

Public Safety & Transportation Committee Agenda

City of Newton In City Council

Wednesday, May 4, 2022

7:30 PM

The Public Safety & Transportation Committee will hold this meeting as a virtual meeting on Wednesday, May 4, 2022 at 7:30 pm. To view this meeting using Zoom use this link https://us02web.zoom.us/j/89956528669 or call 1-646-558-8656 and use the following Meeting ID: 899 5652 86569

Item Scheduled for Discussion:

Chair's Note: The Committee will join the Public Facilities Committee for discussion on the following one item:

Referred to Public Safety & Transportation and Public Facilities Committees

#243-22 Discussion regarding MassDOT's intersection project

<u>HER HONOR THE MAYOR</u> requesting a discussion of MassDOT's proposed modification to the roundabout design located at the Grove Street intersection from the I-95 SB offramp and Quinobequin Road consistent with the requirements of Riverside Special Permit #27-20(2), Condition 14c.

Public Facilities Held 7-0 on 04/06/22
Public Safety & Transportation Held 7-0 on 04/06/22

Respectfully submitted,

Andreae Downs, Chair

The location of this meeting is accessible and reasonable accommodations will be provided to persons with disabilities who require assistance. If you need a reasonable accommodation, please contact the city of Newton's ADA Coordinator, Jini Fairley, at least two business days in advance of the meeting: jfairley@newtonma.gov or (617) 796-1253. The city's TTY/TDD direct line is: 617-796-1089. For the Telecommunications Relay Service (TRS), please dial 711.



City of Newton, Massachusetts

Office of the Mayor

Telephone (617) 796-1100 Fax (617) 796-1113 TDD/TTY (617) 796-1089 Email rfuller@newtonma.gov

March 28, 2022

Honorable City Council Newton City Hall 1000 Commonwealth Avenue Newton, MA 02459

Honorable City Councilors:

I respectfully submit this docket item to this Honorable Council requesting a discussion of MassDOT's proposed modification to the roundabout design located at the Grove Street intersection with the I-95 SB off-ramp and Quinobequin Road consistent with the requirements of Riverside Special Permit #27-20 (2), Condition 14c.

The relevant language from the Riverside Special Permit states:

Any material modifications to the final design of the Interchange Improvements by either MassDOT or FHWA will be considered consistent with the conceptually approved plan if, in the opinion of the Commissioner of Public Works, after consultation with the appropriate committee(s) of the City Council, the modified design achieves the same performance objectives as the conceptually approved design.

Please see the attached memo from Commissioner of Public Works James McGonagle and the detailed report from VHB on behalf of the project proponents.

Thank you for your consideration of this matter.

Sincerely,

Mayor Ruthanne Fuller

NEWTON MA 02450

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City of Newton Ruthanne Fuller

DEPARTMENT OF PUBLIC WORKS

OFFICE OF THE COMMISSIONER

1000 Commonwealth Avenue Newton Centre, MA 02459-1449

March 25, 2022

To:

Jonathan Yeo, Chief Operating Officer

From:

James McGonagle, Commissioner

Subject: Request for Docket Item for Discussion of Riverside Station Off-site Transportation

Improvements

Consistent the requirements of Special Permit #27-20(2), Condition 14.c., DPW would like to discuss MassDOT's proposed modification to the roundabout design located at the Grove Street intersection with the I-95 SB off-ramp and Quinobequin Road.

The relevant language from the Riverside Special Permit states:

Any material modifications to the final design of the Interchange Improvements by either MassDOT or FHWA will be considered consistent with the conceptually approved plan if, in the opinion of the Commissioner of Public Works, after consultation with the appropriate committee(s) of the City Council, the modified design achieves the same performance objectives as the conceptually approved design.

Sincerely,

James McGonagle Commissioner of Public Works

cc:

Shawna Sullivan, DPW Deputy Commissioner Louis M. Taverna, P.E., City Engineer Jason Sobel, P.E., PTOE, Director of Transportation Operations

Isaac Prizant, Transportation Engineer

Telephone: 617-796-1009 • Fax: 617-796-1050 • Jmcgonagle@newtonma.gov



To: City of Newton

Date: 02/04/2022

Memorandum.

Project #: 10865.03

From: Randy Hart, Principal Matthew Duranleau, PE Re: Grove Street at I-95 Southbound Ramps Potential Intersection Treatments

VHB, on behalf of Mark Development (the Proponent) has prepared this memorandum to discuss the evaluation of the various different treatments that were done for the intersection of Grove Street at the I-95 Southbound Ramps in Newton, Massachusetts. This intersection will be reconstructed as part of the approved Riverside redevelopment, which will include the construction of approximately 1,025,000 of new development on the existing site of the MBTA Riverside station parking lot and the Hotel Indigo. As part of the development, significant roadway improvements will be implemented, including the reconstruction of the I-95 Northbound Exit 38 off-ramp to Grove Street, an extension of Recreation Road to Grove Street, the installation of three adaptive traffic signals, and improvements at the intersection of Grove Street at the I-95 Southbound Ramps.

In the local and state filings, the intersection of Grove Street at the I-95 Southbound Ramps was proposed to be replaced with a single-lane roundabout with four approaches: Grove Street from the east and west, the I-95 Southbound Ramps from the south, and Asheville Road from the north. As development of the 25-percent design plans began, the Proponent has been in close coordination with MassDOT regarding all aspects of the offsite design. During these detailed consultations, MassDOT has stressed the need to create more deflection on the various approaches to the proposed intersection reconstruction, specifically the Grove Street westbound and I-95 Southbound Off-Ramp approaches to the intersection. Increasing deflection will slow the traffic entering the roundabout thereby enhancing the pedestrian environment.

Revised Roundabout Concept

To meet the requests of MassDOT, the roundabout has been shifted a short distance to the northeast and by doing so, the geometry and right-of-way doesn't allow for Asheville Road to be included in the roundabout. Under this scenario, Ashville Road becomes a right-in/right-out at Grove Street south of the roundabout and drivers exiting Asheville Road would only be able to take a right turn onto Grove Street. To access Grove Street eastbound, drivers would need to use Pine Grove Avenue or Pierrepont Road to turn left onto Grove Street instead. Alternatively, drivers could use Pierrepont Road to turn right onto Grove Street and reverse direction at the roundabout. The proposed roundabout would consist of three approaches: Grove Street from the east and west and the I-95 Southbound Ramps from the south.

The shifting of the roundabout is a minor change from what was previously contemplated for the design of this intersection, and the only significant change is the shifting of the Roundabout easterly and the treatment of Asheville Road. There are benefits and disadvantages associated with this change, which include the following:



Benefits

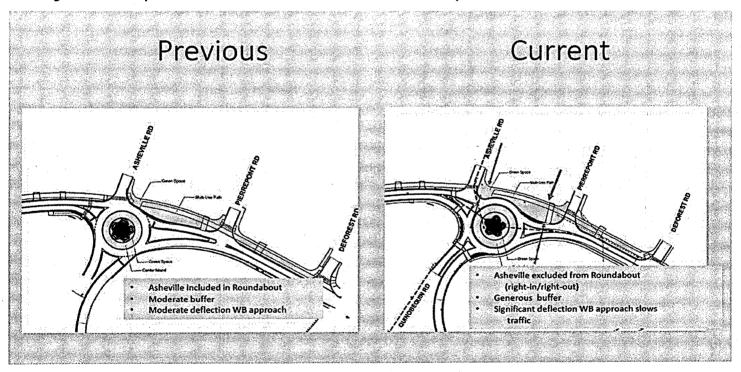
- > Increased deflection of the approaches will slow traffic even more than former concepts
- > Increased (substantially) green buffer between Grove Street and residents in northwest quadrant of intersection
- > Deemphasizes traffic movements onto Asheville Road (northern neighborhood traffic will likely not use Asheville to gain access to the roundabout)
- > Lower speed and more green space results in enhanced pedestrian environment

Detriments

> Residents on Asheville Road will not be able to turn left at Grove Street from Ashville's intersection with Grove.

To demonstrate the two roundabout options that have been considered, Figure 1 provides a side-by-side comparison of the previous four-legged roundabout concept and the currently proposed three-legged roundabout concept.

Figure 1 Comparison of Previous and Current Roundabout Concepts





Additional Intersection Concepts

At the initial Riverside Redevelopment Liaison Committee meeting on Tuesday January 25, 2022, the revised concept for the roundabout was presented. The initial feedback from members of the community was concern for the changes that would be introduced to Asheville Road. As a result of the comments and concerns, additional review of potential options has been considered and further discussion is being planned with MassDOT and the City of Newton.

To aid in those conversations, this memorandum has been prepared to evaluate various options that have been considered. These include:

- > Original Four-Legged Roundabout Concept (with Asheville Road included)
- > Revised Three-Legged Roundabout Concept (with Asheville Road excluded)
- > Signalized intersection with slight shift of northbound approach (the I-95 Southbound Ramps approach is shifted slightly west from its current location to directly align with Asheville Road)
- Signalized intersection in current location (each approach has the same geometry as existing conditions with the I 95 Southbound Ramps and Asheville Road slightly offset from each other)

Concept plans for the two signalized scenarios are provided in the Attachments to this memorandum.

The following section summarizes the intersection capacity results of the proposed roundabout and signalized intersection concepts.

Intersection Operations

To demonstrate future traffic operations at the intersection under different concept alternatives, intersection capacity analyses have been conducted based on the 2031 Build Conditions with mitigation traffic volumes as presented in the most recent MEPA filings for the Riverside redevelopment project¹. The traffic volumes present a future condition that includes a growth in traffic over existing conditions due to the Riverside redevelopment as well as due to other background projects. The intersection capacity analyses have been conducted for the weekday morning, weekday evening, and Saturday midday peak hours using Synchro 10 software for the signalized concepts and using Sidra 8 software for the roundabout concepts.

Roundabout Concepts

Table 1 presents a summary of the capacity analyses for intersection under the four-legged and three-legged roundabout alternatives. The intersection capacity worksheets are included in the Attachments to this memorandum.

¹ Supplemental Draft Environmental Impact Report, EEA No. 16024, Riverside Station Redevelopment; Prepared by VHB; May 17, 2021.



Table 1 Roundabout Intersection Capacity Analysis Summary

			nditions v our-Legge					nditions w/ ee-Legged	_	on
Location	D a	v/c ^b	Delay ^c	LOS d	95 th Q °	D	v/c	Delay	LOS	95 th Q
Grove Street at I-95 South	bound Ra	mps / A	sheville Ro	oad		·				
Weekday Morning										
Grove Street EB LTR	575	0.75	20	C	321	590	0.76	20	C	339
Grove Street WB LTR	380	0.38	7	Α	50	380	0.38	7	Α	: 50
I-95 SB Off-Ramp NB LTR	375	0.67	20	C	143	375	0.66	20	.C	142
Asheville Road SB LTR	15	0.03	6	Α	2	n/a	n/a	n/a	n/a	n/a
Overall			16	С				16	c	į
Weekday Evening										
Grove Street EB LTR	260	0.43	12	В	56	265	0.43	12	В	57
Grove Street WB LTR	730	0.76	17	C	212	730	0.75	. 17	C	212
I-95 SB Off-Ramp NB LTR	190	0.25	7	Α	25	190	0.25	7	Α	. 25
Asheville Road SB LTR	10	0.02	8	Α	1	n/a	n/a	n/a	n/a	n/a
Overall			14	. В				14	В	
Saturday Midday										
Grove Street EB LTR	220	0.28	7	Α	-29	235	0.29	7	Α	31
Grove Street WB LTR	350	0.36	7	Α	45	350	0.36	7	Α	45
I-95 SB Off-Ramp NB LTR	280	0.33	7	Α	37	280	0.32	7	Α	37
Asheville Road SB LTR	15	0.02	- 5	Α	2	n/a	n/a	n/a	n/a	n/a
Overali			7	Α			Υ.	7	Α	

Source: analyzed with Sidra 8 software.

- a Demand (input)
- b volume-to-capacity ratio
- c average total delay, in seconds per vehicle
- d level of service
- e 95th percentile queue length, measured in feet

As shown in Table 1, the intersection with either roundabout concept is proposed to operate at overall LOS C or better during each peak hour. Each approach is also expected to operate at LOS C or better and the queues on each approach are expected to be less than 350 feet during each peak hour. Operations are expected to be comparable between the four-legged and the three-legged roundabout concepts.

Signalized Intersection Concepts

Table 2 presents a summary of the capacity analyses for intersection under the two different signalized alternatives (Concept 1 assumes the I-95 Southbound Ramps approach is shifted slightly west to directly align with Asheville Road and Concept 2 assumes each approach has the same geometry as under existing conditions). The intersection capacity worksheets are included in the Attachments to this memorandum.



Table 2 Four-Legged Signalized Intersection Capacity Analysis

	203		ondition: Concept	s w/ Mitiga 1	ntion	2031	Build Con Co	ditions oncept	-	ation
Location	v/c ª	Delay ^b	LOS c	50 th Q ^d	95 th Q ^e	v/c	Delay	LOS	50 th Q	95 th Q
Grove Street at I-95 Sout	hbound R	lamps / As	heville F	Road						
Weekday Morning										
Grove Street EB LTR	0.80	27	C	192	#526	0.73	24	C	158	#587
Grove Street WB L	0.45	. 7	Α	22	103	0.50	11	В	22	148
Grove Street WB TR	0.12	5	Α	12	61	0.12	6	Α	12	81
I-95 SB Off-Ramp NB LT	0.03	33	C	2	15	0.03	31	C	2	15
I-95 SB Off-Ramp NB R	0.64	25	C	115	#374	0.74	32	C	120	#426
Asheville Road SB LTR	0.10	35	C	6	28	0.10	34	C	5	29
Overall		21	С				22	С		
Weekday Evening										
Grove Street EB LTR	0.58	27	C	81	220	0.64	32	, C	86	#302
Grove Street WB L	0.56	8	Α	46	212	0.61	13	В	47	#344
Grove Street WB TR	0.23	5	Α	26	122	0.25	7	Α	26	162
I-95 SB Off-Ramp NB LT	0.25	33	C	14	62	0.28	34	C	15	62
I-95 SB Off-Ramp NB R	0.20	10	В	19	102	0.19	11	В	22	104
Asheville Road SB LTR	0.04	31	C	2	18	0.04	33	C	3	18
Overall		13	В				16	В		
Saturday Midday										
Grove Street EB LTR	0.51	23	C	51	173	0.50	23	C	49	188
Grove Street WB L	0.36	7	Α	22	104	0.36	9	Α	20	131
Grove Street WB TR	0.12	6	Α	11.	56	0.12	7	Α	10	71
I-95 SB Off-Ramp NB LT	0.16	25	· C	9	52	0.18	28	C	9	56
I-95 SB Off-Ramp NB R	0.32	11	В	28	157	0.33	14	В	28	194
Asheville Road SB LTR	0.08	26	C	4	27	0.07	30	C	4	30
Overall		13	В				15	В	·	

Source: analyzed with Synchro 10 software.

Note: analyzed with right turns on red prohibited on all approaches to provide a conservative analysis.

- a volume-to-capacity ratio
- b average delay in seconds per vehicle
- c level of service
- d 50th percentile queue length, measured in feet
- e 95th percentile queue length, measured in feet
- # 95th percentile volume exceeds capacity, queue may be longer

As shown in Table 2, the intersection with the four-legged signalized concept is proposed to operate at overall LOS C or better during each peak hour under both concepts. Each approach is also expected to operate at LOS C or better during each peak hour under both concepts.

Overall, operations are slightly better under signalized Concept 1 compared to signalized Concept 2. Under Concept 1, the I-95 Southbound Ramps is shifted slightly west to directly align with Asheville Road. This means that the Asheville Road and the I-95 Southbound Ramps approaches can run concurrently and have green lights at the same time. Under Concept 2, the two approaches cannot run concurrently and have green lights at different times due to the



approaches being offset from each other. By not allowing the two approaches to run at the same time, there is additional lost time at the intersection with the needed yellow and all-red time for the additional signal phase, which causes slightly higher delays and queues for all the approaches.

It should be noted that under both signalized concepts the queues are expected to be longer then compared to the roundabout concepts. For example, during the weekday morning peak hour, the 95th-percentile queue on the Grove Street eastbound approach is expected to be approximately 526 feet or 587 feet under the two signalized concepts but only 339 feet under the three-legged roundabout concept. In addition, the 95th-percentile queue on the I-95 Southbound Off-Ramp is expected to be approximately 374 feet or 426 feet during the weekday morning peak hour under the two signalized concepts but only 142 feet under the three-legged roundabout option.

Comparison of Options

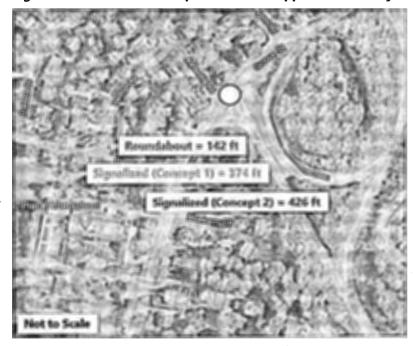
The operational analyses presented above show the difference in operations between a roundabout and traffic signal options. As highlighted, there is significant difference in vehicle queuing along Grove Street northbound and on the Southbound Ramp. To demonstrate, visually, the differences in options the following two graphics have been created to demonstrate the difference between the two critical periods. Figure 2 and Figure 3 provide illustrative comparisons of the 95th-percentile queues during the weekday morning peak hour on the Grove Street eastbound and I-95 SB Off-Ramp northbound approaches, respectively.



Figure 2 Grove Street Eastbound Approach Weekday Morning Peak Hour 95th Percentile Queues



Figure 3 I-95 SB Off-Ramp Northbound Approach Weekday Morning Peak Hour 95th Percentile Queues





As shown in Figures 1 and 2, queues on critical approaches to the intersection are substantially shorter with the roundabout proposed. This is particularly true along the I-95 Southbound Off-Ramp, where the queue under the proposed roundabout concept is less than one-third the length of the queue under the potential signalized options.

As part of the proposed Project, the Proponent is being required to do clearing in the interior of the I-95 Southbound Grove Street Off-Ramp to increase sight lines to ensure visibility to back of queue is available. This is a very important safety consideration for MassDOT and therefore treatments that minimize ramp queues should be considered preferable.

In addition, a major difference between the proposed roundabout concept and the signalized options is the elimination of the right-turn slip lane from the I-95 Southbound Off-Ramp to Grove Street eastbound. Under existing conditions, the slip lane does not provide adequate deflection to significantly reduce the speed of drivers exiting the interstate. Although the signalized options would include a signal on the slip lane, drivers will still be able to travel at high speeds onto Grove Street without significantly slowing down when the signal is green. Under the roundabout concept, the slip lane is eliminated, and all right-turning traffic must travel through the roundabout. The deflection provided in the three-legged roundabout will force drivers to slow down as they turn onto Grove Street.

Conclusion

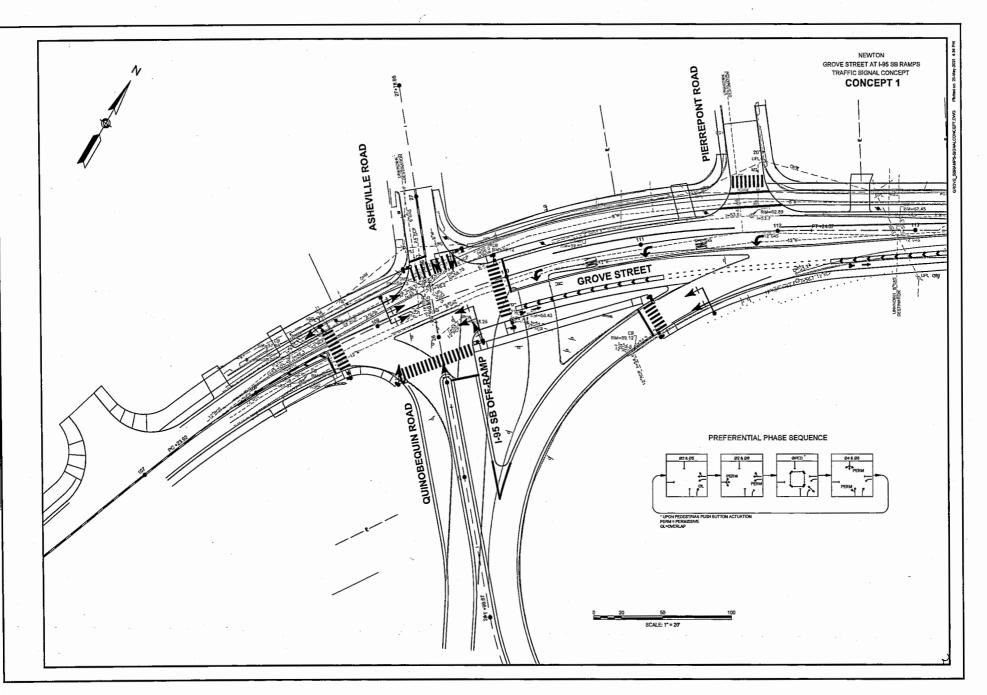
As outlined in this memorandum, future traffic conditions at the intersection of Grove Street at the I-95 Southbound Ramps are expected to operate at acceptable levels-of-service under both the roundabout concepts and the four-legged signalized concepts. However, the queues on each approach are expected to be much shorter under the roundabout concepts than under the signalized concepts. In addition, the three-legged roundabout concept is expected to provide improved safety for all users over the signalized concepts with lower vehicle speeds through the intersection and the elimination of the right-turn slip lane from the I-95 Southbound Off-Ramp to Grove Street eastbound.

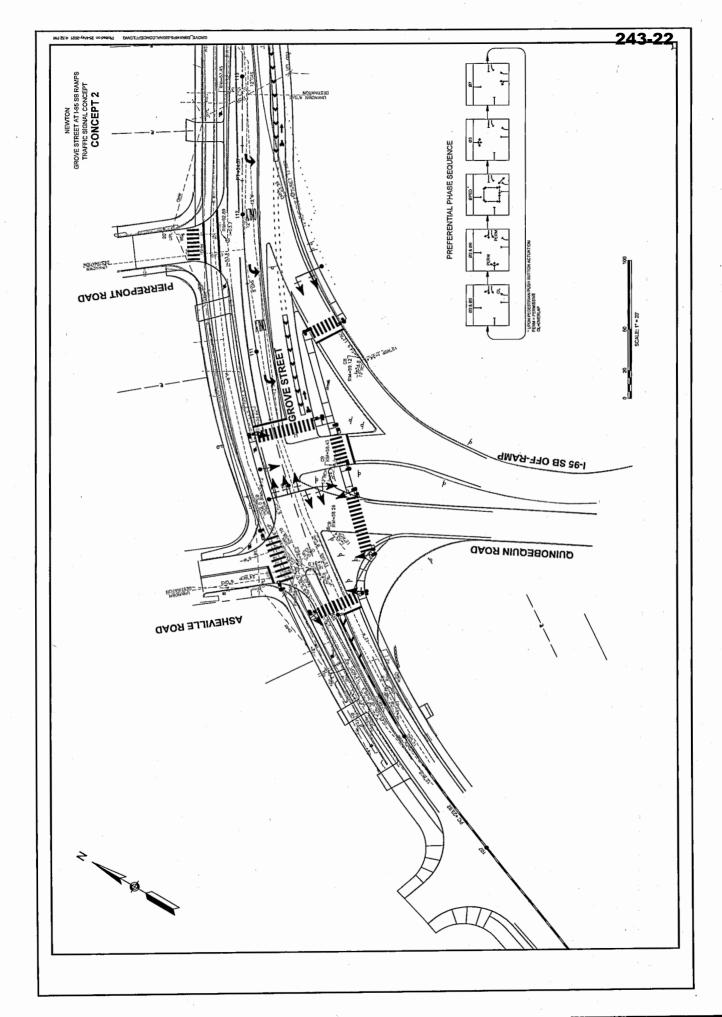
City of Newton Ref: 10865.03 02/04/2022 Attachments

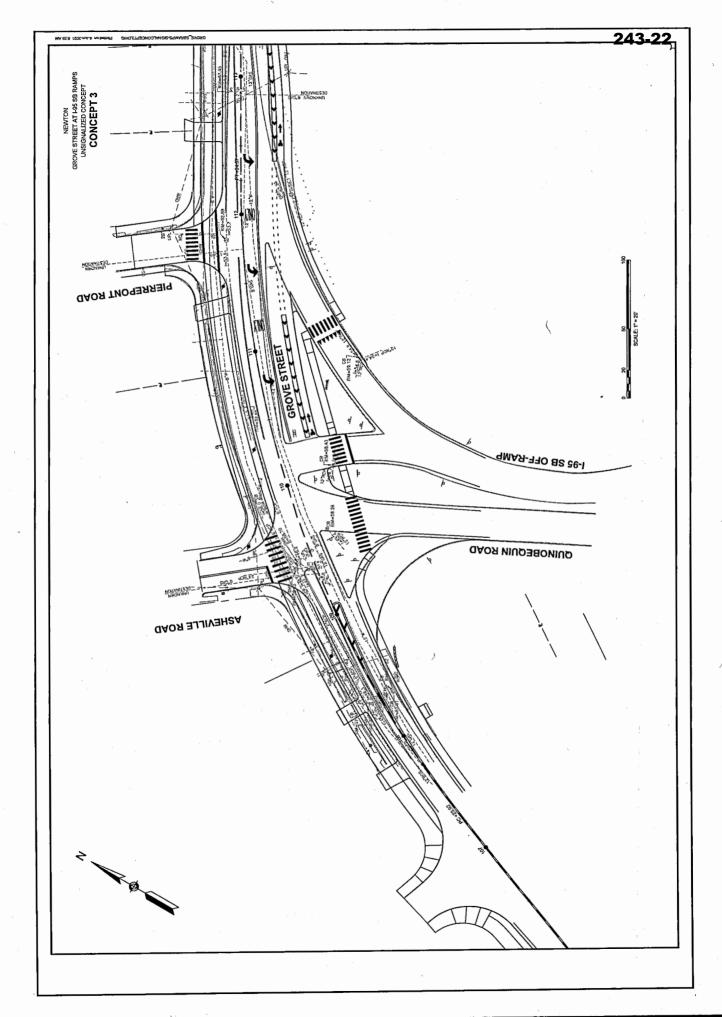


Attachments

- > Concept Plans Signalized
-) Intersection Capacity Analyses Roundabout
- > Intersection Capacity Analyses Signalized







Site: 101 [Weekday Morning_2031 Build with Mitigation]

Grove Street at Asheville Road / I-95 SB Ramps Site Category: (None)

Roundabout

Lane Use a			nce	ested _ various as	Contract the second state	dere i maliciar de l'esconomic	percentage of the second of the	temperate i militar avvi i i sembe fine	no Reundaliserenciens	Rodone mikonomi senomena	saccini de Ambienas de	a Leonardaea	on was the
	Demand F Total	lows HV	Cap	Deg. Satn	Lane Util	Average Delay	Level of Service	95% Back Veh	of Queue : Dist	Lane Config		Cap. Adi	Prob. Block.
	veh/h	%	veh/h		%	sec			ft		ft	%	%
South: I-95 S	B Ramps												dire.
Lane 1 ^d	409	2.0	615	0.665	100	20.0	LOS C	5.6	143.1	Full	1600	0.0	0.0
Approach	409	2.0		0.665		20.0	LOS C	5.6	143.1				
East: Grove S	Street			1.00									
Lane 1 ^d	413	3.0	1089	0.379	100	7.2	LOS A	2.0	50.1	Full	1600	0.0	0.0
Approach	413	3.0		0.379		7.2	LOSA	2.0	50.1				
North: Ashev	ille Road			an er monen men josepi All San		COMPANY TO SERVE							
Lane 1 ^d	17	7.0	690	0.025	100	5.5	LOSA	0.1	2.1	Full	1600	0.0	0.0
Approach	17	7.0		0.025		5.5	LOS A	0.1	2.1				
West: Grove	Street			-									
Lane 1 ^d	626	2.0	832	0.752	100	20.0	LOS C	12.6	321.1	Full	1600	0.0	0.0
Approach	626	2.0		0.752		20.0	LOS C	12.6	321.1				
Intersection	1465	2.3		0.752		16.2	LOS C	12.6	321.1				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab). Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies. Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

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Project: \\vhb\gbl\proj\Wat-TS\10865.03 Mark Inv Riverside Newto\tech\Traffic\Sidra\TIAS\February 2021 TIA\Grove Street at I-95 SB

Ramps_Asheville Road_No Slip Lane.sip8

♥ Site: 101 [Weekday Evening_2031 Build with Mitigation]

Grove Street at Asheville Road / I-95 SB Ramps

Site Category: (None)

Roundabout

Lane Use	and Perfo	rmar	тсе	· Harri					. 7. ^{A.V.}				
	Demand F Total veh/h	HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Veh	Queue Dist	Lane Config	Lane Length	Cap Adj %	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
South: I-95				Analisa alia									
Lane 1 ^d	207	5.0	840	0.246	100	6.9	LOSA	0.9	24.7	Full	1600	0.0	0.0
Approach	207	5.0		0.246		6.9	LOSA	0.9	24.7				
East: Grove	Street						A constitution			e o			1000
Lane 1 ^d	793	2.0	1051	0.755	100	16.9	LOS C	8.3	212.0	Full	1600	0.0	0.0
Approach	793	2.0		0.755		16.9	LOS C	8.3	212.0				
North: Ashe	ville Road								Mention of the Control		E Malle		
Lane 1 ^d	9	0.0	486	0.018	100	7.6	LOS A	0.1	1.4	Full	1600	0.0	0.0
Approach	9	0.0		0.018		7.6	LOS A	0.1	1.4				
West: Grov	e Street	14					- 1 July 1						
Lane 1 ^d	284	3.0	665	0.427	100	11.5	LOS B	2.2	56.0	Full	1600	0.0	0.0
Approach	284	3.0		0.427		11.5	LOS B	2.2	56.0				
Intersection	1292	2.7		0.755		. 14.1	LOSB	8.3	212.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab). Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies. Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

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Organisation: VANASSE HANGEN BRUSTLIN INC. | Processed: Thursday, February 18, 2021 7:53:21 AM
Project: \\hhb\gbl\proj\Wat-TS\10865.03 Mark Inv Riverside Newto\tech\Traffic\Sidra\TIAS\February 2021 TIA\Grove Street at I-95 SB

Ramps_Asheville Road_No Slip Lane.sip8

Site: 101 [Saturday Midday_2031 Build with Mitigation]

Grove Street at Asheville Road / I-95 SB Ramps Site Category: (None) Roundabout

Lane Use	and Perfo	ormai	псе										
	Demand F Total veh/h	· HV	Cap veh/h	Deg Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back o Veh	of Queue Dist ft	Lane Config	Lane Length ft		Prob. Block %
South: I-95	SB Ramps				Y Line								
Lane 1 ^d	304	1.0	934	0.326	100	7.3	LOSA	1.5	37.1	Full	1600	0.0	0.0
Approach	304	1.0		0.326		7.3	LOSA	1.5	37.1				
East: Grove	e Street												
Lane 1 ^d	380	1.0	1065	0.357	100	7.0	LOSA	1.8	45.2	Full	1600	0.0	0.0
Approach	380	1.0		0.357		7.0	LOSA	1.8	45.2				1
North: Ashe	ville Road												
Lane 1 ^d	17	0.0	745	0.023	100	5.1	LOSA	0.1	1.9	Full	1600	0.0	0.0
Approach	17	0.0		0.023		5.1	LOSA	0.1	1.9				
West: Grov	e Street												
Lane 1 ^d	239	1.0	855	0.280	100	7.2	LOSA	1.2	29.3	Full	1600	0.0	0.0
Approach	239	1.0	-	0.280		7.2	LOSA	1.2	29.3				
Intersection	941	1.0		0.357		7,1	LOSA	1.8	45.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab). Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies. Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

₩ Site: 101 [Weekday Morning_2031 Build with Mitigation]

Grove Street at Asheville Road / I-95 SB Ramps

Site Category: (None)

Roundabout

Lane Use	and Perfo	rmai	1ce										
	Demand F		Cap.			Average	Level of	95% Back	Strategic Strategic Control of the C	Lane	Services and Associated William	Cap.	
	Total veh/h	A TRANSPORT	veh/h	Satn v/c	Util. %	Delay sec	Service	⊥ Veh	Dist ft	Config	Length ft	Adj. %	ыоск. %
South: I-95	SB Ramps		all Francis	Will Fail		75 mil 1			Late Africa	ng Lings ig	Secolar Sec		1007
Lane 1 ^d	408	2.0	616	0.662	100	19.9	LOS C	5.6	141.8	Full	1600	0.0	0.0
Approach	408	2.0		0.662		19.9	LOS C	5.6	141.8				
East: Grove	Street		Company of the State of							And the second s		in starting	
Lane 1 ^d	413	3.0	1091	0.379	100	7.2	LOS A	2.0	50.0	Full	1600	0.0	0.0
Approach	413	3.0		0.379		7.2	LOS A	2.0	50.0				
West: Grov	e Street		lile.		D cui			. Property					
Lane 1 ^d	641	2.0	847	0.757	100	20.0	LOS C	13.4	339.3	Full	1600	0.0	0.0
Approach	641	2.0		0.757		20.0	LOS C	13.4	339.3				1
Intersection	1462	2.3		0.757	e veneti	16.3	LOS C	13.4	339.3		72 20 20 20 20 20 20 20 20 20 20 20 20 20		

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab). Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies. Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Site: 101 [Weekday Evening_2031 Build with Mitigation]

Grove Street at Asheville Road / I-95 SB Ramps Site Category: (None) Roundabout

Lane Use	and Perfo	rmar	тсе										
	Demand F						Level of	95% Back of		Lane		Cap.	
	Total veh/h	HV	Cap. veh/h	Satn V/c	Util. %	Delay sec	Service	Véh	Dist	Config	Length	Adj. %	Block %
South: I-95	The second livery of the secon		avelvar.	V/C	/0	<u> 555</u>						/0	200 ZOK
Lane 1 ^d	207	5.0	841	0.245	100	6.9	LOS A	0.9	24.6	Full	1600	0.0	0.0
Approach	207	5.0		0.245		6.9	LOS A	0.9	24.6				
East: Grove	Street												7
Lane 1 ^d	793	2.0	1052	0.754	100	16.8	LOS C	8.3	211.8	Full	1600	0.0	0.0
Approach	793	2.0		0.754		16.8	LOS C	8.3	211.8				
West: Grov	e Street	NGP'N COUNTY											117 SHIP
Lane 1 ^d	288	3.0	670	0.430	100	11.5	LOS B	2.2	57.0	Full	1600	0.0	0.0
Approach	288	3.0		0.430		11.5	LOS B	2.2	57.0				
Intersection	1288	2.7		0.754		14,1	LOS B	8.3	211.8				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab). Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010. HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies. Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

SIDRA INTERSECTION 8.0 | Copyright © 2000-2019 Akcelik and Associates Pty Ltd | sidrasolutions.com
Organisation: VANASSE HANGEN BRUSTLIN INC. | Processed: Thursday, January 27, 2022 4:25:26 PM
Project: \\vhob\gb\\proj\\Vat-TS\10865.03 \text{Mark Inv Riverside Newto\tech\Traffic\Sidra\TIAS\February 2021 TIA\January 2022_No Asheville Road
Approach\Grove Street at I-95 SB Ramps Asheville Road_No Slip Lane.sip8

Site: 101 [Saturday Midday_2031 Build with Mitigation]

Grove Street at Asheville Road / I-95 SB Ramps

Site Category: (None)

Roundabout

Lane Use	and Perf	ormar	ıce			g. Pager							
	Demand F Total veh/h	HV	Cap. veh/h	Sath	Lane Util. %	Average Delay sec	Level of Service	95% Back of Veh	Queue Dist	Lane Config	Lane Length ft	Cap. Adj. %	
South: I-95	SB Ramps		See La	ding u									
Lane 1 ^d	304	1.0	939	0.324	100	7.3	LOS A	1.5	36.9	Full	1600	0.0	0.0
Approach	304	1.0		0.324		7.3	LOS A	1.5	36.9				
East: Grove	Street			2.46.7									
Lane 1 ^d	380	1.0	1071	0.355	100	7.0	LOS A	1.8	44.9	Full	1600	0.0	0.0
Approach	380	1.0		0.355		7.0	LOS A	1.8	44.9				
West: Grove	e Street										il Zasti		
Lane 1 ^d	250	1.0	869	0.288	100	7.2	LOSA	1.2	30.5	Full	1600	0.0	0.0
Approach	250	1.0		0.288		7.2	LOS A	1.2	30.5				
Intersection	935	1.0		0.355		7.2	LOSA	1.8	44.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab). Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies. Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

101: Route 128 SB Ramps/Asheville Road & Grove Street Timing Plan: Weekday Moming t 4 NBL NBT NBR WBT Lane Group Lane Configurations Traffic Volume (vph) 370 Future Volume (vph) 520 55 240 135 5 370 10 5 0 deal Flow (vphpl) 1900 900 1900 900 1900 1900 1900 900 1900 Storage Length (ft) Λ ٥ 200 Λ n 200 Λ Λ Storage Lanes - 1 25 0 25 0 0 25 Taper Length (ft) 25 1752 Satd. Flow (prot) 0 0 0 0.243 Flt Permitted 0.837 0.843 Satd. Flow (perm) 448 1559 1497 Right Turn on Red No No No No Satd. Flow (RTOR) Link Speed (mph) 30 30 30 30 Link Distance (ft) 1604 920 838 182 Travel Time (s) 36.5 20.9 19.0 4.1 Confl. Peds. (#/hr) Confl. Bikes (#/hr) Peak Hour Factor Heavy Vehicles (%) 2% 2% 2% 3% 3% 3% 2% 2% 2% 7% 7% 7% Shared Lane Traffic (% n 626 0 261 152 0 402 n 16 Lane Group Flow (vph) n 6 ٥ Turn Type NA n+pt NA NA ot+ov NA I Protected Phases 6 2 8 58 9 Permitted Phases **Detector Phase** 6 6 2 8 58 4 Switch Phase Minimum Initial (s) 10.0 10.0 6.0 6.0 6.0 6.0 6.0 4.0 Minimum Split (s) 14.0 14.0 10.0 14.0 10.0 10.0 10.0 10.0 20.0 Total Split (s) 39.0 39.0 19.0 58.0 12.0 12.0 12,0 20.0 12.0 Total Split (%) 3% 3.3% 4.4% 3.3% 3.3% 3.3% Yellow Time (s) 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 All-Red Time (s) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 Lost Time Adjust (s) 0.0 0.0 0.0 ሰበ 0.0 Total Lost Time (s) 4.0 4.0 4.0 4.0 4.0 Lead/Lag Lag Lag Lead Lead-Lag Optimize Recall Mode Min Min None Min None None None None None Act Effct Green (s) 28.0 45.8 45.8 8.4 6.8 Actuated g/C Ratio 0.43 0.70 0.70 0.13 0.40 0.10 v/c Ratio 0.80 0.45 0,12 0.03 0.64 0.10 Control Delay 27.0 7.0 33.0 25,3 34.5 Queue Delay 0.0 0.0 0.0 0.0 0.0 7.0 Total Delay 27.0 4.5 33.0 25.3 34.5 Los О. 34.5 Approach Delay 27.0 61 254 Approach LOS C . . . ıΑ C 115 22 Queue Length 50th (ft) 192 12 2 6 Queue Length 95th (ft) #374 #526 103 Internal Link Dist (ft) 1524 840 758 102 Tum Bay Length (ft) Base Capacity (vph) 1026 626 1531 199 683 191 Starvation Cap Reductn Spillback Cap Reductn 0 0 Storage Cap Reductn 0 0 0.61 0.03 0.59 0.08 Reduced v/c Ratio 0.42 0.10 ntersection Summary Area Type: Cycle Length: 90 Other Actuated Cycle Length: 65.4 Natural Cycle: 90 Control Type: Actuated-Uncoordinated Maximum v/g Ratio: 0.80 Intersection LOS: C Intersection Signal Delay: 20.7 ICU Level of Service C Intersection Capacity Utilization 6 Analysis Period (min) 15 # 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles. Splits and Phases: 101: Route 128 SB Ramps/Asheville Road & Grove Street

#1₀₉ ₽<u>Ø4</u> **₹** Ø2 12 s 58 s **₹** 105 PM

101. Route 120 OB Re	imps//tsricti	iic rtoad c	x Olove Out	CCL					Timing t term tree	onday Evening
	<i>→</i>	`	✓	_	\ f	*	\	4		
	-	Y	•		, ,		*			
Lane Group	EBL EBT		WBL WBT	Children Tarabase Control	IBL NBT	····	SBL SBT	SBR Ø9		
Lane Configurations	4 4 1 215	45	*i } 445 275	10	4 0 5	145	4 ≽ 5 2	and the second second		
Traffic Volume (vph) Future Volume (vph)	1 215		445 275 445 275	10	40 5 40 5	145	5 2 5 2	1		
Ideal Flow (vphpl)	1900 1900		1900 1900	1900 19	900 1900		900 1900			
Storage Length (ft)	0	0	200	0	0	200	0	0		decard the sources
Storage Lanes	0	0		0 "	0	1		0		
Taper Length (ft)	25	14	25		25		25	WARREST POLICE		pp. Land and Commission and Commissi
Satd. Flow (prot)	0 1802		1770 1851	. 0	0 1732	1538	0 1812	-0		Market Section
Flt Permitted	0.999		0.341		0.743	120	0.813		the standard of the latest of the standard of	
Satd, Flow (perm)	0 1800		635 1851		0 - 1344	1538	0 1518			
Right Turn on Red Satd. Flow (RTOR)		No		No	Kuladi e Sadeda	No	CPROCESSION OF	No	The the transfer of the second	
Link Speed (mph)	30		30	10 LA	30	<u> </u>	30		Same and the same of the same	
Link Distance (ft)	1604		883		838	APPROXICATION OF THE PROPERTY	182		per man account to the second at the	
Travel Time (s)	36.5		20,1	HISTORICA GENERALISMO	19.0	in the state of th	4.1			Laurida Militaria de Carlos III.
Confl. Peds. (#/hr)	16	e de la companya de		16					The state of the s	
Peak Hour Factor	0.92 0.92		0.92 0.92		.92 0.92	0.92 0	,92 0.92	0.92	300 007 000 000 000 000 000 000 000 000	
Heavy Vehicles (%)	3% 3%	3%	2% 2%	2%	5% 5%	5%	0% 0%	0%		
Shared Lane Traffic (%)		and the second s			BOZIK TIMBURAN PERSONA					
Lane Group Flow (vph)	0 284		484 310		0 48		0 8	0		
Turn Type Protected Phases	Perm NA		m+pt NA 5 2		erm NA 8		erm NA 4	en de la companya de		water the second
Protected Phases Permitted Phases	6		2 2		8 8	06	4	9.		
Detector Phase	6 6		5 2		8 8	58	4 4			
Switch Phase										
Minimum Initial (s)	10.0 10.0		6.0 6.0		6.0 6.0		6.0 6.0	4.0		
Minimum Split (s)	14.0 14.0		10.0 10.0	1	0.0 10.0		0.0 10.0	20.0	CT - ANNANCOMENSOR SECTION OF THE PROPERTY OF	- Management and Account account
Total Split (s)	29.0 29.0		29.0 58.0	1	2.0 12.0	de de la	2.0 12.0	20.0		1
Total Split (%)	32.2% 32.2%		32.2% 64.4%	13.3	3% 13.3%	13.		22%		
Yellow Time (s)	3.0 3.0		3.0 3.0		3.0 3.0	APPRILATED TO SERVICE AND ADDRESS OF THE SECOND	3.0 3.0	3.0		
All-Red Time (s)	1.0 1.0		1.0 1.0		1.0 1.0	-	1.0 1.0	1.0		
Lost Time Adjust (s)	0.0		0.0 0.0		0.0		0.0			
Total Lost Time (s)	4.0		4.0 4.0		4.0		4.0		Non-manufacture of the control of the second	national characteristics
Lead/Lag Lead-Lag Optimize?	Lag Lag		Lead		الأوجينية والماليمان		particular designation of the second			
Recall Mode	Min Min		None None	Ma	ne None	The state of the s	one None	None		
Act Effct Green (s)	15.2		40.4 41.9	Maria de la compania	8.1	29.5	8.1	HOIG	Designation of the second of	not have the
Actuated g/C Ratio	0.27		0.72 0.74		0.14	0.52	0.14			
v/c Ratio	0.58		0.56 0.23	Constitution Chair Section Constitution	0.25	0.20	0.04			Section of the Property of the Party of the
Control Delay	26.7		8.1 5.0		33.0	10.4	31.0	a dia an		
Queue Delay	0.0		0.0 0.0		0.0	0.0	0.0			
Total Delay	26.7		8.1 5.0	1 (4)	33.0	10,4	31.0			1981
LOS	C		A A	The strains of the second	C	В	C			and the second and the second
Approach Delay	26.7	100	6.9		15.6		31.0			
Approach LOS	C 81	minutasers, falles in press	A 46 26		8 14	19	C 2	CONTRACTOR OF THE PROPERTY OF THE	THE RESERVE OF THE PARTY OF THE	
Queue Length 50th (ft) Queue Length 95th (ft)	220	all the last water and a second	46 26 212 122		62	102	2 18			and the same of th
Internal Link Dist (ft)	1524	and the second second	803	and the same of the second second	758 ×	102	102		Aller Committee Control	
Turn Bay Length (ft)	3927		200			200	194	u juliju di kalendari se salah da salah	on en der II in die ee die de	
Base Capacity (vph)	907		1027 1660		216	975	244			
Starvation Cap Reductn	0		0 0		0	0	0	The second contract of	······································	
Spillback Cap Reductn	0		0 0	Market Hardward Brand Hilliam Control	0,		0			
Storage Cap Reductn	0		0 0		0	0	0		The start will be supply to the start of the	COMPANY OF THE PARTY OF THE PAR
Reduced v/c Ratio	0.31		0.47 0.19		0.22	0.16	0.03			
ntersection Summary									196	
	ner			vara Umar (S		Maria an			ar ar ar	
Cycle Length: 90	Table Million Street, Stroke Cl		one and the second of the	and the second second second	ega illin beak bilin dedi	and the second	om autor or sustain produced all a	THE RESERVE OF THE PARTY OF THE		nama Rabarra da Kalamana
Actuated Cycle Length: 56.3					ore to compare the compare to the co					
Delagica Choic reliding Solo	A CONTRACTOR DE LA CONT		A COLUMN TO A COLU		A CONTRACTOR OF THE PROPERTY O					
Natural Cycle: 65										
Natural Cycle: 65 Control Type: Actuated-Uncoordi	nated		and fruits and any continues	a de la companya de l	mayni ita kanala han da	ACTOR STATE	a California de la Cali	e, and the beauty of the history		COLD SERVICE CONTRACTOR CONTRACTOR
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum v/c Ratio: 0.58	nated						A Curio condia i calpada i			
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum v/c Ratio: 0.58 Intersection Signal Delay: 12.8			Intersection							
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum v/c Ratio: 0.58 Intersection Signal Delay: 12.8 Intersection Capacity Utilization 5	3.8%			n LOS; B of Service A						
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum v/c Ratio: 0.58 Intersection Signal Delay: 12.8	3.8%									
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum v/c Ratio: 0.58 Intersection Signal Delay: 12.8 Intersection Capacity Utilization 5 Analysis Period (min) 15	3.8%	sheville Road	ICU Level							
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum vic Ratio: 0.58 Intersection Signal Delay: 12.8 Intersection Capacity Utilization 5 Analysis Period (min) 15 Splits and Phases: 101: Route	3.8%	sheville Road	ICU Level							
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum vic Ratio: 0.58 Intersection Signal Delay: 12.8 Intersection Capacity Utilization 5 Analysis Period (min) 15 Splits and Phases: 101: Route	3.8%	sheville Road	ICU Level			programme and the second secon	Ak _{Ø9}		↓ **o₄	
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum vic Ratio: 0.58 Intersection Signal Delay: 12.8 Intersection Capacity Utilization 5 Analysis Period (min) 15 Splits and Phases: 101: Route	3.8%	sheville Road	ICU Level			And the second s	Ak _{Ø9}		6 12 s	
Natural Cycle: 65 Control Type: Actuated-Uncoordi Maximum vic Ratio: 0.58 Intersection Signal Delay: 12.8 Intersection Capacity Utilization 5 Analysis Period (min) 15 Splits and Phases: 101: Route	3.8%		ICU Level	of Service A			ÿ 20 s			

Riverside Station Development :: 10865.03 101: Route 128 SB Ramps/Asheville Road & Grove Street

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<i>,</i> –	·	- (↑ T	<i>></i>	+ -	
	BT EBR WBL	CARACTER STATE STA	NBL NOT	NBR SBL	SBT SBR	Ø9
Lane Configurations Fraffic Volume (vph) 5 1	\$ 50 65 230		୍ଷ 35 5	240 10	4	
	50 65 230		35 5	240 10	5 1	
the same of the sa	00 1900 1900	1900 1900	1900 1900	1900 1900	1900 1900	
Storage Length (ft) 0 Storage Lanes 0	0 200 0 1		0	200 0 1 0	0	
Taper Length (ft) 25	25	AND STREET STREET STREET STREET STREET STREET STREET	25	25		
Said, Flow (prot) 0 18 Flt Permitted 0.9	04 0 1787 95 0.398	1868 0	0 1802 0.767	1599 0	1826 Ö 0.849	
Satd. Flow (perm) 0. 17	97 0 749	1868 0	0 1443	1599 0	1600 0	
Right Turn on Red Satd. Flow (RTOR)	No .	No		No	No	
Link Speed (mph)	30	30	30		30	50 TO 17 TO 18
	04 i.5	883 20.1	759 17.3		182 4.1	
Confl. Peds. (#/hr) 4		20.1				
	92 0.92 0.92 % 1% 1%		0.92 0.92 1% 1%	0.92 0.92 1% 0%	0.92 0.92	
Heavy Vehicles (%) 1% 1 Shared Lane Traffic (%)	76 176 176	170 176	170 170	76 U76	· U/o · · · · · · · · · · · · · · · · · · ·	
	39 0 250	the second residence of the second	0 43	261 0	17 0	
	IA pm+pt 6 5	NA 2	Perm NA 8	pt+ov Perm	NA 4	9
Permitted Phases 6	2		8	58 4		
Detector Phase 6 Switch Phase	6 - 5		8 8	58 4	**** 4	
Minimum Initial (s) 10.0 10	.0 6.0	10.0	6.0 6.0	6.0		
Minimum Split (s) 14.0 14 Total Split (s) 34.0 34	.0 10.0 .0 23.0		10.0 10.0 13.0 13.0	10.0 13.0		0.0 0.0
Total Split (%) 37.8% 37.8	% 25.6%	63.3%	14.4% 14.4%	14.4%	14.4% 2	2%
	.0 3.0 .0 1.0		3.0 3.0 1.0 1.0	3.0 1.0		3.0 1.0
Lost Time Adjust (s).	.0 0.0	0.0	0,0		0.0	
	.0 4.0 ag Lead	4.0	4.0	SAME TO SERVICE STREET	4.0	
Lead-Lag Optimize?			Andreas de la companya de la company			
Recall Mode Min N Act Effct Green (s) 12	in None .9 29.4	Min 29.4	None None 9.0	None 25.5	None No 6.9	ne financia
Actuated g/C Ratio 0.00	26 0.59	0.59	0.18	0.52	0.14	
v/c Ratio 0. Control Delay 22		0.12 5.9	0.16 25.0	0.32 10.8	0.08 25.9	anni oraz (h. 1881). Anni oraz (h. 1881). Anni oraz (h. 1881).
Queue Delay 0	.0 0.0	0.0	0.0	0.0	0.0	
	5 7.4	The same of the sa	25.0 C	10.8	25.9	
Approach Delay 22	C A	A 6.91	12.8	В	C 25.9	
	C 51 22	A	B 9	28	C 4	
Queue Length 95th (ft) 1		56 ·/	52	26 157	, 27	
Internal Link Dist (ft) 15	CONTRACTOR STATE OF THE PARTY O	803	679	200	102	
Turn Bay Length (ft) Base Capacity (vph) 11	200 876	1738	283	200 1052	315	
Starvation Cap Reductn	0 0	0	0	0	0	
Spillback Cap Reductn Storage Cap Reductn	0 0	and the second s	. 0	0	0	
Reduced v/c Ratio 0.	20 0.29	0.07	0.15	0.25	0.05	
ntersection Summary						
Area Type: Other Cycle Length: 90						
Actuated Cycle Length: 49,5						
Natural Cycle: 60 Control Type: Actuated-Uncoordinated						di 1386 Sir 1587 - Heli II ku The Tallin
Maximum v/c Ratio: 0.51						
Intersection Signal Delay: 13.1 Intersection Capacity Utilization 42.4%		ntersection LOS: B CU Level of Service A				
Analysis Period (min) 15						
Splits and Phases: 101: Route 128 SB Ramps	/Asheville Road & Gro	ve Street				
₹02				Aka	39	₽ Ø4
57.s				₫ 20 s		138
₹PØ5						≪ Pøs

t ٩ NBR EBT WBL WBT NBT SBT Lane Group Lane Configurations Traffic Volume (vph) 240 520 Future Volume (vph) 55 240 135 5 370 10 0 5 1900 deal Flow (vphpl) 1900 900 1900 1900 900 QUU 900 1900 Storage Length (ft) n Λ 200 Λ Ω 200 Λ ٥ Storage Lanes 0 Taper Length (ft) 25 25 25 25 Satd. Flow (prot) 1752 Ö 0 0 Fit Permitted 0.253 0.832 Satd. Flow (perm) 467 1550 Right Turn on Red No No No No Satd, Flow (RTOR) Link Speed (mph) 30 30 30 30 1604 920 838 182 Link Distance (ft) Travel Time (s) 36.5 20.9 19.0 4.1 Confl. Peds. (#/hr) Confl. Bikes (#/hr) 1 1 Peak Hour Factor Heavy Vehicles (%) 3% 2% 2% 2% 3% 3% 2% 2% 2% 7% 7% 7% Shared Lane Traffic (% 261 626 152 n n 402 0 16 0 Lane Group Flow (vph) Λ ٥ 6 Turn Type NA n+pt NA ot+ov NA Protected Phases 6 57 3 9 Permitted Phases **Detector Phase** 6 6 5 2 57 3 3 Switch Phase Minimum Initial (s) 10.0 10.0 6.0 10.0 6.0 6.0 6.0 6.0 4.0 Minimum Split (s) 14.0 14.0 10.0 14.0 10.0 10.0 10.0 10.0 20,0 34.0 34.0 20.0 Total Split (s) 14.0 48.0 12.0 12.0 10.0 10.0 Total Split (%) .8% 5.6% 3.3% 1.1% .8% 3.3% 1.1% 3% 3.0 Yellow Time (s) 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 All-Red Time (s) 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 0.0 0.0 Lost Time Adjust (s) 0.0 0.0 0.0 Total Lost Time (s) 4.0 4.0 4.0 4.0 4.0 Lead/Lag Lag Lag Lead Lag Lag Lead Lead Lead-Lag Optimize Recall Mode Min Min None Min None None None None None Act Effct Green (s) 30.8 45.2 45.2 8.2 6.2 Actuated g/C Ratio 0.47 0.68 0.68 0.12 0.34 0.09 v/c Ratio 0.73 0,50 0.12 0.03 0.74 0.10 Control Delay 23.8 11.0 6,4 31.3 32.4 33.6 Queue Delay 0.0 0.0 0.0 0.0 0.0 0.0 Total Delay 23.8 11.0 31.3 32.4 33.6 6.4 OS В 32.4 33.6 Approach Delay 23.8 93 Approach LOS 22 Queue Length 50th (ft) 158 120 12 2 5 #148 #426 Queue Length 95th (ft) #587 Internal Link Dist (ft) 1524 840 758 102 Turn Bay Length (ft) Base Capacity (vph) 856 519 1254 192 541 165 Starvation Cap Reductn Spillback Cap Reductn 0 n n 0 Storage Cap Reductn 0 Ö 0 0.74 0.10 0.73 0.50 0.12 0.03 Reduced v/c Ratio intersection Summary Other Area Type: Cycle Length: 90 Actuated Cycle Length: 66 Natural Cycle: 90 Control Type: Actuated-Uncoordinated Maximum v/c Ratio: 0.74 Intersection LOS: C Intersection Signal Delay: 22.2 ICU Level of Service C Intersection Capacity Utilization 6 Analysis Period (min) 15 # 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles. Splits and Phases: 101: Route 128 SB Ramps/Asheville Road & Grove Street **≪**‡ø7 ₩ Ø2 #R09 ₽_{Ø3}

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø9	100	100	Metal Cal	
Lane Configurations Traffic Volume (vph)		4 > 215	45	ኝ 445	1> 275	10	40	र्व	7 145	E	4 } 2			-100 grand 1977	CONTRACTOR OF THE		
Future Volume (vph)	1	215	45	445	275 275	10	40	5 5 5	145	5 5	2	1					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900					
Storage Length (ft) Storage Lanes	0		0	200 1		0	0 0	1.7	200 1	0		0					
Taper Length (ft)	25			25			25		Material September 1997 1997 1997	25		ALLEGA MARIE CANADA			io inventamentale, speine	(SECONDARY CHIMINES C	
Satd. Flow (prot) Fit Permitted	0	1802 0.999	0	1770 0.283	1851	0	0	1732 0.743	1538	0	1812	0				لفتحدث	
Satd. Flow (perm)	0	1800	0	527	1851	0	. 0		1538	0.7	1868	0					
Right Turn on Red Satd, Flow (RTOR)			No			No	er og grande		No			No			000000000000000000000000000000000000000		
Link Speed (mph)		30			30	W. 1525.		30			30						
Link Distance (ft)		1604			883	第一规划		838			182		fat 1				
Travel Time (s) Confl. Peds, (#/hr)	16	36.5			20.1	16	Level 1	19.0			4.1		10 T	1540			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92					
Heavy Vehicles (%) Shared Lane Traffic (%)	3%	3%	3%	2%	2%	2%	5%	5%	5%	0%	0%	0%	**************************************		21.02.11	Ale in	
Lane Group Flow (vph)	0	284	0	484	310	0	0	48	158	0	A STATE OF THE PARTY OF THE PAR	Ō		and the second second	American Action		Perpose and the second
Turn Type Protected Phases	Perm	NA 6		pm+pt 5	NA 2		Perm	NA 7	pt+ov 5.7	Perm	NA 3		o de la companya de	學服務地別	The state of the state of		
Permitted Phases	6			2	and the second	Zan Se in more communication of the	7		U	3							
Detector Phase	6	6		5	2		7	7	5.7	3	3						
Switch Phase Minimum Initial (s)	10.0	10.0		6.0	6.0		6.0	6.0		6.0	6.0		4.0				
Minimum Split (s)	14.0	14.0		10.0	10.0		10.0	10.0		10.0	10.0		20.0	A STATE OF THE STA			
Total Split (s) Total Split (%)	20.0 22.2%	20.0	第32.11	28.0 31.1%	48.0 53.3%		12.0 13.3%	12.0 13.3%		10,0 11,1%	10.0 11.1%		20.0 22%	ALEX DUCATE STREET	diameter miles	Strandens 28 (St.	
Yellow Time (s)	3.0	3,0		3.0	3.0		3.0	3.0		3.0	3.0		3.0				
All-Red Time (s)	1.0	1.0		1.0	1.0	CHARLESTON THE	1.0	1.0		1.0	1.0	nanos de la compansión de	1.0	er en	na ostanomene		
Lost Time Adjust (s) Total Lost Time (s)	والنفيدة ويوانين	#0.0 4.0		0.0 4.0	0.0 4.0	man light year and		0.0 4.0		december 110	0.0 4.0	Control of the Contro		**************************************			
Lead/Lag	Lag	Lag		Lead			Lag	Lag		Lead	Lead	Orom y			The state of		
Lead-Lag Optimize? Recall Mode	Min	Min		None	None		None	None		None	None		None				
Act Effct Green (s)		15.2	in States to be Labor.	40.9	40.9	a constant and	1.010	7.8	33.5	7,010	6.3		1010	San Marca III		and the same of th	
Actuated g/C Ratio v/c Ratio		0.25 0.64		0.67 0.61	0,67 0,25		was del	0.13 0.28	0.55 0.19		0.10			Da Eromonia			
Control Delay		32.4		12.7	7.0		121	34,4	10.8		32.9						
Queue Delay	qraeeeee	0.0		0.0	0.0		TO SUPERIOR CONTRA	0.0	0,0	SICCESION COMPA	0.0	contributed assessed	An derivativities and de	nancos controles		en proposition de	
Total Delay LOS	and a different	32,4 C		12,7 B	7,0 A	L. Children of the Color		34,4 C	10.8 B		32,9 C			And the Control of th	200	A-THER RESIDENCE	
Approach Delay		32.4			10.5			16.3			32.9						
Approach LOS Queue Length 50th (ft)	A VENT	C 86		47	B 26			B 15	22		C				the age of the control of	PRINCIPLE DE LA	
Queue Length 95th (ft)		#302	orinila cuationistics	#344	162			62	104	4 maria 10 da 40 da 40 d	18	in the second	J. 12. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10		NON-SELLANT DE SE		articol Control
Internal Link Dist (ft) Turn Bay Length (ft)		1524	210	200	803			758	200		102		-		100		
Base Capacity (vph)		497		866	1405			185	904		193			1	. 1		
Starvation Cap Reductn	medical section and	0		0	0			0	0	en ande en en en help de	0			e sa enema		and the same of th	
Spillback Cap Reductn Storage Cap Reductn		0		0 0	0			0 0	0 0		0				and the soul		
Reduced v/c Ratio		0.57		0.56	0.22			0.26	0.17	Tak conse	0.04						
ntersection Summary			600 2000														
Area Type: Oth	ier,				. (2)			15.4					فأنجأك				
Cycle Length: 90 Actuated Cycle Length: 61.2		and the second		or in the s								Cr. Alt			ATT TO SHAPE		
Natural Cycle: 80	micron Securita mana									1 - Page 2 and 1 and 1 and 1	SECTION OF THE SECTION	ACT AUTOMITE SCHOOL	the second second	Charles and the control of the contr			OFFICE OF THE PARTY OF T
Control Type: Actuated-Uncoordin Maximum v/c Ratio: 0.64	nated				diff (Back)			第 5 2 2 2								and the second	S. S. S. S. S.
Intersection Signal Delay: 16.4					ersection l												
Intersection Capacity Utilization 5 Analysis Period (min) 15	3.8%		Secondary would	ICI	J Level of	Service A				1 02 THE STREET	A CHARLES IN THE REAL PROPERTY.			v v m			
# 95th percentile volume exceed	ds capacit	y, queue r	may be long	jer.													
Queue shown is maximum afte		***************************************				1.40		0					din Hati		1		
Splits and Phases: 101: Route	128 SB R	amps/Ash	eville Road	& Grove	Street			4.2					T _{rea}		12		\neg
₩ 02 48 s				a Die Will aller		A 250 120 200		. ∱ Å.	Ø9				∳ [≽] ø3	188375	12 s		
		Section 1995		A ₁₀₆			SOURCE OF STREET	20.5	2000							784	
€ €05 28 s	Market less		2	06 0 s			51,77 (136)	6									

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Lane Group	EBL	EBT	EBR	WBE WE	at war	NBL	NBT	NBR	SBL	SBT	SBR	'Ø9			7000
Lane Configurations		4		ካ	ħ		4	7	претнозатурующ	4			anton metalizationisti sost	And the second of the state of the second	
Traffic Volume (vph) Future Volume (vph)	5 5	150 150	65 65		15 5 15 5	AND DESCRIPTION OF THE PARTY	- 5 <u>"</u> 5	240 240	10 10	5 5	1			Passache de la	
Ideal Flow (vphpl)	1900	1900			00 1900		1900	1900	1900 0	1900				THE PARTY	
Storage Length (ft) Storage Lanes	0		0	200	0	THE PARTY OF THE P		200 1	0	117.44	0 0				
Taper Length (ft)	25	2001		25		25	4000	4500	25	4000					
Satd, Flow (prot) Flt Permitted	0	1804 0.995		1787 18 .380	68 0	<u></u>	1802 0.756	1599	0	1826	0			Accomplished to the second	
Satd, Flow (perm)	0	1797	Carlos a Vande audito cità Shi al annocase.	715 18	68 0	Commence of the Commence	1422	1599	0	1885	0				
Right Turn on Red Satd: Flow (RTOR)		To diverse on the stage	No		No			No			No	100			
Link Speed (mph)		30			30	dentantic pendenta	30 759			30 182	eles en action		USE SUPERIOR	an da mara a sa	
Link Distance (ft) Travel Time (s)		1604 36.5		20 20	83),1	ies i Lucalitada	17.3	allication canno		4.1	فنافأ والمدينان الديبان		3 Mary 2 Mary		bk and
Confl. Peds. (#/hr)	4	200	0.00	0.00	4	0.00	0.92	0.92	0.92	0.92	0.92				
Peak Hour Factor Heavy Vehicles (%)	0.92 1%	0.92 1%		0.92 0.9 1% 1			1%	0.92 1%	0.92	0.92	0.92	CONTRACTOR OF THE PARTY OF THE	arahin da karana		
Shared Lane Traffic (%)		000		oeo .	20	Smiles Senson	43	261	0	17	Ö		· Car at the State of the State		
Lane Group Flow (vph) Turn Type	0 Perm	239 NA	0 pr		30 0 VA	0. Perm	NA	pt+ov	Perm	NA	y.		Augustania Catagoria		02010
Protected Phases		6		5	2	7	7	5.7	. 3	3	ter star	9			1/2
Permitted Phases Detector Phase	6	6		2 5	2	W 7	7	57	3	3		and the	ir Kari		5.44°
Switch Phase	400	786		20 20	A	8.6	20			6.0		4.0			
Minimum Initial (s) Minimum Split (s)	10.0 14.0	10.0 14.0	100000000	6.0 10 10.0 14		6.0 10.0	6.0 10.0		6,0 10.0	10.0		20.0			
Total Split (s)	28.0	28.0		20.0 48	3.0	12.0	12.0		10.0	10.0 11.1%		20.0 22%			4.0
Total Split (%) Yellow Time (s)	31.1% 3.0	31.1% 3.0	22	2.2% 53.3 3.0 3	% 3.0	13.3% 3.0	13.3% 3.0		11.1% 3.0	3.0		3.0	HARRIST SHIPE TO BE	-01-200	
All-Red Time (s)	1.0	1.0		1.0 1	.0	1.0	1.0		1.0	1.0 0.0	malangalini ka	1.0	urenin erdeksirikk		
Lost Time Adjust (s) Total Lost Time (s)		0.0 4.0			.0 .0		0.0 4.0			4.0					
Lead/Lag	Lag	Lag		ead		Lag	Lag	in Las	Lead	Lead			talis (Bellis)		
Lead-Lag Optimize? Recall Mode	Min	Min		lone M	lin .	None	None		None	None		None			
Act Effct Green (s)		13.7		30,7 30 0,59 0,8		yesa wanye ca	8.6 0.17	25.6 0.50	in sates () is well to	6.6 0.13			a communicación de la compansión de la comp		
Actuated g/C Ratio v/c Ratio		0,27 0.50		0.59 0.4 0.36 0.1			0.18	0.33	the rubble cause	0.07					anasi -
Control Delay		23.0			1		28.4 0.0	13.6 0.0		29.6 0.0		AC COL	* **		8
Queue Delay Total Delay		0.0 23.0	M.SE		.0 .1		28,4	13.6		29.6				en and the second	
LOS		C 23.0	Danisio - 146		A 1 1 2 2 3		C 15.7	В		C 29,6					
Approach Delay Approach LOS		C			A		В			С	2, 2, 2, 2, 11, 2, 2, 11				ALIANA S
Queue Length 50th (ft)		49 188			10 71	JT. 4	9 56	28 194		4 30			45.4		
Queue Length 95th (ft) Internal Link Dist (ft)	14	1524)3	The state of the s	679			102					
Turn Bay Length (ft)		924		200 793 163	55	5.6	244	200 924		242	mar i seur	William Auf Thi			
Base Capacity (vph) Starvation Cap Reductn		924			0		0	0	i wen	0				And the Land of the Land	THE PARTY OF THE P
Spillback Cap Reductn	Control was not	0	104,000	The Local of the Control of the Cont	0		0 0 0	0 0		0 · 0			entransas da la companya		
Storage Cap Reductn Reduced V/c Ratio		0.26		0,32 0.0	Enter Assessment Statement of the A		0.18	0.28		0,07		and the second	dillion a maior a a liberal di		
Intersection Summary					77								100		
Area Type: Ot	her			30.0	er zana Tr							Andreas Anna Anna Anna Anna Anna Anna Anna An	Library Calendar		
Cycle Length: 90 Actuated Cycle Length: 51.6														A STATE OF THE STA	
Natural Cycle: 65			art with the same and a		. Aller Aller			di worte	Nation 187						
Control Type: Actuated-Uncoord Maximum v/c Ratio: 0.50	nated														oattid opened
ntersection Signal Delay: 14.7					tion LOS: B el of Service	Ā	Line of South and								
Intersection Capacity Utilization Analysis Period (min) 15				ICU Lev	ei oi delvice	Λ				1.1					
Bisson 100 John Wilmong Harack Stiffminton and Burg Ground Annual Edit of the DECEMBER of the entire transfer in provinces			ovilla Pand a	Grove Street	at .										
	120 SB F	vamps/Ash	eville Road &	Glove Stree			AB					[™] 03	₹	37	٦
₩ Ø2 48 s						16 - 16 - 15 - 15 - 15 - 15 - 15 - 15 -	7 F	צער			₹ 10	5	■ 12 s		<u> </u>
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