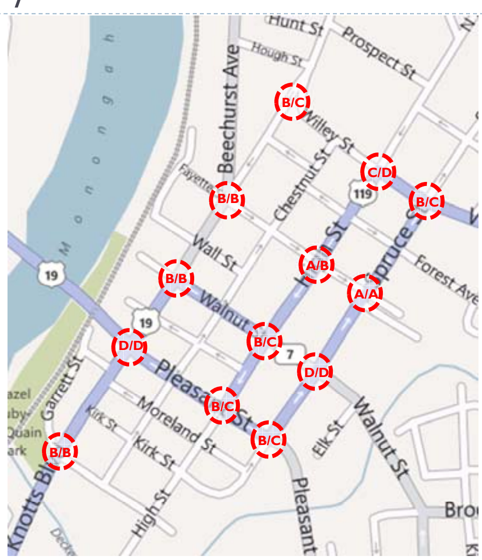
Alt 2 AM/PM Intersection LOS



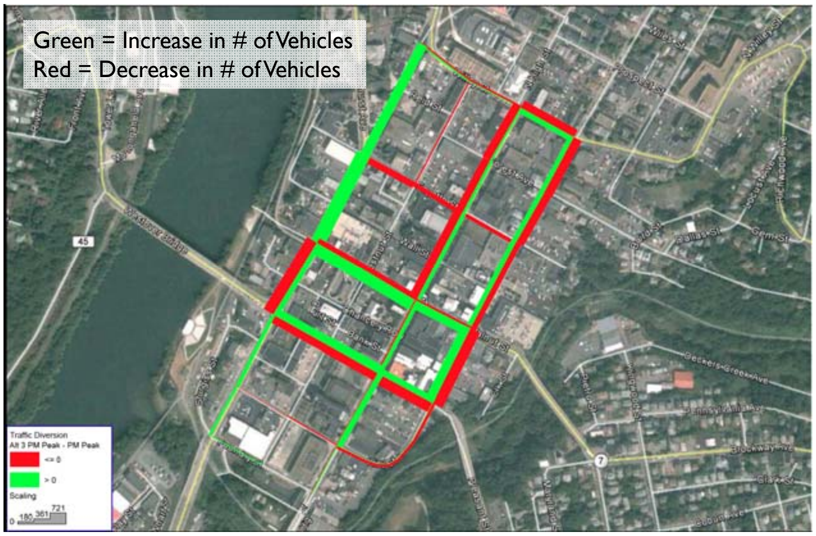
Redistribution of Trips
Existing – Alternative 2 (PM Peak)



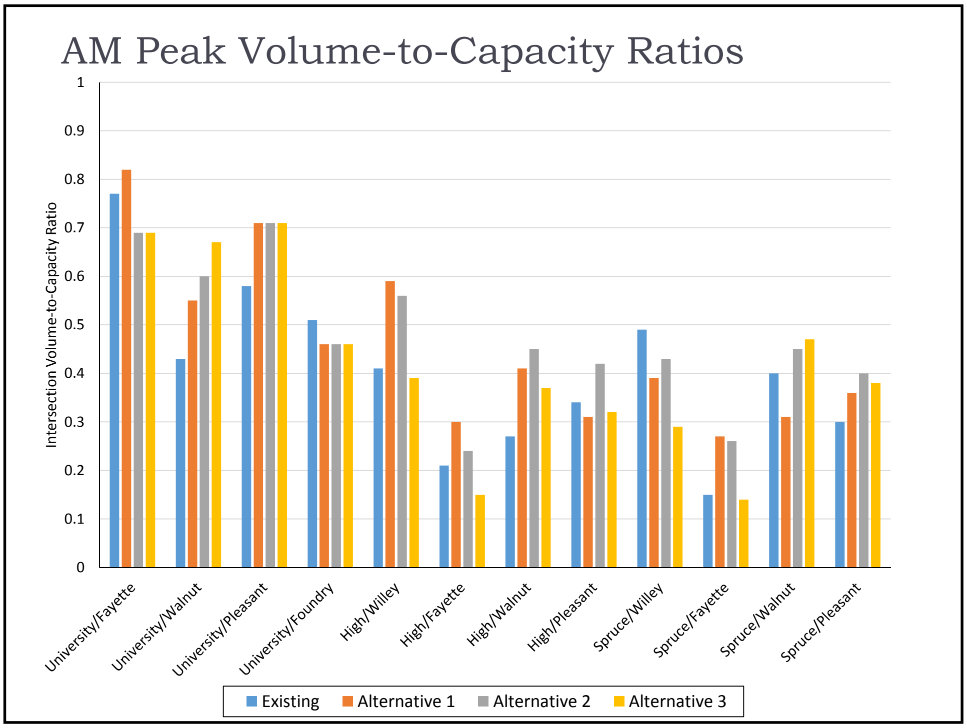
Alt 3 AM/PM Intersection LOS

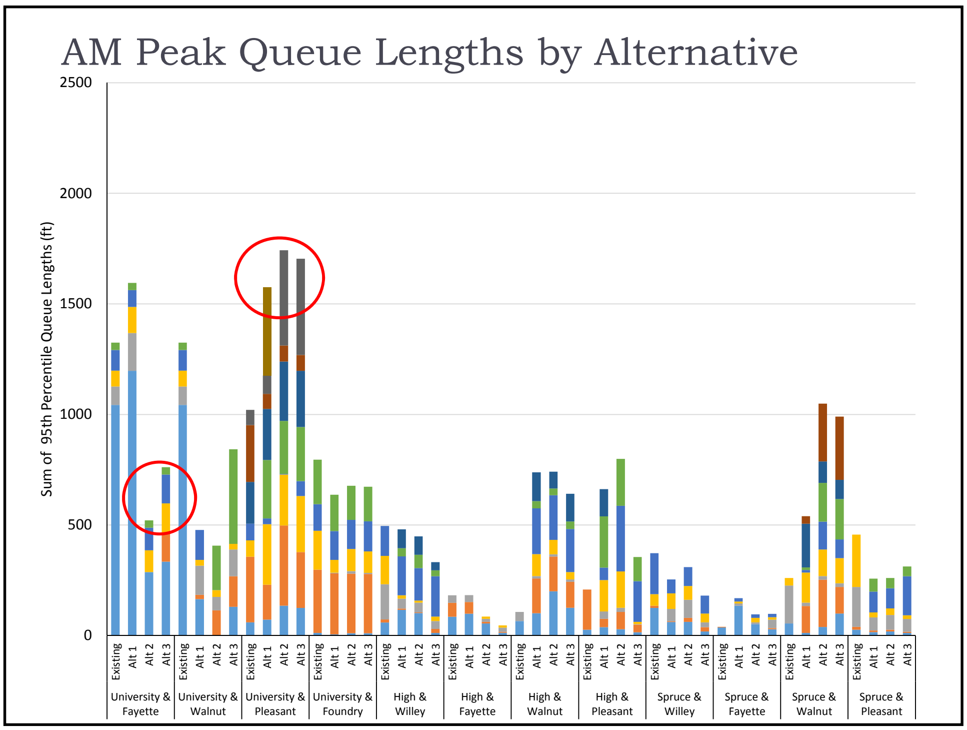


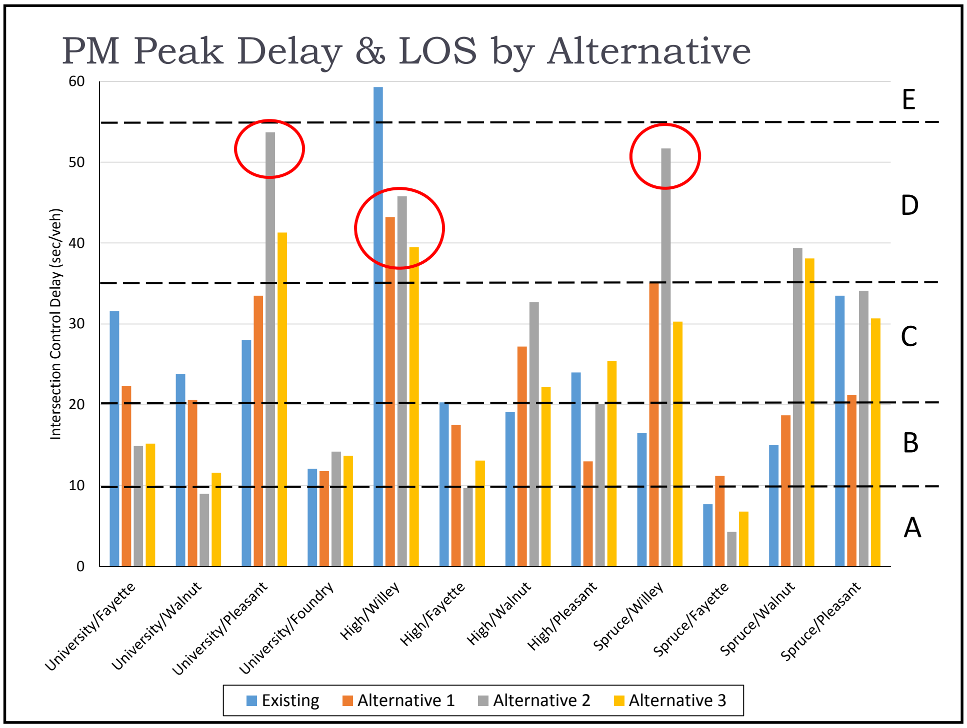
Redistribution of Trips
Existing – Alternative 3 (PM Peak)

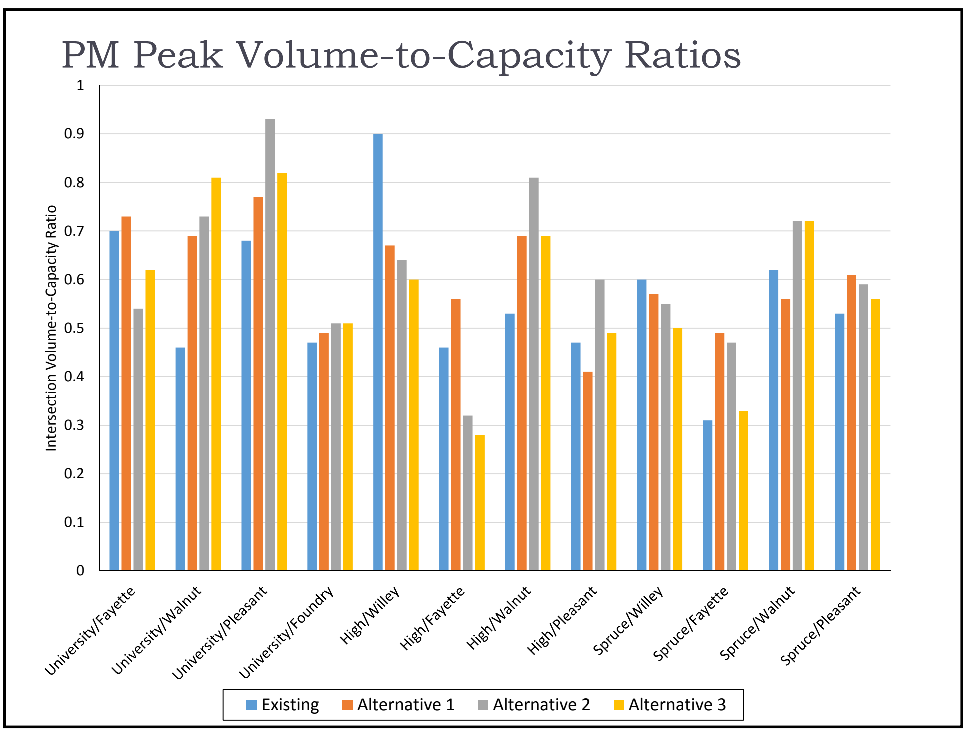


AM Peak Delay & LOS by Alternative

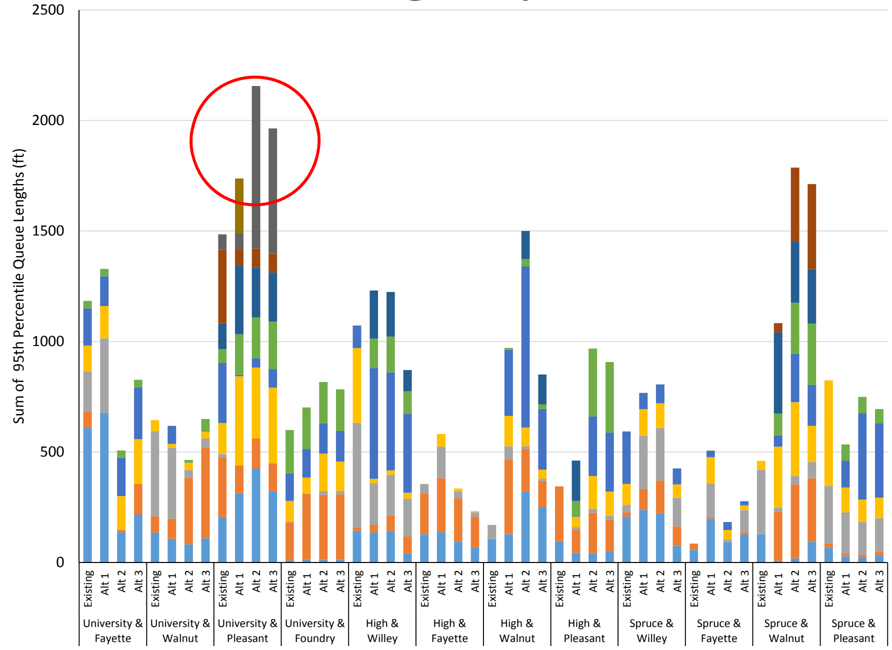

AM Peak Volume-to-Capacity Ratios
Intersection Volume-to-Capacity Ratio
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
University/Fayette
University/Walnut
University/Pleasant
University/Foundry
High/Willey
High/Fayette
High/Walnut
High/Pleasant
Spruce/Willey
Spruce/Fayette
Spruce/Walnut
Spruce/Pleasant
Existing
Alternative 1
Alternative 2
Alternative 3


AM Peak Queue Lengths by Alternative
Sum of 95th Percentile Queue Lengths (ft)
2500
2000
1500
1000
500
0
Existing
Alt 1
Alt 2
Alt 3
University & Fayette
University & Walnut
University & Pleasant
University & Foundry
High & Willey
High & Fayette
High & Walnut
High & Pleasant
Spruce & Willey
Spruce & Fayette
Spruce & Walnut
Spruce & Pleasant


PM Peak Delay & LOS by Alternative
Intersection Control Delay (sec/veh)
0
10
20
30
40
50
60
E
D
C
B
A
University/Fayette
University/Walnut
University/Pleasant
University/Foundry
High/Willey
High/Fayette
High/Walnut
High/Pleasant
Spruce/Willey
Spruce/Fayette
Spruce/Walnut
Spruce/Pleasant
Existing
Alternative 1
Alternative 2
Alternative 3


PM Peak Volume-to-Capacity Ratios
Intersection Volume-to-Capacity Ratio
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
University/Fayette
University/Walnut
University/Pleasant
University/Foundry
High/Willey
High/Fayette
High/Walnut
High/Pleasant
Spruce/Willey
Spruce/Fayette
Spruce/Walnut
Spruce/Pleasant
Existing
Alternative 1
Alternative 2
Alternative 3

PM Peak Queue Lengths by Alternative



Summary

- There is no perfect solution to solve congestion problems
- Two-way conversion seems feasible as long as increase in congestion and shift in its location is acceptable
- Alternative 1 was only modeled to determine initial feasibility of one-way to two-way conversion
- Alternative 2 Performance (compared to Existing)
  - Reduces congestion at University/Fayette
  - Significantly increases congestion at University/Pleasant
  - Increases congestion at High/Walnut
  - Increases congestion at Spruce/Willey

Summary

- Alternative 3 Performance (compared to Existing)
  - Reduces congestion at all Spruce/High intersections
  - Reduces congestion at University/Pleasant
  - Increases congestion at University/Fayette
  - Increases congestion at University/Walnut
  - Operationally, this is the preferred alternative because some traffic is shifted from High Street and Spruce Street
- Future Work and Recommendations
  - Improvements to the east leg of Pleasant Street at University Avenue would greatly improve LOS at that intersection
  - Investigate feasibility of the recommended intersection modifications
  - After final configuration is determined, additional operational considerations could be evaluated (e.g., turn restrictions)

Principal Investigator:
Andrew P. Nichols, PhD, PE, PTOE

Associate Professor of Engineering
Marshall University

Director of Intelligent Transportation Systems
Rahall Transportation Institute

andrew.nichols@marshall.edu
304-696-3203