

HIGHTSTOWN REDEVELOPMENT AREA CIRCULATION STUDY

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Borough of Hightstown

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In association with
Bright View Engineering



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Introduction

The Borough of Hightstown received funds from the Delaware Valley Regional Planning Commission (DVRPC) to conduct a Redevelopment Area Circulation Study to examine the change in circulation arising from the planned redevelopment of the vacant Rug Mill in the downtown. The NV5/Brightview project team was tasked with reviewing the series of studies and plans that envision an active downtown with planned redevelopment and identify potential opportunities and constraints associated with circulation in the downtown area as a result of the planned improvements. Reviewing alternatives for the intersection of North Main Street and Franklin Street, including feasibility and assessment of a roundabout at this intersection instead of the existing traffic signal was the focus of the study, and set the groundwork for all the traffic analysis throughout the study area.

Major work tasks included:

1. Review Existing Plans and Traffic Projections
2. Traffic Count Data Collection (to complete the study area base information)
3. Traffic Model Development
4. Safety Enhancement Concept Development
5. Traffic Modeling for potential Build Scenarios
6. Community Input

NV5 worked with the Hightstown Complete Streets Committee and developed recommendations for enhancing pedestrian safety and access while maintaining motor vehicle circulation throughout the Redevelopment Area. This includes presentation to and coordination with the Hightstown Planning Board.

The study area for this project included the streets and intersections adjacent to all three phases of the redevelopment area as shown on Figure 1: below. The following intersections were included in the assessment:

1. N. Main Street and Franklin Street
2. N. Main Street and Stockton Street
3. N. Main Street and Bank Street
4. Franklin Street and Maxwell Avenue
5. Stockton Street and Academy Street



Figure 1: Study Area Map

Analysis of Existing Plans and Traffic Projections

NV5 staff reviewed the redevelopment plans for the Lakefront Plan and the Hightstown Mobility Master Plan to plan field work and identify site opportunities and constraints. The review of the report suggests that the increased parking and traffic growth associated with these projects appears to conform to industry standards and be consistent with the vision described by the Complete Streets Committee during project coordination meetings. NV5 collected additional data for the intersection of Franklin Street at Maxwell Avenue and N. Main Street at Franklin Street to develop the traffic models as the recent redevelopment studies did not include existing traffic counts at that intersection.

Traffic Count Data Collection

NV5 collected turning movement counts using a video traffic data collection system at the intersections of Franklin Street at Maxwell Avenue and N. Main Street at Franklin Street to augment the data provided from other recent studies.

Appendix A – Traffic Data includes a summary of all traffic data collected.

Traffic Model Development

The NV5 Team built a traffic model using Synchro, version 11 to quantify existing operational conditions for the weekday morning, weekday evening and Saturday mid-day peak hours and set a base line for comparing future traffic and potential safety enhancement concept analysis. Using the existing conditions model as a base condition, The NV5 Team surcharged traffic from known planned developments in the area onto the existing conditions model to establish the anticipated future conditions for each of the study area intersections. The resulting 2022 projected future volumes are shown in Figure 2 below.

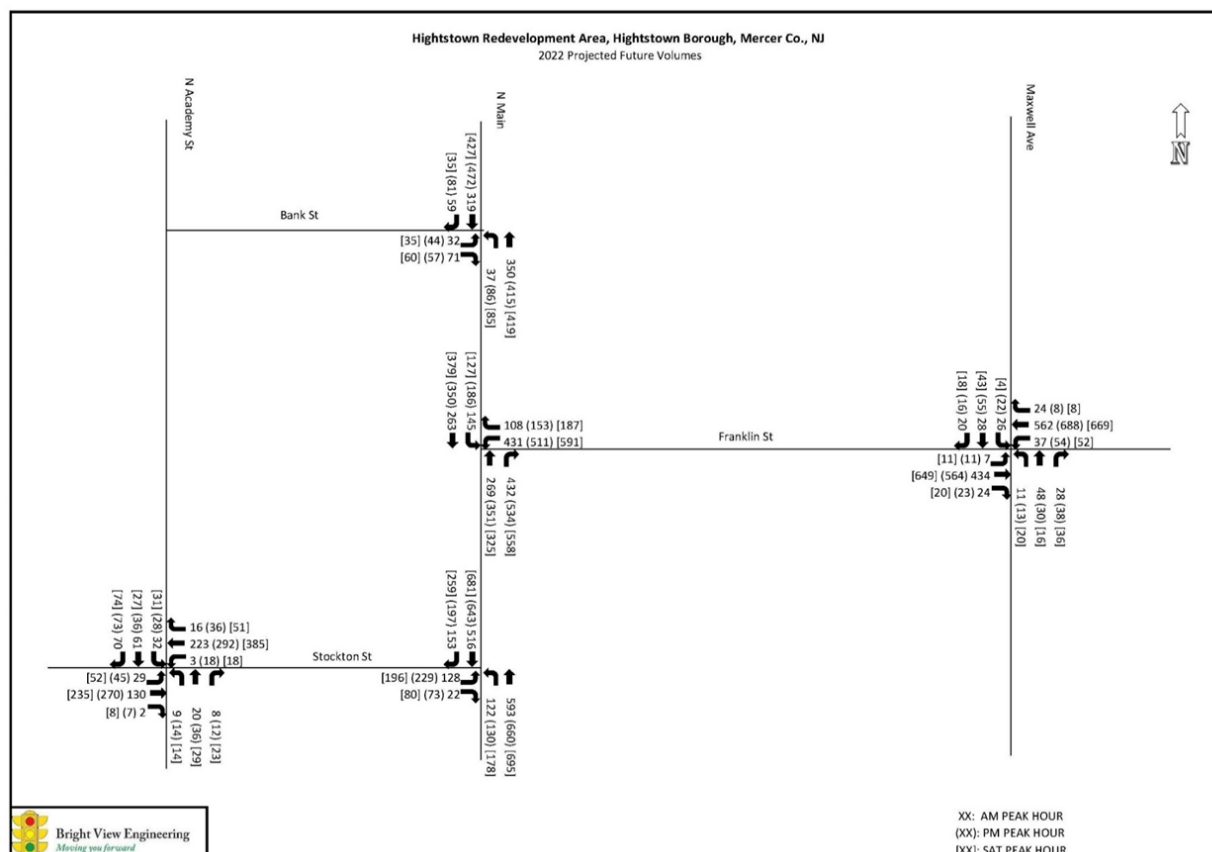


Figure 2: Traffic Model

Safety Enhancement Concept Development

Initial Screening

Central to the project is the identification of improvements at the intersection of North Main Street and Franklin Street. Previous efforts by the Borough identified a roundabout as a potential alternative to the existing traffic signal at the intersection. The team's initial screening efforts focused on determining if a roundabout could effectively process the needed traffic volumes at the intersection without adversely affecting the surrounding area. Since roundabouts work most effectively with clear downstream conditions, one of the key measures in this analysis was to determine if vehicle queues from adjacent intersections would queue back into the proposed roundabout.



Figure 3: Roundabout Concept

To that end, the NV5 team reviewed the expected operation of the roadway network with the introduction of a modern one lane roundabout at the intersection of North Main Street and Franklin Street. This included an estimation of the vehicle queues from the intersections surrounding the roundabout.

This screening produced several key findings that directed the intersection configuration of all safety concepts developed. The results of the queuing analysis showed that there is a high likelihood that the southbound traffic along N. Main Street approaching the Stockton Street intersection would likely backup into and through the intersection at Franklin Street. With a traditional signalized intersection, this can be mitigated with 'DO NOT BLOCK THE BOX' type treatments or roadway widening where possible. If a roundabout intersection configuration were considered, this downstream queue backing into the intersection could stop all circulating traffic and cause gridlock. This was particularly critical at the intersection of North Main Street and Franklin Street due to the firehouse located at the intersection. Traffic queued at the roundabout would be difficult to clear and could impede emergency response times. Figure 3 below shows the initial roundabout concept considered, which provides the minimum acceptable lane geometries while attempting to minimize impacts.

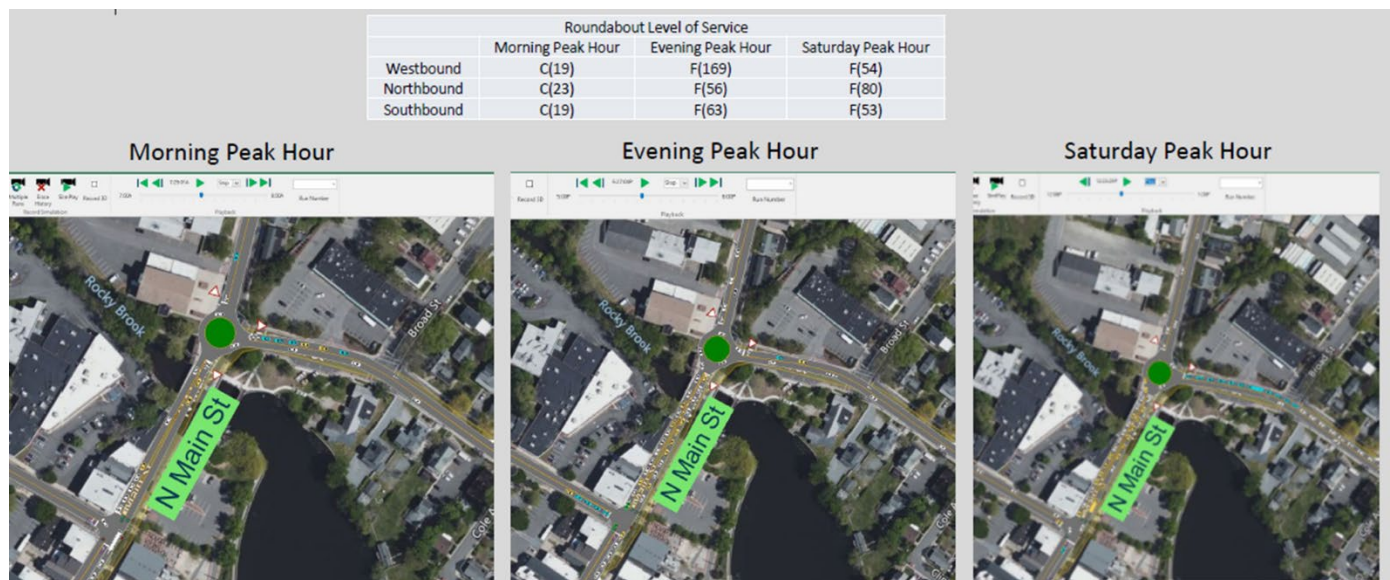


Figure 4: Roundabout Level of Service

The traffic simulation modeling indicated a fatal flow in the roundabout scenario, requiring it to be removed from future considerations. It was recommended that safety enhancements to the traditional traffic signal configuration be developed in lieu of the roundabout at the intersection.

Safety Enhancement concepts

Seven scenarios were developed to model potential circulation and safety enhancement throughout the study area, these are summarized in Table 1, below:

- M1 – Add a Right Turn Lane along Franklin St approach to N. Main St & Update Signal Timing
- M2 – Add a Dedicated Pedestrian Signal Phase @ Franklin St and N. Main St & Update Signal Timing
- M3 – Add a Right Turn Lane along Franklin St approach to N. Main St, a Dedicated Pedestrian Signal Phase & Update Signal Timing
- M4 – Add a Lead Pedestrian Interval across Franklin St approach to N. Main St
- M5 – Add a Turn Lane AND Lead Pedestrian Interval across Franklin St approach to N. Main St & Update Signal Timing
- M6 – Add a Lead Pedestrian Interval at Stockton St & N. Main St & Update Signal Timing
- M7 – Add a 4-Way STOP at Stockton St & Academy St

Table 1: Traffic Model Scenarios

	Intersection	Right Turn Lane	Update Signal Timing	Dedicated Pedestrian Signal Phase	Lead Pedestrian Interval (LPI)	4-Way Stop
Model 1(M1)	N. Main St. & Franklin St.	●	●			
Model 2(M2)	N. Main St. & Franklin St.		●	●		
Model 3(M3)	N. Main St. & Franklin St.	●	●	●		
Model 4(M4)	N. Main St. & Franklin St.				●	
Model 5(M5)	N. Main St. & Franklin St.	●	●		●	
Model 6(M6)	Stockton St. & N. Main St.		●		●	
Model 7(M7)	Academy St. & Stockton St.					●

Traffic Modeling Scenarios

Traffic Modeling Scenario M1

The M1 traffic model is based on redesigning/reconfiguring the intersection of North Main Street and Franklin Street by adding a Right Turn Lane along the westbound Franklin St approach to N. Main St and updating the traffic signal timing accordingly. Table 2, below, compares the anticipated future intersection operation without any changes to the proposed mitigation measures. Abbreviations are included in Appendix D.

Table 2: Traffic Model 1 Level of Service

Intersection	FBAM		FBPM		FBSA		FBAM-M1 WB L+R		FBPM-M1 WB L+R		FBSA-M1 WB L+R	
N Main St & Franklin St	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
WBLR	D	42.2	D	51.2	D	43.6						
WBL							D	44.8	D	45.3	D	43.7
WBR							D	25.2	C	22.6	C	20.2
NBT	C	23.3	D	36	D	38.5	B	17.9	C	25.5	C	25.3
NBR	D	37.2	F	198.1	F	275.5	A	6	A	7.9	A	6.5
SBL	E	56.8	E	66	F	122.7	D	46.6	D	45.1	E	56.5
SBT	B	12.5	B	17.8	C	24.8	A	8.8	B	12.2	B	15.4



Figure 5: Traffic Model 1

As Table 2 indicates, the addition of the westbound right turn lane in conjunction with traffic signal timing and phasing improvements results in significantly improved levels of service for vehicles. Pedestrian mobility, however is not improved, as pedestrians in this scenario are required to cross

concurrent with vehicle movements. The addition of the westbound right turn also increases pedestrian crossing time for the westbound approach.

Traffic Modeling Scenario M2

The M2 traffic model is based on redesigning/reconfiguring the intersection by adding a Dedicated Pedestrian Signal Phase at Franklin Street and N. Main Street and updating the traffic signal timing / phasing.

Table 3: Traffic Model 2 Level of Service

Intersection	FBAM		FBPM		FBSA		FBAM-M2 PED PHASE		FBPM-M2 PED PHASE		FBSA-M2 PED PHASE	
N Main St & Franklin St	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
WBLR	D	42.2	D	51.2	D	43.6	D	35.5	E	60.4	E	78.6
WBL												
WBR												
NBT	C	23.3	D	36	D	38.5	D	36.2	E	76.8	E	70
NBR	D	37.2	F	198.1	F	275.5	A	2.4	A	2.4	A	3.6
SBL	E	56.8	E	66	F	122.7	D	37.5	D	39.2	D	37.2
SBT	B	12.5	B	17.8	C	24.8	B	14.2	B	17.5	B	19.6



Figure 6: Traffic Model 2

As Table 3 indicates, revisions to the traffic signal timing improves vehicular flow and results in improved levels of service for vehicles. The dedicated pedestrian phase minimizes the conflicts between pedestrians and vehicles, improving pedestrian connectivity. It must be noted that while

the timing has been balanced to eliminate any level of service 'F' conditions, very little capacity remains in this scenario for future increases in traffic volumes.

Traffic Modeling Scenario M3

The M3 traffic model is based on redesigning/reconfiguring the intersection by adding a Right Turn Lane along Franklin Street approach to N. Main Street, a Dedicated Pedestrian Signal Phase at Franklin Street and N. Main Street and updating the traffic signal timing.

Intersection	FBAM		FBPM		FBSA		FBAM-M3 PED PHASE, WB L+R		FBPM-M3 PED PHASE, WB L+R		FBSA-M3 PED PHASE, WB L+R	
N Main St & Franklin St	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
WBLR	D	42.2	D	51.2	D	43.6						
WBL							C	31.4	D	49.1	D	40.8
WBR							B	17.5	C	22.1	B	17.3
NBT	C	23.3	D	36	D	38.5	C	30.5	D	38.9	D	41
NBR	D	37.2	F	198.1	F	275.5	A	2.4	A	2.4	A	3.5
SBL	E	56.8	E	66	F	122.7	D	37.5	D	39.2	D	37.2
SBT	B	12.5	B	17.8	C	24.8	B	12.2	B	12.9	B	16.3

Table 4: Traffic Model 4



Figure 7: Traffic Model 3

As one could expect, Table 4 shows a hybrid result compared to scenarios M1 & M2, with improvements to both traffic flow and the addition of a dedicated pedestrian phase to improve pedestrian connectivity.

Traffic Modeling Scenario M4

The M4 traffic model is based on redesigning/reconfiguring the intersection by adding a Lead Pedestrian Interval across Franklin Street approach to N. Main Street.

Intersection	FBAM		FBPM		FBSA		FBAM-M4 LPI FRANKLIN ST		FBPM-M4 LPI FRANKLIN ST		FBSA-M4 LPI FRANKLIN ST	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
N Main St & Franklin St												
WBLR	D	42.2	D	51.2	D	43.6	D	43.3	E	60.4	E	68.3
NBT	C	23.3	D	36	D	38.5	C	32.3	D	53	D	51
NBR	D	37.2	F	198.1	F	275.5	A	2.7	A	5.4	A	4.2
SBL	E	56.8	E	66	F	122.7	D	46	D	46.7	D	49.7
SBT	B	12.5	B	17.8	C	24.8	B	14.7	B	17.5	C	22.5
Maxwell St & Franklin St	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay

Table 5: Traffic Model 4 Level of Service



Figure 8: Traffic Model 4

The lead pedestrian interval (LPI) consists of providing a comparatively short (3-5 second) head start for pedestrians prior to vehicles receiving a green light. While the timing changes proposed do improve vehicular circulation and the LPI does improve pedestrian movements, pedestrians and vehicles remain in conflict with each other moving through the intersection.

Traffic Modeling Scenario M5

The M5 traffic model is based on redesigning/reconfiguring the intersection by adding a Turn Lane and a Lead Pedestrian Interval across Franklin Street approach to N. Main Street and updating the traffic signal timing.

Intersection	FBAM		FBPM		FBSA		FBAM-M5 LPI FRANKLIN WB L+R		FBPM-M5 LPI FRANKLIN WB L+R		FBSA-M5 LPI FRANKLIN WB L+R	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
N Main St & Franklin St												
WBLR	D	42.2	D	51.2	D	43.6						
WBL							D	37.1	D	38.2	D	43.9
WBR							C	21.4	C	20.8	C	21.1
NBT	C	23.3	D	36	D	38.5	C	28.5	D	41.2	D	37.2
NBR	D	37.2	F	198.1	F	275.5	A	2.6	A	5.1	A	3.9
SBL	E	56.8	E	66	F	122.7	D	46	D	46	D	46
SBT	B	12.5	B	17.8	C	24.8	B	12.7	B	15.6	B	17.9

Table 6: Traffic Model 5 Level of Service



Figure 9: Traffic Model 5

Scenario M5 includes both the LPI and the westbound approach widening. Table 6 shows, this results in an improvement in vehicular levels of service but still has similar pedestrian concerns as Scenario M4 since pedestrians and vehicles are still required to traverse the intersection concurrently.

Traffic Modeling Scenario M6

The M6 traffic model is based on redesigning/reconfiguring the Stockton Street and N. Main Street intersection by adding a Lead Pedestrian Interval and updating the traffic signal timing.

Intersection	FBAM		FBPM		FBSA		FBAM-M6 LPI STOCKTON		FBPM-M6 LPI STOCKTON		FBSA-M6 LPI STOCKTON	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
N Main St & Stockton St												
EBLR	D	42.4	E	76.3	E	61.4	D	40.6	E	64.3	E	56.7
NBL	A	7	B	19.8	C	31.4	A	5.8	C	26.6	C	27.4
NBT	A	4.7	A	9	A	5	A	7.4	B	10.5	A	5.5
SBTR	B	11.8	C	28.5	D	48.8	C	21.1	F	81.1	F	84.4

Figure 10: Traffic Model 6

This alternative evaluates the intersection of North Main Street and Stockton Street with the addition of a Lead Pedestrian Interval. This results in a degradation in vehicular levels of service as time during the traffic signal cycle is diverted from vehicles to pedestrians.



Table 7: Traffic Model 6 Level of Service

Traffic Modeling Scenario M7

The M7 traffic model is based on adding a 4-way stop at Stockton Street and Academy Street intersection.

Average and Delay Percentile Queue Lengths (ft)												
Intersection	FBAM		FBPM		FBSA		FBAM-M7 4WAY ACAD & STOCKTON		FBPM-M7 4WAY ACAD & STOCKTON		FBSA-M7 4WAY ACAD & STOCKTON	
Academy St & Stockton St	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
EBLTR	A	1.4	A	1.1	A	1.5	A	9.4	B	13.5	B	13.3
WBLTR	A	0.1	A	0.4	A	0.3	B	10.2	B	13.9	C	19.2
NBLTR	B	13.2	C	20.5	C	21	A	8.6	A	9.9	B	10.2
SBLTR	B	14.3	C	19.1	C	22.3	A	9.4	B	10.5	B	10.8

Table 8: Traffic Model 7 Level of Service



Figure 11: Traffic Model 7

As Table 8 indicates, the intersection is anticipated to operate at acceptable Levels of Service with an all-way stop in place. It is important to note, however, that prior to implementing an all-way stop at this intersection, a formal all-way stop analysis should be prepared for Mercer County review and approval.

Community Outreach

The NV5 Team participated in monthly Complete Streets Committee meetings throughout the project. The plan to facilitate educational community outreach activities was modified due in part to the COVID-19 restrictions and reinforced once the roundabout concept was removed from consideration allowing the labor to be targeted to the concepts developed and analyzed. The team also presented to the Planning Board and the Town Council on the project findings.

Conclusions/Next Steps

Traffic Modeling Scenario M5 with the Right Turn Lane added to the Franklin Street approach to N. Main Street, Lead Pedestrian Interval added, and signal timing changes, was chosen. The crosswalk on the north side of N. Main Street is realigned to reduce the crossing distance and better align with the planned new parking garage in the redevelopment area, which should prevent pedestrians going outside the crosswalk.



Figure 12: Concept 3 – All Pedestrians Crossings Provided

Global traffic recommendations include coordinating all three traffic signals – Main Street at Franklin Street, Main Street at Stockton Street, and Franklin Street at Maxwell Avenue – to optimize operations and minimize

queuing; and providing high visibility crosswalks. Consider adding Shared Lane Markings along the High Point to Cape May bicycle route wherever there are no bicycle lanes.

Recommendations for specific intersections are described below.

At Main Street at Stockton Street, recommendations include installing high visibility striping at pedestrian crosswalks across Main Street and Stockton Street; installing shared lane markings along Main Street; removing 'no crossing' sign along northern crossing across Main Street and installing high-visibility pedestrian crosswalks with ADA-compliant ramps; installing landscaping along the center median for traffic calming while being mountable for fire truck access, and pedestrian refuge with ADA-compliant ramps/ pass through area. Consider reconfiguring traffic signal phasing to include either an all-pedestrian phase or lead pedestrian interval and be coordinated with adjacent signals.

At Main Street at Bank Street, recommendations include installing high visibility striping at pedestrian crosswalks across Main Street and Bank Street and consider pedestrian crossing warning beacons along Main Street; installing shared lane markings along Main Street between Monmouth Street and Franklin Street to connect with the bike lanes to the north; and daylighting the intersection with localized parking restrictive colored pavement marking and/or collapsible bollards. Consider providing high visibility STOP sign features on the Bank Street approach, such as a colored post and/or actuated flashing illumination.

At Franklin Street at Maxwell Avenue, recommendations include eliminating the slip lane and reconfiguring the sidewalk network; installing high visibility striping at all four pedestrian crosswalks; building curb extensions with ADA-compliant tactile warning surfaces and pedestrian actuated signals with lead pedestrian interval; extending the sidewalk network southbound (eastside of Maxwell Street) and eastbound (north and south sides of NJ-33); installing signed and striped protected bike lane treatment on Franklin Street/ NJ-33; and daylighting the intersection with localized parking restrictive colored pavement marking and/or collapsible bollards. Consider reconfiguring traffic signal phasing to include an all-pedestrian phase and be coordinated with adjacent signals.

At Academy Street at Stockton Street, recommendations include installing high visibility striping at all four pedestrian crosswalks; daylighting the intersection with localized parking restrictive colored pavement marking and/or collapsible bollards; providing high visibility STOP sign features, such as a colored post and/or actuated flashing illumination. Installing a 4-way STOP will introduce only minor delays along Stockton Street.

The anticipated schedule is as follows:

- Preliminary engineering – 9 months
- ROW acquisition – 2 years
- Final Design – 6 months
- Construction – 12-18 months

Appendices

Appendix A – Traffic Data (Level of Service, Delay and Queue)

Appendix B – Concept Plans

Appendix C – Cost Estimate

Appendix D – Level of Service Abbreviations

Appendix E – Truck Turning Movements

Appendix A – Traffic Data (Level of Service, Delay and Queue)

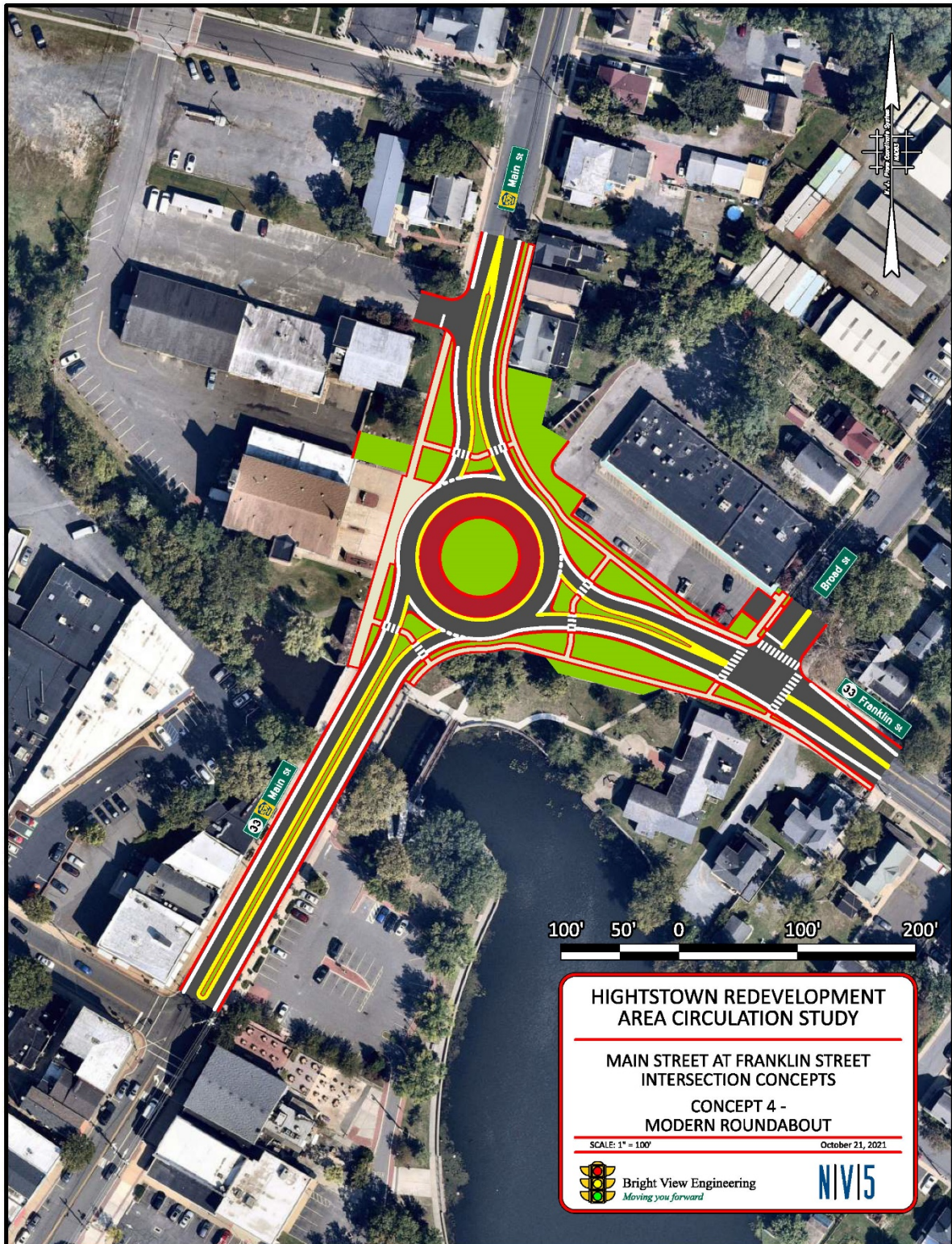
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Appendix B – Concept Plans









Appendix C – Cost Estimate

Franklin-Main Order of Magnitude Cost Estimate				
Major Item	Unit	Unit Cost	Quantity	Item Cost
Full Depth Pavement	SY	\$ 70.00	190	\$ 13,300.00
2" Surface Course				
6" Base Course				
8" Dense Aggregate Base Course				
Milling & Resurfacing	SY	\$ 30.00	3,483	\$ 104,490.00
Milling 3" or Less				
2" HMA Surface Course				
Variable HMA Intermediate Course (assume 2.5")				
9"x16" Concrete Vertical Curb	LF	\$ 40.00	820	\$ 32,800.00
Brick Sidewalk	SY	\$ 100.00	34	\$ 3,400.00
Concrete Sidewalk, 4" Thick	SY	\$ 75.00	300	\$ 22,500.00
HMA Driveway	SY	\$ 30.00	-	\$ -
Concrete Driveway	SY	\$ 110.00	86	\$ 9,460.00
Roadway Drainage (per Roadway CL length)	LF	\$ 150.00	160	\$ 24,000.00
Landscape Wall	LF	\$ 250.00	-	\$ -
Topsoil/Seeding/Mulching	SY	\$ 40.00	377	\$ 15,080.00
New Traffic Signal	LS	\$ 250,000.00	1	\$ 250,000.00
Foundations, Poles, Mast Arms, Signs, Conduit,				
Junction Boxes, Signal Heads, Controller, Wiring,				
and Pedestrian Push Buttons				
Subtotal Estimated Cost:			\$ 475,030.00	
Non-Quantified Construction Costs:	Percent of Subtotal Costs:			
Stormwater Management	N/A		N/A	
Maintenance and Protection of Traffic	7%		\$ 33,252.10	
Lighting, Traffic Striping, Delineators, & Signs	3%		\$ 14,250.90	
ROW Impacts (1750 SF fee taking, 4 parking spaces)			\$ 75,000.00	
Utility Relocation (Based on anticipated utility impacts and relocations)			\$ 250,000.00	
Total Estimated Cost:			\$ 847,533.00	

USE FOR Franklin-Main: \$ 850,000.00

Appendix D – Level of Service Abbreviations

FBAM – Full Build AM

FBPM – Full Build PM

FBSA – Full Build Saturday

EBLR – Eastbound Left/Right

EBLTR – Eastbound Left/Through/Right

NBL – Northbound Left

NBR – Northbound Right

NBT – Northbound Through

NBLTR – Northbound Left/Through/Right

SBL – Southbound Left

SBT – Southbound Through

SBTR – Southbound Through/Right

SBLTR – Southbound Left/Through/Right

WBL – Westbound Left

WBR – Westbound Right

WBLR – Westbound Left/Right

WBLTR – Westbound Left/Through/Right

Appendix E – Truck Turning Movements



