Kimley»Horn

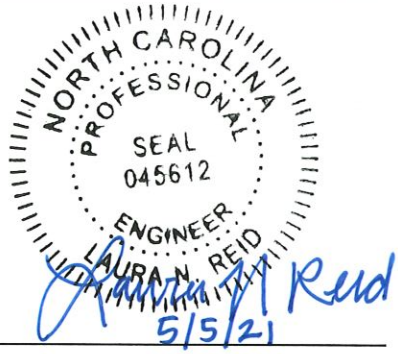
Memorandum

To: Chris Medlin, NCDOT (Division 13, District 2)
Mike Reese, PE, NCDOT (Congestion Management)
Ken Putnam, City of Asheville

From: Laura Reid, PE
Kimley-Horn

Re: ***Charlotte Chestnut Masterplan***
Mitigation Memorandum

Date: May 5, 2021



The purpose of this mitigation memorandum is to address City of Asheville, North Carolina Department of Transportation (NCDOT) District 2, and NCDOT Congestion Management comments on the *Charlotte Chestnut Masterplan Traffic Impact Analysis* (Kimley-Horn, January 2021) and to document the final mitigation requirements of the proposed development.

Comment/Response

Per the *NCDOT Final Decision on the Charlotte Chestnut Masterplan Development* dated March 10, 2021 **(attached)**, the following comments were provided relative to the proposed mitigation in the traffic impact analysis (TIA). In the sections below, comments provided by NCDOT are shown in **bold** and responses are shown below each comment in *italics*.

Site Plan and Geometric Suggestions

1. **Please ensure that the proposed driveways are in accordance with the NCDOT Driveway Manual.**
   The proposed driveways access roadways maintained by the City of Asheville. Driveways will be designed in accordance with the City of Asheville's Standard Specifications and Details Manual.

2. **Internal Protected Stem lengths for each proposed driveway should be provided in the TIA in conformance with requirements in the NCDOT Driveway Manual. Minimum suggested length is 100 feet.**
   Required internal protected stem length will be based on the City of Asheville's Standard Specifications and Details Manual, Table 3-13. Modifications from this manual will be considered on a case-by-case basis. Final requirements will be determined during the site plan/ rezoning process.

3. **Extend/restripe (maximize) of the westbound right-turn lane on the I-240 WB Off-Ramp to help mitigate the site should be considered (Approach LOS drops from E to F)**
   As shown in Table 6.5 in the TIA (page 28), the proposed development is projected to extend the westbound right-turn queue by 51' and 40' in the AM and PM peak hours, respectively. In both peak hours, the westbound left-turn and through queues are projected to be under 300'. Based on a review of existing aerials, the projected queues should be able to be accommodated within the existing pavement on the westbound

*approach of this intersection. As shown in **Figure 1 (attached)**, it is recommended that the westbound right-turn lane striping be extended to 350' to improve driver expectation as vehicle determine where to position themselves on the ramp. At 350', the striping would begin about 66' before the back of the longest Synchro queue.*

*It should be noted that the original Synchro models assumed that this turn lane has 250' of storage based on current striping and tapers. The model has been updated to reflect the recommended 350' turn lane striping. Synchro and SimTraffic reports for this intersection with this extension are **attached**.*

4. **Maximize the distances of proposed site accesses A and B from the Charlotte St intersections and/or they should be monitored and conversion of this intersection from an all-movement to a left-over or right-in/right-out with median channelized island could be considered. In addition, side-by-side left-turn lanes may be needed between proposed site access A and Charlotte St on Chestnut St**

   Required intersection spacing will be based on the City of Asheville's Standard Specifications and Details Manual, Table 3-16. Modifications from this manual will be considered on a case-by-case basis. Final requirements will be determined during the site plan/ rezoning process.

Synchro Coding

1. **The PEF used several values for Peak Hour Factor (PHF) in the analyses (all less than 0.90). Unless sufficient information is given to support another value, 0.90 for signalized intersections should be used. NOTE: PHF values less than 0.90 will alter the results to be more "conservative."**
   As stated on page 22 of the TIA, "Observed peak-hour factors (PHFs) were used in existing conditions analysis. A weighted PHF was used during the AM peak hour for all scenarios [due to schools in the vicinity of the study area]. A PHF of 0.90 was used in all future year analysis in the PM peak-hour." This approach should provide "conservative" results as noted.

2. **The "Code Error Check" should be run in Synchro before finalizing the analysis, and any errors or warnings should be justified or corrected prior to activating SimTraffic.**
   Acknowledged. Based on a review of the Build Synchro files, the errors and warnings from the "Code Error Check" reflect limited capacity, laneage/signal conditions, or existing volume imbalances.

3. **Analysis of all lanes with finite storage should include an appropriate taper.**
   Storage and taper lengths in the model are reflective of field measurements.

4. **Congestion Management Guidelines encourage using a minimum turning count movement of 4 vph on Synchro for all allowed movements.**
   As stated on page 21 of the TIA, "allowable movements with traffic volumes under four vehicles were changed to four vehicles per hour, with the exception of movements into and out of the project site."

5. **All link termini should extend a reasonable distance beyond the last node (typically 1000 feet) to ensure adequate queuing can be calculated in SimTraffic.**
   Link termini were extended to 1,000 feet (or more) where the potential for long queues was anticipated. Driveway links within the proposed site were limited in length due to the available storage between Baird Street and Chestnut Street.

Identified Mitigation

Based on the discussions above and the mitigation identified in the Charlotte Chestnut Masterplan Traffic Impact Analysis (Kimley-Horn, January 2021), the identified mitigation for this site is outlined below.

Charlotte Street and Chestnut Street

- Construct a westbound left-turn lane along Chestnut Street with storage maximized to the proposed left-turn lane at Access A (creating a three-lane section).

Charlotte Street and I-240 WB Ramp

- Restriping of the westbound right-turn lane to provide 350' of storage within the existing pavement section.

Chestnut Street and Access A

- Construct the site driveway with a single lane approach. Driveway spacing and internal protected stem will be constructed in accordance with the *City of Asheville's Standard Specifications and Details Manual.*
- Construct an eastbound left-turn lane along Chestnut Street with storage maximized to the proposed left turn lane at Charlotte Street (creating a three-lane section).

Baird Street and Access B

- Construct the site driveway with a single lane approach. Driveway spacing and internal protected stem will be constructed in accordance with the *City of Asheville's Standard Specifications and Details Manual.*
- Construct an eastbound right-turn lane along Baird Street with 100' of storage and appropriate taper.

This identified mitigation is shown in **Figure 2**. The improvements shown on this figure are subject to approval by NCDOT and the City of Asheville. All additions and attachments to the State and City roadway system shall be properly permitted, designed, and constructed in conformance to standards maintained by the agencies.

Please contact me if you have any questions (704) 319-7696.

Very truly yours,
KIMLEY-HORN AND ASSOCIATES, INC.

Laura Reid, PE

Attachments

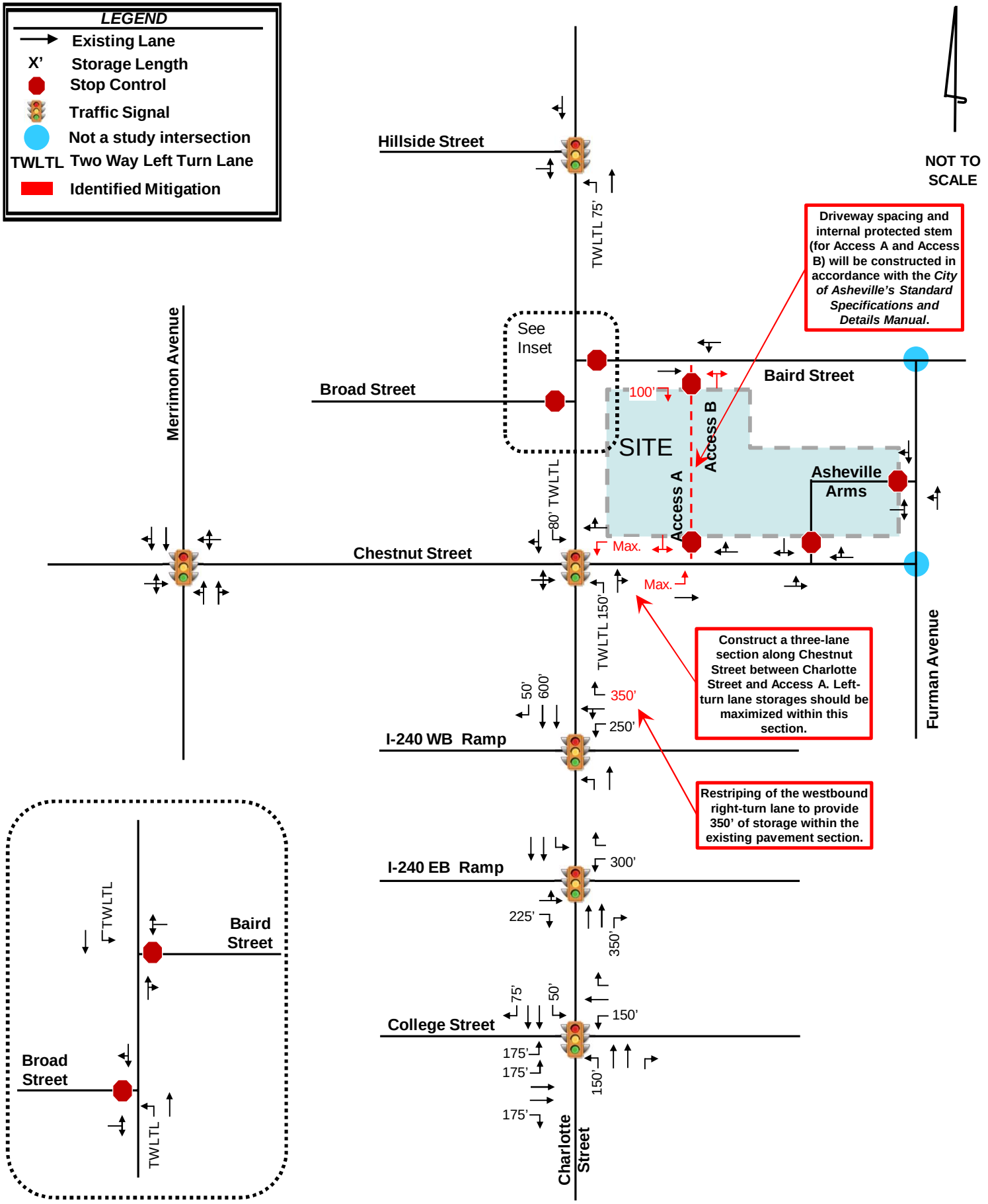
- Figure 1 – Roadway Concept
- Figure 2 – Identified Roadway Mitigation
- NCDOT Final Decision on the Charlotte Chestnut Masterplan Development
- Synchro Reports
- SimTraffic Reports

Cc: Nick Dorato, PE NCDOT
Robert Gallo, PE NCDOT

CDC Civil Design Concepts, PA
NCBELS #: C-2184

mcmillan | pazdan | smith ARCHITECTURE

Charlotte Chestnut Masterplan
Figure 1: Roadway Concept
May 2021



Kimley»Horn	Charlotte Chestnut Masterplan Mitigation Memorandum	Identifed Roadway Mitigation	Figure 2

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

March 10, 2021

Laura N. Reid, P.E. – Kimley-Horn and Associates, Inc.
Prepared for:
Charlotte Chestnut Masterplan
Civil Design Concepts, PA
Asheville, NC

SUBJECT: ****FINAL DECISION** *Charlotte Chestnut Masterplan Development-***
Charlotte Street (COA Maintained) Mixed-Use development TIA and Site Plan review located in Asheville, Buncombe County Division 13.

The District Office has performed a TIA and Site Plan review of the subject mixed-use development located on Charlotte St and East Chestnut St in Asheville, Buncombe County.

The District Office has determined the following listed improvement(s) (please see attached document) are required to be done in accordance with the *Policy on Street and Driveway Access to North Carolina Highways*. All improvements and documentation shall be shown on the plans and provided as part of the package submitted to the NCDOT District Office for review and approval of a Driveway Access Permit.

All work is to be done in strict compliance with the North Carolina Department of Transportation Standards and Specifications. At your convenience, please submit for a driveway access permit in accordance and provide all necessary documentation. Feel free to give us a call at the District Office (828) 298-2741 if you would like to discuss further.

Sincerely,

DocuSigned by:
Christopher D. Medlin
6D92D71E27C94A3...

Christopher D. Medlin, P.E.
District Engineer

CDM/nkd
Attachments

NC DEPARTMENT OF TRANSPORTATION
DIVISION 13 DISTRICT II OFFICE
ASHEVILLE, NC 28802

Telephone: (828) 298-2741
Fax: (828) 299-3747
Customer Service: 1-877-368-4968

11 OLD CHARLOTTE HWY.
ASHEVILLE, NC 28803

Website: www.ncdot.gov

CHARLOTTE CHESTNUT MASTERPLAN DEVELOPMENT TIA CURSORY REVIEW

BULLET LIST OF NCDOT COMMENTS AND CONCERNS (SC-2020-170)

March 11, 2021

The Department of Transportation (NCDOT) has performed a cursory review of the Charlotte Chestnut Masterplan Development traffic impact assessment (TIA) prepared by Kimley-Horn and Associates, Inc., sealed January 12, 2021. The CMS preliminary review was sent to the local NCDOT District Office on February 12, 2021 - deeming the TIA "Complete." This proposed development is to be located in the northeast quadrant of Charlotte St and East Chestnut St in Asheville, Buncombe County The traffic impact assessment states that the full build-out of the development is to be constructed by 2025 and is to consist of a mixed-use development with 3,890 daily unadjusted trips. Based on our cursory review, we have the following comments at this time:

General

- The following roads below are assumed to be maintained by the City of Asheville:
    - Charlotte St (north of I-240 interchange)
    - Hillside St
    - Broad St
    - Baird St
    - Furman Ave
    - Chestnut St
    - College St (west leg of US 70/SR 3284 (Charlotte St) and US 70 (College St) intersection)

Trip Generation and Adjustments

- Trip generation appears reasonable.
- NCHRP 684 Internal Capture and mode split calculations appear reasonable.
- Volume calculations appear reasonable.

Trip Distribution

- The trip distribution appears reasonable.

Synchro Coding

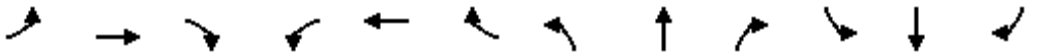
- The PEF used several values for Peak Hour Factor (PHF) in the analyses (all less than 0.90). Unless sufficient information is given to support another value, 0.90 for signalized intersections should be used. *
    - *NOTE: PHF values less than 0.90 will alter the results to be more "conservative."
- The "Code Error Check" should be run in Synchro before finalizing the analysis, and any errors or warnings should be justified or corrected prior to activating SimTraffic.
- Analysis of all lanes with finite storage should include an appropriate taper.
- Congestion Management Guidelines encourage using a minimum turning count movement of 4 vph on Synchro for all allowed movements.
- All link termini should extend a reasonable distance beyond the last node (typically 1000 feet) to ensure adequate queuing can be calculated in SimTraffic.

Site Plan and Geometric Suggestions

- The site plan appears to match with the proposed trip generation. However, please ensure that the proposed driveways are in accordance with the NCDOT Driveway Manual.*
    - *NOTE: Proposed site driveways will access roads not maintained by NCDOT.
- Internal Protected Stem lengths for each proposed driveway should be provided in the TIA in conformance with requirements in the NCDOT Driveway Manual. Minimum suggested length is 100 feet. *
    - NOTE: Proposed site driveways will access roads not maintained by NCDOT.

- For Nodes 5 and 6 (Charlotte St and I-240 EB and WB and On/Off Ramps): the 2025 AM and PM No Build and Build Synchro files show that there is queue spillback along the interchange and into Interstate (spillback along I-240 EB Off Ramp). No mitigation was recommended from the sealed TIA.
    - **Extending/restriping (maximize) the west bound right-turn lane on the I-240 WB Off Ramp to help mitigate for site should be considered (Approach LOS drops from E to F).**
- The TIA indicates that, in 2025 Build PM peak hour, queuing from Charlotte St/Chestnut St and Charlotte St/Baird St intersections are anticipated to spillback onto the proposed site access A and B intersections, respectively.
  In other words, the queuing could cause these site accesses to be in the functional area(s) of the Charlotte St/Chestnut St and Charlotte St/Baird St intersections (the TIA indicates the westbound approach queue on Chestnut St is anticipated to block proposed site access A 92 percent of the PM peak hour and the westbound approach queue on Baird St is anticipated to block proposed site access B 97 percent of the PM peak hour, respectively).
    - **Therefore, it is required to maximize the distances of proposed site accesses A and B from the Charlotte St intersections and/or they should be monitored and conversion of this intersection from an all-movement to a left-over or right-in/right-out with median channelized island could be considered**. **In addition, side-by-side left-turn lanes may be needed between proposed site access A and Charlotte St on Chestnut St.***
        - *NOTE: Proposed site driveways will access roads not maintained by NCDOT.
- **Otherwise, based on our cursory review, the proposed recommendations in the traffic impact assessment (sealed January 12, 2021) appear reasonable. ***
    - ***NOTE: The PEF should also consider the concerns and suggestions from the local authorities (e.g. City of Asheville).**

□



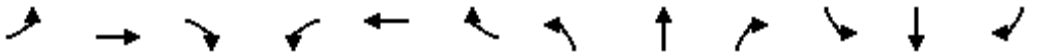
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	433	107	383	233	573	0	0	652	256
Future Volume (vph)	0	0	0	433	107	383	233	573	0	0	652	256
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			-3%			-4%			4%	
Storage Length (ft)	0		0	250		350	0		0	600		50
Storage Lanes	0		0	1		1	1		0	1		1
Taper Length (ft)	25			100			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Ped Bike Factor						0.98	1.00					0.97
Frt						0.850						0.850
Flt Protected				0.950	0.972		0.950					
Satd. Flow (prot)	0	0	0	1706	1746	1607	1705	1863	0	0	3468	1552
Flt Permitted				0.950	0.972		0.950					
Satd. Flow (perm)	0	0	0	1706	1746	1573	1697	1863	0	0	3468	1505
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			35			35			35	
Link Distance (ft)		781			1188			440			831	
Travel Time (s)		17.8			23.1			8.6			16.2	
Confl. Peds. (#/hr)	1					1	6		6	6		6
Confl. Bikes (#/hr)									2			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.80	0.85	0.84	0.84	0.90	0.90	0.90	0.83
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	8%	4%	2%	2%	2%	2%
Adj. Flow (vph)	0	0	0	481	134	451	277	682	0	0	724	308
Shared Lane Traffic (%)				37%								
Lane Group Flow (vph)	0	0	0	303	312	451	277	682	0	0	724	308
Turn Type				Perm	NA	Perm	Prot	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8						6
Detector Phase				8	8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	10.0
Minimum Split (s)				12.8	12.8	12.8	11.9	15.6			15.6	15.6
Total Split (s)				48.0	48.0	48.0	33.0	72.0			39.0	39.0
Total Split (%)				40.0%	40.0%	40.0%	27.5%	60.0%			32.5%	32.5%
Maximum Green (s)				42.2	42.2	42.2	28.1	66.4			33.4	33.4
Yellow Time (s)				3.7	3.7	3.7	3.0	4.1			4.1	4.1
All-Red Time (s)				2.1	2.1	2.1	1.9	1.5			1.5	1.5
Lost Time Adjust (s)				-0.8	-0.8	-0.8	0.1	-0.6			-0.6	-0.6
Total Lost Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lead/Lag							Lead				Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)				1.0	1.0	1.0	1.0	3.0			3.0	3.0
Recall Mode				None	None	None	None	C-Min			C-Min	C-Min
Act Effct Green (s)				39.1	39.1	39.1	22.2	70.9			43.6	43.6
Actuated g/C Ratio				0.33	0.33	0.33	0.18	0.59			0.36	0.36
v/c Ratio				0.54	0.55	0.88	0.88	0.62			0.57	0.56
Control Delay				36.4	36.5	57.1	52.2	18.9			35.1	38.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay				0.4	0.4	0.0	0.0	3.4			0.0	0.0
Total Delay				36.8	36.8	57.1	52.2	22.3			35.1	38.4
LOS				D	D	E	D	C			D	D
Approach Delay					45.4			30.9			36.1	
Approach LOS					D			C			D	
Queue Length 50th (ft)				191	197	313	190	495			249	201
Queue Length 95th (ft)				284	249	413	m207	m481			338	289
Internal Link Dist (ft)		701			1108			360			751	
Turn Bay Length (ft)				250		350						50
Base Capacity (vph)				612	626	564	397	1100			1260	547
Starvation Cap Reductn				0	0	0	0	313			0	0
Spillback Cap Reductn				65	67	0	0	0			0	0
Storage Cap Reductn				0	0	0	0	0			0	0
Reduced v/c Ratio				0.55	0.56	0.80	0.70	0.87			0.57	0.56

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 80 (67%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.88			
Intersection Signal Delay: 37.7		Intersection LOS: D	
Intersection Capacity Utilization 62.3%		ICU Level of Service B	
Analysis Period (min) 15			

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

Splits and Phases: 5: Charlotte Street & I-240 WB Ramp



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	218	54	490	572	752	0	0	693	323
Future Volume (vph)	0	0	0	218	54	490	572	752	0	0	693	323
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			-3%			-4%			4%	
Storage Length (ft)	0		0	250		350	0		0	600		50
Storage Lanes	0		0	1		1	1		0	1		1
Taper Length (ft)	25			100			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Ped Bike Factor							1.00					0.96
Frt						0.850						0.850
Flt Protected				0.950	0.971		0.950					
Satd. Flow (prot)	0	0	0	1706	1744	1607	1805	1900	0	0	3468	1537
Flt Permitted				0.950	0.971		0.950					
Satd. Flow (perm)	0	0	0	1706	1744	1607	1797	1900	0	0	3468	1474
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			35			35			35	
Link Distance (ft)		781			1188			440			831	
Travel Time (s)		17.8			23.1			8.6			16.2	
Confl. Peds. (#/hr)							9		4	4		9
Confl. Bikes (#/hr)									2			1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%
Adj. Flow (vph)	0	0	0	242	60	544	636	836	0	0	770	359
Shared Lane Traffic (%)				38%								
Lane Group Flow (vph)	0	0	0	150	152	544	636	836	0	0	770	359
Turn Type				Perm	NA	Perm	Prot	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8						6
Detector Phase				8	8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	10.0
Minimum Split (s)				12.8	12.8	12.8	11.9	15.6			15.6	15.6
Total Split (s)				42.0	42.0	42.0	45.0	78.0			33.0	33.0
Total Split (%)				35.0%	35.0%	35.0%	37.5%	65.0%			27.5%	27.5%
Maximum Green (s)				36.2	36.2	36.2	40.1	72.4			27.4	27.4
Yellow Time (s)				3.7	3.7	3.7	3.0	4.1			4.1	4.1
All-Red Time (s)				2.1	2.1	2.1	1.9	1.5			1.5	1.5
Lost Time Adjust (s)				-0.8	-0.8	-0.8	0.1	-0.6			-0.6	-0.6
Total Lost Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lead/Lag							Lead				Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)				1.0	1.0	1.0	1.0	3.0			3.0	3.0
Recall Mode				None	None	None	None	C-Min			C-Min	C-Min
Act Effct Green (s)				37.0	37.0	37.0	40.0	73.0			28.0	28.0
Actuated g/C Ratio				0.31	0.31	0.31	0.33	0.61			0.23	0.23
v/c Ratio				0.29	0.28	1.10	1.06	0.72			0.95	1.05
Control Delay				33.3	33.2	109.6	66.6	4.9			67.5	106.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay				0.1	0.1	0.0	16.1	5.5			0.4	0.0
Total Delay				33.4	33.3	109.6	82.7	10.4			68.0	106.2
LOS				C	C	F	F	B			E	F
Approach Delay					82.4			41.6			80.1	
Approach LOS					F			D			F	
Queue Length 50th (ft)				92	93	~478	~517	26			311	~302
Queue Length 95th (ft)				152	154	#695	m#618	m44			#435	#492
Internal Link Dist (ft)		701			1108			360			751	
Turn Bay Length (ft)				250		350						50
Base Capacity (vph)				526	537	495	601	1155			809	343
Starvation Cap Reductn				0	0	0	25	257			0	0
Spillback Cap Reductn				38	39	0	0	0			3	0
Storage Cap Reductn				0	0	0	0	0			0	0
Reduced v/c Ratio				0.31	0.31	1.10	1.10	0.93			0.96	1.05

Intersection Summary

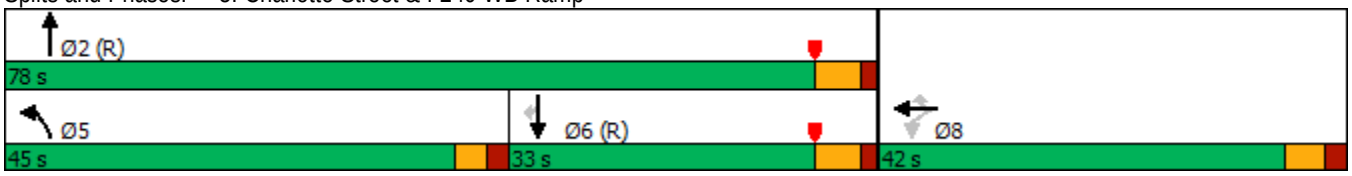
Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 66 (55%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.10
Intersection Signal Delay: 64.2 Intersection LOS: E
Intersection Capacity Utilization 78.3% ICU Level of Service D
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

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

Splits and Phases: 5: Charlotte Street & I-240 WB Ramp



Intersection: 1: Charlotte Street & Hillside Street

Movement	EB	NB	NB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	239	142	222	373
Average Queue (ft)	111	71	81	158
95th Queue (ft)	199	121	170	300
Link Distance (ft)	1728		1012	1208
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		75		
Storage Blk Time (%)		16	6	
Queuing Penalty (veh)		63	7	

Intersection: 2: Charlotte Street & Baird Street

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	189	21	88	770
Average Queue (ft)	79	1	14	188
95th Queue (ft)	189	10	56	721
Link Distance (ft)	199	2		1012
Upstream Blk Time (%)	17	0		1
Queuing Penalty (veh)	12	0		6
Storage Bay Dist (ft)			50	
Storage Blk Time (%)			0	19
Queuing Penalty (veh)			1	5

Intersection: 3: Charlotte Street & Broad Street

Movement	EB	NB	NB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	149	37	45	57
Average Queue (ft)	48	8	1	15
95th Queue (ft)	158	31	18	46
Link Distance (ft)	1415		352	2
Upstream Blk Time (%)				16
Queuing Penalty (veh)				107
Storage Bay Dist (ft)		50		
Storage Blk Time (%)		0	0	
Queuing Penalty (veh)		1	0	

Intersection: 4: Charlotte Street & Chestnut Street

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	L	TR	L	TR	L	TR
Maximum Queue (ft)	327	124	204	165	353	131	373
Average Queue (ft)	121	83	78	58	168	37	264
95th Queue (ft)	265	141	195	130	300	114	420
Link Distance (ft)	1854		192		741		352
Upstream Blk Time (%)			15				14
Queuing Penalty (veh)			27				99
Storage Bay Dist (ft)		100		150		80	
Storage Blk Time (%)		29	2	0	8	0	40
Queuing Penalty (veh)		17	2	0	6	1	14

Intersection: 5: Charlotte Street & I-240 WB Ramp

Movement	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	LT	R	L	T	T	T	R
Maximum Queue (ft)	330	479	402	347	338	625	757	125
Average Queue (ft)	108	234	225	165	160	389	530	100
95th Queue (ft)	264	418	363	300	324	741	853	170
Link Distance (ft)		1143		362	362		741	
Upstream Blk Time (%)				0	0		8	
Queuing Penalty (veh)				1	1		66	
Storage Bay Dist (ft)	250		350			600		50
Storage Blk Time (%)	0	8	2			1	50	33
Queuing Penalty (veh)	1	46	9			6	292	215

Intersection: 6: Charlotte Street & I-240 EB Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	R	T	T	R	L	T	T
Maximum Queue (ft)	949	425	29	16	684	698	550	375	320	332
Average Queue (ft)	703	403	6	1	578	635	388	299	180	196
95th Queue (ft)	1221	487	25	9	826	798	773	447	285	301
Link Distance (ft)	892				668	668		362	362	362
Upstream Blk Time (%)	25				9	38		16	0	0
Queuing Penalty (veh)	0				27	116		59	0	1
Storage Bay Dist (ft)		225	300				350			
Storage Blk Time (%)	1	43				89	0			
Queuing Penalty (veh)	12	157				100	1			

Intersection: 7: Charlotte Street & College Street

Movement	EB	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	R	L	T	T	R
Maximum Queue (ft)	60	99	128	87	98	192	314	650	199	814	813	804
Average Queue (ft)	15	42	51	17	25	89	96	246	59	467	487	267
95th Queue (ft)	45	87	104	55	69	173	211	608	170	979	967	834
Link Distance (ft)			920	920			988	988		777	777	777
Upstream Blk Time (%)										33	37	23
Queuing Penalty (veh)										0	0	0
Storage Bay Dist (ft)	175	175			175	150			150			
Storage Blk Time (%)						4	3		1	31		
Queuing Penalty (veh)						7	4		1	20		

Intersection: 7: Charlotte Street & College Street

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (ft)	100	627	641	125
Average Queue (ft)	96	346	340	86
95th Queue (ft)	110	605	630	179
Link Distance (ft)		668	668	
Upstream Blk Time (%)		0	1	
Queuing Penalty (veh)		4	7	
Storage Bay Dist (ft)	50			75
Storage Blk Time (%)	71	21	34	0
Queuing Penalty (veh)	285	52	153	0

Intersection: 8: Merrimon Avenue & Chestnut Street

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR	T	TR
Maximum Queue (ft)	288	185	398	371	321	287
Average Queue (ft)	138	79	180	168	181	160
95th Queue (ft)	232	147	321	303	273	258
Link Distance (ft)	672	1854	1040	1040	1326	1326
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 9: Chestnut Street & Asheville Arms Driveway

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	18	5	35
Average Queue (ft)	1	0	12
95th Queue (ft)	9	5	37
Link Distance (ft)	135	1186	455
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 10: Furman Avenue & Asheville Arms Driveway

Movement	EB
Directions Served	LR
Maximum Queue (ft)	40
Average Queue (ft)	3
95th Queue (ft)	20
Link Distance (ft)	455
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 11: Chestnut Street & Access A

Movement	EB	WB	SB	B32
Directions Served	L	TR	LR	T
Maximum Queue (ft)	37	66	130	22
Average Queue (ft)	6	10	57	5
95th Queue (ft)	28	58	138	32
Link Distance (ft)		135	138	40
Upstream Blk Time (%)		0	10	8
Queuing Penalty (veh)		0	0	0
Storage Bay Dist (ft)	75			
Storage Blk Time (%)	0			
Queuing Penalty (veh)	0			

Intersection: 12: Access B & Baird Street

Movement	WB	NB	B35
Directions Served	LT	LR	T
Maximum Queue (ft)	157	88	26
Average Queue (ft)	36	28	3
95th Queue (ft)	211	86	24
Link Distance (ft)	1339	97	55
Upstream Blk Time (%)		8	4
Queuing Penalty (veh)		0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 21: I-240 EB Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 2012

Intersection: 1: Charlotte Street & Hillside Street

Movement	EB	NB	NB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	505	150	403	966
Average Queue (ft)	193	94	192	385
95th Queue (ft)	518	161	352	1004
Link Distance (ft)	1728		1012	1208
Upstream Blk Time (%)				7
Queuing Penalty (veh)				0
Storage Bay Dist (ft)		75		
Storage Blk Time (%)		21	17	
Queuing Penalty (veh)		158	25	

Intersection: 2: Charlotte Street & Baird Street

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	203	31	100	1029
Average Queue (ft)	170	3	37	696
95th Queue (ft)	261	18	102	1319
Link Distance (ft)	199	2		1012
Upstream Blk Time (%)	73	0		13
Queuing Penalty (veh)	65	3		80
Storage Bay Dist (ft)			50	
Storage Blk Time (%)			2	61
Queuing Penalty (veh)			11	23

Intersection: 3: Charlotte Street & Broad Street

Movement	EB	NB	NB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	298	64	219	76
Average Queue (ft)	108	19	23	34
95th Queue (ft)	289	51	106	60
Link Distance (ft)	1415		352	2
Upstream Blk Time (%)			0	49
Queuing Penalty (veh)			0	344
Storage Bay Dist (ft)		50		
Storage Blk Time (%)		2	1	
Queuing Penalty (veh)		16	1	

Intersection: 4: Charlotte Street & Chestnut Street

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	L	TR	L	TR	L	TR
Maximum Queue (ft)	1038	125	222	224	602	140	367
Average Queue (ft)	570	116	183	118	301	36	342
95th Queue (ft)	1153	144	260	228	513	119	420
Link Distance (ft)	1854		192		741		352
Upstream Blk Time (%)			74		0		44
Queuing Penalty (veh)			167		1		313
Storage Bay Dist (ft)		100		150		80	
Storage Blk Time (%)		86	7	3	18	1	68
Queuing Penalty (veh)		75	10	26	22	6	18

Intersection: 5: Charlotte Street & I-240 WB Ramp

Movement	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	LT	R	L	T	T	T	R
Maximum Queue (ft)	192	967	450	382	354	625	761	125
Average Queue (ft)	55	408	361	320	121	602	729	119
95th Queue (ft)	131	1078	512	448	295	743	867	146
Link Distance (ft)		1143		362	362		741	
Upstream Blk Time (%)		8		7	0		31	
Queuing Penalty (veh)		0		48	3		275	
Storage Bay Dist (ft)	250		350			600		50
Storage Blk Time (%)		0	28			5	67	66
Queuing Penalty (veh)		0	76			37	450	457

Intersection: 6: Charlotte Street & I-240 EB Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	R	T	T	R	L	T	T
Maximum Queue (ft)	755	425	43	75	634	660	550	360	169	164
Average Queue (ft)	323	302	8	20	416	440	314	198	85	78
95th Queue (ft)	682	472	32	55	699	727	610	351	150	147
Link Distance (ft)	892				655	655		362	362	362
Upstream Blk Time (%)	2				1	2		1		
Queuing Penalty (veh)	0				10	15		3		
Storage Bay Dist (ft)		225	300				350			
Storage Blk Time (%)	8	34				24	1			
Queuing Penalty (veh)	31	92				98	6			

Intersection: 7: Charlotte Street & College Street

Movement	EB	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	R	L	T	T	R
Maximum Queue (ft)	179	208	286	261	139	224	349	392	200	608	649	455
Average Queue (ft)	73	112	112	85	49	134	169	193	85	346	401	184
95th Queue (ft)	161	201	263	232	106	228	310	332	198	671	705	525
Link Distance (ft)			920	920			988	988		777	777	777
Upstream Blk Time (%)										5	8	5
Queuing Penalty (veh)										0	0	0
Storage Bay Dist (ft)	175	175			175	150			150			
Storage Blk Time (%)	1	7	1	0	0	16	11		0	33		
Queuing Penalty (veh)	1	9	1	0	0	40	15		1	22		

Intersection: 7: Charlotte Street & College Street

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (ft)	100	444	403	125
Average Queue (ft)	94	222	143	24
95th Queue (ft)	115	396	322	103
Link Distance (ft)		655	655	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	50			75
Storage Blk Time (%)	71	16	19	
Queuing Penalty (veh)	170	43	33	

Intersection: 8: Merrimon Avenue & Chestnut Street

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR	T	TR
Maximum Queue (ft)	446	367	665	622	414	402
Average Queue (ft)	274	178	320	287	257	241
95th Queue (ft)	524	342	621	586	374	361
Link Distance (ft)	672	1854	1040	1040	1326	1326
Upstream Blk Time (%)	2		0	0		
Queuing Penalty (veh)	0		0	0		
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 9: Chestnut Street & Asheville Arms Driveway

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	16	217	114
Average Queue (ft)	1	44	43
95th Queue (ft)	9	170	122
Link Distance (ft)	135	1186	455
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 10: Furman Avenue & Asheville Arms Driveway

Movement	EB
Directions Served	LR
Maximum Queue (ft)	28
Average Queue (ft)	4
95th Queue (ft)	20
Link Distance (ft)	455
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 11: Chestnut Street & Access A

Movement	EB	WB	SB	B35
Directions Served	L	TR	LR	T
Maximum Queue (ft)	37	143	198	43
Average Queue (ft)	5	87	153	16
95th Queue (ft)	25	182	242	41
Link Distance (ft)		135	140	19
Upstream Blk Time (%)		40	78	46
Queuing Penalty (veh)		30	0	0
Storage Bay Dist (ft)	75			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 12: Access B & Baird Street

Movement	WB	NB	B32
Directions Served	LT	LR	T
Maximum Queue (ft)	681	136	35
Average Queue (ft)	255	91	13
95th Queue (ft)	663	175	35
Link Distance (ft)	1339	89	31
Upstream Blk Time (%)		63	48
Queuing Penalty (veh)		0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 21: I-240 EB Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 3330