

CONCEPT DEVELOPMENT REPORT

Improvements at Route 24 and Columbia Turnpike Interchange

Morris Township, Bouough of Florham Park and Hannover Township,
Morris County, New Jersey



NEW JERSEY DEPARTMENT OF TRANSPORTATION
DIVISION OF PROJECT MANAGEMENT

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Route 24 and Columbia Turnpike Interchange
Morris Township, Borough of Florham Park and Hanover Township
Morris County, New Jersey

I. INTRODUCTION

Project UPC NO.: 154330, DB # 15433

NJDOT Division of Project Management, Project Manager – Edward D’Arcy

A. Foreword

The project is located in the area between Route 24 EB and the signalized intersection of CR 510 (Columbia Turnpike) and CR 523 (Park Avenue) in Morris and Hanover Townships, Morris County. Based on the Smart Solution Study, the intersection is currently at capacity with several movements failing during the AM peak hours. (See project location map in *Appendix ‘H’*).

The Route 24 EB exit ramp merges with Columbia Turnpike approximately 650’ east of the signalized intersection and there is a heavy movement from this ramp to the double left-turn lane at the intersection. Columbia Turnpike is currently striped as two through lanes, two left turn lanes and one right turn lane. A copy of the NJDOT Straight Line Diagrams for Route 24, Columbia Turnpike and Park Avenue are included in *Appendix ‘I’*.

B. Original and Successor Projects

Since the 1980’s, Florham Park and the surrounding townships have experienced considerable growth in commercial development, particularly Class A office development. Between 1980 and 2000, over 15 million square feet of office space were constructed in the communities within a five (5) mile radius of Florham Park. The main driving force behind this development was the construction of Interstates 80, 280 and 287 which provided regional accessibility for the office development and land available for new development closer to New York City. In response to this growth, during the 1990’s the New Jersey Department of Transportation replaced Route 24 with new freeway facility, which connected Interstate 287 with Interstate 78 (in the vicinity of Springfield). The previous Route 24 was then renumbered Route 124. The Route 24 Freeway alignment runs through Florham Park.

Presently, Route 24 has a full interchange with Columbia Turnpike. To the east of this interchange, there is a spacing of approximately 6 miles until the next interchange, where Route 24 intersects Route 124. The Route 24 Columbia Turnpike interchange serves as the sole access for over half of the traffic generated by more than 5 million square feet of office space. This has placed an extremely heavy traffic burden on the interchange and on Columbia Turnpike itself. In particular, the adjacent intersection of Columbia Turnpike and Park Avenue has considerable traffic operational problems during AM peak hours.

The following project is within or near the project limits (Based on FY 2016-2025 Statewide Transportation Improvement Program):

- **Route 10, WB Route 287 to Jefferson Road** – This project will re-construct the pavement within the project limits, MP 12.79 to MP 13.19 in Hanover Township.

C. Data Reviewed

During the data collection phase of this project, various sources were consulted to obtain the information on the existing conditions within the study area. This information was evaluated to determine areas of non-conformance with current design standards and to form the base data for use in the development of alternatives. For this project the following reports and As-Built plans are available to review in Appendix 'D' and Tax Maps in Appendix E:

- Florham Park Local Traffic Study – 2027 Transportation Needs Assessment Study by Greenman-Pedersen, Inc. dated December 23, 2007.
- Route 24 Interchange and Columbia Turnpike – Smart Solution Study by Value Engineering/Smart Solutions Unit of NJDOT – Morris County updated June 2, 2014.
- Route 24 Freeway, Sections 9E and 10H from Rte. 287 to East of Columbia Turnpike – Grading, Paving and Structures, November 1989.

In addition to this information, numerous field visits were conducted to ascertain and document existing conditions. Photos are included in *Appendix 'H'*

D. Design Standards

The following design standards were utilized in the analysis of the existing conditions and identification of deficiencies within the project area and in the development of alternatives for this project.

- Highway Capacity Manual (HCM) – Transportation Research Board, 2010
- Manual on Uniform Traffic Control Devices (MUTCD) – FHWA, 2009
- A Policy on Geometric Design of Highways and Streets, AASHTO, 2018
- Roadside Design Guide (RDG), AASHTO, 2011 and Errata to Roadside Design Guide to 4th Edition, 2015.
- NJDOT Standard Specifications for Road and Bridge Construction, 2019
- AASHTO LRFD Bridge Design Specifications, 8th Edition, 2017
- NJDOT Roadway Design Manual (NJDOT-RDM), 2016
- NJ State Highway Access Management Code
- NJDOT Design Manual for Bridges and Structures, 6th Edition, 2016
- Construction Cost Estimation Guide (w/Average Bid Price Reports)
- Technical Summary, Roundabouts - FHWA

E. Characteristics of the Roadways and Surrounding Area

1. State Route

Route 24 is a limited access freeway under the jurisdiction of New Jersey Department of Transportation. Route 24 runs east-west and is a divided four-lane urban principal arterial highway with a posted speed of 65 mph at the project location. The Freeway

provides access to Route 78 to the east and Route 287 to the west. Route 24 intersects Columbia Turnpike at a cloverleaf interchange.

2. County Route

Columbia Turnpike runs from east to west and is an Urban Principal Arterial between CR609 (Eisenhower Parkway) and CR511 (Whippany Road). Within the project limits the posted speed limit is 50 mph.

Park Avenue (CR623) is an Urban Minor Arterial that runs from north to south with a posted speed limit of 35 mph.

3. Interchange

Exit 2A - Route 24 EB ramp to Columbia Turnpike west forms an auxiliary lane along Columbia Turnpike to the intersection of Park Avenue and Columbia Turnpike.

Exit 2B - Route 24 EB ramp to Columbia Turnpike east forms an auxiliary lane and ends at the entrance ramp to Route 24 WB.

The area within the project limits is a mix of residential, commercial and Industrial properties. (Project Location Map and Straight Line Diagram see *Appendix 'H and Appendix 'I' respectively*).

F. Concept Development Scope Statement

A CD Scope Statement was not provided for this project.

G. CD Public Involvement Action Plan

A meeting was held with the NJDOT SME's on May 18, 2017. At this meeting three Alternatives were presented for review and comment. These alternatives are the Flyover, Roundabout, and Route 24 EB Ramp 2A Diverted (see *Appendix 'M'*). Of these alternatives, the Route 24 EB Ramp 2A Diverted option has the lowest cost, the least impacts and the Best level of service). Value Solutions asked that a fourth alternative be reviewed that creates a partial interchange at Campus Drive off of Park Avenue to the South.

A Public Officials meeting was held with the Borough of Florham Park, Township of Hanover, Township of Morris, Township of Madison, Borough of Chatham and Morris County on August 23, 2017. The meeting outlined the four proposed alternatives for the improvements to the interchange. During this meeting the participants were informed of the construction cost, level of service at present and projected 20 years, and ROW cost, for all but the Campus Drive Alternative. It was explained that Campus Drive was provided just to point out the issues associated with the businesses with access to the roadway.

Due to the COVID-19 Public Health Emergency, the second Public Officials meeting was held with the Borough of Florham Park, Township of Hanover, Township of Morris, Township of Madison, Borough of Chatham and Morris County virtually on September 25, 2020. Topics discussed were the ramp shift to the south on Park Avenue by 350' due to the parcel originally set for the ramp being sold to a developer to build a hotel.

Preliminary Preferred Alternative is essentially the same with the exception of the shift. The new location has two added benefits over the original location. First the new signal will now be a greater distance from the signal at Columbia and Park and the ramp will be constructed over a parking lot which reduces the environmental impact by reducing the impervious area required for the project. It was also stated that due to the time that has passed, new crash data and traffic counts were obtained to confirm that the Preliminary Preferred Alternative is still valid. For Minutes of the Meeting see *Appendix 'N'*.

Due to the COVID-19 Public Health Emergency, the Public Information Center (PIC) was conducted virtually at the website <https://www.dewberry.com/njdot-rt24-columbiatpk-parkave-interchange>. The presentation and survey were open between November 30, 2020 and December 14, 2020. NJDOT invited comments from the community via the survey on the website as well as by email. More than 100 comments were reviewed and responses were consolidated to the "7 most Frequently Asked Questions". The responses to the FAQ's were uploaded on the website for public view on December 18, 2020. The PIC handout, power point document, Preliminary Preferred Alternative Plan, comments, and FAQs are provided in *Appendix 'N'*.

H. STIP Conformity

This project is included in the FY 2016-2017 "Study and Development Program". A copy of the project sheet can be found in *Appendix 'O'*.

II. PURPOSE AND NEED

The purpose of this project is to develop recommendations that would improve the traffic flow between the Route 24 EB Ramp 2A and the Columbia Turnpike intersection with Park Avenue along with providing improvements to the operation of the intersection.

A. Bridge Needs

There is no bridge work involved in the project scope.

B. Scour/Drainage Needs

There is no bridge work involved in the project scope.

C. Maintenance Needs

No maintenance issues were identified during Concept Development.

D. Roadway Needs

Operational Deficiency:

The Route 24 EB Ramp 2A merges with Columbia Turnpike approximately 650' east of the signalized intersection of Columbia Turnpike and Park Avenue. At this intersection there is a heavy AM left turn movement on the Columbia Turnpike WB approach that currently utilizes a double left turn lane.

Columbia Turnpike WB is impacted by the vehicles entering from Route 24 EB Ramp 2A weaving to the left turn lanes to Park Avenue SB. There is inadequate length for this movement to operate smoothly. This creates congestion that backs up onto the Route 24 mainline during the morning peak.

The intersection of Columbia Turnpike and Park Avenue operates at or close to capacity during both peak hours. During the morning peak hours, the WB left and SB through movements operate at unacceptable levels of service. During the evening peak hour, the NB approach operates at marginal levels of service.

E. Goals and Objectives

It is the intent of this project to meet the purpose and address the needs while minimizing impacts to the environment, quality of life, access, right of way and utilities. Any proposed improvements will consider improvements to circulation, as well as impacts to emergency services and road user costs.

III. EXISTING INVENTORY AND CONDITION

A. Existing Bridge Inventory and Condition

There is no bridge work involved in the project scope.

B. Scour/Drainage

There is no bridge work involved in the project scope.

C. Maintenance Issues

No maintenance issues were identified during Concept Development.

D. Existing Roadway Inventory and Condition

The existing roadway conditions are limited to intersection capacity.

E. Existing Utilities

IH Engineers prepared and distributed Utility Contact Letters, which requests verification of existing and/or proposed facilities within project limits. On **October 28, 2016**, "Utility Contact Letters" were sent to all possible utility providers in the Borough of Florham Park, Townships of Morris and Hanover, Morris County. In this letter the utility providers were informed about the project purpose and need. The following is a summary of information provided to date from the utility providers within the study area including funding requirements for Preliminary Engineering.

Facility	Utility Company	Requested PE Funding	Remark
Cable	Cablevision	\$5,000	-
Telephone	Verizon	\$20,000	-
Electric	JCP&L	\$20,000	-
Gas	NJ Natural Gas	\$10,000	-
Gas	PSE&G	\$25,000	-
Gas	Algonquin Gas Transmission Co.		No response
Gas	Texas Eastern Gas		No response
Sewer	Florham Park Borough	None	Outside of the project limits
Water	Florham Park Borough		No response

Sewer	Morris Township	-	
Water	The Southeast Morris County MUA	-	
Sewer	Hanover Sewerage Authority		No response

Utility correspondence is provided in *Appendix 'N'*.

F. Summary of Existing Deficiencies

Information gathered from available record plans and reports, combined observations during field visits, was used to identify areas that were noted to be deficient according to current design criteria. Section II summarizes the project's purpose and need as well as goals and objectives based on these deficiencies.

The focus of the project is to improve traffic flow between the ramp and the intersection along with providing improvements to the operation of the intersection. There are no bridge replacement issues, flooding issues or other significant maintenance issues related to the structure. However, upon evaluation the following deficiencies exist:

- Through traffic on Columbia Turnpike WB are impacted by the weaving movement from traffic movements from Route 24 EB Ramp making left turns from Columbia Turnpike WB to Park Avenue SB. There is inadequate transition length (650') for this movement to operate smoothly. This creates congestion that backs up onto the Route 24 mainline during the morning peak.
- The intersection of Columbia Turnpike and Park Avenue operates at or close to capacity during both peak hours. During the morning peak hours, the WB left and SB through movements operate at unacceptable levels of service. During the evening peak hour, the NB approach operates at marginal levels of service.

G. List of Substandard Design Elements

There are no existing substandard design elements.

H. Management Systems Input

The following Management Systems have been cross referenced:

Bridge Management System (BMS): There was no input from Bridge Management System as there are no existing bridge-structures involved in this project.

Pavement Management System (PMS): There was no input from Pavement Management System as this project is on a County Road.

Congestion Management System (CMS): The CMS has ranked Route 24 between MP 1.65 to 2.09 as "Severely Congested". The CMS Score is 8.19 out of 10. ADT (2012) is 89,112 vpd. The CMS has ranked Columbia Turnpike between MP 14.23 to 14.60 as "Medium Congested". The CMS Score is 5.37 out of 10. ADT (2012) is 27,730 vpd.

Drainage Management System (DMS): There was no input from Drainage Management System as this project is on County Road.

Smart Growth Management System (SGMS): There was no input from Smart Growth Management System as this project is on County Road.

Safety Management System (SMS): There was no input from Safety Management System as this project is on County Road. However, crash data was provided by NJDOT's Bureau of Transportation Data and Safety programs.

I. As-Built Plans, Right of Way Maps and Jurisdiction Map:

The following plans were provided by the NJDOT for this study and are located in *Appendix 'D'*.

- Jurisdictional Limit Map (2 of 3) of Route 24, Sections 9E and 10H from Whippany Road to Columbia Turnpike, Townships of Hanover and Morris, Morris County.
- Jurisdictional Limit Map (3 of 3) of Route 24, Sections 9E and 10H from Whippany Road to Columbia Turnpike, Townships of Hanover and Morris, Morris County.
- As Built Plan of Route 24 Freeway, Section 9E and 10H from RTE 287 to East of Columbia Turnpike, Grading, Paving, & Structures dated November 1989.
- Right of Way Map (Legal-size) from Park Avenue to Route 24 on Columbia Turnpike.

IV. TRAFFIC AND CRASH SUMMARY

This section of the report summarizes the traffic analysis conducted by IH as part of this Concept Development assignment. The results of the analysis, and the conclusions supported by the analysis from a traffic safety, capacity and accessibility standpoint are included in a detailed discussion later in this Report. Backup calculations can be found in *Appendix 'G' and Appendix 'J'*.

A. Existing Traffic Operations

The roadways in the study area include:

NJ Route 24 - This is a four-lane Urban Principal Arterial Freeway aligned in a general NW to-SE direction; however, since the highway is posted as east/west this report will refer to it as such. Route 24 connects Interstate Routes I-287 and I-78 through portions of Morris, Union and Essex County and is an important regional route. The posted speed limit within the project area is 65 mph. Route 24 Interchange 2A-2B is fully directional with Columbia Turnpike; this interchange straddles the Townships of Morris and Hanover. A viaduct carries Route 24 over Columbia Turnpike. A collector /distributor (CD) road is provided through the interchange on Route 24 WB, isolating merging/weaving movements from through traffic; however, in the EB direction, no CD roadway is provided. There is a $\pm 600'$ weaving section between the striped gore areas between the on ramp from Columbia Turnpike WB and the Exit 2B ramp to Columbia Turnpike WB.

Columbia Turnpike - This is an Urban Principal Arterial roadway aligned in an east-west direction. Columbia Turnpike provides a connection to Morristown to the west and to Florham Park and The Oranges to the east. Within the study area Columbia Turnpike typically provides two through travel lanes in each direction, separated by a concrete

median barrier. To the west of the signalized intersection of Park Avenue the posted speed limit is 40 mph; to the east of that intersection the posted speed limit is 50 mph. Columbia Turnpike widens to provide multiple exclusive turning lanes at the Park Avenue intersection; the intersection geometry is described below.

Based on information provided to IH by the NJDOT, as well as our own field observations, the section of Columbia Turnpike between the Park Avenue traffic signal and the nearest ramps to/from Route 24 are of critical importance, especially in the WB direction. Along Columbia Turnpike WB there is a distance of $\pm 730'$ between the gore point of the ramp from Route 24 EB and the stop bar at the Park Avenue signal. Observations indicate a significant volume of traffic on this ramp crosses over the through lanes in order to turn left onto Park Avenue SB. Especially during the morning peak hour, that left turn volume is so high that queues regularly extend farther east than that ramp merge point, with the result that ramp traffic trying to access the left turn lanes, blocks the through lanes. This significant safety issue will be discussed in greater detail in a later section of this report.

Park Avenue - Park Avenue is an Urban Minor Arterial/Urban Principal Arterial within the study area, aligned in a north-south direction and with a posted speed limit of 35 mph. Park Avenue provides two through lanes in each direction, widening to provide exclusive turning lanes at the signalized intersection with Columbia Turnpike.

The intersection of Columbia Turnpike with Park Avenue is controlled by a fully-actuated traffic signal providing protected/prohibited left turn operation on all approaches, with overlapping right turn green arrows on all four approaches. Triangular islands are present on each quadrant of the intersection, forming channelized right turn lanes. The geometry of each approach to this intersection is as follows:

- *NB Park Avenue*: Two through lanes; one 160' long left turn lane; two 175' long channelized right turn lanes.
- *SB Park Avenue*: Two through lanes and two 240' long left turn lanes. A channelized right turn and an overlapping right turn green arrow are provided; however, there is no right turn lane present; a queue of two to three vehicles in the right-hand through lane will prevent access to this right turn channel.
- *EB Columbia Turnpike*: Two through lanes; one 220' long left turn lane; and one 220' long channelized right turn lane.
- *WB Columbia Turnpike*: Two through lanes; two left turn lanes with a minimum length of 430' (see note below); one 310' long channelized right turn lane.

With regard to the WB Columbia Turnpike approach: IH requested a copy of the current existing traffic signal plan and timing from the Morris County Engineer's Office. The signal layout plan provided, dated February 1999, indicates that there are two WB lanes approaching the intersection, with two left turn lanes developed along the left side of the roadway. However, review of pavement markings in the field suggests that this layout has since been revised. Of the two WB lanes approaching from the Route 24 interchange area, the left of these two lanes is marked as a left turn lane (with arrows and "ONLY" pavement markings) beginning a distance of $\pm 1,360'$ from the stop bar. The on-ramp from Route 24 EB becomes an added lane that continues as the second through lane at the signal; the second left turn lane is introduced at 430' from the stop bar.

B. Traffic Data

IH Engineers conducted traffic counts in the area of the intersection, in order to quantify the daily and peak hour traffic volumes moving through the project area. IH placed Automated Traffic Recorder (ATR) machines at eight (8) locations, conducted manual counts and performed a license plate survey to create the complete picture at this very busy intersection.

1. Manual Turning Movement Counts

Manual turning movement counts were conducted for the signalized intersection of Columbia Turnpike and Park Avenue on Wednesday April 27, 2016 and again on Thursday, October 17, 2019 during the AM and PM peak periods. From these counts we determined that the AM peak hour is from 7:30 to 8:30 while the PM peak hour is from 5:00 to 6:00.

2. ATR Count Locations

ATR's were placed at eight locations as follows:

Friday, April 22, 2016 to Thursday, April 28, 2016

- Columbia Turnpike WB Approaching Park Avenue
- Park Avenue NB Approaching Columbia Turnpike
- Park Avenue SB Approaching Columbia Turnpike
- NJ Route 24 EB Ramp To Columbia Turnpike WB

Thursday, April 28, 2016 to Wednesday May 4, 2016

- Columbia Turnpike EB Approaching Park Avenue

Tuesday, May 10, 2016 to Monday, May 16, 2016

- NJ Route 24 EB Ramp To Columbia Turnpike EB
- Columbia Turnpike EB Ramp To NJ Route 24 EB
- Columbia Turnpike WB Ramp To NJ Route 24 EB

3. Origin Destination Survey

The traffic movement from the Route 24 EB exit ramp to the left turn onto Park Avenue EB requires vehicles to cross two very congested lanes of traffic in a distance of 750'. Many of the accidents that have occurred in this location are a result of this weave and impatient drivers. A license plate survey was conducted on June 22, 2016 to determine the number of vehicles exiting from Route 24 EB destined for Park Avenue EB. During the morning from 8:00 to 9:00, 90% of the vehicles identified were making this move. During the afternoon between 5:00 to 6:00, 75% of the vehicles identified were making this move.

4. Existing Daily and Peak Hourly Traffic Volumes

IH's traffic data collection effort for this assignment has included the following:

- Placement of Automated Traffic Recorder (ATR) machines on the four approaches to the Columbia Turnpike /Park Avenue intersection, and on the four (4) Columbia Turnpike interchange ramps on the south side of NJ Route 24;

- Conduct of weekday morning and evening peak hour manual turning movement counts at the intersection of Columbia Turnpike and Park Avenue;
- Conduct of a license plate matching origin-destination survey to identify the proportion of vehicles exiting Route 24 EB to Columbia Turnpike WB that proceed to turn left onto Park Avenue SB;
- Review of the online NJDOT traffic count database to identify any other recent, relevant traffic count data.

IH staff placed ATR machines at the four approaches to the Columbia Turnpike / Park Avenue intersection, and on the four Columbia Turnpike interchange ramps along the south (EB) side of the Route 24 Freeway. ATRs were installed in May and June of 2016 and each machine collected a minimum of seven complete days' worth of data. Table 1 summarizes the average daily traffic volume for each of these locations, which represents the arithmetic average of the observed traffic volume a period of seven (7) consecutive days. The overall vehicle classification percentages for the seven-day period are also included.

Table 1 Average Daily Traffic (ADT) Volumes

Location	ADT (vpd)	Vehicle classifications			
		Passenger cars	Bus	SU Truck	Semi Truck
Columbia Turnpike EB Approach to Park Avenue	7,521	98.2%	0.1%	1.4%	0.3%
Columbia Turnpike WB Approach CR 623	13,070	97.9%	0.3%	1.5%	0.3%
CR 623 NB Approach Columbia Turnpike	10,016	89.0%	0.7%	5.8%	4.5%
CR 623 SB Approach Columbia Turnpike	5,963	97.1%	0.4%	2.1%	0.4%
Ramp from Route 24 EB to Columbia Turnpike WB	4,151	94.7%	0.6%	4.2%	0.5%
Ramp from Route 24 EB to Columbia Turnpike EB	4,567	95.3%	0.4%	3.7%	0.6%
Ramp from Columbia Turnpike EB to Route 24 EB	4,626	93.0%	0.6%	5.6%	0.8%
Ramp from Columbia Turnpike WB to Route 24 EB	2,555	94.9%	0.7%	3.4%	1.0%

IH staff conducted a manual turning movement count at the intersection of Columbia Turnpike and Park Avenue on Wednesday April 27, 2016 and again on Thursday, October 17, 2019. IH staff confirmed that area schools and colleges were in session under normal operation on this day. Due to heavy volumes and the number of lanes at the intersection, three (3) persons conducted this count, between the hours of 7:00 a.m. and 9:00 a.m., and between 4:00 p.m. and 6:00 p.m. For full Traffic Count

Spread Sheet for manual counts (April 27, 2016 and October 17, 2019) see Appendix 'G'.

During the weekday morning peak hour the WB Columbia Turnpike left turn volume onto Park Avenue SB exceeds 1,600 vehicles within a single hour. The heaviest-volume approaches are the WB Columbia Turnpike approach during the weekday morning peak hour and the NB Park Avenue approach during the weekday evening peak hour. As shown in the table above, these are also the two highest-volume approaches in terms of average daily traffic volume.

Existing Weekday Peak Hour Levels of Service – Columbia Turnpike and Park Avenue
IH has used the "HCS2010" analysis module within the Synchro/SimTraffic (version 9) software application to evaluate the existing weekday morning and evening peak hour levels of service (LOS) at the intersection of Columbia Turnpike and Park Avenue. This analysis has assumed existing volume characteristics (volume, peak hour factor, heavy vehicle %) as observed during IH's data collection program, and intersection geometry and signal timings per the plans and timing directive forwarded to us by Morris County. Based on this analysis, the existing peak hour LOS at the intersection are as follows:

**Table 2 Existing Weekday Morning and Evening Peak Hour Levels of Service
Columbia Turnpike and Park Avenue**

Approach	Movement	Level of Service (delay, seconds)	
		Weekday Morning Peak Hour	Weekday Evening Peak Hour
Columbia Turnpike EB	Left	E (69.6)	E (65.8)
	Through	F (117.3)	F (286.0)
	Right	F (104.2)	C (34.7)
Columbia Turnpike WB	Left	F (274.6)	D (49.4)
	Through	B (18.2)	D (38.0)
	Right	B (11.0)	D (40.5)
Park Avenue NB	Left	F (110.6)	F (531.8)
	Through	D (45.6)	F (355.4)
	Right	B (16.0)	C (29.5)
Park Avenue SB	Left	F (220.7)	F (418.6)
	Through	F (165.8)	D (40.8)
	Right	F (165.3)	D (40.8)
<i>Overall Intersection</i>		F (153.1)	F (146.3)

Movements operating at level 'F' are indicated by red/boldface type. As shown, during the weekday morning peak hour, seven of the twelve movements at the

intersection operate at level 'F', including the very high-volume WB Columbia Turnpike left turn, and the opposing through/right turn movements on Columbia Turnpike EB. During the weekday evening peak hour, overall intersection operation is generally better, with significant delays on the NB Park Avenue approach. As noted previously, these patterns of heaviest delays – on Columbia Turnpike WB during the morning peak hour, and on Park Avenue NB during the evening peak hour – are consistent with IH's observations of peak hour traffic operations.

IH's observations of the area indicate that the high WB Columbia Turnpike traffic volume approaching the Park Avenue intersection during the weekday morning peak hour causes queues that extend all the way east beyond the overpass of the Route 24 mainline. These queues fill the left-hand travel lane on Columbia Turnpike WB approaching the signal. Much of the traffic exiting the Route 24 Freeway EB via the Exit 2A ramp is also destined to Park Avenue SB, but must enter the left-hand lane of WB Columbia Turnpike in order to do so. Given the prevailing queues during this time period, this traffic cannot fully enter this lane, and instead blocks the right-hand WB lane of Columbia Turnpike while waiting to gain entry to the left-hand lane. The result is queues that extend even further and WB through traffic attempting to weave around/through these queues of vehicles.

Table 3 Projected Future Year 2040 Weekday Morning and Evening "No-Build" Peak Hour Levels of Service - Columbia Turnpike and Park Avenue

Approach	Movement	Level of Service (delay, seconds)	
		Weekday Morning Peak Hour	Weekday Evening Peak Hour
Columbia Turnpike EB	Left	E (72.0)	F (168.6)
	Through	F (345.0)	F (748.6)
	Right	F (83.1)	D (38.1)
Columbia Turnpike WB	Left	F (312.7)	F (71.6)
	Through	C (31.9)	F (172.6)
	Right	B (11.4)	F (118.7)
Park Avenue NB	Left	F (978.8)	F (733.9)
	Through	D (49.4)	F (453.5)
	Right	B (18.0)	C (39.2)
Park Avenue SB	Left	F (272.8)	F (523.7)
	Through	F (396.6)	D (44.7)
	Right	F (402.1)	D (44.9)
Overall Intersection		F (240.5)	F (289.8)

C. Traffic Volume Forecasts

For the purposes of evaluating future traffic conditions both with and without any proposed improvements, IH has projected future weekday morning and evening peak hour traffic volumes, for the years 2020 and 2040. We have also considered the development of townhomes on the Honeywell property in the southwest quadrant and the proposed access for these residential properties on both Park Avenue and on Columbia Turnpike.

D. Crash Data Analysis and Crash Diagram

The Crash Diagrams prepared for the years 2011 to 2013 and the years 2016 to 2018 both indicate that the weave from the Route 24 EB Ramp 2A to the left turn from Columbia Turnpike WB to Park Avenue SB is the cause for the majority of the accidents in this short stretch of roadway. On Columbia Turnpike WB the crashes for the years 2011 to 2013 were 25 same direction rear end crashes and 9 same direction sideswipe crashes out of 38 crashes and for the years 2016 to 2018 were 28 same direction rear end crashes and 8 same direction sideswipe crashes out of 38 crashes. These types of crashes are indicative of a weaving condition. The total number of crashes for both EB and WB Columbia Turnpike is 55 for 2011 to 2013 61 for 2016 to 2018. The Crash Data and Collision Diagrams are available in Appendix 'F' and Appendix 'K' respectively.

V. SOCIAL, ECONOMIC AND ENVIRONMENTAL SCREENING

An Environmental Screening (ES) Report was performed for the project by the NJDOT Division of Environmental Resources in May 06, 2016. The screening report is included *in Appendix 'L'*.

A. Community Outreach

As stated previously, a Public Officials meeting was held with the Borough of Florham Park, Township of Hanover, Township of Morris, Township of Madison, Borough of Chatham and Morris County on August 23, 2017. The meeting outlined the four proposed alternatives for the improvements to the interchange. During this meeting the participants were informed of the construction cost, level of service at present and projected 20 years, and ROW cost, for all but the Campus Drive Alternative. It was explained that Campus Drive was provided just to point out the issues associated with the businesses with access to the roadway.

As stated previously, due to the COVID-19 Public Health Emergency, the second Public Officials meeting was held with the Borough of Florham Park, Township of Hanover, Township of Morris, Township of Madison, Borough of Chatham and Morris County virtually on September 25, 2020. Topics discussed were the ramp shift to the south on Park Avenue by 350' due to the parcel originally set for the ramp being sold to a developer to build a hotel.

The Public Information Center (PIC) was also conducted virtually at the website <https://www.dewberry.com/njdot-rt24-columbiatpk-parkave-interchange>.

The presentation and survey were open between November 30, 2020 and December 14, 2020. The responses to the FAQ's were uploaded on the website for public view on

December 18, 2020. The PIC handout, power point document, Preliminary Preferred Alternative Plan, comments, and FAQs are provided in Appendix 'N'.

B. Noise and Air Quality

The Project is in a PM 2.5 maintenance area. Traffic data detailing the Level-of-Service will be needed to determine if a hot-spot analysis is needed. Due to the potential changes to highway alignment and the relocation and addition of interchange lanes, and the addition of through traffic lanes, a noise study may be required. Air/Noise impacts will have to be re-evaluated once a more detailed scope of work is available.

C. Socioeconomics

14% of the population is considered to be a minority with 7% being Asian, 4% Hispanic, and 2% Black. 83% of the population has a household income of \$75,000 or higher. This does not appear to be an Environmental Justice community.

D. Cultural Resources

The Normandy Park Historic Boundary Increase is located just outside of the project area to the west. SHPO consultation will likely be needed due to scope of work and potential archeological impacts.

E. Section 4(f) Properties

Black Meadows is a wildlife preserve located on the eastern side of Route 24. Farleigh Dickinson University is located just south of the project.

F. Highlands/Pinelands

The majority of the project is within the Highlands Planning Area, Highlands Rules will have to be followed. Due to all of the causeways, there may be a need for wildlife crossing amenities.

G. Wetlands

There are wetlands scattered throughout project area.

H. Reforestation

The deforestation may take place in accordance with the No Net Loss Reforestation Act (NNL P.L.2001 Chapter 10 Reforestation).

I. Floodplain

There are no floodplains within the project limits.

J. Sole Source Aquifer

The project is within the Buried Valley Sole Source Aquifer.

K. Threatened/Endangered Species

Threatened and Endangered Species within the project area include:

- According to the Fish & Wildlife IPaC tool, Indiana Bat, Northern Long-Eared Bat, and Bog Turtles have the potential to be found within the project limits.
- Florham Park, Hanover Township and Morris Township have maternity population of both the Northern Long-Eared Bat and the Indiana Bat. If tree clearing is proposed, it cannot occur from April 1 – November 15 due to bat populations.
- According to NJDEP's Species Based Habitat GIS layer, Bald Eagle (State Endangered) may be present in the project area.

L. Category 1 Waters

There are no Category 1 Waters in the project area. Black Brook, a freshwater category 2 non-trout waterway, crosses Route 24, but does not reach the Park Avenue/Columbia Turnpike intersection. If work near Black Brook is needed, a riparian zone of 150' may apply.

M. Vernal Pools

There are no known or potential vernal pool habitats within the project study area.

N. Stormwater

The project is expected to create more than ¼ of impervious surface and more than 1 acre of land disturbance. Stormwater Management mitigation will be required for all alternatives. Areas have been identified for the construction of drainage basins.

O. Hazardous Waste

There are active NJDEP enforcement cases and historic fill within the project area. As such there is a potential for involvement with regulated material or contaminated sites. Once more specific project plans are available then a re-evaluation will be made to determine whether an environmental investigation will be required.

P. Anticipated Environmental Permits or Approvals

The following permits are anticipated:

1. NJDEP Freshwater Wetland Permit – Impacts to wetlands may trigger an individual permit where mitigation might be required.
2. NJDEP Stormwater Management Permit – For ¼ or more of impervious or 1 acre or more land is disturbance.
3. Highland Rules/Prevention Area Permits - The majority of the project is within the Highlands Planning Area, Highlands Rules will have to be followed.
4. Morris County Soil Conservation District Certification.

Q. Environmental Summary with Probable NEPA Document required

Due to the extensive impacts to ROW and Wetlands, and the increased impervious area exceeding the Storm Water Management threshold, it is expected that the NEPA Document required for this project will be a CED.

1. The Normandy Park Historic Boundary Increase is located just outside of the project area to the west. SHPO consultation will likely be needed due to scope of work and potential archeological impacts.

2. The Project is in a PM 2.5 maintenance area. Traffic data detailing the Level-of-Service will be needed to determine if a hot-spot analysis is needed. Due to the potential changes to highway alignment and the relocation and addition of interchange lanes, and the addition of through traffic lanes, a noise study may be required. Air/Noise impacts will have to be reevaluated once a more detailed scope of work is available.
3. The Black Meadows Preserve is located within the project area on southeastern side.
4. There are wetlands scattered throughout project area.
5. According to the Fish & Wildlife IPaC tool, Indiana Bat, Northern Long-Eared Bat, and Bog Turtles have the potential to be found within the project area.
6. Due to bat presence, if tree clearing is proposed, it cannot occur from April 1 – November 15 due to bat populations.
7. Black Brook, a freshwater category 2 non-trout waterway, crosses Route 24, but does not reach the Park Avenue/Columbia Turnpike intersection. If work near Black Brook is needed, a riparian zone of 150' may apply.
8. According to NJDEP's Species Based Habitat GIS layer, Bald Eagle (State Endangered) may be present in the project area.
9. The majority of the project is within the Highlands Planning Area, Highlands Rules will have to be followed.
10. If ¼ or more of impervious surface added or if 1 acre or more of land is disturbed then stormwater management will be needed.
11. Impacts to wetlands may trigger an individual permit where mitigation might be required.
12. Due to the presence of active NJDEP enforcement cases and historic fill, there is a potential for involvement with regulated material or contaminated sites. Once more specific project plans are available then a re-evaluation will be made to determine whether an environmental investigation will be required.

VI. EVALUATION OF CONCEPTUAL ALTERNATIVES

A. Conceptual Alternatives

No-Build

No work will be completed to modify roadways or traffic operation, or address safety issues.

Alternative 1

An overpass will be constructed over Columbia Turnpike diverting traffic from the Route 24 EB ramp to Columbia Turnpike WB to a new signalized intersection on Park Avenue approximately 600' south of the Columbia Turnpike intersection. The existing ramp from Route 24 EB to Columbia Turnpike WB will be closed. A new ramp connecting the new signalized intersection at Park Avenue NB to the Ramp leading to Route 24 EB will also be constructed. (See *Appendix 'M'*)

Advantages:

1. Eliminates the weaving conflict between the Route 24 EB ramp (Exit 2A) and Columbia Turnpike WB traffic.
2. Reduces congestion at the Columbia Turnpike and Park Avenue intersection, including the WB Columbia Turnpike left turn onto Park Avenue SB.

Disadvantages:

1. There will be three moves on Columbia Turnpike WB very close to each other namely the Exit to Route 24 EB, the Exit to Park Avenue via the flyover ramp and at the intersection of Park Avenue NB, which may create confusion to motorist.
2. Right-of-way will be required.
3. Environmental issues will be created.
4. Will be costly due to the new structure, land acquisition and environmental issues.
5. Will add another signal on Park Avenue approximately 600' south of the Columbia Turnpike signal.
6. Based on NJDEP Website, the widening on Park Avenue SB involves groundwater contamination, critical environmental and historic sites, and the highland planning area. All the constraints will need investigation, permits and necessary measures to satisfy the permit conditions which will increase time and cost.
7. At the intersection of Columbia Turnpike and Park Avenue, multiple movements will continue to operate at LOS 'F' during both peak hours.

Alternative 2

A new two lane modern roundabout will be constructed to the south of Columbia Turnpike connecting Columbia Turnpike EB, Park Avenue and Route 24 EB. The ramp from Route 24 EB to Columbia WB will be removed and the ramp from Columbia Turnpike WB to Route 24 EB will be pushed further north to provide greater weave distance to the ramp from Route 24 EB to Columbia Turnpike EB. The existing ramps to and from Columbia Turnpike EB will be relocated to the proposed roundabout. Finally a new traffic signal will be provided at the new ramp intersection at Park Avenue. (See *Appendix 'M'*)

Advantages:

1. Eliminates the weaving conflict between the Route 24 EB ramp (Exit 2A) and Columbia Turnpike WB traffic.
2. Reduces congestion at the Columbia Turnpike and Park Avenue intersection, including the WB Columbia Turnpike left turn onto Park Avenue SB.
3. Modern roundabouts typically will provide safe operation with low crash severity.

Disadvantages:

1. Public acceptance.
2. During the morning peak hour, the WB roundabout approach will operate at LOS 'F'. Weaving movement on Route 24 EB between ramps will also operate at LOS 'F'.
3. Right-of-way will be required.
4. Environmental issues will be created.
5. Will be costly due to land acquisition and environmental issues.
6. Will add another signal on Park Avenue approximately 600' south of the Columbia signal.
7. Based on NJDEP Website, the widening on Park Avenue SB has groundwater contamination, critical environmental and historic sites, and the highland planning area. All the constraints will need investigation, permits and necessary measures to satisfy the permit conditions which will increase time and cost.
8. At the intersection of Columbia Turnpike and Park Avenue, multiple movements will continue to operate at LOS 'F' during both peak hours.

Alternative 3

A barrier or island will be constructed on Columbia Turnpike WB from the intersection of Park Avenue to the east of the entering traffic from Route 24 EB Ramp to prevent these vehicles from weaving over to make a left onto Park Avenue SB. The ramp from Columbia Turnpike EB to Route 24 EB will be relocated to Park Avenue at a new signalized intersection approximately 600' south of the intersection with Columbia Turnpike. The relocated ramp will accommodate the vehicles that can no longer turn left at Park Avenue from Columbia Turnpike WB. The ramp from Columbia Turnpike EB to Route 24 EB will be closed and traffic diverted to the new ramp connection at Park Avenue. (Appendix 'M')

Advantages:

1. Eliminates the weaving conflict between the Route 24 EB ramp (Exit 2A) and Columbia Turnpike WB traffic.
2. Reduces congestion at the Columbia Turnpike and Park Avenue intersection, including the WB Columbia Turnpike left turn onto Park Avenue SB.

Disadvantages:

1. Weaving movement on Route 24 EB between ramps will operate at LOS 'F' during the morning peak hour.
2. Right-of-way will be required.
3. Environmental issues will be created.
4. Will be costly due to land acquisition and environmental issues.
5. Will add another signal on Park Avenue approximately 600' south of the Columbia signal.
6. Based on NJDEP Website, the widening on Park Avenue SB has groundwater contamination, critical environmental and historic sites, and the highland planning area. All the constraints will need investigation, permits and necessary measures to satisfy the permit conditions which will increase time and cost.
7. At the intersection of Columbia Turnpike and Park Avenue, multiple movements will continue to operate at LOS 'F' during both peak hours.

Alternative 3 (Revised)(PPA)

This alternative was developed as the property which was to be purchased for alternative 3 is no longer available. The property owner was granted a permit to build the new hotel. A barrier or island will be constructed on Columbia Turnpike WB from the intersection of Park Avenue to the east of the entering traffic from Route 24 EB Ramp to prevent these vehicles from weaving over to make a left onto Park Avenue SB. The ramp from Columbia Turnpike EB to Route 24 EB will be relocated to Park Avenue at a new signalized intersection approximately 950' south of the intersection with Columbia Turnpike. The relocation will accommodate the vehicles that can no longer turn left at Park Avenue from Columbia Turnpike WB. The ramp from Columbia Turnpike EB to Route 24 EB will be closed and traffic diverted to the new ramp connection at Park Avenue. An additional right turn lane will be provided from Columbia Turnpike EB to Park Avenue SB (Appendix 'M')

Advantages:

1. Eliminates the weaving conflict between the Route 24 EB ramp (Exit 2A) and Columbia Turnpike WB traffic.
2. Reduces congestion at the Columbia Turnpike and Park Avenue intersection, including the WB Columbia Turnpike left turn onto Park Avenue SB.
3. The new ramp will be constructed over an existing parking lot reducing the quantity of new impervious surface.
4. The new ramp will be an additional 350' further south of the intersection with Columbia Turnpike than Alternative 3 providing less conflict with the two signalized intersections.

Disadvantages:

1. Weaving movement on Route 24 EB between ramps will operate at LOS 'F' during the morning peak hour.
2. Right-of-way will be required.
3. Will add another signal on Park Avenue approximately 950' south of the Columbia signal.
4. At the intersection of Columbia Turnpike and Park Avenue, multiple movements will continue to operate at LOS 'F' during both peak hours.

Alternative 4:

This alternative involves a new "half-interchange" on the Route 24 east of the Columbia Turnpike interchange, with on and off ramps to the EB roadway to Campus Drive. Campus Drive intersects Park Avenue (CR 623) at a point roughly $\frac{3}{4}$ mile south of Columbia Turnpike (See *Appendix 'M'*).

Advantages:

1. Provides an alternative for the traffic exiting Route 24 EB destined for Park Avenue SB which may reduce the weaving conflict on Columbia Turnpike.
2. Reduces congestion at the Columbia Turnpike and Park Avenue intersection.

Disadvantages:

- Creates a new weaving movement on Route 24 EB between the existing and proposed ramps that will operate at LOS 'F'.
- Campus Drive serves as an access roadway for several large office buildings with multiple access driveways. Access is not allowed on ramps as per the Access Management Code.
- Right-of-way will be required. If the driveways are revoked for the office buildings they will become land locked and therefore a problem for the Department.
- Environmental issues will be created including impacting an existing drainage basins and wetland.
- Will be costly due to land acquisition and environmental issues.
- The new development will be within in Flood Hazard Area/Airport Hazard Area.

B. Traffic Analysis

Discussion of Alternatives Analysis – Traffic

IH has reviewed the projected future “no-build” peak hour traffic volumes within the study area, and reassigned these volumes to reflect the roadway, intersection and interchange reconfigurations proposed as part of Alternatives 1, 2, 3 and 4 as follows (See *Appendix ‘M’*):

Alternative 1:

- Route 24 EB traffic destined for Columbia Turnpike WB to Park Avenue SB has all been diverted to the new flyover ramp.
- Half of the remaining WB Columbia Turnpike left turning volume has been diverted to the proposed loop ramp to the new flyover; the remaining traffic will continue to use the existing left turn.
- We have considered the origin of the volume on the EB Columbia Turnpike ramp onto Route 24 EB:
 - All traffic approaching from the south on Park Avenue has been diverted onto the new ramp connector, at the proposed Park Avenue signal south of Columbia Turnpike
 - Half the traffic approaching from the west on Columbia Turnpike, and from the north on Park Avenue, has been reassigned to enter the proposed ramp connector via a left turn from SB Park Avenue
 - These volume re-assignments have been made on a pro-rated basis per the prevailing turning movements at the Columbia Turnpike/Park Avenue signal.
- The existing signal phasing at the Columbia Turnpike/Park Avenue signal has not been changed; however the splits and cycle lengths for the network have been optimized based on proposed peak hourly flows.

Alternative 2:

- Route 24 EB traffic destined for Columbia Turnpike WB to Park Avenue SB has all been diverted to the Exit 2B ramp and the proposed roundabout.
- Half of the remaining WB Columbia Turnpike left turning volume has been diverted to use the two Route 24 loop ramps, through the proposed roundabout to a left turn onto Park Avenue at the proposed signal; the remaining traffic will continue to use the existing left turn.
- The EB Columbia Turnpike left turn onto Park Avenue NB has been eliminated and this traffic will use the de-facto reverse jug-handle through the proposed roundabout to Park Avenue NB.
- As with Alternative 1, we have considered the origin of the volume on the EB Columbia Turnpike ramp onto Route 24 EB:
 - All traffic approaching from the south on Park Avenue has been diverted onto the new ramp connector, at the proposed Park Avenue signal south of Columbia Turnpike.
 - Half the traffic approaching from the west on Columbia Turnpike, and from the north on Park Avenue, has been reassigned to enter the proposed ramp connector via a left turn from SB Park Avenue.

- These volume reassignments have been made on a pro-rated basis per the prevailing turning movements at the Columbia Turnpike/Park Avenue signal.
- The signal phasing at the Columbia Turnpike/Park Avenue signal is revised to eliminate the EB left turn phase. The splits and cycle lengths for the network have been optimized based on proposed peak hourly flows.

Alternative 3:

- Route 24 EB traffic destined for Columbia Turnpike WB to Park Avenue SB has all been diverted to the Exit 2B ramp along the proposed connector roadway to Park Avenue.
- Half of the remaining WB Columbia Turnpike left turning volume has been diverted to use the two Route 24 loop ramps, along the proposed connector roadway to a left turn onto Park Avenue at the proposed signal; the remaining traffic will continue to use the existing left turn.
- With the elimination of the EB Columbia Turnpike ramp to Route 24 EB, all traffic has been diverted to the proposed connector roadway from Park Avenue, with approach turning movements at the Columbia Turnpike/Park Avenue intersection shifted on a pro-rated basis.
- The existing signal phasing at the Columbia Turnpike/Park Avenue signal has not been changed; however the splits and cycle lengths for the network have been optimized based on proposed peak hourly flows.

Alternative 3 (Revised):

The traffic analysis for this alternative is the same as Alternative 3.

Alternative 4:

This alternative was suggested by NJDOT Value Engineering staff at our Subject Matter Experts Meeting on May 18, 2017. This involves a new “half-interchange” on the Route 24 Freeway to the east of the Columbia Turnpike interchange, with an off-ramp from EB, and an on-ramp to EB. This ramp would connect to the existing “Campus Drive” which intersects Park Avenue at a point roughly $\frac{3}{4}$ mile south of Columbia Turnpike.

Details and assumptions for Alternative 4 are as follows:

- Route 24 EB traffic destined for Columbia Turnpike WB to Park Avenue SB has all been diverted to the proposed new “Campus Drive Connector” ramp east of the Columbia Turnpike interchange.
- WB Columbia Turnpike left turning volume has been split diverting $\frac{2}{3}$ to use the loop ramp onto Route 24 EB to the new “Campus Drive Connector” ramp; the remaining $\frac{1}{3}$ of this traffic will continue to use the existing left turn.
- At the Columbia Turnpike/Park Avenue signal, some of the SB and EB movements onto Park Avenue are likely to divert onto Columbia Turnpike EB, to Route 24 EB, onto the new ramp; however, the traffic most likely to do this will be traffic destined to the buildings on Campus Drive itself. This diversion will not change the total volumes on each approach to the signal; however, it could further increase the traffic volumes using the new ramp, and passing through the weave areas between ramps.

- The existing signal phasing at the Columbia Turnpike/Park Avenue signal has not been changed; however the splits and cycle lengths for the network have been optimized based on proposed peak hourly flows.

Comparison of Alternatives:

IH has conducted weekday morning and evening peak hour capacity analyses for the four potential improvement options as previously described. As with the existing and no-build analyses, capacity analysis results are per the “HCS2010” analysis module with the Synchro/SimTraffic analysis software (version 9). For each of the three improvement alternatives under consideration as well as “no-build” conditions, Table 2 illustrates the projected peak hour levels of service at the intersection of Columbia Turnpike and Park Avenue, and Table 3 illustrates the projected peak hour levels of service at the proposed new signal at Park Avenue and the ramp connector roadway, south of the Columbia Turnpike intersection.

As shown in Table 2, during the weekday morning peak hour under “no-build” conditions, the intersection of Columbia Turnpike and Park Avenue is projected to operate at an overall level of service ‘F’ with an average delay of over four minutes per vehicle, and eight individual movements operating at level ‘F’. Alternatives 1-4 each reduce this overall intersection level of service by an order of magnitude of roughly half, and Alternative 1 provides the least overall intersection delay at 143 seconds per vehicle. However, under Alternatives 1, 2, 3 and 4 the number of individual level ‘F’ movements will be 7, 6, 6 and 6, respectively, during the morning peak hour.

During the weekday evening peak hour, the “no-build” condition at this intersection will be level ‘F’ with an average delay per vehicle of 289.8 seconds and eight individual level ‘F’ movements. Alternatives 2 and 3 will improve the overall intersection delay by a third during this hour, with average delays ranging from 187 to 210 seconds per vehicle. However, Alternatives 2 and 3 will still include six to seven individual movements operating at level ‘F’. Under Alternative 4, the overall intersection will operate at level ‘F’ with 9 individual level ‘F’ movements, the worst LOS of the four during this hour.

It is important to note, however, that each of these improvement alternatives address one of the operational issues of concern within the study area – that being the weaving movement from the EB Route 24 ramp to WB Columbia Turnpike for traffic destined to the south on Park Avenue. Each of the improvement options relocates this traffic away from the Exit 2A ramp, and the reduction in lane blockages due to these weaving/crossover movements should allow the remaining WB Columbia Turnpike lanes, and the associated green time at the Park Avenue signal, to be used more efficiently.

At the proposed traffic signal at Park Avenue and the ramp connector roadway, the roundabout alternative (#2) results in the best overall intersection operation of the three. During the morning peak hour Alternative 2 operation at this intersection will be level ‘D’ with a nominally lower delay than under Alternative 1. During the weekday evening peak hour, the intersection will operate at level ‘f’ under Alternative 2, compared with level ‘f’ for Alternative 1, and level ‘f’ under Alternative 3. (There is no comparable intersection included in Alternative 4).

While Alternative 2 results in the best operation at the proposed Park Avenue signal, this option also includes a modern roundabout within the southeast quadrant of the Columbia Turnpike/Park Avenue intersection, and our analysis has included an evaluation of the anticipated operation of this intersection. During the weekday evening peak hour all approaches to the proposed roundabout will operate at level 'A' or 'C', during the weekday morning peak hour the WB approach to the roundabout (i.e. from the EB Route 24 Exit 2B ramp) carries over 2000 vehicles, and this approach will operate at level 'F'. Synchro-calculated 95th-percentile queues on this approach are 37 vehicles, or 925' assuming 25' per vehicle. These queues will extend to roughly 350'-450' from the Route 24 mainline.

One more conflict point to be evaluated is the weaving section on Route 24 EB between the on-ramp from Columbia Turnpike WB, and the off-ramp to Columbia Turnpike EB. As noted previously, under "no-build" conditions this weaving movement is projected to operate at level 'E' during the weekday morning peak hour, and level 'C' during the weekday evening peak hour. Weaving analysis results for the four alternatives are as follows:

- Under Alternative 1 the weaving volumes and length will remain the same as under projected "no-build" conditions – i.e. LOS 'E' and 'C' during the morning and evening peak hours, respectively.
- Under Alternative 2 the elimination of the existing Exit 2A off-ramp and the provision of an expanded on-ramp from Columbia Turnpike WB to Route 24 EB increases the weaving length to $\pm 1,050'$. The weaving volumes increase due to the consolidation of all exiting traffic to the existing Exit 2B ramp, and the inclusion of diverted WB Columbia Turnpike left turning traffic to the loop ramps to Route 24 EB and then through the proposed roundabout. This weave will operate at level 'F' during the weekday morning peak hour, and level 'D' during the weekday evening peak hour.
- Under Alternative 3, the weaving volumes increase similar to those as discussed under Alternative 2, above; however, the weaving length is not increased above the existing 600'. This weave is projected to operate at level 'F' and level 'D' during the weekday morning and evening peak hours, respectively.
- Under Alternative 3 (Revised), the weaving volumes increase similar to those as discussed under Alternative 3, above.
- Under Alternative 4, this weave also remains the existing 600' length, and is projected to operate at level 'F' and level 'E' during the weekday morning and evening peak hours, respectively.

Alternative 4 also involves a second weave on Route 24 EB, between the on-ramp from Columbia Turnpike EB and the proposed new off-ramp to Campus Drive. The gore-to-gore spacing between these ramps will be approximately 900', which is too short a distance for separate accel and decel lanes per NJDOT RDM Figure 7-I. This weave is projected to operate at level 'F' and level 'F' during the weekday morning and evening peak hours, respectively.

C. Traffic Summary

From a traffic engineering perspective, each of the proposed alternatives will realize a significant reduction in the overall vehicular delay at the intersection of Columbia Turnpike and Park Avenue. However, under each of these alternatives, multiple individual movements are still anticipated to operate at level 'F' – at least six during the weekday morning peak hour, and 6-9 during the weekday evening peak hour. Since the impact of these three alternatives on this intersection is similar in terms of order of magnitude, the selection of a preliminary preferred alternative should consider the relative benefits and drawbacks of these alternatives on the other intersections and/or conflict points in the project area.

We note that Alternatives 2 and 3 result in better overall intersection levels of service at the Columbia Turnpike/Park Avenue intersection. However, some of these improvements are realized through diversion of WB Columbia Turnpike left-turning traffic onto Route 24 EB through two reverse loop ramps. This diversion increases weaving volumes, resulting in projected LOS 'F' operation during the weekday morning peak hour, compared with LOS 'E' under no-build and Alternative 1 conditions. In addition, the roundabout in Alternative 2 will provide LOS 'F' operation on the WB approach during the weekday morning peak hour as over 2,000 vehicles are anticipated to approach during this hour.

Alternative 1 does improve overall intersection levels of service at the Columbia Turnpike/Park Avenue intersection; though delays are forecast to be higher than under the other two alternatives, they still represent a significant reduction over “no-build” levels. In addition, this alternative does not have other negative impacts in terms of traffic capacity (as discussed for Alternatives 2 and 3, above). The reason for this is Alternative 1 includes a new grade-separated ramp carrying exiting Route 24 EB traffic over Columbia Turnpike. By nature this design eliminates vehicle conflicts; however, obviously, this alternative involves increased costs associated with the construction and maintenance of a new overpass structure.

Alternative 4 results in the best operation at the Columbia Turnpike/Park Avenue signal during the morning peak hour, because it subtracts the most volume from the WB Columbia Turnpike left turn which is the highest-volume movement at the intersection. This leaves more green time to be distributed among the other movements. However, during the weekday evening peak hour Alternative 4 results in the third worst level of service of the alternatives evaluated. In the evening the WB left turn is much lower, and so subtraction from that movement has less of a beneficial effect. Also, during this hour, the NB Park Avenue approach is very heavy. Alternatives 1-3 each subtract some volume from this approach at the proposed connector ramp(s); however, Alternative 4 leaves this approach unchanged. In addition, during the weekday morning peak hour, each of the weaves on Route 24 EB are projected to operate at level 'F', with level 'D' and 'E' operation during the weekday evening peak hour.

D. Hydrology & Hydraulics Analysis

There is no H&H work required for this project.

E. Right of Way Impacts and Review

Right of Way impacts were assessed for Alternatives 1 to 3 and 3(Revised). The Parcel Areas in the tables to follow are based on the position of proposed walls and an estimated top or toe of slope taken from GIS files with 1' contours. Parcel requirements for storm water basins have also been included.

ROW Table – Alternative 1

Parcel No.	Block	Lot	Property Area	Parcel Area
1	9101	6	147.140	0.321
2	9201	12	2.700	0.012
3	1201	1	16.722	Access
4	1201	1	16.722	0.093
5	1201	1	16.722	0.522
6	4802	1	8.490	2.275
7	4802	2	3.500	3.500
8	4902	1	8.690	1.311
9	4802	2	1.080	1.080
10	4903	1	0.451	0.451
Total Acreage Required				9.565

ROW Table – Alternative 2

Parcel No.	Block	Lot	Property Area	Parcel Area
1	9101	6	147.140	0.316
2	9201	12	2.700	0.012
3	1201	1	16.722	Access
4	1201	1	16.722	0.094
5	1201	1	16.722	0.295
6	4802	1	8.490	2.126
7	4802	2	3.500	3.500
8	4902	1	8.690	1.272
9	4902	2	1.080	1.080
10	4903	1	0.451	0.451
Total Acreage Required				9.146

ROW Table – Alternative 3

Parcel No.	Block	Lot	Property Area	Parcel Area
1	9101	6	147.140	0.321
2	9201	12	2.700	0.010
3	9502	1	0.662	0.100
4	9502	2	1.084	0.038
5	9502	3	1.757	0.036
6	1201	1	16.722	Access
7	1201	1	16.722	0.093
8	1201	1	16.722	0.456
9	4802	1	8.490	0.269
10	4802	1	8.490	1.882
11	4802	2	3.500	3.500
12	4902	1	8.690	0.391
Total Acreage Required				7.096

ROW Table – Alternative 3(Rev.) (PPA)

Parcel No.	Block	Lot	Property Area	Parcel Area
1	9101	4	16.800	0.200
2	9201	12	2.700	0.028
3	9502	1	0.662	0.054
4	9502	2	1.084	0.047
5	9502	3	1.757	0.032
6	1201	1	16.722	3.870
7	4802	1	8.490	0.259
8	4802	1	8.490	1.898
9	4802	2	3.500	0.056
10	4902	1	8.690	0.435
Total Acreage Required				6.878

ROW Table – Alternative 4

Parcel No.	Block	Lot	Property Area	Parcel Area
1	1201	6*	64.7	5.630
Total Acreage Required				5.630

*- As per Tax map Lot 6 is 64.7 ac and 6.83 ac FHA

F. Utility Impacts

The proposed improvements on Alternatives 1 – 4 will require the relocation of the utility pole lines and fire hydrants along both sides of Park Avenue east of the intersection with Columbia Turnpike. Alternative 3(R) will also require utility pole relocations west of and on Columbia Turnpike. Two Major Gas Transmission Lines cross the project area in two locations. They are Texas Eastern and Algonquin Gas Transmission lines. The first crossing includes both transmission lines on Park Avenue and runs behind the Hyatt Hotel to the Hanover Compressor Station located in the infield to the ramp from Route 24 EB to Columbia Turnpike EB. The second crossing includes only the Algonquin Gas Transmission Line across Columbia Turnpike and through the infield of the ramp from Route 24 EB to Columbia Turnpike WB.



G. ITS Facilities

The Department maintains an inventory of all Intelligent Transportation System (ITS) devices throughout the state by type, route and county on the website. A review of the current inventory revealed that there are no ITS devices within the project limits.

H. Complete Streets Policy

A “Complete Street” is defined as a means to provide safe access for all users by designing and operating a comprehensive, integrated, connected multi-modal network of transportation options. The policy dictates that complete shall be considered during planning, design, construction, maintenance and operation of new and retrofit transportation facilities, enabling safe access and mobility of pedestrian, bicyclist, and transit users of all ages and abilities.

Pedestrian pushbutton controls are located on all four corner islands; however, there are no other pedestrian actuation devices anywhere else in the intersection of Park Avenue and Columbia Turnpike. In addition, there is a bus stop on the south west corner; however, crosswalks and curb ramps are not provided, and sidewalks are only provided bordering the Hyatt Hotel property.

There are no shoulders or multi-use paths provided in the vicinity of Park Avenue or Columbia Turnpike for Bicycle Compatibility.

It is recommended that the intersection be upgraded to include crosswalks and curb ramps across Park Avenue at both the north and south side of the intersection and at least one side of the intersection across Columbia Turnpike. Signal equipment should be upgraded as required to meet ADA Compliance. As a minimum, **“Share The Road”** signs should be placed along both Park Avenue and Columbia Turnpike. The proposed

condition will meet the NJDOT Complete Streets policy. For Complete Street checklist has been addressed and is included in *Appendix 'W'*.

I. Access Impacts and Review

Permanent impacts to existing driveways include the following:

- Revocation of access to the driveway associated with Block 1201, Lot 1 (Advance at Park Normandy Real Estate) due to its proximity to the new Park Avenue Ramp Signal in Alternatives 1, 2 and 3.
- Revocation of access to the driveway associated with Block 4802, Lot 1 (Hyatt Hotel) on Park Avenue due to the widening.
- Modification of access to the driveway associated with Block 4802, Lot 1 (Hyatt Hotel) on Columbia Turnpike due to the widening.

J. Constructability and Staging Plans and Detour Plan

Under all five alternatives the majority of the construction will be carried out off line.

Alternative 1: The construction of new ramps from Route 24 EB and Columbia Turnpike westbound, the bridge over Columbia Turnpike, modification of ramp to Route 24 eastbound and all connector ramps to Park Avenue can be constructed off line. The connection of ramp from Route 24 eastbound and modification on Park Avenue can be achieved by lane closer and/or night hour's work.

Alternative 2: The construction of new ramp from Columbia Turnpike westbound, the roundabout, modification of ramps to Route 24 eastbound to Route 24 eastbound and all connector ramps to Park Avenue can be constructed off line. The connection of ramp to Route 24 eastbound, modification on Park Avenue and Columbia Turnpike can be achieved by lane closer and/or night hour's work.

Alternative 3: The construction of the new ramp connection from Park Avenue to Route 24 eastbound can be constructed off line. The modification on Park Avenue and Columbia Turnpike can be achieved by lane closer and/or night work.

Alternative 3(Rev.) (PPA): The construction of the new ramp connection will be similar to that of Alternative 3.

Alternative 4: The construction of new ramps from Campus Drive to and from Route 24 eastbound can be constructed off line. The reconstruction of Campus Drive can be achieved by making single lane traffic. The modification of Park Avenue can be achieved by lane closer and/or night work.

K. Controlling Substandard Design Elements and Reasonable Assurance

There are no "Controlling Substandard Design Elements and Reasonable Assurance required as the construction will be carried out on local roads.

L. Construction Cost Estimate

The following table provides the construction cost Estimate for each alternative, which includes construction, utility relocations, contingencies and construction engineering.

Work	Estimate
Alternative 1	\$14,510,796
Alternative 2	\$13,888,330
Alternative 3	\$6,298,404
Alternative 3 (Rev.)(PPA)	\$5,735,581
Alternative 4	\$10,615,548

The cost estimates for all alternatives can be found in *Appendix 'R'*. The cost estimates does not include any permit related cost (like wetland mitigations or constructing SWM) or ROW purchase cost.

M. Value Engineering Study and Report

A Value Engineering/Smart Solutions Unit investigated and recommended improvements for the area between the Route 24 EB ramp to Columbia Turnpike and the signalized intersection of Columbia Turnpike and Park Avenue. The report dated June 2, 2014 is attached under *Appendix 'Q'*. There were 14 brain storming ideas studied. Based on the study, IH was asked to review two alternatives in depth (Alternatives 1 and 2). During the CD Phase two more alternatives were examined (Alternatives 3/3rev. and 4).

N. Alternative Matrix

An Alternatives Matrix was developed for this project. A copy of the same can be found in *Appendix 'S'*.

O. Risk Analysis Summary

The risk management efforts conducted during CD phase included performing risk analysis to determine the probability and impacts of potential risk events and populating the risk register with the associated risks for the PPA. As noted in the Risk Management Guideline, during CD and PE Phase, the probability of uncertainty in the cost estimate is 100%, due to uncertain quantities and unit costs, and should be included in the risk register.

Other risk events identified for this project included, but are not limited to survey, utilities conflicts, interchange modification approval, unacceptable congestion/queuing during construction, ROW purchase, NJDEP permit implementations, traffic signals, and construction of stormwater management components. A copy of risk register and Utility Risk Assessment Plan can be found in *Appendix 'T'*.

P. Discussion with Subject Matter Experts

The following meetings were held with NJDOT Subject Matter Experts (SME). The significant issues and concerns that were discussed at each meeting are summarized in the DCR found in *Appendix 'O'*.

Kick Off Meeting - April 27, 2016
 Core Group Meeting - May 18, 2017
 Local Officials Briefing - August 23, 2017
 Local Officials Meeting – September 25, 2020

Q. Preliminary Preferred Alternative (PPA)

The Alternative 3(Revised) was selected for the PPA. This alternative was selected because it is the most cost effective considering initial and future maintenance costs, has the shortest construction duration, and it satisfies the Purpose & Need and meets the Goals & Objective for this project.

The Matrix and detailed impacts of the Preliminary Preferred Alternative (Alternative 3 Revised) are presented in *Appendix 'S'*.

R. Preliminary Engineering Scope Statement

The Preliminary Engineering Scope Statement documents key elements of the project scope starting with information gathered during the Concept Development phase. It is refined as more details become available. All input received to date from the various NJDOT offices, bureaus and units was incorporated into the Preliminary Engineering Scope Statement and a copy of the same can be found in *Appendix 'AA'*.

VII. CONCEPT DEVELOPMENT RECOMMENDATION

A. Federal Highway Administration (FHWA) Approval Report

FHWA reviewed the draft CD Report submitted in _____ and provided comments on same in _____. A comment resolution summary was prepared and submitted on _____. FHWA provided approval of this report via _____ on _____. All correspondence with FHWA can be found in *Appendix – 'Q'*.

B. Capital Program Screening Committee (CPSC) Recommendation

CPSC recommended that this project advance to Preliminary Engineering.

C. Capital Program Committee (CPC) Approval

CPC endorsed the CPSC recommendations at the _____ CPC meeting. A copy of the meeting minutes can be found in *Appendix 'Q'*.