

Westchester County Streams, Byram River Basin,  
Flood Risk Management Feasibility Study  
Fairfield County, Connecticut and Westchester County,  
New York

Appendix A.10  
Traffic Analysis

# Appendix A10 – Byram River Basin Feasibility

## Study Traffic Impact Study

The Byram River Basin Flood Risk Management Feasibility Study evaluates the removal and replacement of two Route 1 bridges across the Byram River located at the New York-Connecticut State Line– the North Bridge on Hillside Avenue and the South Bridge on West Putnam Avenue. This document represents a feasibility level traffic study to assess construction impacts associated with roadway closures during the bridge replacement work. This study summarizes methodology, analyses, findings, and initial recommendations. Additional analyses and a final traffic plan will be developed and coordinated with applicable local and state agencies during the Preconstruction Engineering Design Phase.

### 1.0 Study Area

Based on our understanding of the project and the surrounding roadway network, the study area was defined to include the following intersections:

- Hillside Avenue/ Byram Traffic Circle East
- Hillside Avenue/Byram Traffic Circle West
- Putnam Avenue/Byram Traffic Circle West
- Putnam Avenue/North Main Street
- West Putnam Avenue/Byram Road/Byram Traffic Circle East

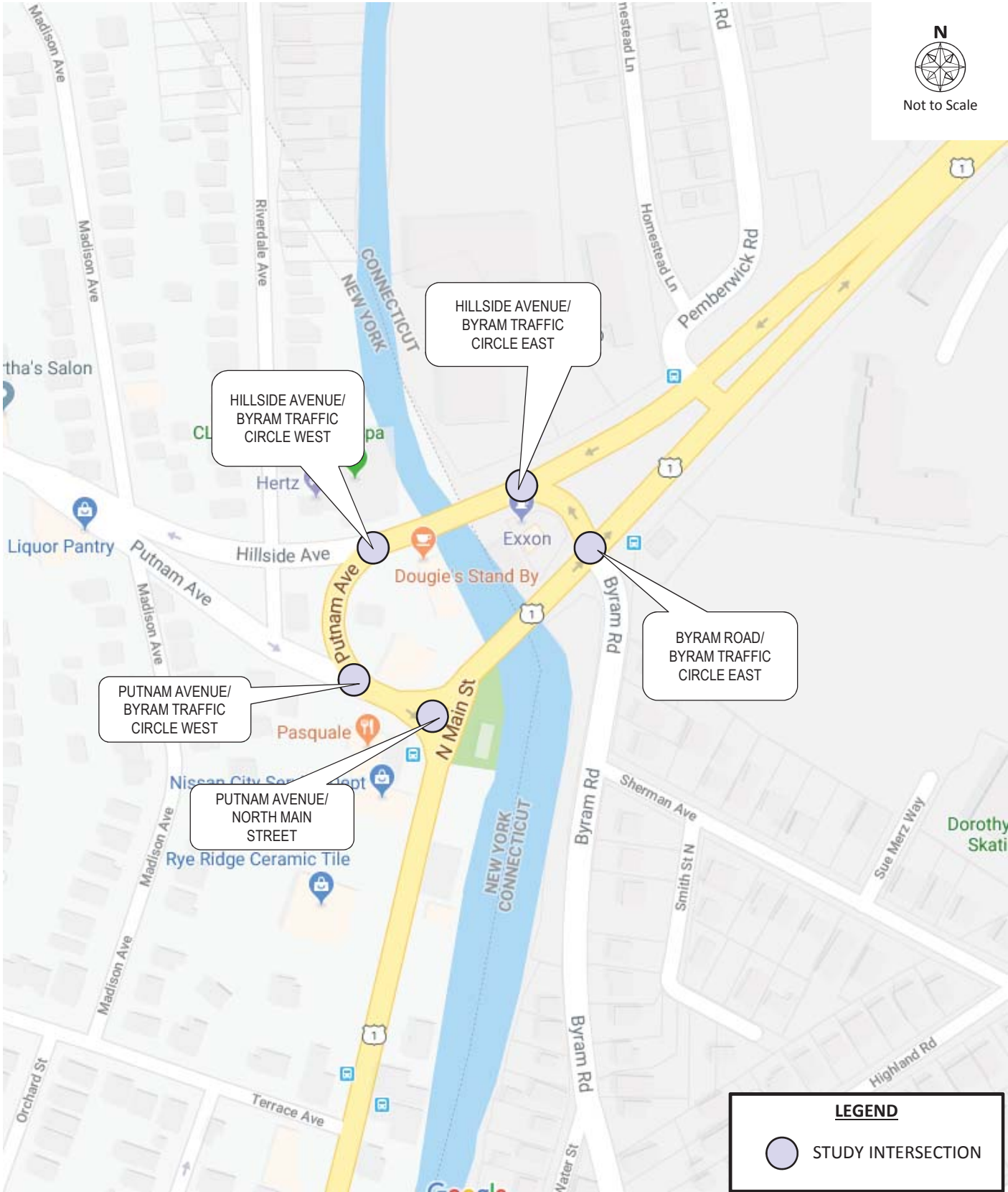
The study area is depicted on **Figure 1**.

### 2.0 Scope of Work

Tasks undertaken in performing this traffic study were as follows:

- Utilize traffic volumes in the Traffic Impact and Access Study for Mixed Use Development on 777 Putnam Avenue, prepared by Frederick P. Clark Associates dated July 2017.
- Conduct capacity analyses, level of service determination, and vehicle queuing analyses as appropriate for five (5) scenarios under existing weekday AM and PM peak hour conditions.
- Based on the traffic analyses, determine any operational deficiencies at the study area intersections under each of the five (5) scenarios.
- Preparation of a Traffic Impact Study summarizing our work, suitable for incorporation into other submittals to the town.

For the purposes of the traffic study, the following options will be investigated:



Scenario	Number of lanes open	
	West Putnam Avenue (Eastbound)	Hillside Avenue (Westbound)
<b>1 – North Bridge Closure</b>	2 (1 EB/1 WB)	0
<b>2 – South Bridge Closure</b>	0	2 (1 EB/1 WB)
<b>3 – Partial Closure of Both Bridges</b>	1 EB	1 WB
<b>4 – Partial Closure of North Bridge</b>	2 (1 EB/1 WB)	1
<b>5 – Partial Closure of South Bridge</b>	1	2 (1 EB/1 WB)

### 3.0 Existing Conditions

The following summarizes the existing roadway characteristics in the vicinity of the project:

#### *Hillside Avenue (U.S. Route 1)*

Hillside Avenue is a two lane westbound only roadway aligned primarily in the east-west direction, serving as the opposite one-way pair roadway to West Putnam Avenue. Hillside Avenue consists of two approximately 12-13 feet wide travel lanes and a shoulder varying in width, but generally approximately 10 feet wide. The posted speed limit is 35 miles per hour.

#### *West Putnam Avenue (U.S. Route 1)*

West Putnam Avenue extends from North Main Street to the east. West Putnam Avenue consists of two eastbound travel lanes and an approximate 30-foot minimum width. Varying width shoulders are provided to the east of Byram Road. The posted speed limit is 35 miles per hour.

#### *Byram Road*

Byram Road is a north-south aligned two way roadway. Byram Road extends from West Putnam Avenue to I-95 to the south. Byram Road consists of one lane in each direction with an approximate 30-foot width. The posted speed limit is 25 miles per hour. Byram Road lies wholly within Greenwich, Connecticut.

#### *Putnam Avenue*

Putnam Avenue is an east-west roadway extending from King Street in the west to North Main Street at the Byram Traffic Circle. In the vicinity of the Byram Traffic Circle, Putnam Avenue consists of two eastbound lanes. The posted speed limit in the vicinity of the project is 30 miles per hour. Putnam Avenue lies wholly within Port Chester, New York.

#### *North Main Street (U.S. Route 1)*

North Main Street is a north-south aligned two way roadway extending northerly from Westchester Avenue to Putnam Avenue/West Putnam Avenue. North Main Street consists of one lane in each direction with an approximate width of 34 feet in the vicinity of the project. The posted speed limit in the vicinity of the project is 30 miles per hour. North Main Street lies wholly within Port Chester, New York.

#### *Byram Traffic Circle*

The Byram Traffic Circle serves to connect the eastbound West Putnam Avenue roadway with the westbound Hillside Avenue roadway. The Circle consists of two one-way connectors between the one-

way pair of roadways. The connection from West Putnam Avenue to Hillside Avenue lies east of the Byram River, opposite Byram Road, additionally allowing direct access from Byram Road to Hillside Avenue. The connection from Hillside Avenue to West Putnam Avenue lies west of the Byram River and intersects Putnam Avenue. For the purposes of this study, the west connector (access from Hillside Avenue to Putnam Avenue) will be referred to as Byram Traffic Circle West and the east connector (access from West Putnam Avenue to Hillside Avenue) will be referred to as Byram Traffic Circle East.

The following summarizes the existing study intersection characteristics:

#### *Byram Road at West Putnam Avenue (U.S. Route 1)*

Byram Road intersects West Putnam Avenue from the south while the Byram Traffic Circle extends from the intersection to Hillside Avenue to the north. The Byram Road stop controlled approach consists of an exclusive through lane to the Byram Traffic Circle and an exclusive right turn lane onto West Putnam Avenue. The uninterrupted West Putnam Avenue approach consists of a shared right turn and through lane and a shared left turn and through lane.

#### *Putnam Avenue at North Main Street (U.S. Route 1)*

Putnam Avenue intersects North Main Street from the west while the northeast leg of the intersection, West Putnam Avenue provides two departure lanes only from the intersection. The Putnam Avenue approach consists of a left turn lane and a channelized uninterrupted right turn lane. The North Main Street approach consists of one uninterrupted through only lane onto West Putnam Avenue.

#### *Putnam Avenue at Byram Traffic Circle West*

The west extent of the Byram Traffic Circle intersects Putnam Avenue from the north to form a three-legged intersection. Putnam Avenue consists of two uninterrupted eastbound only through lanes while the Byram Traffic Circle approach consists of a single stop controlled lane which allows access to the eastbound only flow along Putnam Avenue.

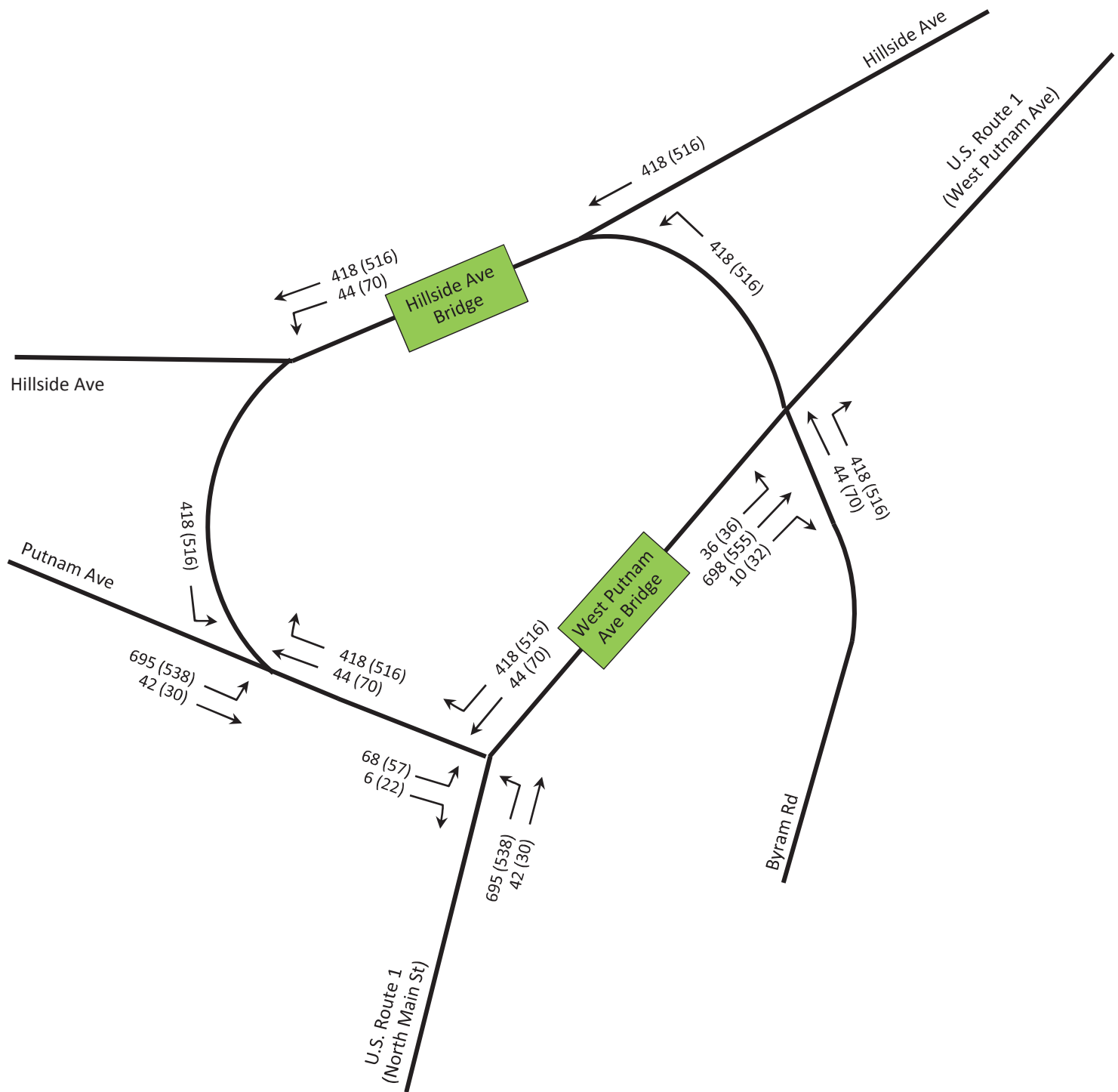
#### *Hillside Avenue at Byram Traffic Circle West*

The west extent of the Byram Traffic Circle diverges from Hillside Avenue to allow access to Putnam Avenue. Hillside Avenue consists of an exclusive through lane and a shared through and left turn lane.

#### *Hillside Avenue at Byram Traffic Circle East*

The east extent of the Byram Traffic Circle intersects Hillside Avenue from the south to form a three-legged yield controlled intersection. The Byram Traffic Circle approach consists of a single yield controlled lane providing access to the two westbound only Hillside Avenue lanes.

The traffic volumes as reported in the Traffic Impact and Access Study for Mixed Use Development on 777 Putnam Avenue, prepared by Frederick P. Clark Associates and dated July 2017, represent the existing conditions traffic volumes and are depicted in **Figure 2**. To be conservative, CDM Smith used the 2019 Build Conditions traffic volumes to incorporate both ambient traffic growth and other area developments.



LEGEND

000 (000)

AM Peak — PM Peak

## 4.0 Construction Scenario Roadway and Traffic Volume Networks

Each construction scenario anticipates temporary traffic control patterns which modify the existing roadway network to facilitate the flow of traffic during construction. The following describes the restrictions to traffic flow throughout the study network relative to each construction scenario.

### ***Scenario 1 – North Bridge Closure***

Under this scenario, the North Bridge, along Hillside Avenue will be closed to traffic. West Putnam Avenue and Putnam Avenue will be converted to two-way roadways under the temporary traffic conditions, providing one eastbound and one westbound lane.

Due to the closure of westbound lanes along Hillside Avenue, the Byram Traffic Circle East and West extents are anticipated to be unused. The Byram Traffic Circle West connector may provide local access only to the service station located adjacent to it.

Byram Road will provide only left turn and right turn access at West Putnam Avenue.

The associated traffic volume network depicting anticipated traffic volumes during Scenario 1 are depicted in **Figure 3**.

### ***Scenario 2 – South Bridge Closure***

Under this scenario, the South Bridge, along West Putnam Avenue will be closed to traffic. Hillside Avenue and Putnam Avenue will be converted to two-way roadways under the temporary traffic conditions, providing one eastbound and one westbound lane.

The North Main Street approach to Putnam Avenue will only provide left turn access onto Putnam Avenue.

The Byram Traffic Circle East and West extents are anticipated to be operational under this scenario. Furthermore, the Byram Traffic Circle West connector may allow two-way traffic to facilitate access for North Main Street traffic to the temporary eastbound Hillside Avenue lane.

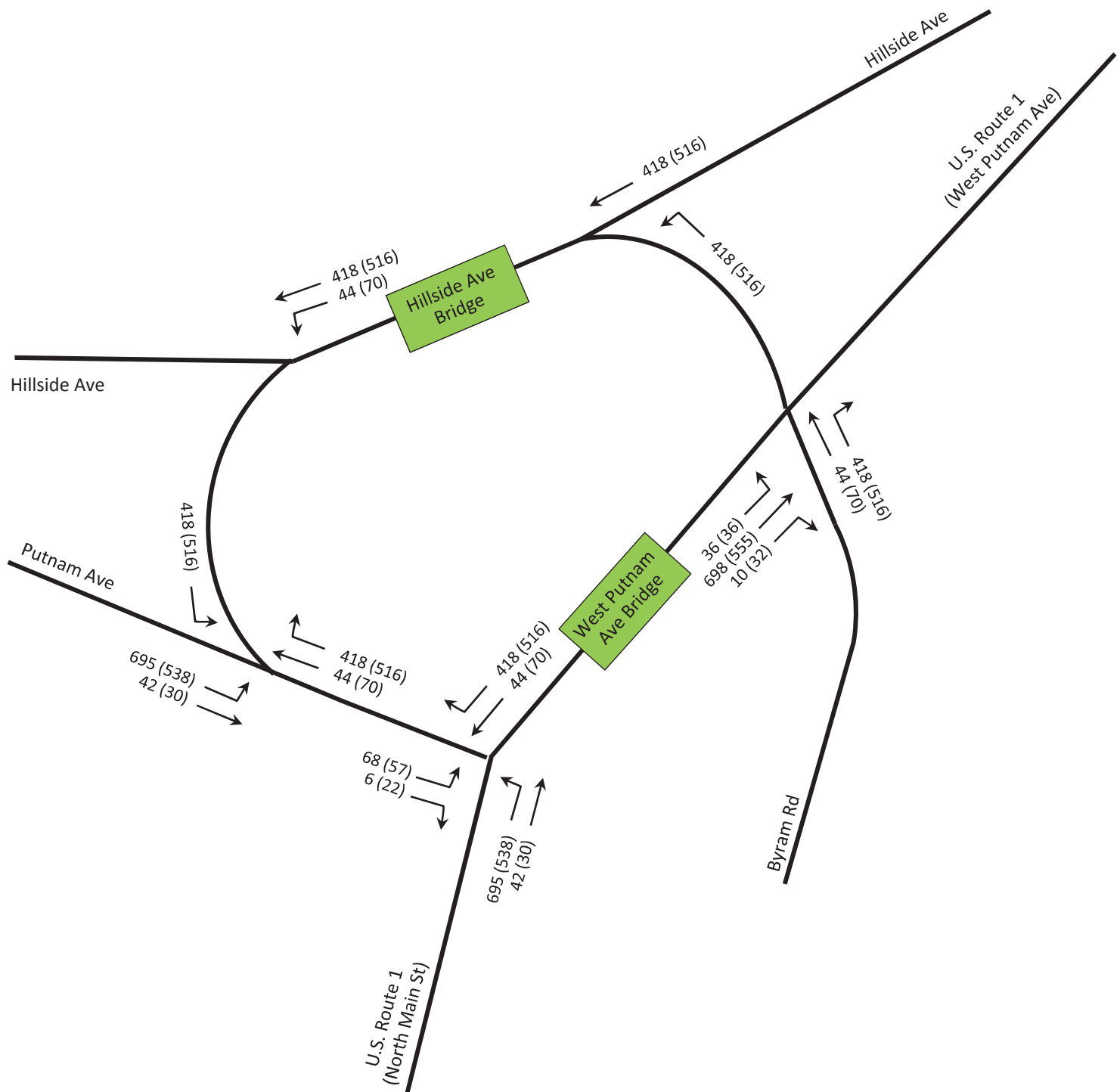
The associated traffic volume network depicting anticipated traffic volumes during Scenario 2 are depicted in **Figure 4**.

### ***Scenario 3 – Partial Closure of Both Bridges***

Under this scenario, the South Bridge and North Bridge will be restricted to one lane flow, but will retain the directionality of traffic currently provided today. Hillside Avenue will provide one lane westbound while West Putnam Avenue will provide one lane eastbound.

No other temporary changes to the study roadways or intersections are introduced.

The associated traffic volume network depicting anticipated traffic volumes during Scenario 3 are depicted in **Figure 5**.



LEGEND

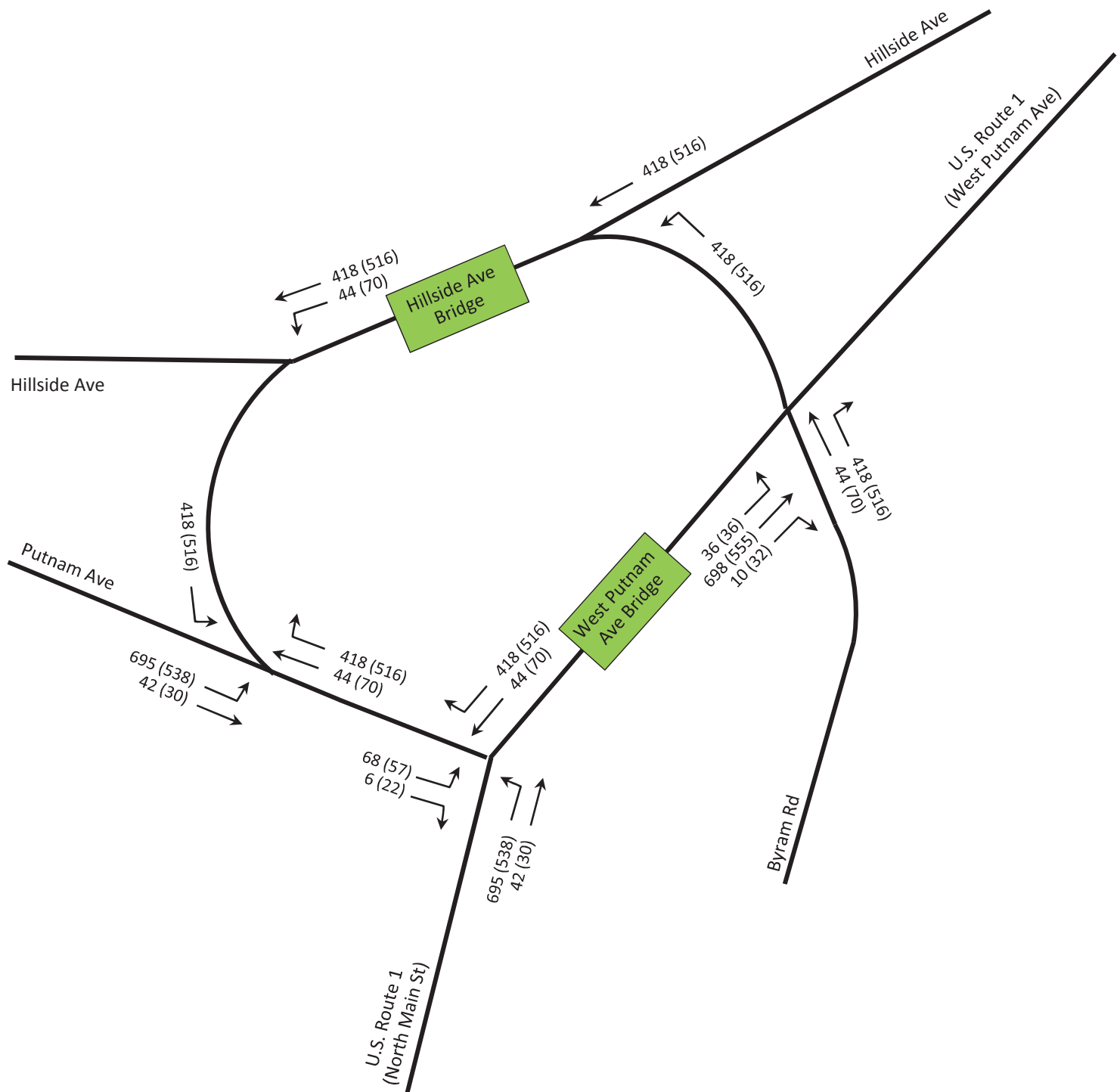
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AM Peak — PM Peak

SCENARIO 1 – NORTH BRIDGE CLOSURE  
PEAK HOUR TRAFFIC VOLUMES

FIGURE 3



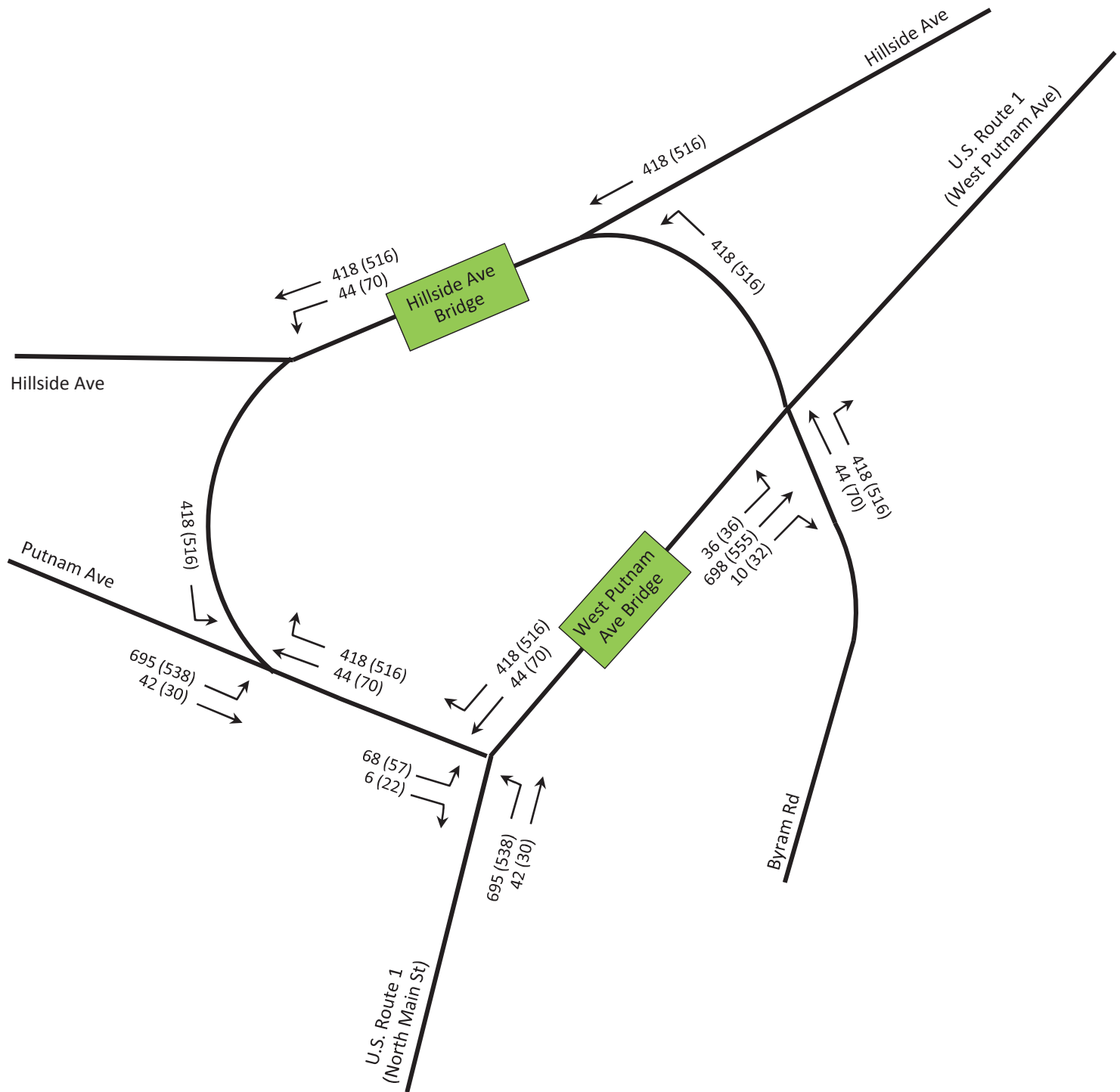


LEGEND

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AM Peak PM Peak

SCENARIO 2 – SOUTH BRIDGE CLOSURE  
PEAK HOUR TRAFFIC VOLUMES



LEGEND

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AM Peak — PM Peak

SCENARIO 3 – PARTIAL CLOSURE OF BOTH BRIDGES  
PEAK HOUR TRAFFIC VOLUMES

***Scenario 4 – Partial Closure of North Bridge***

Under this scenario, the North Bridge will be restricted to one lane flow. Hillside Avenue will retain the westbound directionality of traffic currently provided today. West Putnam Avenue will provide one lane eastbound and one lane westbound.

The eastbound West Putnam Avenue lane could be signed to provide access to North Main Street to reduce left turning vehicles onto Byram Road while opposing uninterrupted eastbound traffic.

Vehicles destined for Byram Road from points east of the study area could utilize the Byram Traffic Circle West connector to Putnam Avenue, turn onto West Putnam Avenue and turn right into Byram Road.

No other temporary changes to the study roadways or intersections are introduced.

The associated traffic volume network depicting anticipated traffic volumes during Scenario 4 are depicted in **Figure 6**.

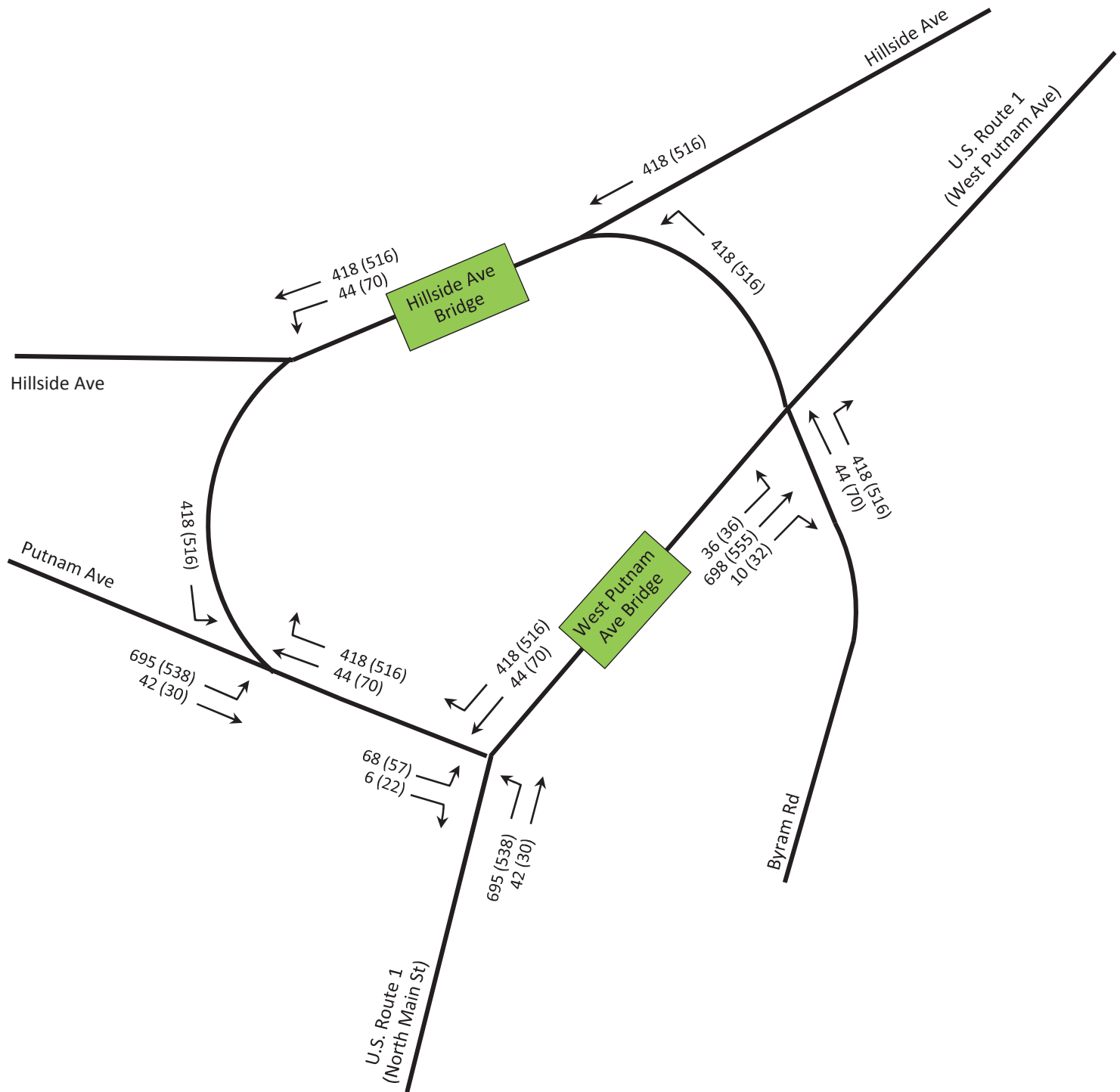
***Scenario 5 – Partial Closure of South Bridge***

Under this scenario, the South Bridge will be restricted to one lane flow. West Putnam Avenue will retain the eastbound directionality of traffic currently provided today. Hillside Avenue will provide one lane eastbound and one lane westbound.

This configuration will allow vehicles originating west of the study area and destined for points east of the study area to bypass the intersections of Putnam Avenue at North Main Street and West Putnam Avenue at Byram Road by travelling directly through eastbound Hillside Avenue.

No other temporary changes to the study roadways or intersections are introduced.

The associated traffic volume network depicting anticipated traffic volumes during Scenario 5 are depicted in **Figure 7**.

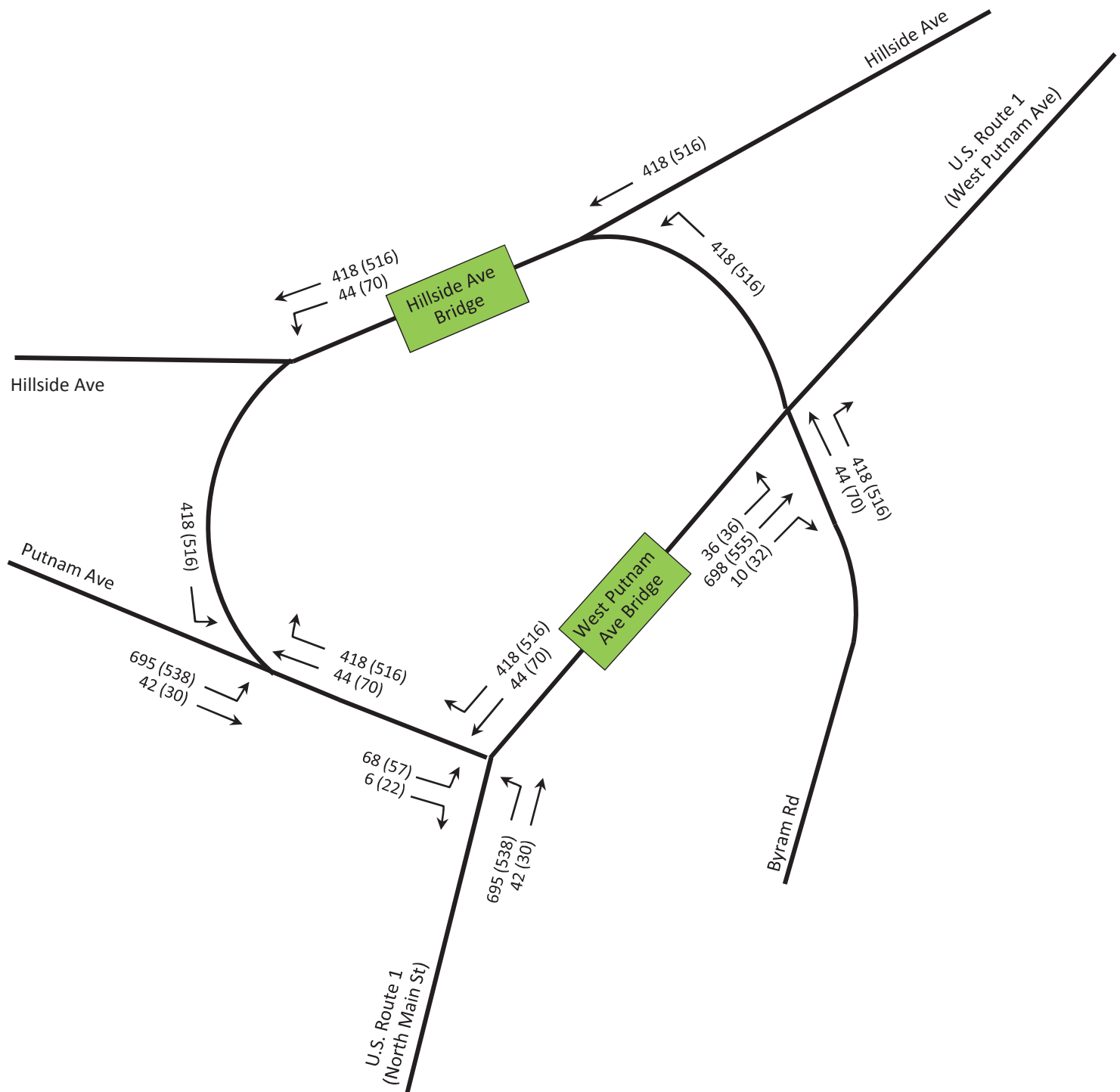


LEGEND

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AM Peak PM Peak

SCENARIO 4 – PARTIAL CLOSURE OF NORTH BRIDGE  
PEAK HOUR TRAFFIC VOLUMES



LEGEND

000 (000)  
AM Peak — PM Peak

SCENARIO 5 – PARTIAL CLOSURE OF SOUTH BRIDGE  
PEAK HOUR TRAFFIC VOLUMES

## 5.0 Traffic Operations Analysis

### *Intersection Performance Measures*

The traffic operations analysis was conducted in accordance with current Highway Capacity Manual (HCM) 2010 standards. The Existing Conditions and each Construction Scenario were modeled under Weekday AM and PM Peak hour conditions in Synchro 9 traffic analysis software.

Critical performance measures evaluated for study area intersections using Synchro 9 include:

- Level of Service (Definition Below)
- Delay (in seconds)
- 95<sup>th</sup> Percentile Queue (in feet)

Level of Service (LOS) analysis provides a measurement of the delay experienced at an intersection as a result of traffic operations at that intersection. In general, there are six levels of service; Level of Service A to Level of Service F.

The highest, Level of Service A, describes a condition of free flow, with low volumes and high speeds. Level of Service B represents a stable traffic flow with operating speeds beginning to be restricted somewhat by traffic conditions. Level of Service C, which is normally utilized for design purposes, describes a stable condition of traffic operation. It entails moderately restricted movements due to higher traffic volumes, but traffic conditions are not objectionable to motorists. Level of Service D reflects a condition of more restrictive movements for motorists and influence of congestion becomes more noticeable. Level of Service E is representative of the actual capacity of the roadway or intersection and involves delay to all motorists due to congestion. The lowest, Level of Service F, is described as force flow and is characterized by volumes greater than the theoretical roadway capacity. Complete congestion occurs, and in extreme cases, the volume passing a given point drops to zero. This is considered an unacceptable traffic operating condition.

95<sup>th</sup> Percentile Queue refers to the vehicle queue formed under traffic volumes which will only be exceeded 5% of the time.

**Table 1** below defines the performance parameter ratings for un-signalized intersections.

**Table 1. LOS Criteria**

LEVEL OF SERVICE	UN-SIGNALIZED INTERSECTIONS
	CONTROL DELAY PER VEHICLE (SECONDS)
<b>A</b>	<b>≤10</b>
<b>B</b>	<b>&gt;10 AND ≤15</b>
<b>C</b>	<b>&gt;15 AND ≤25</b>
<b>D</b>	<b>&gt;25 AND ≤35</b>
<b>E</b>	<b>&gt;35 AND ≤50</b>
<b>F</b>	<b>&gt;50</b>

SOURCE: 2010 HIGHWAY CAPACITY MANUAL, TRANSPORTATION RESEARCH BOARD

### Capacity Analysis Results

The following tables, **Tables 2 and 3**, detail the estimated traffic operations under Existing Condition and each Construction Scenario.

As shown in **Table 2**, there are several intersection approaches which are estimated to operate at unacceptable Levels of Service under Existing Conditions. These approaches and corresponding lanes are listed below:

Location:	Hillside Avenue at Byram Traffic Circle East
Approach/Lane:	Northbound Byram Traffic Circle East
Peak Hour:	PM Peak

Location:	Putnam Avenue at North Main Street
Approach/Lane:	Eastbound Putnam Avenue Left Turn
Peak Hour:	AM & PM Peak

Location:	West Putnam Avenue at Byram Road
Approach/Lane:	Northbound Byram Road Through Lane Northbound Byram Road Right Turn Lane
Peak Hour:	AM & PM Peak

Table 2. Capacity Analysis – Existing Conditions, Scenario 1, and Scenario 2

Intersection	Lane Group	Existing Conditions						Scenario 1				Scenario 2			
		Weekday A.M. Peak		Weekday P.M. Peak		Weekday A.M. Peak		Weekday P.M. Peak		Weekday A.M. Peak		Weekday P.M. Peak		Weekday A.M. Peak	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Hillside Avenue / Byram Traffic Circle East	WB Hillside Avenue	0.0	A	0.0	A	-	-	-	-	0.0	A	0.0	A	0.0	A
	EB Hillside Avenue	-	-	-	-	-	-	-	-	-	-	0.0	A	0.0	A
	NB Byram Road	14.9	B	60.4	F	-	-	-	-	-	-	711.1	F	UNK*	F
Hillside Avenue / Byram Traffic Circle West	WB Hillside Avenue	-	-	-	-	-	-	-	-	-	-	0.0	A	0.0	A
	WBL Hillside Avenue	-	-	-	-	-	-	-	-	-	-	3.5	A	7.7	A
	EB Hillside Avenue	-	-	-	-	-	-	-	-	-	-	0.0	A	0.0	A
	NB Byram Circle	-	-	-	-	-	-	-	-	-	-	70.2	F	27.2	D
Putnam Avenue / Byram Traffic Circle West	EB Putnam Avenue	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
	SB Byram Circle	19.5	C	24.7	C	0.0	A	0.0	A	0.0	A	0.0	A	17.3	C
	NB Main Street	-	-	-	-	-	-	-	-	-	-	12.4	B	0.0	A
Putnam Avenue / North Main Street	EBR Putnam Avenue	9.3	A	10.2	B	-	-	-	-	-	-	-	-	-	-
	EBL Putnam Avenue	268.2	F	130.3	F	UNK*	F	UNK*	F	-	-	-	-	-	-
	NB Main Street	0.0	A	0.0	A	3.2	A	9.9	A	-	-	-	-	-	-
	SB Main Street	-	-	-	-	0.0	A	0.0	A	-	-	-	-	-	-
West Putnam Avenue / Byram Road	EB Putnam Avenue	0.4	A	1.1	A	0.0	A	0.0	A	0.0	A	8.2	A	8.0	A
	WB Putnam Avenue	-	-	-	-	8.9	A	6.9	A	-	-	-	-	-	-
	NB Byram Road	423.9	F	468.2	F	-	-	-	-	-	-	-	-	-	-
	NBR Byram Road	423.9	F	468.2	F	UNK	F	UNK	F	376.6	F	285.3	F	285.3	F
	NBL Byram Road	-	-	-	-	UNK	F	UNK	F	376.6	F	285.3	F	285.3	F

\* Under Scenario 1, this approach consists of one shared right and left turn lane.

UNK: Indicates capacity is exceeded and delay is greater than typical computational values.



Table 3. Capacity Analysis – Scenario 3, Scenario 4, and Scenario 5

Intersection	Lane Group	Scenario 3						Scenario 4						Scenario 5					
		Weekday A.M. Peak			Weekday P.M. Peak			Weekday A.M. Peak			Weekday P.M. Peak			Weekday A.M. Peak			Weekday P.M. Peak		
		Delay	LOS		Delay	LOS		Delay	LOS		Delay	LOS		Delay	LOS		Delay	LOS	
Hillside Avenue / Byram Traffic Circle East	WB Hillside Avenue	0.0	A		0.0	A		0.0	A		0.0	A		0.0	A		0.0	A	
	EB Hillside Avenue	-	-		-	-		-	-		-	-		0.0	A		0.0	A	
	NB Byram Road	14.9	B		60.4	F		18.6	C		186.2	F		138.9	F		533.8	F	
Hillside Avenue / Byram Traffic Circle West	WB Hillside Avenue	-	-		-	-		-	-		-	-		0.0	A		0.0	A	
	WBL Hillside Avenue	-	-		-	-		-	-		-	-		9.4	A		9.6	A	
	EB Hillside Avenue	-	-		-	-		-	-		-	-		0.0	A		0.0	A	
Putnam Avenue / Byram Traffic Circle West	EB Putnam Avenue	0.0	A		0.0	A		0.0	A		0.0	A		0.0	A		0.0	A	
	SB Byram Circle	19.5	C		24.7	C		16.5	C		16.5	C		13.1	B		15.3	C	
	EBR Putnam Avenue	9.3	A		10.2	B		9.5	A		10.6	B		9.3	A		10.2	B	
Putnam Avenue / North Main Street	EBL Putnam Avenue	268.2	F		130.3	F		436.5	F		306.8	F		35.2	E		24.3	C	
	NB Main Street	0.0	A		0.0	A		0.0	A		0.0	A		0.0	A		0.0	A	
	SB Main Street	-	-		-	-		0.0	A		0.0	A		-	-		-	-	
West Putnam Avenue / Byram Road	EB Putnam Avenue	1.1	A		1.8	A		0.0	A		0.0	A		0.7	A		1.6	A	
	NB Byram Road	847.1	F		537.2	F		N/A	F		648.2	F		106.1	F		221.5	F	
	NBR Byram Road	847.1	F		537.2	F		N/A	F		648.2	F		106.1	F		221.5	F	

As shown in **Table 2**, under **Scenario 1**, the intersection approaches of Putnam Avenue at North Main Street and Byram Road at West Putnam Avenue are anticipated to exceed capacity. With two-way one lane travel along West Putnam Avenue, the Byram Road approach to the intersection is not anticipated to process the vehicle demand within the AM and PM peak hours. In addition, the Putnam Avenue approach will exceed capacity due to the existing two lane approach being consolidated to one lane along with additional delay due to waiting for westbound West Putnam Avenue traffic turning onto North Main Street southbound.

As shown in **Table 2**, under **Scenario 2**, the northbound Byram Traffic Circle East connector approach to Hillside Avenue is anticipated to exceed capacity during the PM Peak Hour and operate at unacceptable Level of Service F during the AM Peak Hour due to the two-way one lane travel along Hillside Avenue. In addition, the northbound Byram Road approach to West Putnam Avenue is forecast to operate at unacceptable Level of Service F due to the potential access to southbound Byram Road from westbound West Putnam Avenue. However, the delay anticipated along this approach is less than what is estimated under current conditions due to the absence of conflicting vehicles along the eastbound West Putnam Avenue approach.

As shown in **Table 3**, there are several intersection approaches which are anticipated to operate at unacceptable Levels of Service during Construction **Scenario 3**. These approaches and corresponding lanes are listed below:

Location:	Hillside Avenue at Byram Traffic Circle East
Approach/Lane:	Northbound Byram Traffic Circle East
Peak Hour:	PM Peak
Location:	Putnam Avenue at North Main Street
Approach/Lane:	Eastbound Putnam Avenue Left Turn
Peak Hour:	AM & PM Peak
Location:	West Putnam Avenue at Byram Road
Approach/Lane:	Northbound Byram Road Through Lane Northbound Byram Road Right Turn Lane
Peak Hour:	AM & PM Peak

It should be noted that the northbound Byram Traffic Circle East and Eastbound Putnam Avenue Left Turn approaches are not anticipated to be impacted by the temporary traffic control during construction. The poor operations at these approaches are due to current traffic conditions. The Byram Road approach lanes, however are anticipated to experience greater delay due to the reduction of travel lanes along West Putnam Avenue. By reducing the travel lanes from two to one, West Putnam Avenue traffic is confined to one lane creating fewer vehicle gaps for Byram Road traffic to negotiate.

As shown in **Table 3**, the same intersection approaches are anticipated to operate at unacceptable Levels of Service during Construction **Scenario 4** as noted under Scenario 3. The potential temporary traffic control conditions are anticipated to exacerbate the higher vehicle delay along these approaches. The reduction in travel lanes along Hillside Avenue and West Putnam Avenue and anticipated to increase delay for vehicles attempting to enter into those roadways.

Relative to Construction Scenario 5, as shown in **Table 3**, there are several intersection approaches which are anticipated to operate at unacceptable Levels of Service. The intersection approaches anticipated to experience unacceptable delay are as follows:

Location:	Hillside Avenue at Byram Traffic Circle East
Approach/Lane:	Northbound Byram Traffic Circle East
Peak Hour:	AM & PM Peak

Location:	Putnam Avenue at North Main Street
Approach/Lane:	Eastbound Putnam Avenue Left Turn
Peak Hour:	AM Peak

Location:	West Putnam Avenue at Byram Road
Approach/Lane:	Northbound Byram Road Through Lane Northbound Byram Road Right Turn Lane
Peak Hour:	AM & PM Peak

The potential temporary traffic control conditions under Scenario 5, however, are anticipated to improve operations for several intersection approaches compared to Existing Conditions. Despite operating at unacceptable Levels of Service, the following intersection approaches may experience less delay under Scenario 5 conditions:

Location:	Putnam Avenue at North Main Street
Approach/Lane:	Eastbound Putnam Avenue Left Turn
Peak Hour:	AM Peak

Location:	West Putnam Avenue at Byram Road
Approach/Lane:	Northbound Byram Road Through Lane Northbound Byram Road Right Turn Lane
Peak Hour:	AM & PM Peak

The eastbound Putnam Avenue approach to North Main Street is anticipated to improve from a Level of Service F during the PM Peak under Existing Conditions to a Level of Service C under Scenario 5 due to a large portion of eastbound traffic being diverted from Putnam Avenue to Hillside Avenue.

### *Queue Analysis Results*

The following tables, **Tables 4 and 5**, detail the estimated queue conditions under Existing Condition and each Construction Scenario.

**Table 4: Queue Lengths – Existing Conditions, Scenario 1, and Scenario 2**

Intersection	Lane Group	Available Storage (ft)	Existing Conditions		Scenario 1		Scenario 2	
			Weekday A.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday P.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday A.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday P.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday A.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday P.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)
Hillside Avenue / Byram Traffic Circle East	NB Byram Circle	110	51	274	-	-	639	UNK
Hillside Avenue / Byram Traffic Circle West	WBL Hillside Avenue	250	-	-	-	-	20	38
	NBR Byram Circle	175	-	-	-	-	245	112
Putnam Avenue / Byram Traffic Circle West	SB Byram Circle	175	88	155	-	-	25	63
Putnam Avenue / North Main Street	EBR Putnam Avenue	150	22	43	UNK*	UNK*	-	-
	EBL Putnam Avenue	150	1159	625	UNK*	UNK*	-	-
West Putnam Avenue / Byram Road	NB Byram Road	300	1152	980	-	-	-	-
	NBR Byram Road	50	1152	980	UNK	UNK	1096	849
	NBL Byram Road	300	-	-	UNK	UNK	1096	849

\* Under Scenario 1, this approach consists of one shared right and left turn lane.

UNK: Indicates capacity is exceeded and queue length is greater than typical computational values.

BOLD – Indicates queue length exceeds available storage

**Table 5: Queue Lengths – Scenario 3, Scenario 4, and Scenario 5**

Intersection	Lane Group	Available Storage (ft)	Scenario 3		Scenario 4		Scenario 5	
			Weekday A.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday P.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday A.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday P.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday A.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)	Weekday P.M. Peak 95 <sup>th</sup> Percentile Queue Length (ft)
Hillside Avenue / Byram Traffic Circle East	NB Byram Circle	110	51	274	58	387	292	522
Hillside Avenue / Byram Traffic Circle West	WBL Hillside Avenue	250	-	-	-	-	29	42
Putnam Avenue / Byram Traffic Circle West	SB Byram Circle	175	88	155	57	71	52	91
Putnam Avenue / North Main Street	EBR Putnam Avenue	150	22	43	8	21	22	43
	EBL Putnam Avenue	150	1159	625	1477	985	223	138
West Putnam Avenue / Byram Road	NB Byram Road	300	1506	1037	N/A	1114	561	687
	NBR Byram Road	50	1506	1037	N/A	1114	561	687

BOLD – Indicates queue length exceeds available storage

As shown in **Table 4**, there are several intersection approach queue lengths which are estimated to exceed the available storage under Existing Conditions. These approaches and corresponding lanes are listed below:

Location: Hillside Avenue at Byram Traffic Circle East  
 Approach/Lane: Northbound Byram Traffic Circle East  
 Peak Hour: PM Peak

Location: Putnam Avenue at North Main Street  
 Approach/Lane: Eastbound Putnam Avenue Left Turn  
 Peak Hour: AM & PM Peak

Location: West Putnam Avenue at Byram Road  
 Approach/Lane: Northbound Byram Road Through Lane  
 Northbound Byram Road Right Turn Lane  
 Peak Hour: AM & PM Peak

These approaches correspond to those which experience longer delays and operate at unacceptable Levels of Service.

As shown in **Table 4**, under Scenario 1, the intersection approaches of Putnam Avenue at North Main Street and Byram Road at West Putnam Avenue are anticipated to generate queue lengths which exceed the available storage. As these approaches exceed capacity, the queue lengths are indeterminable.

As shown in **Table 4**, under Scenario 2, the queue along the northbound Byram Traffic Circle East connector approach to Hillside Avenue is anticipated to exceed the available storage during all Peak Hours due to the two-way one lane travel along Hillside Avenue. In addition, the vehicle queue along northbound Byram Road approach to West Putnam Avenue is forecast to exceed the available storage due to the potential access to southbound Byram Road from westbound West Putnam Avenue. However, the queue length anticipated along this approach is less than what is estimated under current conditions due to the absence of conflicting vehicles along the eastbound West Putnam Avenue approach.

As shown in **Table 5**, the intersection approach queue lengths which are estimated to exceed available storage under Existing Conditions are anticipated to exceed available storage under Construction Scenario 3, also.

Again, the northbound Byram Traffic Circle East and Eastbound Putnam Avenue Left Turn approaches are not anticipated to be impacted by the temporary traffic control during construction. The longer vehicle queues at these approaches are due to current traffic conditions. The Byram Road approach lanes, however are anticipated to experience an increase in vehicle queues due to the reduction of travel lanes along West Putnam Avenue. By reducing the travel lanes from two to one, West Putnam Avenue traffic is confined to one lane creating fewer vehicle gaps for Byram Road traffic to negotiate.

As shown in **Table 5**, the vehicle queue lengths for those approaches which exceed available storage under Scenario 3 are anticipated to increase further during Construction Scenario 4. The reduction in

travel lanes along Hillside Avenue and West Putnam Avenue and anticipated to increase delay for vehicles attempting to enter into those roadways.

Relative to Construction Scenario 5, as shown in **Table 5**, the intersection approaches anticipated to generate vehicle queue lengths which exceed available storage include:

Location:	Hillside Avenue at Byram Traffic Circle East
Approach/Lane:	Northbound Byram Traffic Circle East
Peak Hour:	AM & PM Peak

Location:	Putnam Avenue at North Main Street
Approach/Lane:	Eastbound Putnam Avenue Left Turn
Peak Hour:	AM Peak

Location:	West Putnam Avenue at Byram Road
Approach/Lane:	Northbound Byram Road Through Lane Northbound Byram Road Right Turn Lane
Peak Hour:	AM & PM Peak

The potential temporary traffic control conditions under Scenario 5, however, are anticipated to improve operations for several intersection approaches compared to Existing Conditions. Despite generating vehicle queue lengths which exceed available storage, the following intersection approaches may experience reduced queue lengths under Scenario 5 conditions:

Location:	Putnam Avenue at North Main Street
Approach/Lane:	Eastbound Putnam Avenue Left Turn
Peak Hour:	AM Peak

Location:	West Putnam Avenue at Byram Road
Approach/Lane:	Northbound Byram Road Through Lane Northbound Byram Road Right Turn Lane
Peak Hour:	AM & PM Peak

### Conclusions and Future Considerations

The proposed replacement of the Byram River bridges will require a thoroughly assessed plan for temporary traffic control during construction. CDM Smith has evaluated the existing conditions of the study area along with five (5) potential options for temporary traffic control to assess the impacts of roadway closures or modifications during construction.

- Scenario 1 – North Bridge Closure
- Scenario 2 – South Bridge Closure
- Scenario 3 – Partial Closure of Both Bridges
- Scenario 4 – Partial Closure of North Bridge
- Scenario 5 – Partial Closure of South Bridge

As noted under the Traffic Operations Analysis section, the study area is estimated to currently operate with operational deficiencies in terms of vehicle delay and vehicle queuing at several locations:

- Northbound Byram Traffic Circle East approach to Hillside Avenue
- Eastbound Putnam Avenue Left Turn approach to North Main Street
- Byram Road approach to West Putnam Avenue

These approaches represent critical components to the functionality of the roadway infrastructure surrounding the Byram River bridges. Byram Road serves as the main access from I-95 Exit 2 to Route 1 northbound and southbound as well as Hillside Avenue. The Byram Traffic Circle East connector serves as the main access from I-95 Exit 2 to westbound Hillside Avenue and Route 1 southbound. Putnam Avenue provides eastbound access to Route 1 southbound, Route 1 northbound as well as I-95 Exit 2 via Byram Road.

The analysis findings of Scenario 1 indicate that Hillside Avenue and the north bridge provide a critical means of access through the study area. The potential closure of the north bridge is anticipated to result in the surrounding study intersections exceeding their operating capacity and being unable to serve the resulting vehicle demand due to the redistribution of traffic. Additional analysis of potential improvements to accommodate the traffic would be necessary.

The analysis findings of Scenario 2 indicate that study intersections may accommodate the potential closure of the south bridge with the exception of operational deficiencies along the Byram Traffic Circle East connector. Additional analysis of potential improvements to accommodate the traffic along this segment to better facilitate traffic during construction would be beneficial.

The analysis findings of Scenario 3 indicate that study intersections may accommodate the potential closure of the one lane along each bridge with the exception of the northbound Byram Road approach to West Putnam Avenue which would be anticipated to experience operational deficiencies due to increased difficulty crossing or merging with West Putnam Avenue traffic restricted to one lane. Additional analysis of potential improvements to accommodate the traffic along this segment to better facilitate traffic during construction would be beneficial.

The analysis findings of Scenario 4 indicate that construction activities would exacerbate operational deficiencies at study intersections already deficient under Existing Conditions. Again, additional analysis of potential improvements to accommodate the traffic along this segment to better facilitate traffic during construction would be beneficial.

The analysis findings of Scenario 5 indicate that study intersections may accommodate the construction activities with the exception of operational deficiencies along the Byram Traffic Circle East connector. The forecasted traffic operations at many intersections, in fact, improve compared to Existing Conditions. Additional analysis of potential improvements to accommodate the traffic along the Byram Traffic Circle East connector to better facilitate traffic during construction would be beneficial.

In general, potential improvements during construction that could be considered to mitigate the exacerbation of operational deficiencies include:

- Additional larger scale detours
- Temporary intersection widening to provide auxiliary lanes
- Temporary intersection traffic signal control

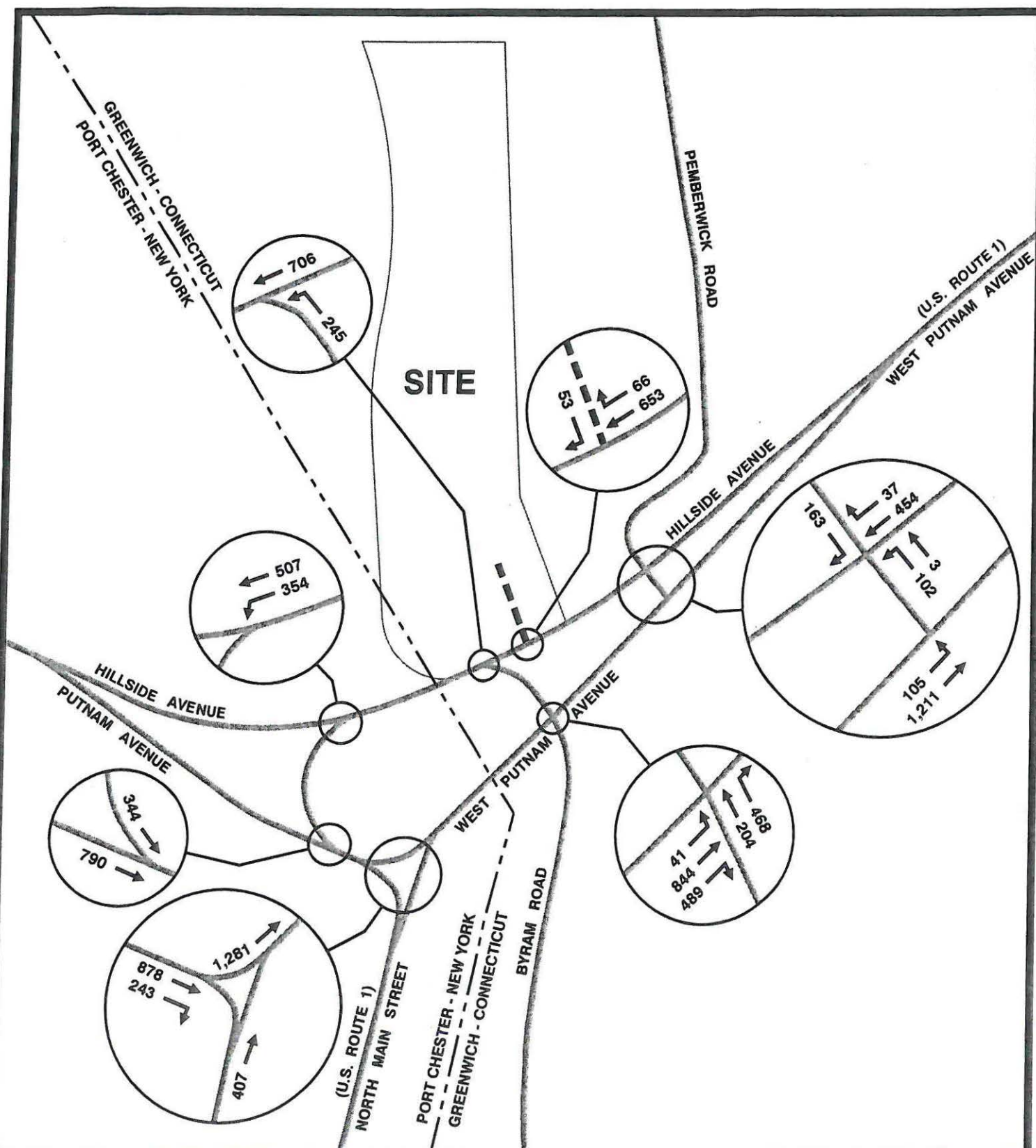
## Attachments:

- Attachment A - 2019 Build Conditions traffic volumes from Traffic Impact and Access Study for Mixed Use Development on 777 Putnam Avenue, prepared by Frederick P. Clark Associates and dated July 2017
- Attachment B - Synchro Analysis Reports
- B1. Existing Conditions
  - B2. Construction Scenario 1
  - B3. Construction Scenario 2
  - B4. Construction Scenario 3
  - B5. Construction Scenario 4
  - B6. Construction Scenario 5



## Attachments:

Attachment A - 2019 Build Conditions traffic volumes from Traffic Impact and Access Study for Mixed Use Development on 777 Putnam Avenue, prepared by Frederick P. Clark Associates and dated July 2017



Note: The 2019 Build Traffic Volumes include the 2019 No-Build Traffic Volumes and the Site Traffic Generation.

**LEGEND**

- — — — — SITE ACCESS DRIVE
- - - - - TOWN/STATE LINE

**2019 BUILD TRAFFIC VOLUMES  
WEEKDAY MORNING PEAK HOUR**

**MIXED-USE DEVELOPMENT  
777 West Putnam Avenue  
Greenwich, Connecticut**

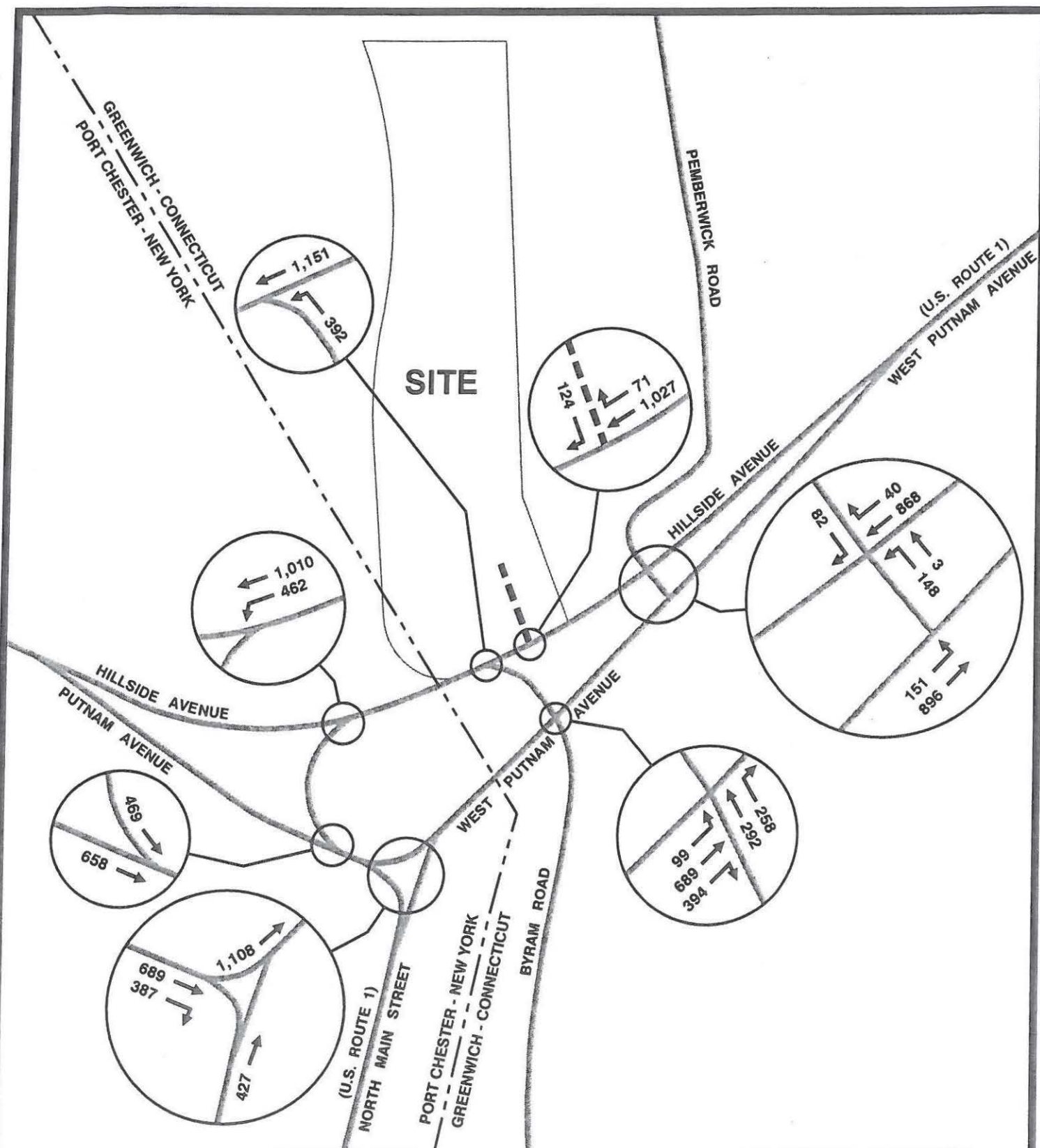


FREDERICK P. CLARK ASSOCIATES, INC.  
PLANNING, TRANSPORTATION, ENVIRONMENT AND DEVELOPMENT  
RYE, NEW YORK FAIRFIELD, CONNECTICUT

**19**

Not to Scale

Date: 4/27/17



**Note: The 2019 Build Traffic Volumes include the 2019 No-Build Traffic Volumes and the Site Traffic Generation.**

**2019 BUILD TRAFFIC VOLUMES  
WEEKDAY AFTERNOON PEAK HOUR**

**FREDERICK P. CLARK ASSOCIATES, INC.**  
PLANNING, TRANSPORTATION, ENVIRONMENT AND DEVELOPMENT  
RYE, NEW YORK FAIRFIELD, CONNECTICUT

**Not to Scale**







## Attachments:

Attachment B -      Synchro Analysis Reports  
                             B1. Existing Conditions

# HCM Unsignalized Intersection Capacity Analysis

## 3: HILLSIDE AVE.

Existing Conditions  
AM Peak








						
Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations				↑↑	↑	
Traffic Volume (veh/h)	0	0	0	644	238	0
Future Volume (Veh/h)	0	0	0	644	238	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	700	259	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		350	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		350	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		58	100
cM capacity (veh/h)			1622		621	1084
Direction, Lane #	WB 1	WB 2	NW 1			
Volume Total	350	350	259			
Volume Left	0	0	259			
Volume Right	0	0	0			
cSH	1700	1700	621			
Volume to Capacity	0.21	0.21	0.42			
Queue Length 95th (ft)	0	0	51			
Control Delay (s)	0.0	0.0	14.9			
Lane LOS			B			
Approach Delay (s)	0.0		14.9			
Approach LOS			B			
Intersection Summary						
Average Delay			4.0			
Intersection Capacity Utilization			37.7%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Existing Conditions

AM Peak

						
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	0	0	302	492	0	0
Future Volume (Veh/h)	0	0	302	492	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	0	0	321	523	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		904	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		904	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			80		100	100
cM capacity (veh/h)			1622		222	1084
Direction, Lane #	WB 1	WB 2				
Volume Total	495	349				
Volume Left	321	0				
Volume Right	0	0				
cSH	1622	1700				
Volume to Capacity	0.20	0.21				
Queue Length 95th (ft)	18	0				
Control Delay (s)	5.6	0.0				
Lane LOS	A					
Approach Delay (s)	3.3					
Approach LOS						
Intersection Summary						
Average Delay		3.3				
Intersection Capacity Utilization		50.4%		ICU Level of Service		A
Analysis Period (min)		15				



# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Existing Conditions  
AM Peak












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↱	
Traffic Volume (veh/h)	0	773	0	0	293	0
Future Volume (Veh/h)	0	773	0	0	293	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	840	0	0	318	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0				420	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				420	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				43	100
cM capacity (veh/h)	1622				561	1084
Direction, Lane #	EB 1	EB 2	SB 1			
Volume Total	420	420	318			
Volume Left	0	0	318			
Volume Right	0	0	0			
cSH	1700	1700	561			
Volume to Capacity	0.25	0.25	0.57			
Queue Length 95th (ft)	0	0	88			
Control Delay (s)	0.0	0.0	19.5			
Lane LOS			C			
Approach Delay (s)	0.0		19.5			
Approach LOS			C			
Intersection Summary						
Average Delay			5.3			
Intersection Capacity Utilization			50.4%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 6: North Main Street & PUTNAM AVE.

Existing Conditions  
AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	826	228	0	392	0	0
Future Volume (Veh/h)	826	228	0	392	0	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	898	248	0	426	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	426	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	426	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	77	100			
cM capacity (veh/h)	585	1085	1623			
Direction, Lane #	EB 1	EB 2	NB 1			
Volume Total	898	248	426			
Volume Left	898	0	0			
Volume Right	0	248	0			
cSH	585	1085	1700			
Volume to Capacity	1.53	0.23	0.25			
Queue Length 95th (ft)	1159	22	0			
Control Delay (s)	268.2	9.3	0.0			
Lane LOS	F	A				
Approach Delay (s)	212.1		0.0			
Approach LOS	F					
Intersection Summary						
Average Delay		154.6				
Intersection Capacity Utilization		73.1%		ICU Level of Service		D
Analysis Period (min)		15				

















# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Existing Conditions

AM Peak

										
Movement	NBL	NBR	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations						 				
Traffic Volume (veh/h)	199	457	0	0	39	805	461	0	0	0
Future Volume (Veh/h)	199	457	0	0	39	805	461	0	0	0
Sign Control	Stop		Stop			Free			Free	
Grade	0%		0%			0%			0%	
Peak Hour Factor	0.92	0.95	0.92	0.92	0.92	0.95	0.95	0.92	0.92	0.92
Hourly flow rate (vph)	216	481	0	0	42	847	485	0	0	0
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)		3								
Median type						None			None	
Median storage (veh)										
Upstream signal (ft)										
pX, platoon unblocked										
vC, conflicting volume	1174	666	616	1416	0			1332		
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	1174	666	616	1416	0			1332		
tC, single (s)	6.5	6.9	7.5	6.5	4.1			4.1		
tC, 2 stage (s)										
tF (s)	4.0	3.3	3.5	4.0	2.2			2.2		
p0 queue free %	0	0	0	100	97			100		
cM capacity (veh/h)	186	402	0	133	1622			514		
Direction, Lane #	NB 1	NE 1	NE 2							
Volume Total	697	466	908							
Volume Left	0	42	0							
Volume Right	481	0	485							
cSH	374	1622	1700							
Volume to Capacity	1.87	0.03	0.53							
Queue Length 95th (ft)	1152	2	0							
Control Delay (s)	423.9	0.9	0.0							
Lane LOS	F	A								
Approach Delay (s)	423.9	0.3								
Approach LOS	F									
Intersection Summary										
Average Delay		142.9								
Intersection Capacity Utilization		73.1%				ICU Level of Service			D	
Analysis Period (min)		15								

# HCM Unsignalized Intersection Capacity Analysis

## 3: HILLSIDE AVE.

Existing Conditions

PM Peak








	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑	↖	
Traffic Volume (veh/h)	0	0	0	1086	380	0
Future Volume (Veh/h)	0	0	0	1086	380	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	1180	413	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		590	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		590	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		6	100
cM capacity (veh/h)			1622		439	1084
Direction, Lane #	WB 1	WB 2	NB 1			
Volume Total	590	590	413			
Volume Left	0	0	413			
Volume Right	0	0	0			
cSH	1700	1700	439			
Volume to Capacity	0.35	0.35	0.94			
Queue Length 95th (ft)	0	0	274			
Control Delay (s)	0.0	0.0	60.4			
Lane LOS			F			
Approach Delay (s)	0.0		60.4			
Approach LOS			F			
Intersection Summary						
Average Delay			15.7			
Intersection Capacity Utilization			101.0%	ICU Level of Service		G
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Existing Conditions

PM Peak

						
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	0	0	411	985	0	0
Future Volume (Veh/h)	0	0	411	985	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	0	0	437	1048	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		1398	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		1398	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			73		100	100
cM capacity (veh/h)			1622		96	1084
Direction, Lane #	WB 1	WB 2				
Volume Total	786	699				
Volume Left	437	0				
Volume Right	0	0				
cSH	1622	1700				
Volume to Capacity	0.27	0.41				
Queue Length 95th (ft)	27	0				
Control Delay (s)	5.7	0.0				
Lane LOS	A					
Approach Delay (s)	3.0					
Approach LOS						
<b>Intersection Summary</b>						
Average Delay		3.0				
Intersection Capacity Utilization		63.5%		ICU Level of Service		B
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Existing Conditions

PM Peak












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↱	
Traffic Volume (veh/h)	0	639	0	0	418	0
Future Volume (Veh/h)	0	639	0	0	418	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	695	0	0	454	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0				348	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				348	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				27	100
cM capacity (veh/h)	1622				623	1084
Direction, Lane #	EB 1	EB 2	SB 1			
Volume Total	348	348	454			
Volume Left	0	0	454			
Volume Right	0	0	0			
cSH	1700	1700	623			
Volume to Capacity	0.20	0.20	0.73			
Queue Length 95th (ft)	0	0	155			
Control Delay (s)	0.0	0.0	24.7			
Lane LOS			C			
Approach Delay (s)	0.0		24.7			
Approach LOS			C			
Intersection Summary						
Average Delay			9.8			
Intersection Capacity Utilization			63.5%	ICU Level of Service		B
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 6: North Main Street & PUTNAM AVE.

Existing Conditions

PM Peak

















						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	639	367	0	400	0	0
Future Volume (Veh/h)	639	367	0	400	0	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	695	399	0	435	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	435	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	435	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	63	100			
cM capacity (veh/h)	578	1085	1623			
Direction, Lane #	EB 1	EB 2	NB 1			
Volume Total	695	399	435			
Volume Left	695	0	0			
Volume Right	0	399	0			
cSH	578	1085	1700			
Volume to Capacity	1.20	0.37	0.26			
Queue Length 95th (ft)	625	43	0			
Control Delay (s)	130.3	10.2	0.0			
Lane LOS	F	B				
Approach Delay (s)	86.5		0.0			
Approach LOS	F					
Intersection Summary						
Average Delay		61.9				
Intersection Capacity Utilization		63.1%		ICU Level of Service		B
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Existing Conditions

PM Peak

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations								 				
Traffic Volume (veh/h)	0	285	235	0	0	0	95	642	367	0	0	0
Future Volume (Veh/h)	0	285	235	0	0	0	95	642	367	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.92	0.95	0.92	0.92	0.92	0.92	0.95	0.95	0.92	0.92	0.92
Hourly flow rate (vph)	0	310	247	0	0	0	103	676	386	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1075	1075	531	699	1268	0	0			1062		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1075	1075	531	699	1268	0	0			1062		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	0	50	0	100	100	94			100		
cM capacity (veh/h)	165	204	493	0	157	1084	1622			652		
Direction, Lane #	NB 1	NE 1	NE 2									
Volume Total	557	441	724									
Volume Left	0	103	0									
Volume Right	247	0	386									
cSH	286	1622	1700									
Volume to Capacity	1.95	0.06	0.43									
Queue Length 95th (ft)	980	5	0									
Control Delay (s)	468.2	2.2	0.0									
Lane LOS	F	A										
Approach Delay (s)	468.2	0.8										
Approach LOS	F											
Intersection Summary												
Average Delay		152.0										
Intersection Capacity Utilization		81.8%				ICU Level of Service			D			
Analysis Period (min)		15										

## Attachments:

Attachment B -      Synchro Analysis Reports  
                             B2. Construction Scenario 1

# HCM Unsignalized Intersection Capacity Analysis

## 4: PUTNAM AVE.

Construction Scenario 1  
AM Peak












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↱		↱	
Traffic Volume (veh/h)	0	790	507	18	0	0
Future Volume (Veh/h)	0	790	507	18	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	859	551	20	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	571				1420	561
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	571				1420	561
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1002				150	527
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	859	571	0			
Volume Left	0	0	0			
Volume Right	0	20	0			
cSH	1700	1700	1700			
Volume to Capacity	0.51	0.34	0.00			
Queue Length 95th (ft)	0	0	0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			44.9%		ICU Level of Service	
Analysis Period (min)			15		A	



# HCM Unsignalized Intersection Capacity Analysis 6: North Main Street & PUTNAM AVE.











Construction Scenario 1  
AM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	708	82	97	310	161	428
Future Volume (Veh/h)	708	82	97	310	161	428
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	770	89	105	337	175	465
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	954	408	640			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	954	408	640			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	86	89			
cM capacity (veh/h)	255	644	944			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	859	442	640			
Volume Left	770	105	0			
Volume Right	89	0	465			
cSH	272	944	1700			
Volume to Capacity	3.16	0.11	0.38			
Queue Length 95th (ft)	Err	9	0			
Control Delay (s)	Err	3.2	0.0			
Lane LOS	F	A				
Approach Delay (s)	Err	3.2	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		4425.8				
Intersection Capacity Utilization		110.7%		ICU Level of Service		H
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Construction Scenario 1  
AM Peak

						
Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (veh/h)	248	424	737	279	210	341
Future Volume (Veh/h)	248	424	737	279	210	341
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.92	0.92
Hourly flow rate (vph)	261	446	776	294	228	371
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1750	923			1070	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1750	923			1070	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	0			65	
cM capacity (veh/h)	61	327			651	
Direction, Lane #	NB 1	NE 1	SW 1			
Volume Total	707	1070	599			
Volume Left	261	0	228			
Volume Right	446	294	0			
cSH	127	1700	651			
Volume to Capacity	5.58	0.63	0.35			
Queue Length 95th (ft)	Err	0	39			
Control Delay (s)	Err	0.0	8.9			
Lane LOS	F		A			
Approach Delay (s)	Err	0.0	8.9			
Approach LOS	F					
Intersection Summary						
Average Delay		2977.5				
Intersection Capacity Utilization		109.1%		ICU Level of Service		H
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 4: PUTNAM AVE.

Construction Scenario 1  
PM Peak












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↱		↱	
Traffic Volume (veh/h)	0	697	1010	37	0	0
Future Volume (Veh/h)	0	697	1010	37	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	758	1098	40	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1138				1876	1118
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1138				1876	1118
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	614				79	252
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	758	1138	0			
Volume Left	0	0	0			
Volume Right	0	40	0			
cSH	1700	1700	1700			
Volume to Capacity	0.45	0.67	0.00			
Queue Length 95th (ft)	0	0	0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			58.7%	ICU Level of Service		B
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 6: North Main Street & PUTNAM AVE.











Construction Scenario 1  
PM Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	564	133	193	259	254	854
Future Volume (Veh/h)	564	133	193	259	254	854
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	613	145	210	282	276	928
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1442	740	1204			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1442	740	1204			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	65	64			
cM capacity (veh/h)	93	417	580			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	758	492	1204			
Volume Left	613	210	0			
Volume Right	145	0	928			
cSH	109	580	1700			
Volume to Capacity	6.94	0.36	0.71			
Queue Length 95th (ft)	Err	41	0			
Control Delay (s)	Err	9.9	0.0			
Lane LOS	F	A				
Approach Delay (s)	Err	9.9	0.0			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		3090.5				
Intersection Capacity Utilization		139.6%		ICU Level of Service		H
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Construction Scenario 1  
PM Peak

						
Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (veh/h)	332	254	616	207	187	787
Future Volume (Veh/h)	332	254	616	207	187	787
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.92	0.92
Hourly flow rate (vph)	349	267	648	218	203	855
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2018	757			866	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2018	757			866	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	34			74	
cM capacity (veh/h)	47	408			777	
Direction, Lane #	NB 1	NE 1	SW 1			
Volume Total	616	866	1058			
Volume Left	349	0	203			
Volume Right	267	218	0			
cSH	77	1700	777			
Volume to Capacity	8.01	0.51	0.26			
Queue Length 95th (ft)	Err	0	26			
Control Delay (s)	Err	0.0	6.9			
Lane LOS	F		A			
Approach Delay (s)	Err	0.0	6.9			
Approach LOS	F					
<b>Intersection Summary</b>						
Average Delay		2427.8				
Intersection Capacity Utilization		125.2%		ICU Level of Service		H
Analysis Period (min)		15				

## Attachments:










Attachment B -      Synchro Analysis Reports  
                             B3. Construction Scenario 2

# HCM Unsignalized Intersection Capacity Analysis

## 3: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 2











AM Peak

						
Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	1005	0	0	330	248	0
Future Volume (Veh/h)	1005	0	0	330	248	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	1182	0	0	388	292	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1182		1570	1182
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1182		1570	1182
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		0	100
cM capacity (veh/h)			591		122	231
Direction, Lane #	EB 1	WB 1	NW 1			
Volume Total	1182	388	292			
Volume Left	0	0	292			
Volume Right	0	0	0			
cSH	1700	1700	122			
Volume to Capacity	0.70	0.23	2.40			
Queue Length 95th (ft)	0	0	639			
Control Delay (s)	0.0	0.0	711.1			
Lane LOS			F			
Approach Delay (s)	0.0	0.0	711.1			
Approach LOS			F			
<b>Intersection Summary</b>						
Average Delay			111.5			
Intersection Capacity Utilization			73.3%	ICU Level of Service		D
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 2  
AM Peak

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				 		
Traffic Volume (veh/h)	708	0	161	410	0	297
Future Volume (Veh/h)	708	0	161	410	0	297
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	770	0	175	446	0	323
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			770		1343	770
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			770		1343	770
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			79		100	6
cM capacity (veh/h)			840		113	343
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	770	324	297	323		
Volume Left	0	175	0	0		
Volume Right	0	0	0	323		
cSH	1700	840	1700	343		
Volume to Capacity	0.45	0.21	0.17	0.94		
Queue Length 95th (ft)	0	20	0	245		
Control Delay (s)	0.0	6.7	0.0	70.2		
Lane LOS	A			F		
Approach Delay (s)	0.0	3.5		70.2		
Approach LOS				F		
Intersection Summary						
Average Delay			14.5			
Intersection Capacity Utilization			62.3%	ICU Level of Service	B	
Analysis Period (min)			15			



# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Construction Scenario 2  
AM Peak












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↱		↱	
Traffic Volume (veh/h)	0	82	97	310	161	0
Future Volume (Veh/h)	0	82	97	310	161	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	85	100	320	166	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	420				345	260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	420				345	260
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				75	100
cM capacity (veh/h)	1139				652	779
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	85	420	166			
Volume Left	0	0	166			
Volume Right	0	320	0			
cSH	1700	1700	652			
Volume to Capacity	0.05	0.25	0.25			
Queue Length 95th (ft)	0	0	25			
Control Delay (s)	0.0	0.0	12.4			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	12.4			
Approach LOS			B			
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			39.8%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 7: Byram Road & Byram Circle & West Putnam Avenue

Construction Scenario 2  
AM Peak










						
Movement	NBL	NBR	SEL	SER	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	248	424	0	0	489	0
Future Volume (Veh/h)	248	424	0	0	489	0
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	258	442	0	0	509	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1018	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1018	0			0	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	59			69	
cM capacity (veh/h)	180	1085			1623	
Direction, Lane #	NB 1	SW 1				
Volume Total	700	509				
Volume Left	258	509				
Volume Right	442	0				
cSH	397	1623				
Volume to Capacity	1.76	0.31				
Queue Length 95th (ft)	1096	34				
Control Delay (s)	376.6	8.2				
Lane LOS	F	A				
Approach Delay (s)	376.6	8.2				
Approach LOS	F					
Intersection Summary						
Average Delay		221.5				
Intersection Capacity Utilization		47.5%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 3: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 2











PM Peak

						
Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	823	0	0	787	332	0
Future Volume (Veh/h)	823	0	0	787	332	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	968	0	0	926	391	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			968		1894	968
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			968		1894	968
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		0	100
cM capacity (veh/h)			712		77	308
Direction, Lane #	EB 1	WB 1	NW 1			
Volume Total	968	926	391			
Volume Left	0	0	391			
Volume Right	0	0	0			
cSH	1700	1700	77			
Volume to Capacity	0.57	0.54	5.10			
Queue Length 95th (ft)	0	0	Err			
Control Delay (s)	0.0	0.0	Err			
Lane LOS			F			
Approach Delay (s)	0.0	0.0	Err			
Approach LOS			F			
<b>Intersection Summary</b>						
Average Delay		1711.0				
Intersection Capacity Utilization		68.4%		ICU Level of Service		C
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 2  
PM Peak

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				 		
Traffic Volume (veh/h)	564	0	302	817	0	259
Future Volume (Veh/h)	564	0	302	817	0	259
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	613	0	328	888	0	282
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			613		1713	613
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			613		1713	613
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			66		100	35
cM capacity (veh/h)			962		54	435
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	613	624	592	282		
Volume Left	0	328	0	0		
Volume Right	0	0	0	282		
cSH	1700	962	1700	435		
Volume to Capacity	0.36	0.34	0.35	0.65		
Queue Length 95th (ft)	0	38	0	112		
Control Delay (s)	0.0	7.7	0.0	27.2		
Lane LOS	A			D		
Approach Delay (s)	0.0	3.9		27.2		
Approach LOS				D		
Intersection Summary						
Average Delay			5.9			
Intersection Capacity Utilization			67.7%		ICU Level of Service	
Analysis Period (min)			15		C	

# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Construction Scenario 2

PM Peak












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↱		↱	
Traffic Volume (veh/h)	0	133	193	259	254	0
Future Volume (Veh/h)	0	133	193	259	254	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	137	199	267	262	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	466				470	332
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	466				470	332
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				53	100
cM capacity (veh/h)	1095				552	709
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	137	466	262			
Volume Left	0	0	262			
Volume Right	0	267	0			
cSH	1700	1700	552			
Volume to Capacity	0.08	0.27	0.47			
Queue Length 95th (ft)	0	0	63			
Control Delay (s)	0.0	0.0	17.3			
Lane LOS			C			
Approach Delay (s)	0.0	0.0	17.3			
Approach LOS			C			
Intersection Summary						
Average Delay			5.2			
Intersection Capacity Utilization			46.8%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 7: Byram Road & Byram Circle & West Putnam Avenue

Construction Scenario 2

PM Peak

						
Movement	NBL	NBR	SEL	SER	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	332	256	0	0	394	0
Future Volume (Veh/h)	332	256	0	0	394	0
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	346	267	0	0	410	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	820	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	820	0			0	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	75			75	
cM capacity (veh/h)	258	1085			1623	
Direction, Lane #	NB 1	SW 1				
Volume Total	613	410				
Volume Left	346	410				
Volume Right	267	0				
cSH	395	1623				
Volume to Capacity	1.55	0.25				
Queue Length 95th (ft)	849	25				
Control Delay (s)	285.3	8.0				
Lane LOS	F	A				
Approach Delay (s)	285.3	8.0				
Approach LOS	F					
Intersection Summary						
Average Delay		174.2				
Intersection Capacity Utilization		46.9%		ICU Level of Service		A
Analysis Period (min)		15				

## Attachments:

Attachment B -      Synchro Analysis Reports  
                             B4. Construction Scenario 3

# HCM Unsignalized Intersection Capacity Analysis

## 3: HILLSIDE AVE.

Construction Scenario 3  
AM Peak



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations				↑↑	↑	
Traffic Volume (veh/h)	0	0	0	644	238	0
Future Volume (Veh/h)	0	0	0	644	238	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	700	259	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		350	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		350	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		58	100
cM capacity (veh/h)			1622		621	1084
Direction, Lane #	WB 1	WB 2	NW 1			
Volume Total	350	350	259			
Volume Left	0	0	259			
Volume Right	0	0	0			
cSH	1700	1700	621			
Volume to Capacity	0.21	0.21	0.42			
Queue Length 95th (ft)	0	0	51			
Control Delay (s)	0.0	0.0	14.9			
Lane LOS			B			
Approach Delay (s)	0.0		14.9			
Approach LOS			B			
Intersection Summary						
Average Delay			4.0			
Intersection Capacity Utilization			37.7%	ICU Level of Service		A
Analysis Period (min)			15			



# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 3  
AM Peak

	→	↗	↖	←	↘	↙
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations				↖		
Traffic Volume (veh/h)	0	0	302	492	0	0
Future Volume (Veh/h)	0	0	302	492	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	0	0	321	523	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0	1165	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0	1165	0	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			80	100	100	
cM capacity (veh/h)			1623	172	1085	
Direction, Lane #	WB 1					
Volume Total	844					
Volume Left	321					
Volume Right	0					
cSH	1623					
Volume to Capacity	0.20					
Queue Length 95th (ft)	18					
Control Delay (s)	4.3					
Lane LOS	A					
Approach Delay (s)	4.3					
Approach LOS						
Intersection Summary						
Average Delay	4.3					
Intersection Capacity Utilization	70.6%					
ICU Level of Service	C					
Analysis Period (min)	15					

# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Construction Scenario 3  
AM Peak
















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↘	
Traffic Volume (veh/h)	0	773	0	0	293	0
Future Volume (Veh/h)	0	773	0	0	293	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	840	0	0	318	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0				420	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				420	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				43	100
cM capacity (veh/h)	1622				561	1084
Direction, Lane #	EB 1	EB 2	SB 1			
Volume Total	420	420	318			
Volume Left	0	0	318			
Volume Right	0	0	0			
cSH	1700	1700	561			
Volume to Capacity	0.25	0.25	0.57			
Queue Length 95th (ft)	0	0	88			
Control Delay (s)	0.0	0.0	19.5			
Lane LOS			C			
Approach Delay (s)	0.0		19.5			
Approach LOS			C			
Intersection Summary						
Average Delay			5.3			
Intersection Capacity Utilization			70.6%	ICU Level of Service		C
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Construction Scenario 3

AM Peak

										
Movement	NBL	NBR	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations										
Traffic Volume (veh/h)	199	457	0	0	39	805	461	0	0	0
Future Volume (Veh/h)	199	457	0	0	39	805	461	0	0	0
Sign Control	Stop		Stop			Free			Free	
Grade	0%		0%			0%			0%	
Peak Hour Factor	0.92	0.95	0.92	0.92	0.92	0.95	0.95	0.92	0.92	0.92
Hourly flow rate (vph)	216	481	0	0	42	847	485	0	0	0
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)		3								
Median type						None			None	
Median storage (veh)										
Upstream signal (ft)										
pX, platoon unblocked										
vC, conflicting volume	1174	1090	1282	1416	0			1332		
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	1174	1090	1282	1416	0			1332		
tC, single (s)	6.5	6.2	7.1	6.5	4.1			4.1		
tC, 2 stage (s)										
tF (s)	4.0	3.3	3.5	4.0	2.2			2.2		
p0 queue free %	0	0	0	100	97			100		
cM capacity (veh/h)	187	262	0	134	1623			518		
Direction, Lane #	NB 1	NE 1								
Volume Total	697	1374								
Volume Left	0	42								
Volume Right	481	485								
cSH	250	1623								
Volume to Capacity	2.79	0.03								
Queue Length 95th (ft)	1506	2								
Control Delay (s)	847.1	1.1								
Lane LOS	F	A								
Approach Delay (s)	847.1	1.1								
Approach LOS	F									
Intersection Summary										
Average Delay		285.8								
Intersection Capacity Utilization		107.6%				ICU Level of Service			G	
Analysis Period (min)		15								

# HCM Unsignalized Intersection Capacity Analysis

## 3: HILLSIDE AVE.

Construction Scenario 3  
PM Peak








	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑	↖	
Traffic Volume (veh/h)	0	0	0	1086	380	0
Future Volume (Veh/h)	0	0	0	1086	380	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	1180	413	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		590	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		590	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		6	100
cM capacity (veh/h)			1622		439	1084
Direction, Lane #	WB 1	WB 2	NB 1			
Volume Total	590	590	413			
Volume Left	0	0	413			
Volume Right	0	0	0			
cSH	1700	1700	439			
Volume to Capacity	0.35	0.35	0.94			
Queue Length 95th (ft)	0	0	274			
Control Delay (s)	0.0	0.0	60.4			
Lane LOS			F			
Approach Delay (s)	0.0		60.4			
Approach LOS			F			
Intersection Summary						
Average Delay		15.7				
Intersection Capacity Utilization		130.2%		ICU Level of Service		H
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 3

PM Peak

						
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	0	0	411	985	0	0
Future Volume (Veh/h)	0	0	411	985	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	0	0	437	1048	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		1922	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		1922	0
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			73		100	100
cM capacity (veh/h)			1623		54	1085
Direction, Lane #	WB 1					
Volume Total	1485					
Volume Left	437					
Volume Right	0					
cSH	1623					
Volume to Capacity	0.27					
Queue Length 95th (ft)	27					
Control Delay (s)	6.3					
Lane LOS	A					
Approach Delay (s)	6.3					
Approach LOS						
Intersection Summary						
Average Delay	6.3					
Intersection Capacity Utilization	98.9%					
Analysis Period (min)	15					
	ICU Level of Service F					

# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Construction Scenario 3

PM Peak


















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↱	
Traffic Volume (veh/h)	0	639	0	0	418	0
Future Volume (Veh/h)	0	639	0	0	418	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	695	0	0	454	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0				348	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				348	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				27	100
cM capacity (veh/h)	1622				623	1084
Direction, Lane #	EB 1	EB 2	SB 1			
Volume Total	348	348	454			
Volume Left	0	0	454			
Volume Right	0	0	0			
cSH	1700	1700	623			
Volume to Capacity	0.20	0.20	0.73			
Queue Length 95th (ft)	0	0	155			
Control Delay (s)	0.0	0.0	24.7			
Lane LOS			C			
Approach Delay (s)	0.0		24.7			
Approach LOS			C			
Intersection Summary						
Average Delay			9.8			
Intersection Capacity Utilization			98.9%	ICU Level of Service		F
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Construction Scenario 3

PM Peak

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	0	285	235	0	0	0	95	642	367	0	0	0
Future Volume (Veh/h)	0	285	235	0	0	0	95	642	367	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.92	0.95	0.92	0.92	0.92	0.92	0.95	0.95	0.92	0.92	0.92
Hourly flow rate (vph)	0	310	247	0	0	0	103	676	386	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1075	1075	869	1230	1268	0	0			1062		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1075	1075	869	1230	1268	0	0			1062		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	0	30	0	100	100	94			100		
cM capacity (veh/h)	188	206	351	0	158	1085	1623			656		
Direction, Lane #	NB 1	NE 1										
Volume Total	557	1165										
Volume Left	0	103										
Volume Right	247	386										
cSH	266	1623										
Volume to Capacity	2.10	0.06										
Queue Length 95th (ft)	1037	5										
Control Delay (s)	537.2	1.8										
Lane LOS	F	A										
Approach Delay (s)	537.2	1.8										
Approach LOS	F											
Intersection Summary												
Average Delay		175.0										
Intersection Capacity Utilization		111.1%			ICU Level of Service				H			
Analysis Period (min)		15										

## Attachments:

Attachment B -      Synchro Analysis Reports  
                             B5. Construction Scenario 4



# HCM Unsignalized Intersection Capacity Analysis

## 3: HILLSIDE AVE.

Construction Scenario 4  
AM Peak

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑	↖	
Traffic Volume (veh/h)	0	0	0	533	199	0
Future Volume (Veh/h)	0	0	0	533	199	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	579	216	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		579	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		579	0
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		55	100
cM capacity (veh/h)			1623		477	1085
Direction, Lane #	WB 1	NB 1				
Volume Total	579	216				
Volume Left	0	216				
Volume Right	0	0				
cSH	1700	477				
Volume to Capacity	0.34	0.45				
Queue Length 95th (ft)	0	58				
Control Delay (s)	0.0	18.6				
Lane LOS		C				
Approach Delay (s)	0.0	18.6				
Approach LOS		C				
Intersection Summary						
Average Delay		5.1				
Intersection Capacity Utilization		45.7%	ICU Level of Service	A		
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 4  
AM Peak

	→	↗	↖	←	↘	↙
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations				↖		
Traffic Volume (veh/h)	0	0	240	492	0	0
Future Volume (Veh/h)	0	0	240	492	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	0	0	255	523	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		1033	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		1033	0
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			84		100	100
cM capacity (veh/h)			1623		217	1085
Direction, Lane #	WB 1					
Volume Total	778					
Volume Left	255					
Volume Right	0					
cSH	1623					
Volume to Capacity	0.16					
Queue Length 95th (ft)	14					
Control Delay (s)	3.7					
Lane LOS	A					
Approach Delay (s)	3.7					
Approach LOS						
Intersection Summary						
Average Delay	3.7					
Intersection Capacity Utilization	67.2%					
Analysis Period (min)	15					
	ICU Level of Service C					

# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Construction Scenario 4  
AM Peak













Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↱	
Traffic Volume (veh/h)	0	773	0	0	231	0
Future Volume (Veh/h)	0	773	0	0	231	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	840	0	0	251	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0				420	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				420	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				55	100
cM capacity (veh/h)	1622				561	1084
Direction, Lane #	EB 1	EB 2	SB 1			
Volume Total	420	420	251			
Volume Left	0	0	251			
Volume Right	0	0	0			
cSH	1700	1700	561			
Volume to Capacity	0.25	0.25	0.45			
Queue Length 95th (ft)	0	0	57			
Control Delay (s)	0.0	0.0	16.5			
Lane LOS			C			
Approach Delay (s)	0.0		16.5			
Approach LOS			C			
Intersection Summary						
Average Delay			3.8			
Intersection Capacity Utilization			67.2%	ICU Level of Service		C
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 6: North Main Street & PUTNAM AVE.

















Construction Scenario 4  
AM Peak

						
Movement	EBL	EBR	NBL	NBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	826	78	0	392	150	0
Future Volume (Veh/h)	826	78	0	392	150	0
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	898	85	0	426	163	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	589	163	163			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	589	163	163			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	90	100			
cM capacity (veh/h)	471	882	1416			
Direction, Lane #	EB 1	EB 2	NB 1	SW 1		
Volume Total	898	85	426	163		
Volume Left	898	0	0	0		
Volume Right	0	85	0	0		
cSH	471	882	1700	1700		
Volume to Capacity	1.91	0.10	0.25	0.10		
Queue Length 95th (ft)	1477	8	0	0		
Control Delay (s)	436.5	9.5	0.0	0.0		
Lane LOS	F	A				
Approach Delay (s)	399.5		0.0	0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			249.8			
Intersection Capacity Utilization			60.7%	ICU Level of Service		B
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road









Construction Scenario 4  
AM Peak

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	0	199	457	0	0	0	0	844	461	0	150	0
Future Volume (Veh/h)	0	199	457	0	0	0	0	844	461	0	150	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.92	0.95	0.92	0.92	0.92	0.92	0.95	0.95	0.92	0.92	0.92
Hourly flow rate (vph)	0	216	481	0	0	0	0	888	485	0	163	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1294	1294	1130	1642	1536	163	163			1373		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1294	1294	1130	1642	1536	163	163			1373		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	0	0	0	100	100	100			100		
cM capacity (veh/h)	140	163	248	0	116	882	1416			500		
Direction, Lane #	NB 1	NE 1	SW 1									
Volume Total	697	1373	163									
Volume Left	0	0	0									
Volume Right	481	485	0									
cSH	228	1700	1700									
Volume to Capacity	3.05	0.81	0.10									
Queue Length 95th (ft)	Err	0	0									
Control Delay (s)	Err	0.0	0.0									
Lane LOS	F											
Approach Delay (s)	Err	0.0	0.0									
Approach LOS	F											
Intersection Summary												
Average Delay		3121.0										
Intersection Capacity Utilization		107.5%				ICU Level of Service				G		
Analysis Period (min)		15										

# HCM Unsignalized Intersection Capacity Analysis

## 3: HILLSIDE AVE.








Construction Scenario 4  
PM Peak

						
Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	981	285	0
Future Volume (Veh/h)	0	0	0	981	285	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	1066	310	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		1066	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		1066	0
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		0	100
cM capacity (veh/h)			1623		246	1085
Direction, Lane #	WB 1	NW 1				
Volume Total	1066	310				
Volume Left	0	310				
Volume Right	0	0				
cSH	1700	246				
Volume to Capacity	0.63	1.26				
Queue Length 95th (ft)	0	387				
Control Delay (s)	0.0	186.2				
Lane LOS		F				
Approach Delay (s)	0.0	186.2				
Approach LOS		F				
Intersection Summary						
Average Delay		41.9				
Intersection Capacity Utilization		74.1%		ICU Level of Service		D
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 4  
PM Peak

						
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	0	0	281	985	0	0
Future Volume (Veh/h)	0	0	281	985	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	0	0	299	1048	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			0		1646	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		1646	0
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			82		100	100
cM capacity (veh/h)			1623		89	1085
Direction, Lane #	WB 1					
Volume Total	1347					
Volume Left	299					
Volume Right	0					
cSH	1623					
Volume to Capacity	0.18					
Queue Length 95th (ft)	17					
Control Delay (s)	4.6					
Lane LOS	A					
Approach Delay (s)	4.6					
Approach LOS						
Intersection Summary						
Average Delay			4.6			
Intersection Capacity Utilization			91.7%	ICU Level of Service	F	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Construction Scenario 4  
PM Peak



















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↱	
Traffic Volume (veh/h)	0	639	0	0	288	0
Future Volume (Veh/h)	0	639	0	0	288	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	695	0	0	313	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0				348	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				348	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				50	100
cM capacity (veh/h)	1622				623	1084
Direction, Lane #	EB 1	EB 2	SB 1			
Volume Total	348	348	313			
Volume Left	0	0	313			
Volume Right	0	0	0			
cSH	1700	1700	623			
Volume to Capacity	0.20	0.20	0.50			
Queue Length 95th (ft)	0	0	71			
Control Delay (s)	0.0	0.0	16.5			
Lane LOS			C			
Approach Delay (s)	0.0		16.5			
Approach LOS			C			
Intersection Summary						
Average Delay			5.1			
Intersection Capacity Utilization			91.7%	ICU Level of Service		F
Analysis Period (min)			15			



# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Construction Scenario 4  
PM Peak

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	285	235	0	737	367	0	200	0
Future Volume (Veh/h)	0	0	0	0	285	235	0	737	367	0	200	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.95	0.92	0.95	0.92	0.95	0.95	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	310	247	0	776	386	0	217	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						3						
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1464	1379	217	1186	1186	969	217			1162		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1464	1379	217	1186	1186	969	217			1162		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	100	100	0	20	100			100		
cM capacity (veh/h)	0	144	823	166	189	308	1353			601		
Direction, Lane #	NW 1	NE 1	SW 1									
Volume Total	557	1162	217									
Volume Left	0	0	0									
Volume Right	247	386	0									
cSH	238	1700	1700									
Volume to Capacity	2.34	0.68	0.13									
Queue Length 95th (ft)	1114	0	0									
Control Delay (s)	648.2	0.0	0.0									
Lane LOS	F											
Approach Delay (s)	648.2	0.0	0.0									
Approach LOS	F											
Intersection Summary												
Average Delay			186.5									
Intersection Capacity Utilization			82.8%	ICU Level of Service						E		
Analysis Period (min)			15									










## Attachments:

Attachment B -      Synchro Analysis Reports  
                             B6. Construction Scenario 5

# HCM Unsignalized Intersection Capacity Analysis

## 3: HILLSIDE AVE.










Construction Scenario 5  
AM Peak

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	376	0	0	644	238	0
Future Volume (Veh/h)	376	0	0	644	238	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	409	0	0	700	259	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			409		1109	409
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			409		1109	409
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		0	100
cM capacity (veh/h)			1150		232	642
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	409	700	259			
Volume Left	0	0	259			
Volume Right	0	0	0			
cSH	1700	1700	232			
Volume to Capacity	0.24	0.41	1.12			
Queue Length 95th (ft)	0	0	292			
Control Delay (s)	0.0	0.0	138.9			
Lane LOS			F			
Approach Delay (s)	0.0	0.0	138.9			
Approach LOS			F			
Intersection Summary						
Average Delay			26.3			
Intersection Capacity Utilization			77.4%	ICU Level of Service		D
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 5  
AM Peak

						
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	386	0	302	492	0	0
Future Volume (Veh/h)	386	0	302	492	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	420	0	321	523	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			420		1585	420
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			420		1585	420
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			72		100	100
cM capacity (veh/h)			1139		86	633
Direction, Lane #	EB 1	WB 1	WB 2			
Volume Total	420	321	523			
Volume Left	0	321	0			
Volume Right	0	0	0			
cSH	1700	1139	1700			
Volume to Capacity	0.25	0.28	0.31			
Queue Length 95th (ft)	0	29	0			
Control Delay (s)	0.0	9.4	0.0			
Lane LOS		A				
Approach Delay (s)	0.0	3.6				
Approach LOS						
Intersection Summary						
Average Delay			2.4			
Intersection Capacity Utilization			77.4%	ICU Level of Service		D
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Construction Scenario 5  
AM Peak












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↱	
Traffic Volume (veh/h)	0	387	0	0	293	0
Future Volume (Veh/h)	0	387	0	0	293	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	421	0	0	318	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0				210	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				210	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				58	100
cM capacity (veh/h)	1622				759	1084
Direction, Lane #	EB 1	EB 2	SB 1			
Volume Total	210	210	318			
Volume Left	0	0	318			
Volume Right	0	0	0			
cSH	1700	1700	759			
Volume to Capacity	0.12	0.12	0.42			
Queue Length 95th (ft)	0	0	52			
Control Delay (s)	0.0	0.0	13.1			
Lane LOS			B			
Approach Delay (s)	0.0		13.1			
Approach LOS			B			
Intersection Summary						
Average Delay			5.6			
Intersection Capacity Utilization			33.6%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 6: North Main Street & PUTNAM AVE.

Construction Scenario 5  
AM Peak
















						
Movement	EBL	EBR	NBL	NBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	452	228	0	392	0	0
Future Volume (Veh/h)	452	228	0	392	0	0
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	491	248	0	426	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	426	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	426	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	16	77	100			
cM capacity (veh/h)	585	1085	1623			
Direction, Lane #	EB 1	EB 2	NB 1			
Volume Total	491	248	426			
Volume Left	491	0	0			
Volume Right	0	248	0			
cSH	585	1085	1700			
Volume to Capacity	0.84	0.23	0.25			
Queue Length 95th (ft)	223	22	0			
Control Delay (s)	35.2	9.3	0.0			
Lane LOS	E	A				
Approach Delay (s)	26.5		0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		16.8				
Intersection Capacity Utilization		28.4%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Construction Scenario 5










AM Peak

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	0	199	457	0	0	0	39	344	461	0	0	0
Future Volume (Veh/h)	0	199	457	0	0	0	39	344	461	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.92	0.95	0.92	0.92	0.92	0.92	0.95	0.95	0.92	0.92	0.92
Hourly flow rate (vph)	0	216	481	0	0	0	42	362	485	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	688	688	604	796	931	0	0			847		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	688	688	604	796	931	0	0			847		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	40	3	100	100	100	97			100		
cM capacity (veh/h)	353	359	498	5	260	1085	1623			790		
Direction, Lane #	NB 1	NE 1										
Volume Total	697	889										
Volume Left	0	42										
Volume Right	481	485										
cSH	611	1623										
Volume to Capacity	1.14	0.03										
Queue Length 95th (ft)	561	2										
Control Delay (s)	106.1	0.7										
Lane LOS	F	A										
Approach Delay (s)	106.1	0.7										
Approach LOS	F											
Intersection Summary												
Average Delay		47.0										
Intersection Capacity Utilization		83.5%			ICU Level of Service				E			
Analysis Period (min)		15										

# HCM Unsignalized Intersection Capacity Analysis

## 3: HILLSIDE AVE.

Construction Scenario 1  
PM Peak










						
Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	319	0	0	1086	238	0
Future Volume (Veh/h)	319	0	0	1086	238	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	347	0	0	1180	259	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			347		1527	347
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			347		1527	347
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		0	100
cM capacity (veh/h)			1212		129	696
Direction, Lane #	EB 1	WB 1	NW 1			
Volume Total	347	1180	259			
Volume Left	0	0	259			
Volume Right	0	0	0			
cSH	1700	1700	129			
Volume to Capacity	0.20	0.69	2.00			
Queue Length 95th (ft)	0	0	522			
Control Delay (s)	0.0	0.0	533.8			
Lane LOS			F			
Approach Delay (s)	0.0	0.0	533.8			
Approach LOS			F			
Intersection Summary						
Average Delay		77.4				
Intersection Capacity Utilization		97.1%		ICU Level of Service		F
Analysis Period (min)		15				



# HCM Unsignalized Intersection Capacity Analysis

## 4: BYRAM CIRCLE & HILLSIDE AVE.

Construction Scenario 1  
PM Peak

						
Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	319	0	411	985	0	0
Future Volume (Veh/h)	319	0	411	985	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	347	0	437	1048	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			347		2269	347
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			347		2269	347
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			64		100	100
cM capacity (veh/h)			1212		28	696
Direction, Lane #	EB 1	WB 1	WB 2			
Volume Total	347	437	1048			
Volume Left	0	437	0			
Volume Right	0	0	0			
cSH	1700	1212	1700			
Volume to Capacity	0.20	0.36	0.62			
Queue Length 95th (ft)	0	42	0			
Control Delay (s)	0.0	9.6	0.0			
Lane LOS	A					
Approach Delay (s)	0.0	2.8				
Approach LOS						
Intersection Summary						
Average Delay	2.3					
Intersection Capacity Utilization	97.1%			ICU Level of Service	F	
Analysis Period (min)	15					

# HCM Unsignalized Intersection Capacity Analysis

## 5: PUTNAM AVE. & BYRAM CIRCLE

Construction Scenario 1  
PM Peak












Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↘	
Traffic Volume (veh/h)	0	320	0	0	418	0
Future Volume (Veh/h)	0	320	0	0	418	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	348	0	0	454	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0				174	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				174	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				43	100
cM capacity (veh/h)	1622				799	1084
Direction, Lane #	EB 1	EB 2	SB 1			
Volume Total	174	174	454			
Volume Left	0	0	454			
Volume Right	0	0	0			
cSH	1700	1700	799			
Volume to Capacity	0.10	0.10	0.57			
Queue Length 95th (ft)	0	0	91			
Control Delay (s)	0.0	0.0	15.3			
Lane LOS			C			
Approach Delay (s)	0.0		15.3			
Approach LOS			C			
Intersection Summary						
Average Delay			8.6			
Intersection Capacity Utilization			38.7%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 6: North Main Street & PUTNAM AVE.
















Construction Scenario 1  
PM Peak

						
Movement	EBL	EBR	NBL	NBR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	371	367	0	400	0	0
Future Volume (Veh/h)	371	367	0	400	0	0
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	403	399	0	435	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	435	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	435	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	30	63	100			
cM capacity (veh/h)	578	1085	1623			
Direction, Lane #	EB 1	EB 2	NB 1			
Volume Total	403	399	435			
Volume Left	403	0	0			
Volume Right	0	399	0			
cSH	578	1085	1700			
Volume to Capacity	0.70	0.37	0.26			
Queue Length 95th (ft)	138	43	0			
Control Delay (s)	24.3	10.2	0.0			
Lane LOS	C	B				
Approach Delay (s)	17.3		0.0			
Approach LOS	C					
Intersection Summary						
Average Delay			11.2			
Intersection Capacity Utilization			28.1%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 7: West Putnam Avenue & Byram Road

Construction Scenario 1  
PM Peak

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	285	235	95	404	367	0	0	0
Future Volume (Veh/h)	0	0	0	0	285	235	95	404	367	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.95	0.92	0.95	0.92	0.95	0.95	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	310	247	103	425	386	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						3						
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	979	1017	0	824	824	618	0			811		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	979	1017	0	824	824	618	0			811		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	100	100	0	50	94			100		
cM capacity (veh/h)	0	222	1085	278	289	489	1623			815		
Direction, Lane #	NW 1	NE 1										
Volume Total	557	914										
Volume Left	0	103										
Volume Right	247	386										
cSH	398	1623										
Volume to Capacity	1.40	0.06										
Queue Length 95th (ft)	687	5										
Control Delay (s)	221.5	1.6										
Lane LOS	F	A										
Approach Delay (s)	221.5	1.6										
Approach LOS	F											
Intersection Summary												
Average Delay		84.9										
Intersection Capacity Utilization		70.6%			ICU Level of Service				C			
Analysis Period (min)		15										