

# Interstate 684 (I-684) & Interstate 84 (I-84) Transportation Corridor Study *Findings Report*



Project Identification Number (PIN): 8113.59  
Contract Number: D037614-05  
Westchester County and Putnam County



**August 2021**

Prepared for:



**Department of  
Transportation**

Prepared by:



# I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

August 2021

## Table of Contents

<b>EXECUTIVE SUMMARY .....</b>	<b>I</b>
<b>FINDINGS REPORT .....</b>	<b>1</b>
FR-1 Introduction .....	1
FR-2 Study Background & Context.....	1
FR-3 Study Purpose.....	2
FR-4 Corridor Vision Statement & Corridor Goal Statements .....	3
FR-5 Study Development Process .....	3
FR-6 Public Outreach Process .....	5
FR-7 Existing (Year 2019) Conditions in the Study Corridor .....	5
FR-7.1 Land Use and Demographics .....	5
FR-7.2 Natural Environment, Farmland, and Parks.....	6
FR-7.3 Transportation and Sustainability .....	7
FR-8 Estimated Future (Year 2045) Conditions in the Study Corridor.....	10
FR-8.1 Land Use and Demographics .....	10
FR-8.2 Transportation Conditions .....	10
FR-9 Transportation Concepts and Identification of Feasible Concepts.....	12
FR-10 Feasible Concept Development and Evaluation .....	19
FR-10.1 Transportation System and Environmental Impacts .....	19
FR-10.2 Noise Barrier Considerations.....	25
FR-11 Final Study Recommendations.....	25
FR-12 Next Steps and Project Development and Environmental Review Process .....	27

## LIST OF FIGURES

Figure FR-1: I-684 & I-84 Transportation Corridor Study Area .....	1
Figure FR-2: Project Schedule Flow Chart.....	4
Figure FR-3: Existing (2019) Weekday AM and Weekday PM Peak Hour Levels of Service .....	8
Figure FR-4: Average Weekday Transit Ridership .....	9
Figure FR-5: Projected (2045) Weekday AM and Weekday PM Peak Hour Levels of Service .....	11
Figure FR-6: Regional Transportation Alternatives Plan.....	13
Figure FR-7: Proposed Ramp Metering Locations, I-684 Corridor.....	14
Figure FR-8: Example of Peak Hour Shoulder Use (I-66 in Virginia) .....	15
Figure FR-9: Conceptual Improvements at I-684 Interchange 6A (NY 138).....	18
Figure FR-10: Conceptual Improvements at I-684 Interchange 7 (NY 116) .....	18
Figure FR-11: I-684 Interchanges 5 and 6 Interim Concept #1 (Third Lane on I-684).....	21
Figure FR-12: I-684 Interchanges 5 and 6 Interim Concept #2 (I-684 / NY 35 DDI).....	22
Figure FR-13: I-684 Interchanges 5 and 6 Full Reconstruction Concept .....	22
Figure FR-14: Bedford Bridge, April 2004 (Source: Google Earth) .....	23
Figure FR-15: I-684 Interchange 9 Concepts .....	24



# I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Executive Summary  
August 2021

## EXECUTIVE SUMMARY

The New York State Department of Transportation (“NYSDOT”) has conducted a Transportation Corridor Study (“the Study”) for an approximately 12-mile segment of Interstate 684 (“I-684”) between the Town of Bedford, Westchester County, and Interstate 84 / northern terminus of I-684 in the Town of Southeast, Putnam County. The Study also includes an approximately 3-mile segment of Interstate 84 (“I-84”) from the I-684 Interchange east to the New York State Line.

A I-684 / I-84 Consortium (“Consortium”), with representation from Putnam County and the Towns of Bedford, Lewisboro, Somers, Southeast, and Ridgefield, Connecticut, was established in 2014. The Consortium worked with NYSDOT, the New York Metropolitan Transportation Council (“NYMTC”), and the Metropolitan Transportation Authority (“MTA”) on an ongoing basis to bring attention to the I-684 and I-84 corridors prior to the start of this Study.

Based on the identified need for increased transportation capacity and multimodal mobility, the purpose of the Study was to identify transportation improvement strategies that will address projected traffic growth along the I-684 and I-84 corridors through the Year 2045. Ideally, transportation strategies would provide an acceptable level of service on I-684 and I-84 within the Study limits at a reasonable cost. Recommended transportation strategies would also consider environmental impacts as well as opportunities to reduce traffic on local roadways, improve access to transit, and improve safety along the Study corridor. The principal results of the Study, as documented in this Findings Report, was the recommendation of preferred concepts to address existing and future capacity and mobility needs.

Public outreach was an integral component of this Study. The public outreach process involved key stakeholders in Putnam and Westchester Counties and the Town of Ridgefield, Connecticut. The Department utilized the public outreach process to obtain input from key stakeholders and to provide information on the Study on an ongoing basis. The public outreach process included:

- **Elected Officials Meeting** – A meeting with elected officials was held on July 25, 2019, to introduce the Study team and provide further information on the Study. In addition to background information on the corridor and the history of the Study’s initiation, presented at the meeting were the Study schedule and public outreach process.
- **Public Workshop** – One public workshop was held on December 12, 2019, to provide information on the Study to stakeholders and to obtain valuable input on all aspects of the Study.
- **Transportation Partnering Committee (“TPC”) Meetings** – The TPC was a working committee comprised of representatives from the Town of Bedford, Town of Lewisboro, Town of North Salem, Town of Southeast, Town of Somers, Town of Ridgefield (Connecticut), Westchester County, Putnam County, MTA Metro-North Railroad (“MNR”), the Connecticut Department of Transportation (“CTDOT”), and Federal and State government officials. A series of TPC meetings (five) were held so that the committee could provide direction and guidance on all major decisions necessary to complete the Study.



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Executive Summary  
August 2021

- **Direct Meetings with Key Stakeholders** – The Study team held direct meetings as needed with government representatives and other agencies to discuss the progression of the Study, gain feedback, and coordinate with other efforts. Throughout the course of the Study, the Study team met with CTDOT, MNR, the New York State Department of Environmental Conservation, the New York City Department of Environmental Protection, and the Town of Bedford.

The Study was advanced through a four-step development process. Step 1 included the collection of data to better understand the existing conditions along the corridor in terms of traffic, environment, and land use. Using this information, a corridor vision statement and supporting goal statements were developed.

During Step 2 of the Study's development, future year 2045 conditions were projected, and transportation concepts with the potential to address the vision and goals of the Study corridor were identified. These concepts included:

- Maintain the existing roadway (the "No Build" concept);
- Implement a regional transportation alternatives plan;
- Implement Transportation Systems Management and Operations (TSMO) solutions;
- Implement mainline improvements along the length of the Study corridor; and
- Implement improvements at interchanges along the Study corridor.

During Step 3 of the Study's development, the following concepts were progressed as feasible concepts and evaluated more closely:

- Ramp Metering Concept (TSMO);
- I-684 Peak Hour Shoulder Use (NY 35 to I-84) Concept;
- I-84 Third Travel Lane (I-684 to New York State Line) Concept;
- I-684 Interchanges 5 and 6 (Saw Mill River Parkway & Route 35) Concepts; and
- I-684 Interchange 9 (I-84) Concepts.

The final study recommendations were identified during Step 4 of the Study's development. Apart from the Ramp Metering Concept, all concepts evaluated during Step 3 of the Study's development were confirmed as preferred concepts to address existing and future capacity and mobility needs. This study also recommends the following based on a planning-level analysis:

- **Regional Transportation Alternatives Plan** – Perform a Master Plan / Feasibility Study to further evaluate enhanced intermodal stations, new express bus services, and new or enhanced local jitney services, between points in Connecticut (Danbury and Ridgefield), Southeast, and Katonah;



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Executive Summary  
August 2021

- **TSMO (Travel and Incident Management)** – Continue NYSDOT’s program to implement Travel and Incident Management measures along the Study corridor;
- **TSMO (Expansion of Rideshare Programs and Park and Ride Facilities)** – Perform a Feasibility Study to identify future locations of Park and Ride facilities along the Study corridor; and
- **TSMO (Improvements to the State & Local Highway System that Access Transit)** – At key intersections surrounding the I-684 interchanges and MNR stations, evaluate operational, safety, and infrastructure improvements to the State and local highway system.

NYSDOT will pursue the recommendations identified herein either individually or collectively, subject to future funding and transportation priorities. All concepts would be progressed through NYSDOT’s Project Development process. As funding becomes available, proposed capital improvements (capital projects) will undergo required environmental reviews in accordance with State Environmental Quality Review Act (SEQRA) and/or National Environmental Policy Act (NEPA) depending on the source of necessary funding. Emerging technologies such as autonomous vehicles would also be further examined through NYSDOT’s Project Development process. Additionally, any future capital projects will be coordinated with FHWA and implemented such that the improvements meet Interstate standards.





# I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Introduction  
August 2021

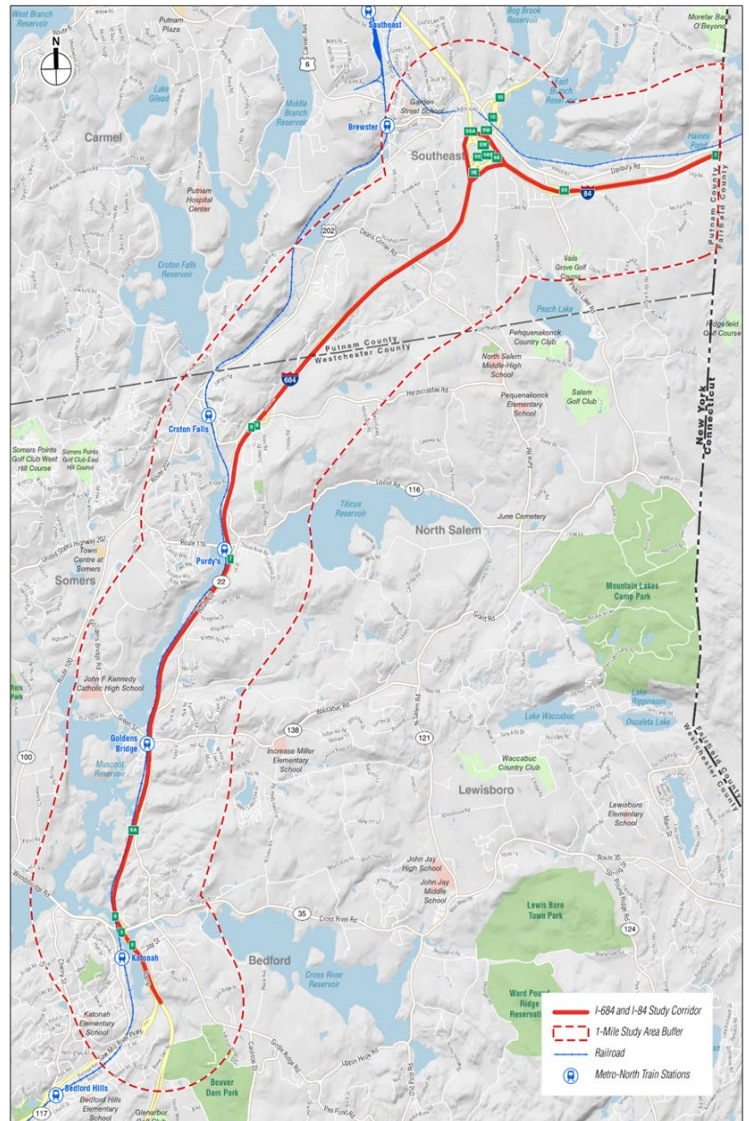
## FINDINGS REPORT

### FR-1 INTRODUCTION

The New York State Department of Transportation (“NYSDOT”) has conducted a Transportation Corridor Study (“the Study”) for an approximately 12-mile segment of Interstate 684 (“I-684”) between Exit 5 (Saw Mill River Parkway) and Exit 9 (Interstate 84 (“I-84”)). The study area extends from the Town of Bedford in Westchester County to the Town of Southeast in Putnam County. The study also includes the I-684 Exit 10 interchange / northern terminus of I-684 and an approximately 3-mile segment of I-84 from the I-684 Interchange east to the New York State Line.

A I-684 / I-84 Consortium (“Consortium”), with representation from Putnam County and the Towns of Bedford, Lewisboro, Somers, Southeast, and Ridgefield, Connecticut, was established in 2014. The Consortium worked with NYSDOT, the New York Metropolitan Transportation Council (“NYMTC”), and the Metropolitan Transportation Authority (“MTA”) on an ongoing basis to bring attention to the I-684 and I-84 corridors prior to the start of this Study.

As documented in this Findings Report, the principal results of the Study are the recommendation of preferred concepts to address existing and future capacity and mobility needs. Preferred concepts would be progressed through NYSDOT’s Project Development process, subject to future funding and transportation priorities.



**Figure FR-1: I-684 & I-84 Transportation Corridor Study Area**

### FR-2 STUDY BACKGROUND & CONTEXT

I-684 within the Study corridor is primarily a six-lane expressway, with three travel lanes in each direction, except between Exits 5 and 6 in Westchester County where I-684 narrows to two travel lanes in each

## **I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT**

Study Purpose  
August 2021

direction and is paralleled in each direction by a two-lane service road. I-84 within the Study corridor is a four-lane expressway, with two travel lanes in each direction. The distance between interchanges varies between approximately 0.5 miles and 5 miles along the Study corridor.

I-684 serves as a commuter route, a commercial truck route, and a recreational route. According to NYSDOT, over 90 percent of the traffic traveling along I-684 are single occupancy vehicles. Commuter use results in significant levels of congestion on weekdays; congestion is particularly pronounced at the southern end of the corridor between Exits 5 and 6 (Saw Mill River Parkway and NY 35) and at the northern end of the corridor near Exit 9 (I-684 interchange with I-84). Congestion on the Study corridor, increased usage of in-vehicle and mobile navigation apps (e.g., Google Maps, Apple Maps, Waze), and limited access to and from the Study corridor (e.g., partial interchanges) result in a significant number of diversions of traffic to various State and local roadways, affecting nearby residential neighborhoods and business districts. The Study corridor is considered a strategic freight highway and is part of the New York State Freight Core Highway Network. Recreational use during the summer season also results in increased traffic and congestion along the Study corridor.

It is anticipated that levels of congestion will worsen along I-684 and I-84 as growth continues along the Study corridor. Estimates of projected growth in population by the NYMTC indicate that Westchester and Putnam Counties will reach to over 1.25 million people by 2045, which represents a 17 percent increase over 2017 population estimates. Using NYMTC's Best Practices Model, a regional multimodal travel demand model, it is projected that traffic levels will increase at an average rate of 0.5 percent per year between 2017 and 2045, absent measures to moderate such increases.

Mass transportation is a significant component to the local and regional transportation network. MTA Metro-North Railroad's ("MNR") Harlem Line (funded by New York State) runs parallel to the Study corridor and MNR's Danbury Branch (funded by the State of Connecticut) is roughly 10 miles to the east of the Study corridor in Connecticut. Limited service along the MNR's Danbury Line results in lower ridership and increased reliance on the MNR Harlem Line for travel into and out of New York City. Commuter shuttle bus services are provided at several MNR Harlem Line stations to facilitate commuter traffic.

There are three park and ride facilities within proximity to the Study corridor that provide ridesharing opportunities for commuters. Two facilities in Southeast provide a total of 84 parking spaces and are free for all users. One facility in South Salem provides 30 parking spaces but requires a parking permit.

Currently planned transportation system improvements in the Study corridor (summarized in Section FR-8.2 of this document) do not provide additional corridor capacity.

### **FR-3 STUDY PURPOSE**

Based on the identified need for increased transportation capacity and multimodal mobility, the purpose of the Study is to identify transportation improvement strategies that will address projected traffic growth along the I-684 and I-84 corridors through the Year 2045. Ideally, transportation strategies will provide an acceptable level of service on I-684 and I-84 within the Study limits at a reasonable cost. Recommended transportation strategies will consider environmental impacts as well as opportunities to reduce traffic on local roadways, improve access to transit, and improve safety along the Study corridor.



## FR-4 CORRIDOR VISION STATEMENT & CORRIDOR GOAL STATEMENTS

Based on the identified purpose for the Study and public input received through the Study's public outreach process, the following vision statement was established for the Study corridor:

*The Interstate corridors of 684 and 84 in Westchester and Putnam counties will support safe, efficient, reliable, and environmentally sound movement of people and goods, minimizing diversions to secondary roadways. Local trips within the corridor and regional trips between New York City, the lower Hudson Valley and Western Connecticut will be along a well-managed and maintained facility with modernized interchanges and efficient, reliable connections to transit. Travel between modes will be well organized, predictable, seamless, and sustainable.*

Based on the identified transportation needs and corridor vision statement, the following corridor goal statements were identified:

- Provide a reliable, safe transportation corridor for all users and modes that minimizes traveler delay, accommodates current and future travel demand, and is perfectly coordinated with public transit.
- Improve transportation opportunities through innovative use of existing and new infrastructure, implementation of intelligent transportation systems, and creation of intermodal hubs.
- Modernize and improve operations and safety of the Interstates, including points of access, while improving the quality of life and enhancing the environment in a cost-effective manner.

## FR-5 STUDY DEVELOPMENT PROCESS

The Study was completed through a four-step development process. The process is summarized below and illustrated in Figure FR-2.

- **Step 1 – Existing Conditions and Corridor Vision** included the collection of environmental data, infrastructure data, socioeconomic data, and transportation (traffic and transit) data to document existing (Year 2019) conditions in the Study corridor. Based on comments received from the TPC and the public, a corridor vision statement and corridor goal statements were established to further guide the Study.
- **Step 2 – Future No Build Conditions and Development of Transportation Strategies** included the development of future (Year 2045) No Build conditions, which incorporated projected growth in population, planned development, and maintenance of the existing roadway and associated infrastructure along the Study corridor. The No Build Condition served as the baseline against which the effectiveness of transportation strategies was evaluated. Strategies and concepts were developed considering existing and future corridor needs and their potential to realize the vision and goals for the Study corridor. Based on input from the TPC and the public, feasible concepts with the greatest potential to address the Study corridor's needs, vision, and goals were identified and advanced for further evaluation.



# I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Study Development Process  
August 2021

- **Step 3 – Feasible Concepts Development** included the further evaluation of feasible concepts identified from Step 2 of the study development process. A further evaluation enabled the project team to better define the anticipated costs and benefits associated with each concept. The findings of the further evaluation were shared with the TPC and summarized within this report for review and comment from the public.
- **Step 4 – Final Study Recommendations** included the development of final study recommendations based on the ability of concepts to address the Study corridor's needs, vision, and goals. The final study recommendations also incorporated feedback received on a draft version of this document that was circulated to TPC members in June 2021.



**Figure FR-2: Project Schedule Flow Chart**



## FR-6 PUBLIC OUTREACH PROCESS

Public outreach was integral to each step of the Study's development process. The public outreach process involved key stakeholders in Putnam and Westchester Counties and the Town of Ridgefield, Connecticut. NYSDOT utilized the public outreach process to obtain input from key stakeholders and to provide information on the Study on an ongoing basis. The public outreach process included:

- **Elected Officials Meeting** – A meeting with elected officials was held on July 25, 2019, to introduce the Study team and provide further information on the Study. In addition to background information on the corridor and the history of the Study's initiation, presented at the meeting were the Study schedule and public outreach process.
- **Public Workshop** – One public workshop was held on December 12, 2019, to provide information on the Study to stakeholders and to obtain valuable input on all aspects of the Study.
- **Transportation Partnering Committee ("TPC") Meetings** – The TPC was a working committee comprised of representatives from the Town of Bedford, Town of Lewisboro, Town of North Salem, Town of Southeast, Town of Somers, Town of Ridgefield (Connecticut), Westchester County, Putnam County, Metro-North Railroad (MNR), the Connecticut Department of Transportation ("CTDOT"), and Federal and State government officials. A series of TPC meetings (five) were held so that the committee could provide direction and guidance on all major decisions necessary to complete the Study.
- **Direct Meetings with Key Stakeholders** – The Study team held direct meetings as needed with government representatives and other agencies to discuss the progression of the Study, gain feedback, and coordinate with other efforts. Throughout the course of the Study, the Study team met with CTDOT, MNR, the New York State Department of Environmental Conservation, the New York City Department of Environmental Protection, and the Town of Bedford.

NYSDOT also received comments via email throughout the course of the Study. These comments were reviewed by the study team and incorporated into the study accordingly.

## FR-7 EXISTING (YEAR 2019) CONDITIONS IN THE STUDY CORRIDOR

Step 1 of the Study's development process involved the documentation of baseline (2019) conditions in the Study corridor, prior to the onset of the COVID-19 pandemic ("pandemic"). As summarized below, this included information on land use and demographics; various elements of the natural environment; and transportation and sustainability.

### FR-7.1 Land Use and Demographics

The approximately 12-mile Study corridor passes through two counties (Westchester and Putnam), four towns – Bedford, Lewisboro, North Salem, and Southeast – and is proximate to the Village of Brewster, the Hamlets of Katonah, Goldens Bridge, Purdy's, and Croton Falls, and City of Danbury, Connecticut, and the Town of Ridgefield, Connecticut. The predominant land uses in the Study corridor are traditional residential subdivisions and mixed commercial uses. Higher densities of uses are generally concentrated around

## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Existing (Year 2019) Conditions in the Study Corridor  
August 2021

hamlet centers. Land uses of regional significance in the Study area corridor include the Croton Watershed and surrounding wetlands; large parcels in active agricultural operation; and the MNR Harlem Line, with seven MNR stations within the Study corridor.

According to U.S. Census Bureau, the estimated combined population of Westchester and Putnam Counties in 2018 was 1,066,504 individuals, up 1.7 percent from 1,048,823 individuals in 2010. Several potential environmental justice areas were identified just west of the I-684 / I-84 Interchange in the Village of Brewster (Putnam County) and within the hamlets of Bedford Hills and Katonah in the Town of Bedford (Westchester County).

### FR-7.2 Natural Environment, Farmland, and Parks

#### *Noise*

Noise sensitive receptors proximate to the Study corridor include residential land uses; educational facilities; health facilities; theaters, auditoriums, historic and cultural facilities; religious facilities; playgrounds, athletic fields, and outdoor sports facilities; recreational facilities such as nature trails and bike paths; state owned forest lands; and public parks.

#### *Air Quality*

Air quality sensitive land uses proximate to the Study corridor include public open spaces (sidewalks, playgrounds, athletic fields, outdoor sports facilities, and public parks); residential buildings; educational facilities; and health facilities. The New York-New-Jersey-Connecticut metropolitan area, including Westchester County, is classified as a Serious Ozone Non-attainment Area under the 2008 8-hour ozone standard effective July 20, 2012, and a Moderate Ozone Non-attainment Area under the 2015 8-hour ozone standard effective August 3, 2018. Putnam County is classified as an attainment area under the 2008 8-hour ozone standard effective July 20, 2012, and the 2015 8-hour ozone standard effective August 3, 2018.

#### *Ecology and Endangered Species*

The U.S. Fish and Wildlife has identified two threatened species (the Northern long-eared bat and the bog turtle) and one endangered species (Indiana bat) in both Westchester and Putnam Counties.

#### *Wetlands, Navigable Waters, and Wild, Scenic, and Recreational Rivers*

National Wetland Inventory ("NWI") freshwater wetlands and New York State Department of Environmental Conservation ("NYSDEC") wetlands including the areas surrounding the Croton Watershed and the six watershed reservoirs (East Branch, Bog Brook, Croton Falls, Titicus, Muscoot, and Cross River) are present throughout the Study corridor. NWI wetlands would likely be under the jurisdiction of the U.S. Army Corps of Engineers (USACE). The Croton Watershed is under the jurisdiction of the New York City Department of Environmental Protection ("NYCDEP"). Additional potential jurisdictional wetlands located within the Study corridor would be identified by further site investigation.

Study area water bodies and watercourses were identified based on data from NYSDEC. Most of the currently identified watercourses located within the Study corridor are classified by the NYSDEC as either



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Existing (Year 2019) Conditions in the Study Corridor  
August 2021

Class A or AA (indicating sources of drinking water), Class B (indicating waters supporting contact recreation), or Class C (indicating waters supporting fisheries and non-contact activities) rivers and streams. There are no state wild, scenic, or recreational rivers within a one-mile buffer of the Study corridor.

### *Parks, Cultural Resources, and Farmland*

Several historic sites listed on the State or National Register of Historic Places are located within the one-mile buffer of the study corridor. Large portions of the Study corridor are identified agricultural land uses. Prime farmland soil areas, as defined by the U.S. Department of Agriculture as land that has the best combination of physical and chemical characteristics needed to produce economically sustained high yields of crops, exist along the study corridor.

### *Section 4(f) and Section 6(f) Resources*

Subsequent to the completion of the Study, an evaluation in conformance with the requirements of Section 4(f) of the United States Department of Transportation Act of 1966 will be completed to (a) identify prudent and feasible alternative to activities that may affect identified resources; (b) document planning measures undertaken to minimize harm to historic sites resulting from use; or (c) identify any measures to minimize harm (such as any avoidance, minimization, mitigation, or enhancement measures) that will result in a de minimis impact on the property.

Section 6(f) of the Land and Water Conservation Fund Act of 1965 ("LWCF") requires that the conversion of lands or facilities acquired with Land and Water Conservation Act funds be coordinated with the Department of the Interior. A review of the LWCF database does not indicate the presence of LWCF-funded lands within a one-mile buffer of the Study corridor.

## **FR-7.3 Transportation and Sustainability**

### *Traffic Volumes*

Baseline (2019) Average Annual Daily Traffic (AADT) volumes along I-684 range from 24,000 vehicles per day (vpd) at the northern terminus of I-684 (north of Exit 10) to over 96,000 vpd between Exit 5 and Exit 6 in Katonah. AADT volumes are also high on I-684 just to the south of the I-84 Interchange, with over 76,000 vpd. Current (2019) AADT volumes on I-84 east of the I-84 interchange are approximately 69,000 vpd.

### *Travel Patterns (Origin and Destination Analysis)*

An origin-destination analysis was performed for the Study corridor to determine how motorists were utilizing the corridors during commuter peak periods using StreetLight Data. The analysis confirmed that both I-684 and I-84 serve their intended purpose to carry traffic through the area. More than half of the traffic in either direction of I-684 is traveling through the area to points outside of the Study area.

### *Traffic Operations (Levels of Service)*

Baseline (2019) traffic volumes were analyzed to determine peak hour levels of service (LOS) along the Study corridor. LOS is a qualitative measure of traffic operations, ranging from LOS A (free flow conditions;



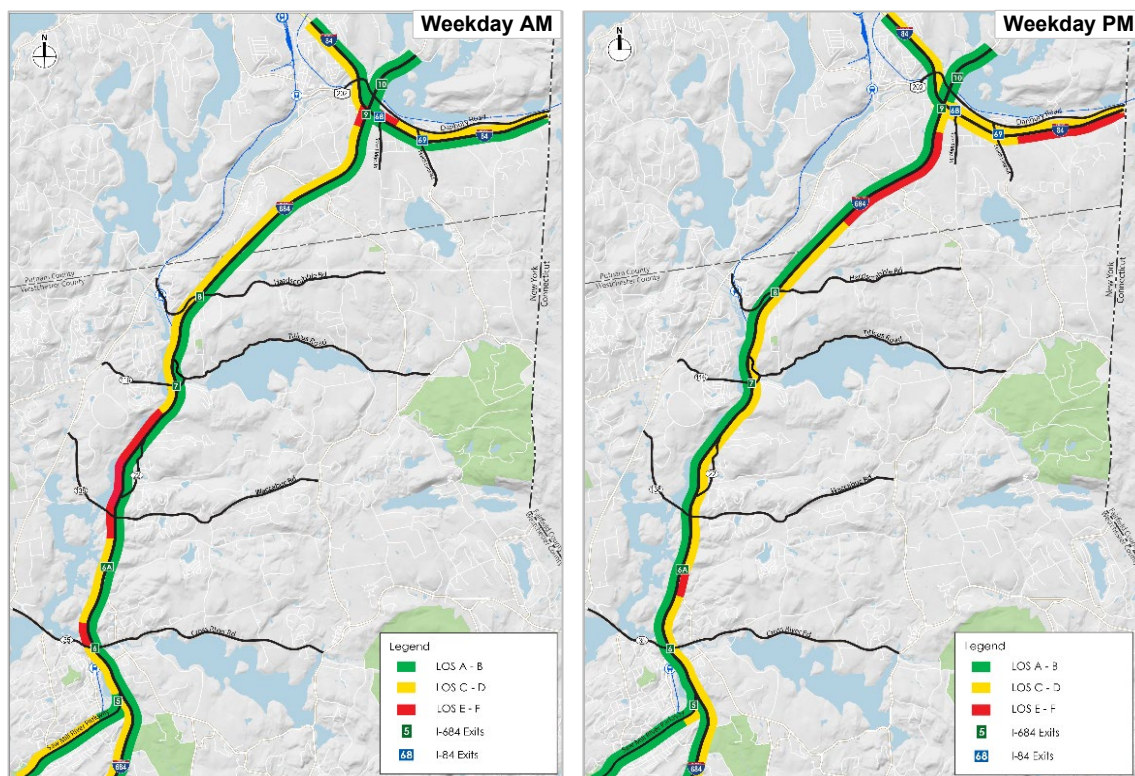
## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Existing (Year 2019) Conditions in the Study Corridor  
August 2021

no delay) to LOS F (breakdown in vehicular flow; significant delay). Generally, LOS D or better is considered as an acceptable LOS.

During the existing AM peak hour, there is congestion at the merge from I-84 onto SB I-684 and further south along I-684 in the vicinity of the on-ramp from Exit 6A (NY 138) and the off-ramp to Exit 6 (NY 35). WB I-84 also experiences congestion just east of the I-684 interchange. During the existing PM peak hour, NB I-684 operates at an acceptable LOS along most corridor segments, with a few exceptions. There is congestion to the north of Exit 6 (NY 35) and along the nearly two-mile segment north of the Brewster Rest Area leading to the single lane off-ramp to EB I-84. EB I-84 also experiences congestion east of the I-684 interchange, continuing past the New York State Line into Connecticut.

Existing weekday AM (7:00 AM to 8:00 AM) and weekday PM (5:00 PM to 6:00 PM) peak hour conditions are illustrated in Figure FR-3. As a result of the congestion at the I-684 / I-84 interchange, motorists are known to divert to other adjacent State and local roadways to bypass the congestion.



**Figure FR-3: Existing (2019) Weekday AM and Weekday PM Peak Hour Levels of Service**

### *Safety Conditions (High Crash Locations)*

Several high crash locations were identified along the Study corridor. Analyses indicate that approximately half of the crashes were minor crashes which only involved property damage. Most of these crashes were rear-end crashes and were caused by motorists following too closely, traveling at an unsafe speed, or performing unsafe lane changes.



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Existing (Year 2019) Conditions in the Study Corridor  
August 2021

### Freight

Both I-684 and I-84 are considered strategic freight highways and facilitate the movement of trucks throughout New York State and the Northeast Region. Both corridors are part of the New York State Freight Core Highway Network. One rest area is located within the Study corridor (north of Exit 8 in Brewster) and serves as a commercial truck stop.

In addition to truck freight, the region surrounding the Study area supports rail freight and air cargo freight. There is no freight rail on the MNR Harlem Line.

### Rail and Bus Transit Services

MNR's Harlem Line generally runs parallel to the Study corridor within the Study extents and provides regional railroad service to the study area. On an average weekday (pre-pandemic), approximately 14,000 trips are made at these seven MNR stations, which makes up 8 percent of total Harlem Line ridership. Limited service along the MNR's Danbury Line (funded by the State of Connecticut) results in lower ridership (approximately 2,400 trips on an average weekday) and increased use of the MNR Harlem Line by commuters from Connecticut. Housatonic Area Regional Transit and Putnam Area Rapid Transit both provide shuttle and bus service at select Harlem Line MNR stations to facilitate commuter traffic. Specific MNR station and shuttle service ridership is illustrated in Figure FR-4.

Most commuters drive to MNR stations. Some MNR stations are difficult to access from I-684; for example, there are no southbound I-684 exits near the Purdy's and Goldens Bridge stations. Typical parking utilization at the seven Harlem Line stations along the corridor ranges from 85 percent to 100 percent on an average weekday; parking usage represents a mix of daily parking and permit parking. Demand for permit parking at Harlem Line stations exceeds the number of available permit parking spaces.

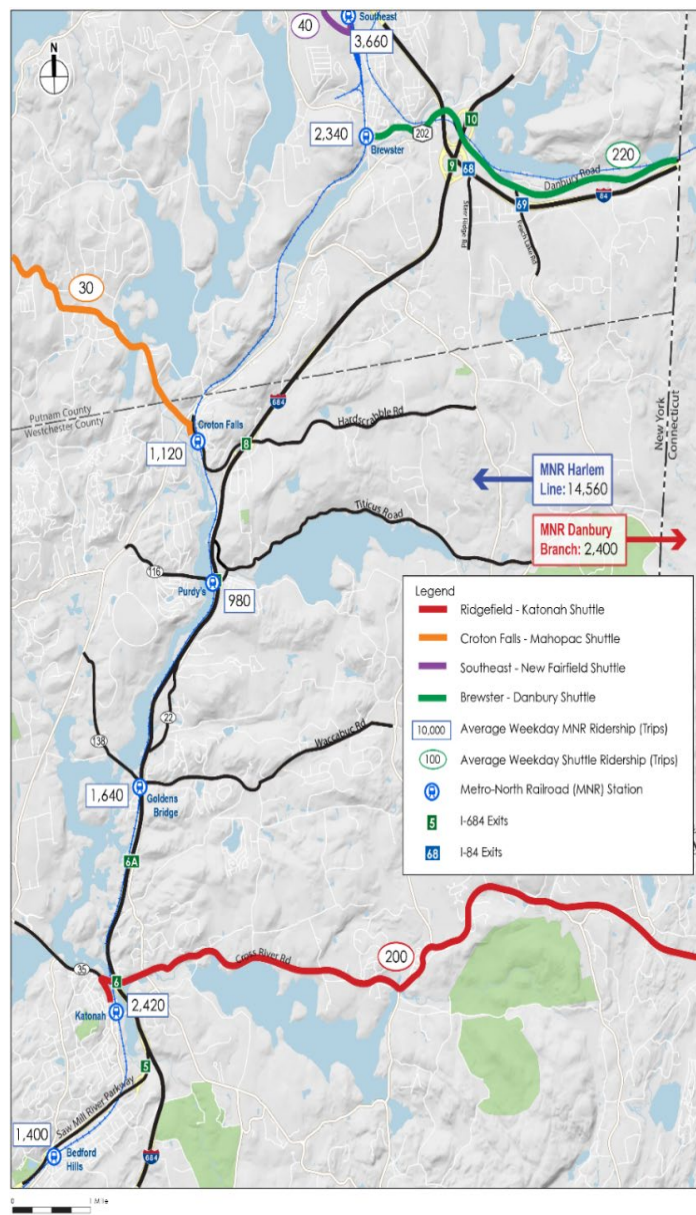


Figure FR-4: Average Weekday Transit Ridership

## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Estimated Future (Year 2045) Conditions in the Study Corridor  
August 2021

### *Sustainability*

Ongoing sustainability efforts potentially affecting the development and evaluation of transportation concepts and strategies identified in this Study include the NYSDOT GreenLITES program and the 2013 Mid-Hudson Regional Sustainability Plan.

## **FR-8 ESTIMATED FUTURE (YEAR 2045) CONDITIONS IN THE STUDY CORRIDOR**

The year 2045 was identified to establish the land use, demographics, and transportation conditions that would be present in the Study corridor. Outside of programmed improvements to the transportation network, the existing Study corridor and associated infrastructure would be maintained. This future No Build Condition served as the baseline against which the effectiveness of potential transportation strategies was evaluated.

### **FR-8.1 Land Use and Demographics**

It is anticipated that the Study corridor within Westchester and Putnam counties will be further developed as permitted by local town comprehensive plans. Major proposed developments within the Study corridor include the proposed Somers Academy project, Commercial Campus at Fields Corner project, and Stateline Retail Center project.

NYMTC's Best Practices Model was used to project changes to travel demand within the Study corridor. Travel demand is driven by projected changes to socioeconomic conditions within the Study corridor. Based on NYMTC data, the estimated combined population of the seven Towns that are in proximity to the Study corridor (Carmel, Southeast, Somers, North Salem, Lewisboro, Bedford, and Pound Ridge) is projected to increase to 25,011 individuals in 2045, which is up 19.3 percent from an estimated 20,964 individuals in 2017 (a compounded annual growth population growth rate of 0.6 percent).

### **FR-8.2 Transportation Conditions**

#### *Future Traffic Volumes*

Using NYMTC's Best Practices Model, it is projected that peak hour traffic levels will increase at an average rate of 0.5 percent per year from 2019 to 2045, absent measures to moderate such increases. This corresponds to a thirteen (13) percent growth in traffic over the 26-year forecast period. It is anticipated that peak hour traffic will grow at a slightly lower rate than off-peak traffic due to peak period congestion within the Study corridor. Projected 2045 AADT volumes within the Study corridor range from approximately 27,150 vehicles per day at the northern terminus of I-684 (north of the I-84 interchange) and increase to over 109,200 vehicles per day further south between Exits 5 and 6.

#### *Future Traffic Operations (Levels of Service)*

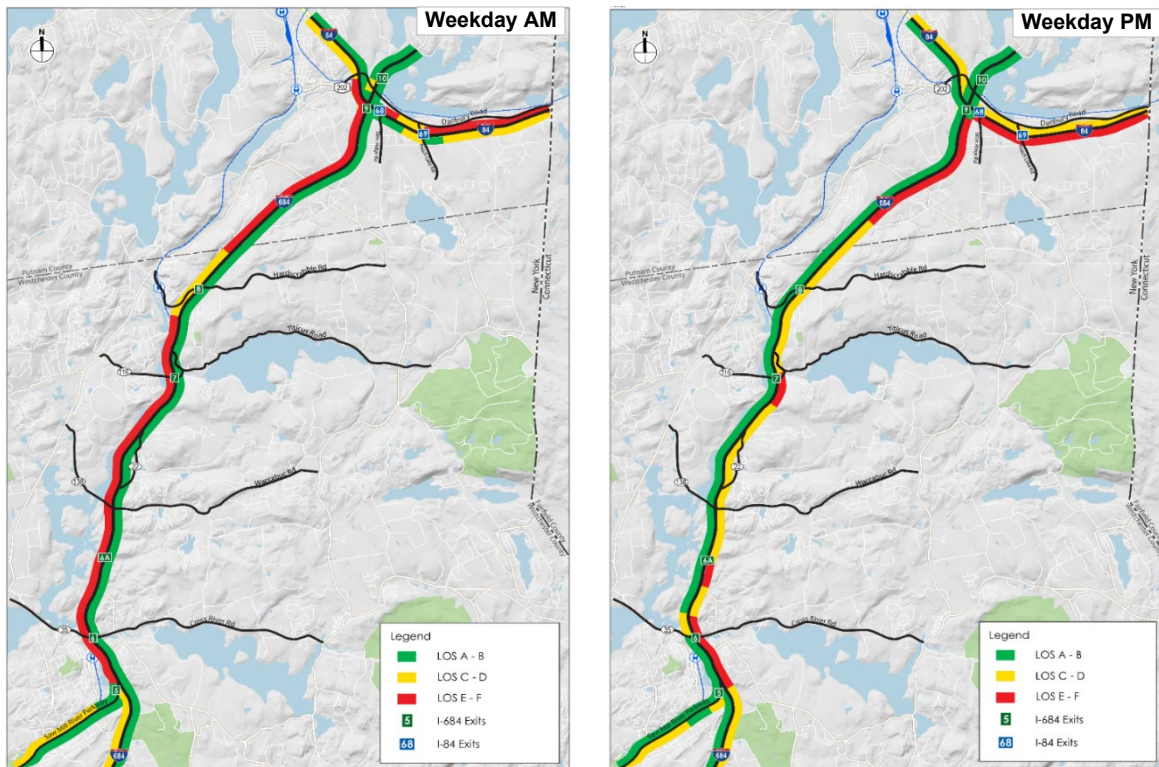
Projected increases in peak hour traffic are expected to worsen congestion along the Study corridor. During the Year 2045 AM peak hour, there is congestion at the merge from I-84 onto SB I-684, which continues



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Estimated Future (Year 2045) Conditions in the Study Corridor  
August 2021

further south to the Westchester / Putnam County line. South of Exit 8 (Hardscrabble Road), congestion continues past Exit 6 (NY 35) under future conditions. WB I-84 also experiences congestion east of the I-684 interchange, continuing past the New York State Line into Connecticut. During the Year 2045 PM peak hour, NB I-684 experiences congestion at the on-ramp from Exit 6 (NY 35), the off-ramp at Exit 6A (Goldens Bridge Road / NY 138), and along the nearly two-mile segment north of the Brewster Rest Area leading to the single lane off ramp to EB I-84. EB I-84 also experiences congestion east of the I-684 interchange, continuing past the New York State Line into Connecticut.



**Figure FR-5: Projected (2045) Weekday AM and Weekday PM Peak Hour Levels of Service**

### *Future Freight Conditions*

Both I-684 and I-84 are considered strategic freight highways and facilitate the movement of trucks throughout New York State and the Northeast Region. The region surrounding the Study area supports rail freight and air cargo freight. Per the August 2019 New York State Freight Transportation Plan, the value of freight moved along New York State's highways, rails, pipelines, maritime ports, and airports is projected to increase by nearly 75 percent to almost \$4 trillion by 2040. It's anticipated that the Study corridor will experience significant increases in freight traffic in response to projected increases in freight value.

### *Planned Roadway Improvements*

Work is ongoing on CTDOT's I-84 Danbury Project, which aims to reduce congestion and improve the mobility of people and goods along the I-84 corridor in greater Danbury. In late 2019, CTDOT decided to extend the project's western study limits from Exit 3 (Route 7) to the New York State Line due to this Study



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Transportation Concepts and Identification of Feasible Concepts  
August 2021

and due to increased development in the west side of Danbury, Connecticut. Improvements to the I-84 corridor in Connecticut could relieve congestion on both I-684 and I-84 in New York.

### *Planned Rail and Bus Transit Improvements*

Planned improvements to MNR include the construction of a 450-space surface parking lot for commuters in proximity to the MNR Croton Falls Station and parking improvements at the MNR Southeast Station related to the Brewster Yard Improvements – Southeast Parking project.

Work is ongoing on the Southeast, NY-to-Danbury, CT Link Feasibility/Planning Study to determine the feasibility of restoring passenger service on the Beacon Line between Southeast and Danbury. This study will include an assessment of project costs and benefits, including the potential for reductions in roadway congestion and passenger travel time. Reconnecting the Beacon line could relieve traffic congestion on the I-684 and I-84 corridors.

The Westchester County Mobility and Bus Re-Design Study ([www.westchestermobility.org](http://www.westchestermobility.org)) will assess the County's transportation services, demographics, employment trends, mobility conditions, and other factors to understand how well the transportation network matches existing travel needs, and identify opportunities to strengthen it and meet future needs. The goal of the study is to better align the county's mobility network with the needs of its residents, workers, and visitors. This has the potential to improve transit service within the Study corridor.

In the near term, there are several transit projects listed in the 2020-2024 *Transportation Improvement Programs* (TIP) for Westchester County and Putnam County, including enhancements to existing bus service in Westchester County and Putnam County.

## **FR-9 TRANSPORTATION CONCEPTS AND IDENTIFICATION OF FEASIBLE CONCEPTS**

Five sets of transportation concepts (also referred to as strategies with the public) were identified as having the potential to address the vision and goals of the Study corridor. Transportation concepts were developed to a schematic level of design, including the preparation of typical cross sections that identify the number of travel lanes, shoulder widths, and other key geometric characteristics. Preliminary cost estimates (in 2020 dollars) were developed for the mainline and interchange improvement concepts using an assumed cross section for each concept and an assumed cost per lane mile based on costs for similar facilities in the region. Anticipated right-of-way ("ROW") costs were not included in the preliminary cost estimates.

A I-684 / I-84 Consortium ("Consortium"), with representation from Putnam County and the Towns of Bedford, Lewisboro, Somers, Southeast, and Ridgefield, Connecticut, was established in 2014 to discuss potential capital improvements to the Study corridor. The Study team reviewed the potential improvements suggested by the Consortium as part of the development of transportation concepts.

Below is a description of each concept and the results of the evaluation process. The concepts were reviewed by the TPC and by the public at Public Workshop 1. None of the transportation concepts referenced herein are discarded or eliminated from further consideration; that is, all concepts not



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Transportation Concepts and Identification of Feasible Concepts  
August 2021

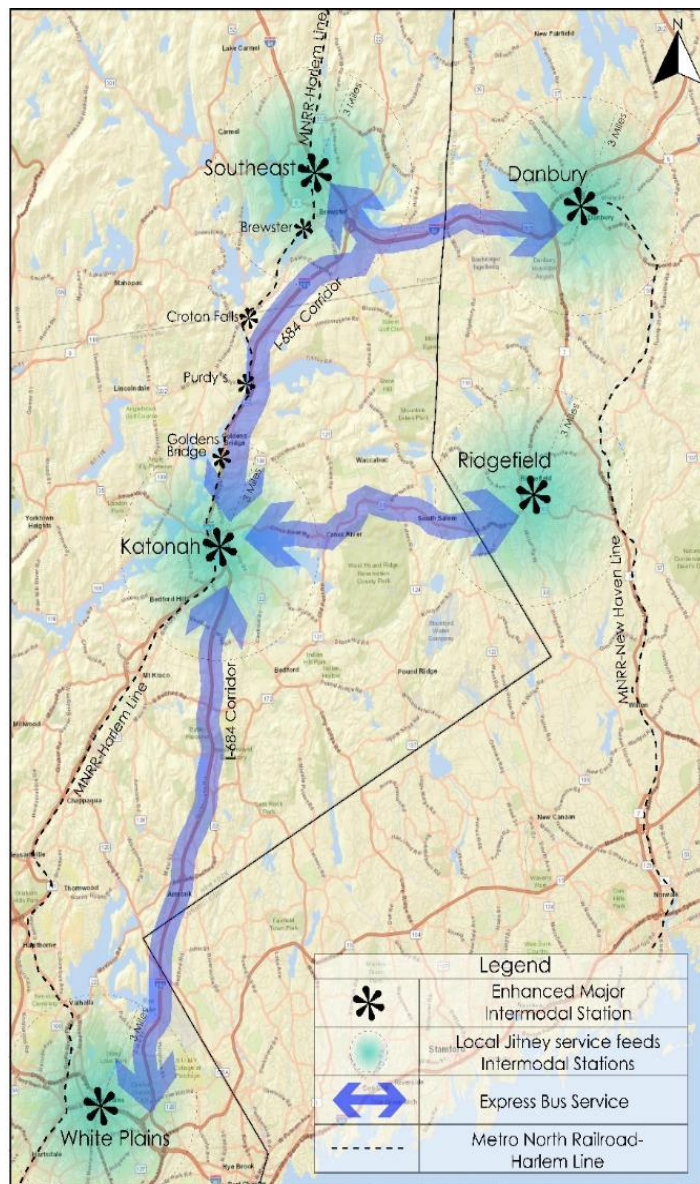
recommended for further evaluation in this study can be evaluated and/or advanced further in the future through a separate effort.

**No Build (Maintain Existing Roadway)** – Under the No Build concept, the Study corridor would continue to operate as it does today. The corridor would maintain the same number of lanes as the existing roadway and would not require a substantial capital investment other than that required to maintain existing infrastructure. However, the No Build concept would not address the vision and goals of the Study corridor. Although this concept was not advanced for further evaluation, it was used as the baseline condition against which other transportation concepts were evaluated.

### Regional Transportation Alternatives Plan

– This high-level concept was developed in response to current transportation trends in the Study corridor. Intermodal stations would be enhanced in White Plains and Katonah in Westchester County, Southeast in Putnam County, and in Danbury and Ridgefield in Fairfield County (Connecticut). Express bus service would be provided in between these intermodal centers and local jitney services would be provided in proximity to each intermodal center to provide “first mile” or “last mile” transit connections. Enhancements to the mass transportation system would improve mobility for commuters throughout the Study corridor and provide higher capacity than typical mainline or interchange widening options, resulting in a more efficient transportation network. This concept had the potential to address the Study’s vision and goals. While it was not advanced for further evaluation, it is recommended that a separate feasibility study / master plan be performed to further evaluate potential improvements and impacts associated with intermodal stations and proposed bus services.

**Transportation System Management & Operations (TSMO) Solutions** – This concept involves the implementation of a broad set of strategies that can optimize overall performance of the existing



**Figure FR-6: Regional Transportation Alternatives Plan**

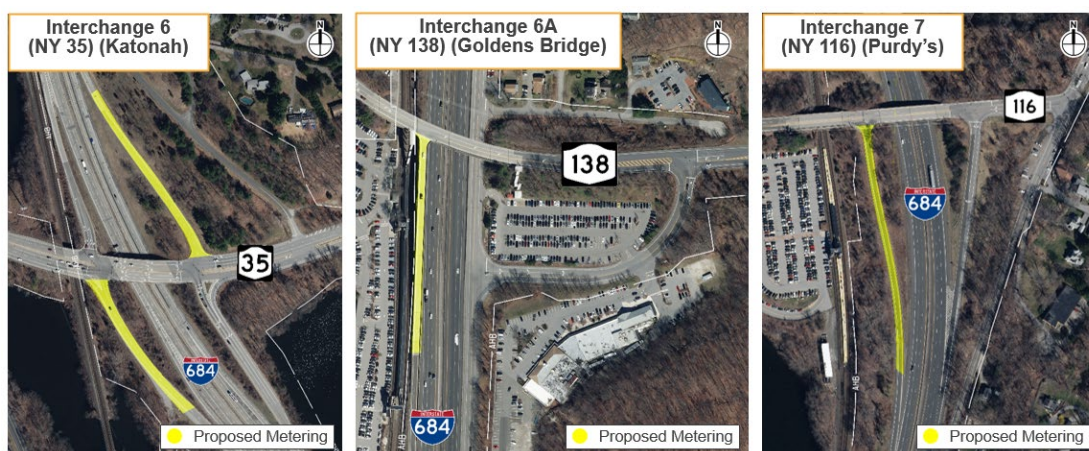


## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

### Transportation Concepts and Identification of Feasible Concepts August 2021

transportation system. These strategies are often coordinated across multiple jurisdictions, agencies, and modes with the goal of making the various transportation modes and facilities work together more efficiently. Four strategies were considered and evaluated:

- **Ramp Metering** – Ramp meters are traffic signals installed on freeway on-ramps to control the frequency at which vehicles leave the ramp queue and enter the flow of traffic on the freeway. This concept is designed to reduce congestion and improve safety by better regulating the flow of traffic at difficult freeway merge locations where there are high on-ramp volumes and/or the ramp geometry is substandard. Ramp metering was considered along I-684 at Exit 6, Exit 6A, and Exit 7. This concept had the potential to address the Study's vision and goals and was advanced for further evaluation.



**Figure FR-7: Proposed Ramp Metering Locations, I-684 Corridor**

- **Travel and Incident Management** – Travel and Incident Management consists of a planned and coordinated multi-agency process to provide real-time travel information to motorists, reducing the potential for diversions along adjacent State and local roadways, and to minimize the duration and impacts of incidents on the transportation network. Hybrid travel time signage and variable message signage are two examples of how important travel information can be provided to motorists. This concept builds upon NYSDOT's current Sign Upgrade and Intelligent Transportation Systems ("ITS") project along the I-684 and I-84 corridors. This concept had the potential to address the Study's vision and goals. While it was not advanced for further evaluation, it is recommended that NYSDOT continue its program to implement these measures in the Study corridor.
- **Expansion of Rideshare Programs and Park and Ride Facilities** – The Study corridor provides limited opportunity by way of facilities for ridesharing commuters. Park and ride lots at Route 6 and Tilly Foster Road (near the Southeast MNR station), Brewster Rest Stop Area, and South Salem provide only 114 spaces for commuters along the 11-mile Study corridor. Expanding rideshare programs and park and ride facilities would encourage carpooling and attract more users to mass transit, which would reduce congestion along the corridor. This concept had the potential to address the Study's vision and goals. While it was not advanced for further evaluation, it is recommended that a separate Park and Ride Feasibility Study be conducted to identify potential future locations of Park and Ride facilities along the Study corridor.

## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Transportation Concepts and Identification of Feasible Concepts  
August 2021

- **Improvements to the State and Local Highway System that Access Transit** – Several State and local highways provide direct access from the Study corridor to MNR stations. Potential improvements would look to improve access to/from MNR stations and the Study corridor, which could result in reduced travel times to/from MNR stations and improved multimodal safety. This concept had the potential to address the Study’s vision and goals. While it was not advanced for further evaluation, it is recommended that NYSDOT further evaluate potential operational and safety improvements to key intersections surrounding I-684 interchanges and MNR stations adjacent to the Study corridor.

**Mainline Improvements** – Several mainline improvement concepts were developed and evaluated. All mainline improvements proposed new travel lanes with have three possible usages – General Use (all traffic can use the travel lane), High Occupancy Vehicle (“HOV”) Use (travel lanes are generally designated for vehicles with two or more passengers), and Transit Use (travel lanes are designated for commuter transit services). Regardless of usage the mainline improvement concepts would provide temporary (peak hours only) or permanent increases to the capacity of the Study corridor, also reducing the potential for diversions along adjacent State and local roadways.

- **I-684 Peak Hour Shoulder Use (NY 35 to I-684)** – This concept involves the utilization of the left or right shoulders of an existing roadway for temporary travel during peak hours. An example of peak hour shoulder use is illustrated below. An additional travel lane in each direction of travel would be constructed in the existing shoulder of the I-684 roadway between Exit 6 (NY 35) and Exit 9 (I-84). Mainline bridges and overpasses may need to be widened or realigned to accommodate the additional travel lane. These lanes would be intended for “part-time” use only, specifically during the AM peak hour in the southbound direction and the PM peak hour in the northbound direction. The peak hour shoulder use could be expanded to off-peak periods as well. The operation of peak hour shoulder use would be managed by NYSDOT to optimize corridor traffic conditions; however, this concept would result in increased operational costs for the I-684 corridor.



**Figure FR-8: Example of Peak Hour Shoulder Use (I-66 in Virginia)**

Implementing peak shoulder use would increase peak period capacity and reduce delays along the I-684 corridor. This concept is more cost-effective compared to new construction since the construction and roadway modifications would generally exist within the footprint of the existing I-684 corridor. Some area may be needed outside of the footprint of the I-684 corridor to construction emergency pull-off areas so that the peak hour shoulder can remain in operation if an incident occurs. Potential

## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

### Transportation Concepts and Identification of Feasible Concepts August 2021

environmental effects of this concept would be minimal compared to other mainline concepts since it would generally not require construction outside of the existing roadway alignment. The capital cost of a peak hour use shoulder lane in each direction between Exit 6 and Exit 9 would range between \$500 million and \$600 million. This concept had the potential to address the Study's vision and goals and was advanced for further evaluation.

- **I-684 Fourth Travel Lane (NY 35 to I-684)** – This concept is comprised of adding an additional (fourth) travel lane along both directions of the I-684 mainline between Exit 6 (NY 35) and Exit 9 (I-84), which would increase peak period capacity and reduce delays along the corridor. Widening into the existing shoulder area would be required to allow for the addition of one travel lane and to reconstruct one right shoulder in each direction of travel. Mainline bridges and overpasses would need to be widened or reconstructed to accommodate the additional travel lane. Implementation of this concept could potentially result in some adverse environmental impacts since the footprint of the I-684 corridor would extend outside of the existing roadway alignment. The capital cost of a fourth lane in each direction between Exit 6 and Exit 9 would range between \$800 million and \$900 million.

Although this concept had the potential to address the Study's vision and goals, it was not advanced for further evaluation as this concept. When compared against the I-684 Peak Hour Shoulder Use concept, the fourth travel lane concept would likely result in more adverse environmental impacts and would require a significantly higher capital cost, while providing comparable travel time and operational benefits.

- **I-84 Third Travel Lane (I-684 to New York State Line)** – This concept would add a third travel lane along both directions of I-84 between I-684 to the west and the New York State Line to the east. This concept would increase peak period capacity and reduce delays along the corridor. Additionally, the improvements associated with this concept would be optimized if a third travel lane was continued east of the New York State Line into Connecticut; this would require further coordination with CTDOT. Widening into the existing grass median area would be required to allow for the addition of two travel lanes and to reconstruct two left shoulders. Mainline bridges and overpasses would need to be widened or reconstructed to accommodate the additional travel lane. Implementation of this concept could potentially result in some adverse environmental impacts since a portion of the existing median would be repurposed as part of the new roadway alignment. The capital cost of a third lane in each direction I-84 between Exit 68 (I-84) and the New York State Line would range between \$200 million and \$250 million. This concept had the potential to address the Study's vision and goals and was advanced for further evaluation.
- **I-684 Reversible “Flex” Lanes (Saw Mill River Parkway to I-84)** – This concept would introduce two reversible “flex” lanes along the I-684 corridor between Exit 5 (Saw Mill River Parkway) and Exit 9 (I-84) to reduce peak hour congestion and improve peak hour traffic operations. Two reversible flex travel lanes with shoulders on both sides of the lanes would be installed in the median and would “open” to accommodate traffic in the peak direction during the AM and PM peak periods, adding more than 50 percent of additional of peak directional capacity along the I-684 corridor. To accommodate these additional lanes, this concept would require reconstruction of existing roadways, interchanges, bridges, and utility infrastructure where wide median areas do not currently exist. Additionally, implementation

## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

### Transportation Concepts and Identification of Feasible Concepts August 2021

of this concept would result in adverse environmental impacts since the footprint of the I-684 corridor would extend outside of the existing roadway alignment. The operation of reversible “flex” lanes would be managed by NYSDOT to optimize corridor traffic conditions; however, this concept result in increased operational costs for the I-684 corridor. The capital cost of reversible “flex” lanes for this 11-mile segment of I-684 would range between \$1 billion and \$1.1 billion.

Given the significant cost and potential for environmental impacts relative to other mainline improvement concepts, this concept was not advanced for further evaluation as it would not address the Study’s vision and goals.

**Interchange Improvements** – Several interchange improvement concepts were developed and evaluated. Each of these concepts would improve interchange operations and improve access to MNR stations.

- **I-684 Interchanges 5 and 6 (Saw Mill River Parkway and NY 35)** – This concept proposes to provide direct connections between the Saw Mill River Parkway and I-684, eliminating the need to use the service roads to connect between the two limited access facilities. The service roads would continue to provide direct connections between I-684 and NY 35. A proposed third travel lane on I-684 will be extended through the interchange, eliminating the existing lane drop between Exit 5 and Exit 6 in both directions. Several bridges would require widening or reconstruction due to the widened footprint and realignment of I-684. At the interchange with NY 35 (Exit 6), it’s proposed to reconstruct the NY 35 / I-684 interchange as a diverging diamond interchange (“DDI”) with several bridges over I-684 and MNR. The DDI would provide additional capacity to serve the high volumes of left turning vehicles coming from points east and destined to either I-684 or the Saw Mill River Parkway.

Implementation of this concept could potentially result in some adverse environmental impacts since the footprint of the I-684 corridor would extend outside of the existing roadway alignment and would require the use of land outside of the existing ROW. Wetland areas would also be impacted. This concept would reduce peak hour congestion and improve traffic operations at these two interchanges. The capital cost of this proposed improvements at the Exit 5 and Exit 6 Interchange would range between \$400 million and \$450 million. This concept had the potential to address the Study’s vision and goals and was advanced for further evaluation. Graphics of this concept are provided in Section FR-10.1.4 of this report.

**I-684 Interchange 6A (Goldens Bridge Road to NY 138)** – This concept proposes to complete the interchange between I-684 and NY 138, improving overall mobility in the area. NY 22 would be realigned to the east to create new northbound I-684 connections to/from NY 138 and a new southbound I-684 connection to NY 138 would be constructed. The NY 138 bridge over I-684 would also be widened. The proposed interchange completion and cross street widening would also improve access to the MNR station at Goldens Bridge. Implementation of this concept could potentially result in some adverse environmental impacts since the footprint of the I-684 corridor would extend outside of the existing roadway alignment, along with potential impacts to the existing properties along the realigned NY 22. The capital cost of proposed improvements at Interchange 6A would range between \$75 million and \$100 million.



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Transportation Concepts and Identification of Feasible Concepts  
August 2021



**Figure FR-9: Conceptual Improvements at I-684 Interchange 6A (NY 138)**

Based upon comments received from both the public and the TPC, it was evident that more study and coordination would be required with adjacent communities on potential partial interchange improvements at Interchange 6A. While this concept had the potential to address the Study's vision and goals, it was not advanced for further evaluation. It is recommended further studies be performed at this interchange. Additional public outreach will be needed to determine whether potential improvements are feasible and supported by the local community.

**I-684 Interchange 7 (NY 116)** – This concept proposes to complete the interchange between I-684 and NY 116, improving overall mobility in the area. New ramps connecting NY 116 to and from I-684 to the north would be constructed. The NY 116 bridge over I-684 would be widened. The proposed interchange completion and cross street widening would improve access to the MNR station at Purdy's. Implementation of this concept could potentially result in some adverse environmental impacts since the footprint of the I-684 corridor would extend outside of the existing roadway alignment. Wetland areas would also be impacted. The capital cost of proposed interchange improvements at Interchange 7 would range between \$50 million and \$75 million.



**Figure FR-10: Conceptual Improvements at I-684 Interchange 7 (NY 116)**

Based upon comments received from both the public and the TPC, it was evident that more study and coordination would be required with adjacent communities on any potential partial interchange



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Feasible Concept Development and Evaluation  
August 2021

improvements at Interchange 7. While this concept had the potential to address the Study's vision and goals, it was not advanced for further evaluation. It is recommended further studies be performed at this interchange. Additional public outreach will be needed to determine whether potential improvements are feasible and supported by the local community.

- **I-684 Interchange 9 (I-84)** – This concept proposes to fully reconstruct the existing interchange to provide high-speed direct connections via flyover bridges between I-684 and I-84. This would increase the capacity of several high-volume ramps at the interchange which are constrained due to existing ramp geometry. Implementation of this concept could potentially result in some adverse environmental impacts since the footprint of the I-684 corridor would extend outside of the existing roadway alignment and would require the use of land outside of the existing ROW. The capital cost of proposed interchange improvements at Interchange 9 would range between \$550 million and \$600 million. This concept had the potential to address the Study's vision and goals and was advanced for further evaluation. Graphics of this concept are provided in Section FR-10.1.5 of this report.

Based on the above assessments, one TSMO concept (Ramp Metering), two mainline concepts (I-684 Peak Hour Shoulder Use; I-84 Third Travel Lane), and two interchange concepts (I-684 Interchanges 5 and 6; I-684 Interchange 9) were identified as feasible concepts with the potential to address the Study's vision and goals. These feasible concepts were evaluated further as part of Step 3 of the Study's development process.

### FR-10 FEASIBLE CONCEPT DEVELOPMENT AND EVALUATION

Feasible concepts identified in Section FR-9 were evaluated in greater detail using traffic simulation modeling software, available mapping data for the corridor, and the NYSDOT Highway Design Manual ("HDM"). The findings of this evaluation are summarized below.

#### FR-10.1 Transportation System and Environmental Impacts

##### FR-10.1.1 Ramp Metering Concept (TSMO)

A further review of on-ramp and mainline traffic volumes and LOS against guidance contained within NYSDOT's HDM determined that only Interchange 6 (NY 35) met the criteria for ramp metering. Ramp metering works best when implemented systemwide and not at just one location. Based on this further evaluation, this study will not recommend ramp metering for the corridor at this time. Ramp metering can be reevaluated in the future should changes in travel demand occur within the Study corridor.

From an environmental perspective, the Ramp Metering Concept would have little potential to result in significant environmental impacts since it would be located within the existing ROW of the I-684 corridor.

##### FR-10.1.2 I-684 Peak Hour Shoulder Use (NY 35 to I-84) Concept

Traffic analyses were performed for this concept assuming that the shoulder is available for general use (all traffic). This does not preclude other types of potential shoulder use in the future if implemented (e.g., HOV Use, Transit Use) nor does it preclude future use of the shoulder during off-peak periods. The results



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Feasible Concept Development and Evaluation  
August 2021

of the traffic analysis indicated that the I-684 Peak Hour Shoulder Use Concept would provide the peak period capacity needed on I-684 between NY 35 and I-84 and reduce peak period, peak directional commuter travel times. Both northbound and southbound I-684 between NY 35 and I-84 are projected to operate at acceptable LOS (that is, LOS D or better) in the peak direction of travel in the year 2045. The analysis also confirmed that the peak hour shoulder is only needed in the peak direction of travel (southbound during the weekday AM peak hour and northbound during the weekday PM peak hour).

A qualitative environmental screening of this concept has indicated that more in-depth environmental analyses would be required for the following resources:

- **Air Quality and Noise:** There are sensitive air quality and noise receptors (residential land uses) within 200 feet of the ROW throughout the Study corridor;
- **Wetlands and Navigable Waters:** NWI wetlands are located within and in the vicinity of the ROW, several Croton Watershed Reservoirs cross the Study corridor, and portions of the Study corridor are within the 100-year floodplain area (Katonah, Goldens Bridge, Purdy's, and Brewster);
- **Cultural Resources:** There are several historic sites near the ROW by Katonah and Purdy's; and
- **Farmland:** There is prime farmland and farmland of statewide importance present along the corridor, especially by Southeast.

There is no change to the capital cost for this concept (\$500 – \$600 million).

### FR-10.1.3 I-84 Third Travel Lane (I-684 to New York State Line) Concept

Traffic analyses were performed for this concept assuming that the third travel lane is available for general use (all traffic). This does not preclude other types of use for the travel lane in the future if implemented (e.g., HOV Use, Transit Use). The traffic analysis indicated that the I-84 Third Travel Lane Concept would provide the additional peak period capacity needed on I-84 east of I-684 to operate at acceptable LOS. There would be minor improvements to commuter travel times. As previously mentioned, improvements associated with this concept would be optimized if a third travel lane was continued east of the New York State Line into Connecticut; this would require coordination with CTDOT.

A qualitative environmental screening of this concept has indicated that more in-depth environmental analyses would be required for the following resources:

- **Air Quality and Noise:** There are sensitive air quality and noise receptors (residential land uses) within 200 feet of the ROW throughout the Study corridor; and
- **Wetlands and Navigable Waters:** NWI and DEC wetlands are located within and in the vicinity of the ROW and a portion of the Study corridor between Exits 68 and 69 are within the 100-year floodplain.

There is no change to the capital cost for this concept (\$200 – \$250 million).



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Feasible Concept Development and Evaluation  
August 2021

### FR-10.1.4 I-684 Interchanges 5 and 6 Concepts

Three improvement concepts were identified for I-684 Interchanges 5 and 6. The evaluation of each of these concepts is summarized below.

**Interim Concept #1 (Third Lane on I-684 between Interchanges 5 and 6)** – This concept would extend the third travel lane on I-684 between Interchanges 5 and 6, providing a continuous third lane on I-684 and eliminating the existing lane drop in both directions. This concept can be completed without the full reconstruction of the I-684 corridor. The capital cost of Interim Concept #1 ranges from \$50 million to \$75 million. Traffic analysis for this concept indicated that both directions of I-684 would operate at acceptable LOS. This biggest improvement is expected in the peak direction of travel, where it is projected that I-684 would operate at LOS F in the 2045 analysis year under the No Build Concept.



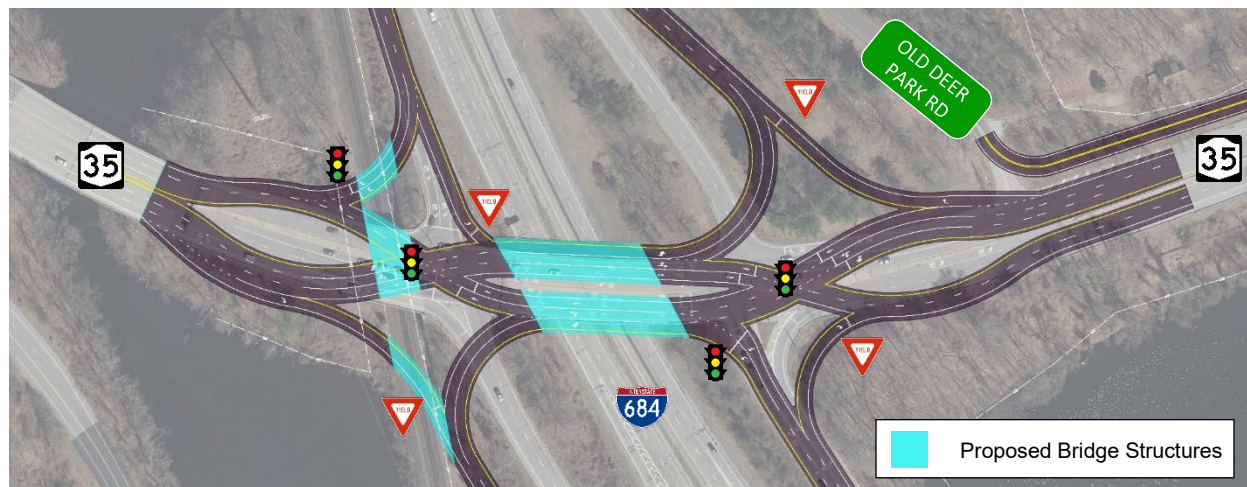
**Figure FR-11: I-684 Interchanges 5 and 6 Interim Concept #1 (Third Lane on I-684)**

**Interim Concept #2 (I-684 / NY 35 Diverging Diamond Interchange)** – This concept would reconstruct the NY 35 / I-684 interchange as a DDI, providing additional capacity to serve the high volumes of left turning vehicles coming from points east and destined to either I-684 or the Saw Mill River Parkway. The NY 35 bridge over I-684 and MNR would need to be widened or reconstructed and two new bridges over MNR would be constructed to accommodate some of the reconfigured interchange movements. This concept can be completed with or without the other conceptual improvements to the I-684 corridor. The capital cost of Interim Concept #2 ranges from \$50 million to \$75 million. Traffic analysis for this concept indicated that each intersection would operate at acceptable LOS during both peak hours. This biggest improvement is expected in the peak direction of travel, where it is projected that I-684 would operate at LOS F in the 2045 analysis year under the No Build Concept.



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Feasible Concept Development and Evaluation  
August 2021



**Figure FR-12: I-684 Interchanges 5 and 6 Interim Concept #2 (I-684 / NY 35 DDI)**

**Full Reconstruction (Interchanges 5 & 6) Concept** – This concept would provide high-speed direct connections between the Saw Mill River Parkway and I-684, eliminating the need to use the service roads to connect between the two limited access facilities. A third travel lane would also be provided on I-684 between Interchanges 5 and 6 under this concept. The service roads would continue to provide direct connections between I-684 and NY 35. Mainline bridges and overpasses would need to be widened or reconstructed to accommodate new direct connections. This concept can be completed with or without improvements to the I-684/NY 35 interchange. The capital cost of the Full Reconstruction (Interchanges 5 & 6) Concept is higher than both interim concepts, ranging from \$400 million to \$450 million. Traffic analysis for this concept indicated that both directions of I-684 would operate at acceptable LOS, both along the mainline and at the newly proposed direct connections. Minor improvements in travel time are also anticipated along I-684 with a reconstructed interchange.



**Figure FR-13: I-684 Interchanges 5 and 6 Full Reconstruction Concept**

A qualitative environmental screening of all three concepts has indicated that more in-depth environmental analyses would be required for the following resources:

- **Air Quality and Noise:** There are sensitive air quality and noise receptors (residential land uses) within 200 feet of the ROW throughout the interchange area;

## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Feasible Concept Development and Evaluation  
August 2021

- **Wetlands and Navigable Waters:** NWI and DEC wetlands are located within and in the vicinity of the ROW, the Muscoot Reservoir crosses the Study corridor, and portions of the interchange area are within the 100-year floodplain area;
- **Cultural Resources:** There are several historic sites in the vicinity of the ROW;
- **Farmland:** There is prime farmland present throughout the interchange area; and
- **Environmental Justice Areas:** There are potential environmental justice areas in the hamlets of Bedford Hills and Katonah within the Town of Bedford.

### *Bedford Bridge and Katonah MNR Station Considerations*

The former Bedford Bridge (illustrated below) crossed over the Muscoot Reservoir and served as a connecting ramp between the southbound I-684 on-ramp (accessible via NY 35) and the Katonah MNR Station (Parking Lot 1, which is not owned by MNR). The bridge was closed over 15 years ago and was decommissioned by the New York City Department of Environmental Protection. Since its closure, all traffic must navigate through several local roads further to the west to access the Katonah MNR station. This results in additional travel time to the Ridgefield-Katonah shuttle bus and to motorists. Furthermore, this also impacts circulation, parking, and pedestrian safety surrounding the Katonah MNR station.



**Figure FR-14: Bedford Bridge, April 2004 (Source: Google Earth)**

It is recommended that the Bedford Bridge and Katonah MNR station be incorporated into each of the I-684 Interchanges 5 and 6 concepts given the proximity between the Katonah MNR station and the I-684 corridor. The bridge should be replaced to allow for two-way traffic into and out of Parking Lot 1 at the Katonah MNR station, with connections to/from NY 35, and a new structured parking garage should be constructed at the northern end of Parking Lot 1 to accommodate additional commuter and shopping parking. This recommendation was supported by members of the public and the TPC.



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Feasible Concept Development and Evaluation  
August 2021

### FR-10.1.5 I-684 Interchange 9 Concepts

Two improvement concepts were identified for I-684 Interchanges 5 and 6. The evaluation of each of these concepts is summarized below.

**Interim Concept (Widened Ramps)** – This concept would widen three of the high-volume ramps at the I-684/I-84 interchange to two lane ramps – (1) the northbound I-684 to EB-I-84 ramp, (2) the westbound I-84 to southbound I-684 ramp, and (3) the westbound I-84 off-ramp to NB/SB I-684 (Exit 68). Ramp overpasses would need to be widened or reconstructed. The capital cost of the Interim Concept ranges from \$100 million to \$150 million. A traffic analysis of this concept indicated that each of the widened ramps would operate at acceptable LOS. Reductions in commuter travel times are anticipated during the peak hours of travel in the peak directions of travel.

**Full Reconstruction (Interchange 9) Concept** – This concept would provide new, high-speed direct connections via flyover bridges between I-684 (to the south) and eastbound / westbound I-84. The fully reconstructed interchange is also more capable of handling additional traffic growth along I-84 west of the Study corridor. While this concept would provide the capacity needed through the I-684/I-84 interchange, it would require a significantly higher capital cost when compared to the Interim Concept. The capital cost for the Full Reconstruction (Interchange 9) Concept ranges from \$550 million to \$600 million. As with the Interim Concept, the traffic analyses indicated that the new high-speed direct connector ramps would operate at an acceptable LOS and commuter travel times would be reduced at the interchange.

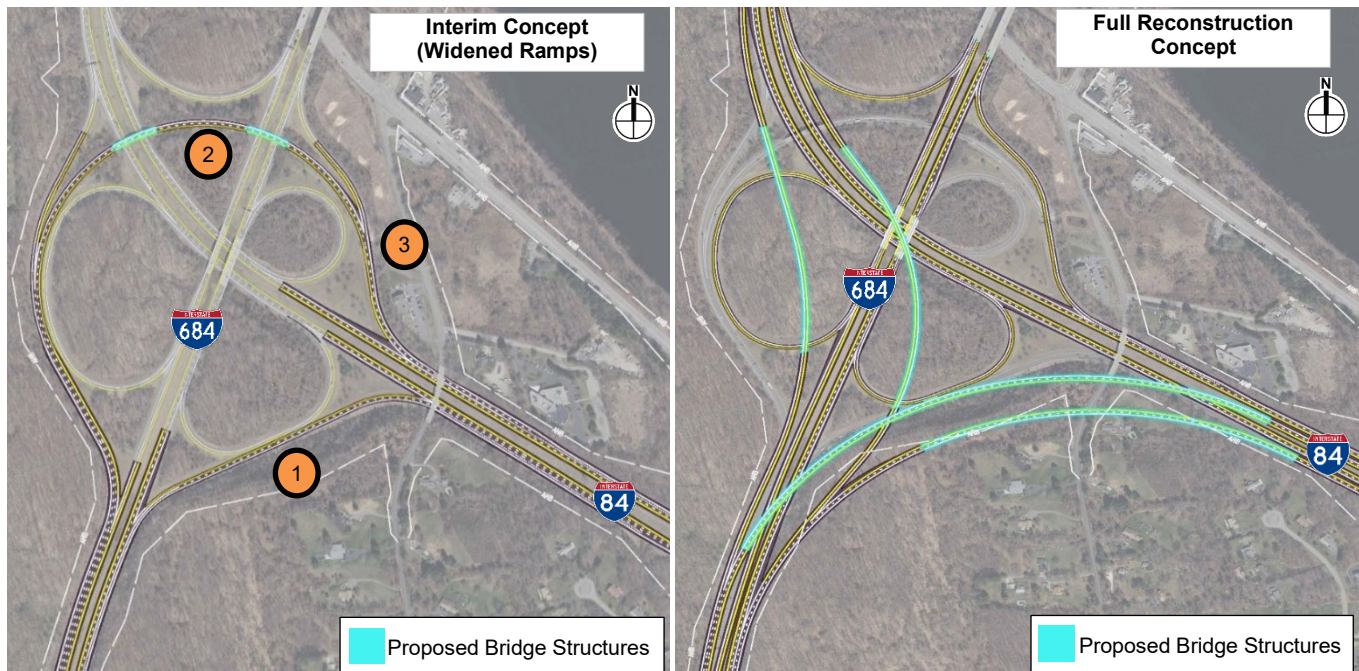


Figure FR-15: I-684 Interchange 9 Concepts

A qualitative environmental screening of the two I-684 concepts has indicated that more in-depth environmental analyses would be required for the following resources:

## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Final Study Recommendations  
August 2021

- **Air Quality and Noise:** There are sensitive air quality and noise receptors (residential land uses) within 200 feet of the ROW throughout the interchange area;
- **Wetlands and Navigable Waters:** NWI wetlands are located within and in the vicinity of the ROW and the East Branch Reservoir crosses the Study corridor east of the interchange;
- **Cultural Resources:** There are several historic sites located approximately one-half mile north and east of the interchange;
- **Farmland:** There is prime farmland present throughout the interchange; and
- **Environmental Justice Areas:** There is a potential environmental justice area in the Village of Brewster.

### FR-10.2 Noise Barrier Considerations

The qualitative environmental analyses indicated that a more in-depth analysis of noise impacts would be required for any concepts that are advanced for further project development as a capital project.

The Federal Noise Regulation 23 CFR 772, by which NYSDOT must abide, states that noise studies and evaluation of noise abatement are conducted only as part of major new construction of highways or bridges or a reconstruction that will significantly change the horizontal or vertical alignment or increase the number of through traffic lanes of an existing roadway.

A noise study is completed during the preliminary engineering phase of a capital project and would include noise level measurements, public outreach, neighborhood identification, and calculations. Noise abatement would be evaluated for the capital project and, if warranted, NYSDOT will install noise barriers. Noise analyses can only be performed as part of a capital project unless dedicated funding can be secured. NYSDOT does not conduct noise analyses outside of the capital project process.

## FR-11 FINAL STUDY RECOMMENDATIONS

A review of the technical analyses and input received throughout the public outreach process indicated that the Study corridor needed different levels of improvements – regional transportation improvements, TSMO improvements, mainline improvements, and interchange improvements.

A recurring theme throughout the public outreach process was the need to improve regional transportation to reduce the amount of vehicular traffic within the Study corridor and on adjacent State and local roadways. It is recommended that a feasibility study / master plan be performed to further evaluate the components of the regional transportation alternatives plan. As this plan involves locations in both New York State and Connecticut, further coordination with CTDOT, the Town of Ridgefield, the City of Danbury, and other key stakeholders would be required.



## I-684 & I-84 TRANSPORTATION CORRIDOR STUDY (WESTCHESTER AND PUTNAM COUNTIES) FINDINGS REPORT

Final Study Recommendations  
August 2021

It is recommended that NYSDOT implement the following TSMO solutions:

- Travel and Incident Management – NYSDOT should continue its program to implement these measures in the Study corridor as it is paramount to keeping traffic on I-684 and I-84 and maintaining the quality of life for residents that live in and around the Study corridor.
- Park and Ride Feasibility Study – NYSDOT should perform a Park and Ride Feasibility Study to identify potential future locations of Park and Ride facilities along the Study corridor. Rideshare programs should also be reviewed and opportunities to expand programs should be identified.
- Improvements to the State and Local Highway System that Access Transit – NYSDOT should further evaluate potential operational and safety improvements to key intersections surrounding I-684 interchanges and MNR stations adjacent to the Study corridor.

It is recommended that a new peak hour shoulder be developed on both directions of I-684 between NY 35 in Katonah and I-84 in Brewster. While the traffic analysis indicated that the peak hour shoulder is only needed during the peak hour and in the peak direction, NYSDOT should not preclude other potential shoulder uses such as managed lane use and off-peak period use.

It is recommended that a new third travel lane be developed on both directions of I-84 east of the I-684 interchange to the New York State Line. NYSDOT should coordinate with CTDOT to continue the third lane further east into Connecticut, which would further optimize the benefits associated with the third travel lane. NYSDOT should not preclude the third lane from being used as a managed lane in the future should funding and transportation priorities change.

It is recommended that a third lane be provided on both directions of I-684 between Interchanges 5 & 6 (Saw Mill River Parkway & NY 35) and the I-684 interchange with NY 35 be reconstructed as a DDI. Both interim concepts would provide significant improvements to the area at a lower cost. Direct connections between I-684 and the Katonah MNR station via the Bedford Bridge should be incorporated into further development of these concepts per recommendations from the public and the TPC. NYSDOT should not preclude consideration for a full reconstruction of Interchanges 5 & 6 (Saw Mill River Parkway & NY 35) in the future should funding and transportation priorities change.

Another recurring theme throughout the public outreach process was the need to further investigate potential partial interchange improvements at Interchange 6A (Goldens Bridge / NY 138) and Interchange 7 (Purdy's / NY 116). It is recommended that these interchanges are further studied under a separate project. Additional public outreach will be needed to determine whether potential improvements are feasible and supported by the local community.

It is recommended that the I-684 / I-84 interchange be partially reconstructed by widening three of the high-volume ramps at the interchange. This interim concept would provide similar benefits when compared to a fully reconstructed I-684/ I-84 interchange but at a lower cost. NYSDOT should not preclude consideration for a full reconstruction of the I-684 / I-84 interchange in the future should funding and transportation priorities change.



Next Steps and Project Development and Environmental Review Process  
August 2021

## **FR-12 NEXT STEPS AND PROJECT DEVELOPMENT AND ENVIRONMENTAL REVIEW PROCESS**

NYSDOT will pursue the recommendations identified herein either individually or collectively, subject to future funding and transportation priorities. All concepts would be progressed through NYSDOT's Project Development process. As funding becomes available, proposed capital improvements (capital projects) will undergo required environmental reviews in accordance with State Environmental Quality Review Act (SEQRA) and/or National Environmental Policy Act (NEPA) depending on the source of necessary funding. Emerging technologies such as autonomous vehicles would also be further examined through NYSDOT's Project Development process. Additionally, any future capital projects will be coordinated with FHWA and implemented such that the improvements meet Interstate standards.