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Our Projects and the Environment

## Route 18/I-287 Connection Overview

# Route 18/I-287 Connection

## Overview

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The Route 18/I-287 Connection project will complete the extension of Route 18 from its existing terminus at Hoes Lane to I-287 in Piscataway Township, Middlesex County. It is one of the ten [Phase I Liberty Corridor](#) projects.

This project includes the rehabilitation of 2.7 miles of land service highway, along with improvements for 20 at-grade intersections, and upgrading of pedestrian/bicyclist mobility. The project will improve the safety and traffic operational performance of the corridor allowing the local road to change jurisdiction to Route 18. Access to I-287 will be improved for Rutgers University, which has five campuses located in the area, local medical centers, technology and research firms and warehouse distributors located in the area.

Construction is scheduled to begin in May 2011 and is estimated to be completed in fall 2012.

- [Categorical Exclusion Documentation](#) (pdf 816k)
- [Cost/Benefit Analysis](#) (pdf 222k)
- [Project Location Map](#) (pdf 235k)
- [Project Map](#) (pdf 2.7m)
- [Section 4\(f\): de minimus](#) (pdf 3.85k)
- [Support - Piscataway Township](#) (pdf 799k)
- [Support - Governor Chris Christie](#) (pdf 311k)
- [Support - Senator Frank R. Lautenberg](#) (pdf 256k)

The files above are in Portable Document Format (PDF). You will need Adobe Acrobat Reader, which is available free from the [state Adobe Access page](#), to view the files.



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 Department of Transportation  
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Last Updated: January 18, 2013

**NEW JERSEY DEPARTMENT OF TRANSPORTATION**  
**CATEGORICAL EXCLUSION DOCUMENTATION**

CED Form Updated September 18, 2007

I. GENERAL INFORMATION			
DOT Job Code No.	1237-523	Federal Project No.	Nh-29 (154)
Project Management Team	Group C--MarkRollo	Data Base No.	N/A
Route & Section	18 3A	Structure No.	N/A
Local Road Name	Hoes Lane		
Municipality(ies)	Piscataway	County(ies)	Middlesex
Type of Project	Rehabilitation	Length	1.72M
From Milepost	45.38	To Milepost	47.20
Congressional District	6	Legislative District	17
ROW Cost	12m	Construction Cost	\$49M

EXISTING FACILITY			
ROW Width	104 ft		
No. Lanes & Width	4-12ft		
Shoulder Width	8ft & 1ft	Median	20 ft
Overall Roadway Width	86ft		

PROPOSED FACILITY			
ROW Width	114 ft		
No. Lanes & Width	4-12ft		
Shoulder Width	8ft & 3ft	Median	20ft
Overall Roadway Width	90ft		

II. PROJECT DESCRIPTION (attach location map; USGS map suggested)
<p><b>A. Project Need</b> (briefly explain why the project is needed):            This project will convert Hoes Lane (Piscataway Township) to State Highway Route 18 and complete the connection of Route 18 to I-287. Improvements include bike/ped paths, Pedestrian Bridge, sidewalks and revised signalized intersections. In order to process this change in jurisdiction, these safety improvements are required.</p>
<p><b>B. Proposed Improvements</b> (provide a brief description of proposed improvements):            Converting Hoes Lane to Route 18 requires total replacement of the pavement box; four signals to be eliminated with remaining signals being updated and connected; realignment of Hoes Lane West with Morris Avenue; construction of two local street connections to proposed signals will allow closure of median openings; multi-use paths and sidewalks will be added for pedestrian safety along Route 18; two new pedestrian structures located at the northern and southern end of project; and the utility poles will be removed from the center median.</p>

C. Right-of-Way Taking			
Total area needed: 11.81ac.-fee 5.71 ac.- easements	Est. No. parcels:	In fee-33	easements-42
Est. No. relocations:	residences-4	businesses-2	parking spaces-20
Community Facilities Affected: 3			
Area of public recreation land taken: 0.78 (acres)		Out of a total area of: 225 (acres)	
<input checked="" type="checkbox"/>	Green Acres/State-owned Land Involvement		
<input type="checkbox"/>	Federally Owned/Federally Funded Land Involvement		
<b>Comments:</b>			

**III. ENVIRONMENTAL CONSIDERATIONS**

**A. Noise**

- Sensitive receptors exist within 200 feet for two lanes or 400 feet for four lanes.
- Project substantially changes the vertical or horizontal alignment of the roadway.
- Traffic volumes or speeds substantially increase.

**Conclusion:**

- Noise study not required. No significant impact anticipated.
- Potential noise impacts were studied and are discussed in comments. Project still meets CE criteria.

**Comments:** The land use in the area is largely commercial with the exception of ten residences south of Morris avenue, adjacent to Rt. 18 and tennis courts at the intersection of Knightsbridge Rd. There is also a church and a public library at the intersection of Skiles Avenue but these buildings have air conditioning and no interior noise impact is expected. Using the design year(2030) traffic, the projected noise levels at the residences and the tennis courts will be 63dbA or less with the project and below the NAC.

**B. Air Quality: CONFORMITY WITH THE CLEAN AIR ACT AMENDMENTS (CAAA) OF 1990**

**Section 1:** Regional Emissions Analysis (STIP or MPO's conforming transportation plan)

- Project is included in the FY 2008 - 2011 approved State Transportation Improvement Plan (STIP).
- Project is not listed in the FY 20\_ - 20\_ approved STIP but is included in the MPO's conforming transportation plan.
- Project is not included in either the approved STIP or the MPO's conforming transportation plan.

**Section 2:** Based on its scope, the project is categorized by the Transportation Conformity Rule (TCR) as:

- A project type listed in **Table 2** of the TCR, i.e., **Exempt** from the conformity requirements of the CAAA (i.e., exempt from regional emissions analysis, Carbon Monoxide (CO) analysis, and Particulate Matter PM2.5 and PM10 analyses requirements) and may proceed towards implementation even in the absence of a conforming transportation plan and TIP.
- A project listed in **Table 3** of the TCR, i.e., **Exempt** from regional emissions analysis requirement, but local effects of this project with respect to CO, PM2.5 and PM10 concentrations must be considered to determine if a hot-spot analysis is required.  
*Complete Section 2a below.*
- A project type **not listed in Table 2 or Table 3** of the TCR, i.e., must be part of a conforming STIP and/or a MPO's conforming transportation plan and requires CO, PM2.5 and PM10 hot-spot analyses.  
*Complete Section 2a below.*

**Section 2a(1): Project type listed in Table 3 of the TCR for CO analysis  
Project type not listed in either Table 2 or Table 3 of the TCR for CO analysis**

- Project located in **CO Attainment Area**. CO analysis not required. Project may proceed to the project development process.
- The total eight-hour Carbon Monoxide levels are expected to be reasonably below the NAAQS of 9 ppm. This is based on LOS data for the intersection(s) and the total highest traffic volumes at this (those) intersection(s) and the distance of the sensitive receptors to the roadway. No quantitative analysis is required. Project may proceed to the project development process even in the absence of a conforming transportation plan and TIP.
- Project located in a Carbon Monoxide **Non-Attainment/Maintenance Area** and requires a Carbon Monoxide hot-spot analysis. A CO Analysis was completed at the following intersection(s):  
  
And the results are:

Section 2a(2): Project type listed in Table 3 of the TCR for PM2.5 analysis Project type not listed in Table 2 or Table 3 of the TCR for PM2.5 analysis	
<input type="checkbox"/>	The project is located in PM2.5 <b>Attainment Area</b> . PM2.5 hot-spot analysis is not required. Project may proceed to the project development process.
<input checked="" type="checkbox"/>	The project is located in a PM2.5 <b>Non-Attainment/Maintenance Area</b> and the project is <b>not an air quality concern</b> under 40CFR 93.123(b) (1). Quantitative/qualitative analysis is not required. Project may proceed to the project development process.
<input type="checkbox"/>	The project is located in a PM2.5 <b>Non-Attainment/Maintenance Area</b> and the project is <b>an air quality concern</b> under 40CFR 93.123(b) (1). A PM2.5 hot-spot analysis was completed at the following location(s): _____  And the results are: _____

Section 2a(3): Project type listed in Table 3 of the TCR for PM10 analysis Project type not listed in Table 2 or Table 3 of the TCR for PM10 analysis	
<input checked="" type="checkbox"/>	The project is located in PM10 <b>Attainment Area</b> . PM10 hot-spot analysis is not required. Project may proceed to the project development process.
<input type="checkbox"/>	The project is located in a PM10 <b>Non-Attainment/Maintenance Area</b> and the project is <b>not an air quality concern</b> under 40CFR 93.123(b) (1). Quantitative/qualitative analysis is not required. Project may proceed to the project development process.
<input type="checkbox"/>	The project is located in a PM10 <b>Non-Attainment/Maintenance Area</b> and the project is <b>an air quality concern</b> under 40CFR 93.123(b) (1). A PM10 hot-spot analysis was completed at the following location(s): _____  And the results are: _____
<b>Comments</b> (include LOS, if appropriate): The project will not result in increase in diesel traffic. No significant impact on air quality is anticipated.	

C. Potential Ecological Constraints (check those that apply)			
<input checked="" type="checkbox"/>	Floodplains	<input type="checkbox"/>	Shellfish Habitat
<input checked="" type="checkbox"/>	Wetlands	<input type="checkbox"/>	Acid Producing Soils
<input type="checkbox"/>	Vernal Pools	<input type="checkbox"/>	Submerged Aquatic Vegetation
<input checked="" type="checkbox"/>	Waterbody:	<input type="checkbox"/>	Sole Source Aquifer
	<input type="checkbox"/> Category One	<input checked="" type="checkbox"/>	Forested Areas
	<input type="checkbox"/> Trout Production	<input checked="" type="checkbox"/>	Threatened and Endangered Species:
	<input type="checkbox"/> Trout Maintenance		<input type="checkbox"/> State-listed species
	<input checked="" type="checkbox"/> Non-Trout		<input checked="" type="checkbox"/> Federally listed species
<input type="checkbox"/>	Wild and Scenic River	<input type="checkbox"/>	Other (specify):
<input type="checkbox"/>	Essential Fish Habitat		

Federally Listed Threatened & Endangered Species Checklist:	
(Please see <a href="http://www.fws.gov/northeast/njfieldoffice/Endangered/consultation.html">http://www.fws.gov/northeast/njfieldoffice/Endangered/consultation.html</a> for guidance on the current US Fish and Wildlife Service (USFWS) Consultation Procedures. County/municipal species lists are only valid for 90 days.)	
<input type="checkbox"/>	The proposed project is <b>not</b> located in an area with county-wide distribution of a federally listed species <i>and</i> is not within or adjacent to a municipality with a known occurrence of a federally listed species. Documentation of this determination is in the project file. No further action is

	required under the Endangered Species Act (ESA).
<input checked="" type="checkbox"/>	The proposed project <b>is</b> located in an area with county-wide distribution of a federally listed species <i>and/or</i> is within or adjacent to a municipality with occurrence of federally listed species. Habitat requirements for each of the species have been reviewed and the project's impact area (i.e., action area) was assessed to determine whether it contains potentially suitable habitat. <i>Based on existing information or field surveys, the results revealed:</i>
<input type="checkbox"/>	The project's impact area (*i.e., action area) <b>does not</b> contain potentially suitable habitat for a federally listed species. Documentation of this determination is in the project file. No further action is required under the ESA. Concurrence from the USFWS is not required.
<input checked="" type="checkbox"/>	The project's impact area (i.e., action area) <b>does or may</b> contain potentially suitable habitat for a federally listed species. <i>The assessment and all relevant project information:</i>
<input checked="" type="checkbox"/>	Have been submitted to the US Fish and Wildlife Service's NJ Field Office for ESA <b>Section 7 consultation</b> . Correspondence is attached. See comments below.
<input type="checkbox"/>	Will be submitted to the New Jersey Division of Land Use Regulation Program during the <b>permitting process</b> . Project requires authorization under the NJ Freshwater Wetlands Protection Act. See comments below.

\*Action Area: The action area is defined by regulation as all areas to be affected **directly or indirectly** by the Federal action and **not merely the immediate area involved in the action** (50 CFR §402.02). This analysis is not limited to the "footprint" of the action nor is it limited by the Federal agency's authority. Rather, it is a biological determination of the reach of the proposed action on listed species. Subsequent analyses of the environmental baseline, effects of the action, and levels of incidental take are based upon the action area.

<b>Conclusion:</b>	
<input type="checkbox"/>	No significant impact anticipated
<input checked="" type="checkbox"/>	Further studies are needed to obtain permits. Project still satisfies CE criteria.
<b>Comments</b> (briefly describe <i>all</i> potential ecological constraints): The roadway within the project area crosses a tributary to Ambrose Brook. Ambrose Brook is classified as FW2-NT. USFWS and the Natural Heritage database were contacted in 2004 and found no occurrences of state or federal threatened or endangered species in the project area. Updated consultation with USFWS resulted in a finding that the proposed project is not likely to adversely affect Indiana bats due to conservation measures proposed by DOT.	

<b>D. Anticipated Environmental Permits/Approvals/Coordination</b> (check those that apply)			
<input type="checkbox"/>	US Coast Guard	<input type="checkbox"/>	NJDEP Pollutant Discharge
<input type="checkbox"/>	USACOE Section 10 (Navigable Waters)	<input type="checkbox"/>	NJDEP Dam Safety
<input type="checkbox"/>	USACOE Section 404 (Nationwide)	<input type="checkbox"/>	NJDEP Remediation Approval
<input type="checkbox"/>	USACOE Section 404 (Individual)	<input type="checkbox"/>	NJDEP Tidelands Conveyance
<input type="checkbox"/>	USEPA Sole Source Aquifer	<input type="checkbox"/>	EO 11990 Wetlands
<input type="checkbox"/>	NJDEP Freshwater Wetlands—GP	<input type="checkbox"/>	EO 11988 Floodplains
<input checked="" type="checkbox"/>	NJDEP Freshwater Wetlands—IP	<input type="checkbox"/>	NJDEP Highlands Preservation Area: <input type="checkbox"/> Exempt <input type="checkbox"/> Highlands Applicability Determination <input type="checkbox"/> Highlands Preservation Area Approval
<input checked="" type="checkbox"/>	NJDEP Transition Area Waiver		
<input type="checkbox"/>	NJDEP Coastal Wetlands		
<input type="checkbox"/>	NJDEP Waterfront Development		
<input type="checkbox"/>	NJDEP CAFRA	<input type="checkbox"/>	USDA-Farmland Conversion (Form AD 1006)
<input checked="" type="checkbox"/>	NJDEP Stream Encroachment (minor)	<input type="checkbox"/>	NJ Agriculture Development Area
<input type="checkbox"/>	NJDEP Stream Encroachment (major)	<input checked="" type="checkbox"/>	NJDEP Green Acres Program/State House Commission
<input checked="" type="checkbox"/>	NJDEP Stormwater Management: <input checked="" type="checkbox"/> ≥ 0.25 acre impervious surface <input checked="" type="checkbox"/> ≥ 1.0 acre disturbance <input type="checkbox"/> Unknown at this time	<input type="checkbox"/>	National Marine Fisheries Service
		<input checked="" type="checkbox"/>	NJDEP Parks & Forestry (PL 2001 Chapter 10 Reforestation)
		<input type="checkbox"/>	D&R Canal Commission
		<input type="checkbox"/>	Meadowlands Commission

<input checked="" type="checkbox"/>	Approval through NJDEP LURP Permit (or)	<input type="checkbox"/>	Pinelands Commission
	<input type="checkbox"/> NJDOT self-certification	<input type="checkbox"/>	Endangered Species Act Section 7 Consultation
<input checked="" type="checkbox"/>	NJPDES Construction Activity Stormwater GP (RFA)	<input type="checkbox"/>	NJDEP Threatened & Endangered Species Coordination
<input checked="" type="checkbox"/>	NJDEP Water Quality Certificate	<input type="checkbox"/>	Other (specify):

**Comments:** The proposed project will impact approximately 1 acre of wetlands, requiring an individual wetlands permit and the associated mitigation. Green Acres approval will be required for impacts to Ambrose & Doty's Brook Park.

<b>E. Cultural Resources</b>	
<b>Technical Findings:</b>	
<input type="checkbox"/>	Project is not an undertaking for Section 106 purposes; concurrence has been received from FHWA.
<input type="checkbox"/>	No Effect per FHWA/SHPO Agreement of 7/6/00; subject to conditions identified in the Agreement.
<input type="checkbox"/>	No Section 106 Consultation per 5/25/01 SHPO concurrence with <i>Section 106 Compliance Procedures, Federally Funded Drainage Improvement Program</i> ; subject to conditions identified in the Agreement.
<input type="checkbox"/>	No Effect to significant properties if they exist in APE per 36CFR800.3(a)(1) with SHPO concurrence. (Because the Section 106 regulations allow for a level of effort for conducting and evaluating cultural resources to be commensurate with the undertaking, this category of finding was developed to be used for certain projects when no cultural resources survey has been conducted; and self-imposed conditions, if applicable, are presented as part of the undertaking, e.g., Pipeline 3 or other small-scale projects.)
<input checked="" type="checkbox"/>	No National Register (NR) listed or eligible properties in APE (Section 106 Findings = No Historic Properties Affected).
<input type="checkbox"/>	National Register listed/eligible properties exist within APE ( <b>see consultation summary below</b> ).

Archaeology	Architecture				Section 106 Finding
	Bridge	Building	District	Other	
					NR listed/eligible property(ies)— No Historic Properties Affected
					NR listed/eligible property(ies)— No Adverse Effect (NAE)
					NR listed/eligible property(ies)— NAE with conditions
					NR listed/eligible property(ies)— Adverse Effect

	Section 106 Consultation Summary	Date
<input type="checkbox"/>	FHWA concurred with Adverse Effect Finding	
<input checked="" type="checkbox"/>	SHPO provided Section 106 consultation comments	3/28/06
<input type="checkbox"/>	FHWA concurred with no Adverse Effect with Conditions	
<input type="checkbox"/>	ACHP notified of Adverse Effect	
<input type="checkbox"/>	ACHP responded to notification (check one/enter date): <input type="checkbox"/> ACHP will participate in consultation <input type="checkbox"/> ACHP declined to participate in consultation	
<input type="checkbox"/>	MOA executed by FHWA (check one/enter date): <input type="checkbox"/> MOA filed with ACHP <input type="checkbox"/> ACHP accepted/signed MOA	

**Comments** (include MOA stipulations or other conditions, if applicable) :

<b>F. Section 4(f) Involvement</b>	
<b>Section 1: Historic Sites</b>	
<input checked="" type="checkbox"/>	No Section 4(f) Involvement
<input type="checkbox"/>	Project results in a "constructive use" of Section 4(f) property.
<input type="checkbox"/>	Project results in a use of Historic site(s) on or eligible for the National Register of Historic Places (check one below):
<input type="checkbox"/>	Section 4(f) Involvement. Project is covered under <b>de minimis Evaluation of Impacts</b> and all applicability criteria have been met, including concurrence <i>first</i> by the FHWA that the project meets the applicability criteria, and <i>then</i> concurrence by SHPO with the "No Effect" or "No Adverse Effect" determination <i>after they are notified</i> of the intent to use a <i>de minimis</i> finding.
<input type="checkbox"/>	Section 4(f) Involvement. Project is covered under the <b>Nationwide Section 4(f) Programmatic Evaluation for minor involvement</b> and all applicability criteria have been met, including concurrence by the SHPO (or ACHP) with the "No Effect" or "No Adverse Effect" determination.
<input type="checkbox"/>	Section 4(f) Involvement. Project is covered under the <b>Nationwide Section 4(f) Programmatic Evaluation for Net Benefits</b> and all applicability criteria have been met, including notification to and concurrence by the FHWA with the determination.
<input type="checkbox"/>	Section 4(f) Involvement. Project has an "Adverse Effect" determination. <b>Individual Section 4(f)</b> was prepared.
<b>Comments:</b>	

<b>Section 2: Historic Bridges</b>	
<input checked="" type="checkbox"/>	No Section 4(f) Involvement
<input type="checkbox"/>	Section 4(f) Involvement. Project is covered under the <b>Nationwide Section 4(f) Programmatic Evaluation for Historic Bridges</b> .
<b>Comments:</b>	

<b>Section 3: Publicly Owned Park, Recreation Area, Wildlife or Waterfowl Refuge</b>	
<input type="checkbox"/>	No Section 4(f) Involvement
<input type="checkbox"/>	Project results in a "Constructive Use" of Section 4(f) property (fill out Site Information below)
<input checked="" type="checkbox"/>	Project requires acquisition from publicly owned recreation land (fill out Site Information below):
<input checked="" type="checkbox"/>	Section 4(f) Involvement. Project is covered under <b>de minimis Evaluation of Impacts</b> and all applicability criteria and conditions have been met, including concurrence <i>first</i> by the FHWA that the project meets the applicability criteria, and <i>then</i> notification to the officials with jurisdiction of the intent to use a <i>de minimis</i> finding.
<input type="checkbox"/>	Section 4(f) Involvement. Project is covered under <b>Nationwide Section 4(f) Programmatic Evaluation for minor involvement</b> and all applicability criteria and conditions have been met, including concurrence by the officials having jurisdiction over the property.
<input type="checkbox"/>	Section 4(f) Involvement. Project is covered under the <b>Nationwide Section 4(f) Programmatic Evaluation for Net Benefits</b> and all applicability criteria have been met, including notification to and concurrence by the FHWA with the determination.
<input type="checkbox"/>	Section 4(f) Involvement. Nationwide Section 4(f) Programmatic applicability criteria were not met; <b>Individual Section 4(f) Evaluation</b> was prepared.
<b>Site Information</b> (for projects involving "Constructive Use" or acquisition from publicly owned recreation land, wildlife or waterfowl refuge):	
<b>Name of Site</b> (use local name):	Ambrose Doty's Park
<b>Lot and Block:</b>	Block 457.4 Lot 2.03
<b>Total acreage of site:</b>	225 acres

**Acreeage of site affected** (acquisition and permanent easements): 0.78 acres

Federal encumbrances involved (e.g., Wild and Scenic Rivers Act, Land and Water Conservation Fund Act, Rivers and Harbors Act).

**Comments:** Middlesex County lists the size of the conservation area as 225 acres. This is an undeveloped linear park along the Ambrose Brook and the Doty's Brook providing floodplain protection to both streams and greenways in a highly developed area of the County. These greenways connect to the ninety acres occupied by the Raritan Landing Golf Course operated by the Middlesex County Improvement Authority. The County's concurrence with a finding of *de minimus* impact has been received.

The amount of the park to be acquired through fee taking and easements is the minimum necessary for the roadway improvements and only involves minor strips of land adjacent to the road. A public information center was held 6/30/03 in which the project in its entirety was presented to solicit public comments. Design changes have necessitated another public information center at which time comments on the taking of parkland will again be accepted. This next meeting has not been scheduled to date.

#### **Section 4: Independent Walkway & Bikeway Construction Projects**

No Section 4(f) Involvement

Section 4(f) Involvement. Project is covered under the **Nationwide Section 4(f) Programmatic Evaluation**. Project requires use of recreation and park areas established and maintained primarily for active recreation, open space, or similar purposes. All applicability criteria have been met, including approval in writing by the official with jurisdiction over the property that the project is acceptable and consistent with the designated use of the property and that all possible planning to minimize harm has been accomplished in the location and design of the bikeway or walkway facility.

**Comments:**

#### **G. Hazardous Materials and Landfills**

Involvement with known or suspected contaminated site.

Involvement with underground storage tanks.

#### **Conclusion:**

Low potential for involvement with contamination; no further investigation required.

Further investigation and/or sampling required to determine extent of involvement with contamination. Project still meets FWHA criteria for a CE.

**Comments:** Investigation of the Peter Chesson property (Parcel 15/Block 593, Lot 23) has been deemed necessary due to the presence of underground tanks at one time. There are several monitoring wells on the property near to where the Skiles Avenue Extension is proposed.

#### **H. Socioeconomics**

The project will **not** result in any significant socioeconomic impacts.

**Comments:** Two businesses that had occupied residential buildings were relocated as part of the project. Additionally 4 residences have been relocated.

#### **I. Environmental Justice**

<input checked="" type="checkbox"/>	Project will have <b>no</b> disproportionately high or adverse effects on low income and/or minority communities.
<input type="checkbox"/>	Project will have disproportionately high and adverse effects on low income and/or minority communities.
<b>Conclusion:</b>	
<input checked="" type="checkbox"/>	Project is in compliance with the goals of Executive Order 12898 and the requirements of the Civil Rights Act of 1964.
<input type="checkbox"/>	Project is in compliance with the goals of Executive Order 12898 and the requirements of the Civil Rights Act of 1964, through the identification of measures to address disproportionate effects, including actions to avoid or mitigate them. Project satisfies CE criteria.
<b>Comments:</b> The project results in only 4 residential relocations, and project improvements include multi-use paths, additional sidewalks, and two new pedestrian overpasses.	

**J. Public Reaction** (briefly describe input from the Office of Community Relations or current status of public reaction):  
A public information center was held 6/30/03 at which time the response to the project was favorable. The town and county continue to support the project and another public information center is anticipated to update the public as to changes in the project.

**K. Environmental Commitments** (refer to MOA stipulations or other conditions noted in Section D, if applicable; permit conditions, etc.):  
As a condition of receiving a finding that the project is not likely to adversely affect Indiana bats DOT must adhere to a seasonal restriction on tree clearing (April 1 to September 30). Also the replacement of suitable tree species in the project area to offset impacts to 3 acres of forest land is required and should be in accordance with USFWS planting recommendations.

Implement soil erosion and sediment control measures during construction.

Implement standard measures for minimization of construction –related noise impacts during construction.

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**DETERMINATION OF CATEGORICAL EXCLUSION**

**Project name and location:** Route 18 Section 3A, Piscataway Township, Middlesex County

**CE #:** 771.117(d) (1) Modernization of a highway by resurfacing, restoration, rehabilitation, reconstruction, adding shoulders, or adding auxiliary lanes

The proposed project satisfies the Categorical Exclusion definition outlined in 23 CFR 771.117 (a) and will not result in significant environmental impacts.

\_\_\_\_\_  
Project Manager, Div. of Project Management

\_\_\_\_\_  
Date

Recommended by:

\_\_\_\_\_  
Environmental Team Leader

\_\_\_\_\_  
Date

**Certified**   
(or)  
**Approved**

\_\_\_\_\_  
Manager, Bureau of Environmental Project Support

\_\_\_\_\_  
Date

**Concurrence**

(non-self certified CEs)

\_\_\_\_\_  
Division Administrator, Federal Highway Administration

\_\_\_\_\_  
Date

enclosures (please include any correspondence referenced in the CED):

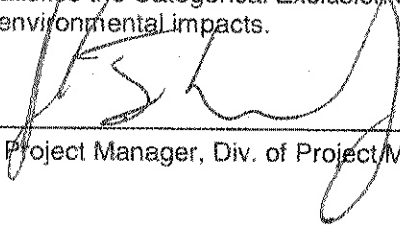
- Project Location Map
- NJ Natural Heritage Program letter
- USFWS coordination letter(s)
- NMFS coordination letter
- SHPO Eligibility & Effects concurrence letter
- Signed MOA
- Final Nationwide Section 4(f) Programmatic Evaluation for:
  - Minor Involvement with Historic Sites
  - Use of Historic Bridges
  - Minor Involvement with Publicly Owned Park, Recreation Area, Wildlife or Waterfowl Refuge
  - Independent Walkway and Bikeway Construction Projects
  - Net Benefits
  - De minimis* Evaluation of Impacts documentation (i.e., notice to SHPO, *de minimis* template)
- Final Individual Section 4(f)
- Resolution of Support from Municipality/County
- Other (specify): \_\_\_\_\_

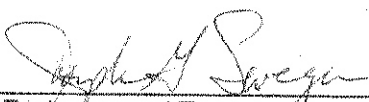
**DETERMINATION OF CATEGORICAL EXCLUSION**

**Project name and location:** Route 18 Section 3A, Piscataway Township, Middlesex County

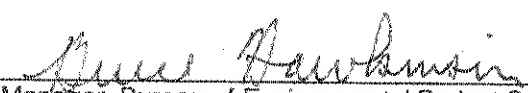
**CE #:** 771.117 (d) (1) Modernization of a highway by resurfacing, restoration, rehabilitation, reconstruction, adding shoulders, or adding auxiliary lanes

The proposed project satisfies the Categorical Exclusion definition outlined in 23 CFR 771.117 (a) and will not result in significant environmental impacts.

  
\_\_\_\_\_  
Project Manager, Div. of Project Management 10/15/07  
Date

Recommended by:   
\_\_\_\_\_  
Environmental Team Leader 15 Oct 2007  
Date

Certified   
(or)  
Approved

  
\_\_\_\_\_  
Manager, Bureau of Environmental Project Support 10/15/07  
Date

Concurrence (non-self certified CEs)   
\_\_\_\_\_  
Division Administrator, Federal Highway Administration 11/13/2007  
Date

enclosures (please include any correspondence referenced in the CED):

- Project Location Map
- NJ Natural Heritage Program letter
- USFWS coordination letter(s)
- NMFS coordination letter
- SHPO Eligibility & Effects concurrence letter
- Signed MOA
- Final Nationwide Section 4(f) Programmatic Evaluation for:
  - Minor involvement with Historic Sites
  - Use of Historic Bridges
  - Minor Involvement with Publicly Owned Park, Recreation Area, Wildlife or Waterfowl Refuge
  - Independent Walkway and Bikeway Construction Projects
  - Net Benefits
- De minimis* Evaluation of Impacts documentation (i.e., notice to SHPO, *de minimis* template)
- Final Individual Section 4(f)
- Resolution of Support from Municipality/County
- Other (specify): \_\_\_\_\_

# Cost/Benefit Analysis of NJDOT Route 18/Hoes Lane Improvement Project

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For TIGER II Grant Application

**August 2010**

The logo for Rutgers University, featuring the word "RUTGERS" in a red, serif font. The letter "R" is stylized with a long, sweeping tail that extends downwards and to the left.

Rutgers Intelligent Transportation Systems Laboratory (RITS)  
Rutgers, The State University of New Jersey  
CoRE Building 7<sup>th</sup> Floor, Busch Campus  
96 Frelinghuysen Rd, Piscataway, NJ 08854  
<http://rits.rutgers.edu>

## EXECUTIVE SUMMARY

In response to USDOT's TIGER II Discretionary Grants notice the New Jersey Department of Transportation (NJDOT) is submitting the Route 18/Hoes Lane construction project for funding. Rutgers RITS Lab conducted benefit-cost analysis of the project using the output of the North Jersey Regional Transportation Model – Enhanced (NJRTM-E), which allows for estimation of the highway network-related costs of travel for the no-build and build alternatives. The benefit-cost analysis was conducted to meet the criteria put forth by USDOT, with special emphasis on the following areas:

1. State of good repair
2. Economic impacts
3. Environmental sustainability
4. Livability
5. Safety

The evaluation criteria is met by estimating the benefits of the project as the difference between the no-build and build scenarios modeled in NJRTM-E. The model output is processed and monetized into costs based on functions developed using New Jersey-specific and national data. The functions estimate costs from the network based on reductions to maintenance costs, operating costs, congestion costs, air pollution costs, noise pollution costs, and accident costs.

The cost-benefit analysis conducted weighed the cost of the project against the differences between the no-build and build estimates of the transportation model. Based on value of time guidelines of USDOT and discount rates suggested by U.S. Office of Management and Budget (USOMB) the costs and benefits are translated to present values and compared. Based on the analysis and adjusted for sensitivity, this project is estimated to have a benefit-cost ratio between 107.65 and 206.69, depending on the lower and higher values of the assumptions used. From the estimates of the regional transportation model, this project is categorized as having a positive impact to the local area and North Jersey region.

## INTRODUCTION

This report describes the economic evaluation framework of the transportation-related benefits from the proposed Route 18/Hoes Lane improvement project in Piscataway, NJ. It utilizes the most important technique of public investment evaluation, *cost-benefit analysis*. Cost-benefit analysis requires the quantification and comparison of various benefits and costs generated by a project over time. The effects from the project are first enumerated and classified as benefits and costs. Then, each effect is quantified and expressed in monetary terms using appropriate conversion factors <sup>(1)</sup>. Benefits arise from the savings to users and society attributed to the project. The areas of focus are state of good repair, economic effects, livability, sustainability, and safety.

The goal of this study is to observe the benefits to the transportation system incurred due to the proposed project, with benefits from the improvement of travel conditions, which can be defined in multiple dimensions (access, time, safety, reliability, etc.). Using a transportation planning model, the North Jersey Regional Travel Model – Enhanced (NJRTM-E), scenarios of capacity improvements incurred by the proposed improvements are run and benefits calculated by modeling the proposed changes to the network, and comparing the model output with model output of the existing network. The following sections describe the NJRTM-E model and the assumptions used to model the proposed improvements. The cost-benefit evaluation process is described, including the various types of benefits quantified from the modeling process. Finally the data obtained for this study is presented and discussed.

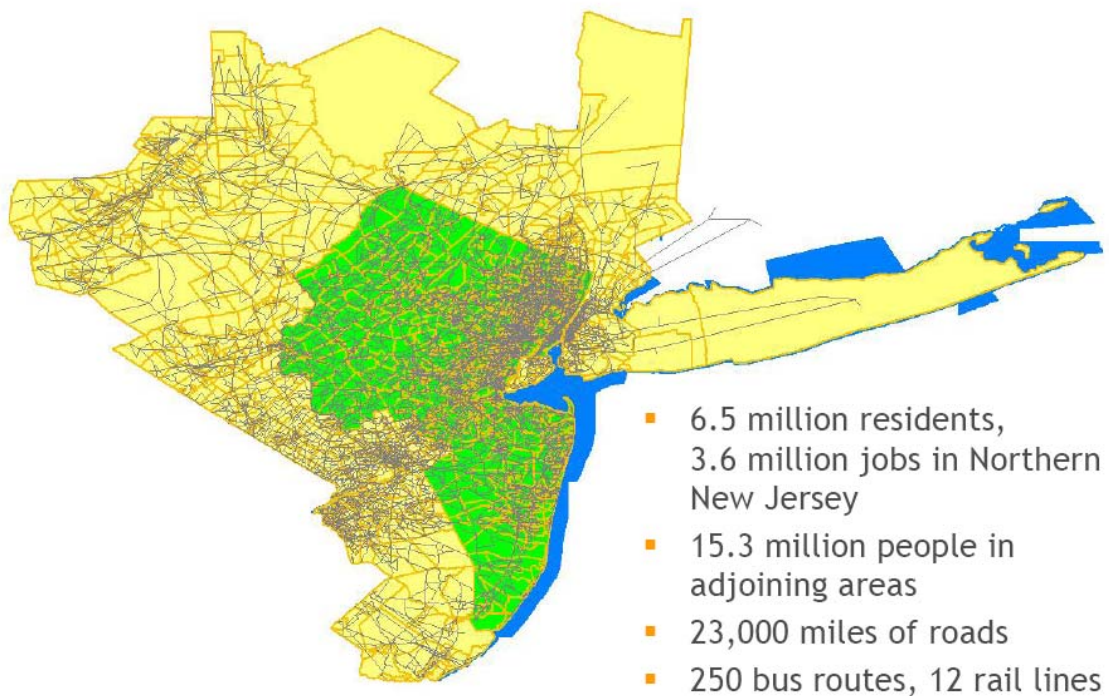
## METHODOLOGY

A major challenge in analyzing the impacts of proposed roadway changes is the estimation of the project's effects on traffic patterns. Accordingly, it is necessary to predict the modified traffic flow in order to estimate benefits. Traditional economic analysis approaches make use of static traffic assignment to assess the impact of capacity expansion. Although these models do not consider the time-dependent dynamics of traffic flow and demand, they are superior to alternatives, such as traffic

simulation tools and spreadsheet models, due to their ability to estimate the changes in network flow characteristics as a result of capacity improvements.

### Transportation Network Model

The North Jersey Regional Transportation Model – Enhanced (NJRTM-E), currently used by the North Jersey Transportation Planning Authority (NJTPA), is used to estimate the changes in traffic flows that occur on both local and network levels as a result of capacity improvements. The model is a tool that is used to help with analyzing projects, developing the long-range plan, and determining compliance with air quality conformity standards. NJRTM-E, shown in Figure 1, is a standard four-step transportation model running in CUBE software platform. The model area consists of the thirteen county North Jersey region and neighboring counties in New York and Pennsylvania.



**Figure 1: NJRTM-E Region in CUBE <sup>(2)</sup>**

Based on the traffic improvements expected from the roadway improvements, the capacities of the links in NJRTM-E are increased. It is, however in most cases, difficult

to quantify the impact of a construction project on roadway capacity. Therefore, the capacity improvement factor is subject to sensitivity analysis.

The NJRTM-E network is run *with and without the capacity improvements*, and the network traffic flows are obtained from CUBE. Using the before and after network results, the benefits of the project are estimated by the reductions in various cost categories, such as congestion, vehicle operating, accident, air pollution, noise and maintenance costs at the network level. Accordingly, the proposed methodology combines sound economic theory with the output of a highly detailed transportation demand model for estimating the benefits to the highway network.

The results are then processed using ASSIST-ME, a tool developed to post-process highway assignment results from transportation planning models. ASSIST-ME is a GIS-based Full Cost Estimation tool that can, among its other capabilities, be used to estimate the recurring annual benefits of transportation projects. ASSIST-ME has been developed to estimate the reductions in various costs of highway transportation using cost reduction models specific to New Jersey. The GIS-based full cost estimation tool enables planners to efficiently identify areas of interest and take advantage of powerful graphical capabilities of ArcGIS.

### **Assumptions Used in the Analysis**

As part of the TIGER Grant application, the New Jersey Department of Transportation (NJDOT) is proposing improvements to the existing Hoes Lane/Centennial Avenue corridor in Piscataway Township, Middlesex County, New Jersey. The project entails extending the current northern terminus of State Route 18 by approximately 2.5 miles to I-287 <sup>(3, 4)</sup>.

In the NJRTM-E model the capacity of the links corresponding to the stretch of Hoes lane which is modified to take into account the planned capacity improvements caused by the removal of four traffic signals and updating eight traffic signals. It is estimated from the capacity calculations based on the Highway Capacity Manual that the capacity will improve by a minimum of 25% and a maximum 120%. NJTRM-E model, calibrated for the year 2009, is used as the basis for the estimation of benefits since this is the most recent network available. It is assumed that the cost estimates provided in the

document “Liberty Corridor: Section 1301 Grant Submission” <sup>(3)</sup> are all given in 2010 dollars. The analysis period is limited to approximately 25 years, after which the growth in traffic will likely reach the improved capacity provided by the project. The benefit analysis is performed on a network-wide basis over the analysis period. The localized variation is traffic growth, which might be affected by various other policies such as increased transit usage, saturation in land use, etc. have not been taken into account.

### **ASSIST-ME Analysis Tool**

Using network output files from NJRTM-E, ASSIST-ME is used to compare the two different networks (base and modified), and estimate the impacts of network changes (e.g., lane and/or link additions, etc.) on trip costs. Once highway assignment is completed in NJTRM-E, four time-period specific database files are produced. Each one of these files contains predicted values for traffic on all the links of the network. They also include basic information about all the links carried over from the input networks. This enables sorting and filtration based on their characteristics; for example, a sort can be conducted for all links within a certain state or county, or for all highway links. The calculation of link costs can be conducted in ASSIST-ME for all network links or select links by user-defined criteria. Link costs can be calculated for two networks, before and after network improvements, and the difference between the outputs can be taken as the network benefits of the improvements.

The full costs of travel in New Jersey were previously studied to quantify the effects of travel in terms of costs to users and their externalities. New Jersey-specific data was used to estimate the costs of travel when possible and national data otherwise. Calculating and monetizing the costs of travel is critical to conducting cost-benefit analysis, and understanding the full local and regional effects of the project. ASSIST-ME uses the estimated cost functions to calculate the costs of all users for all links within the transportation network, for the base and modified cases. The benefits are then taken as the difference between the costs for the two cases. A summary of the equations used by ASSIST-ME can be found in Table 1 and a full description of the costs and the development of the total cost functions is provided in the appendix.

**Table 1 - Cost Functions Used in ASSIST-ME**

Cost	Total Cost Function	Variable Definition	Data Sources
Vehicle Operating	$C_{opr} = 7208.73 + 0.12(m/a) + 2783.3a + 0.143m$	a: Vehicle age (years) m: Vehicle miles traveled	AAA <sup>(5)</sup> , USDOT <sup>(6)</sup> , KBB <sup>(7)</sup>
Congestion	$C_{cong} = \begin{cases} Q \frac{d_{ab}}{V_o} \left( 1 + 0.15 \left( \frac{Q}{C} \right)^4 \right) VOT & \text{if } Q \leq C \\ Q \frac{d_{ab}}{V_o} \left( 1 + 0.15 \left( \frac{Q}{C} \right)^4 \right) VOT + Q \left( \frac{Q}{C} - 1 \right) \frac{VOT}{2} & \text{if } Q > C \end{cases}$	Q = Volume (veh/hr) d = Distance (mile) C = Capacity (veh/hr) VOT = Value of time (\$/hr) V <sub>o</sub> = Free flow speed (mph)	Mun <sup>(8)</sup> Small and Chu <sup>(9)</sup>
Accident	<b>Category 1:</b> Interstate-freeway $C_{acc} = 127.5Q^{0.77} .M^{0.76} .L^{0.53} + 114.75Q^{0.85} .M^{0.75} .L^{0.49} + 198,900Q^{0.17} .M^{0.42} .L^{0.45}$	Q = Volume (veh/day) M = Path length (miles) L = no of lanes	FHWA <sup>(10)</sup> USDOT <sup>(11)</sup>
	<b>Category 2:</b> principal arterial $C_{acc} = 178.5Q^{0.58} .M^{0.69} .L^{0.43} + 18,359Q^{0.45} .M^{0.63} .L^{0.47}$		
	<b>Category 3:</b> arterial-collector-local road $C_{acc} = 229.5Q^{0.58} .M^{0.77} .L^{0.77} + 9,179.96Q^{0.74} .M^{0.81} .L^{0.75}$		
Air pollution	$C_{air} = Q(0.01094 + 0.2155F)$ <p>where;</p> $F = 0.0723 - 0.00312V + 5.403x10^{-5}V^2$	F = Fuel consumption at cruising speed (gl/mile) V = Average speed (mph) Q = Volume (veh/hr)	EPA <sup>(12)</sup>
Noise	$C_{noise} = 2 \int_{r_1=50}^{r_2=r_{max}} (L_{eq} - 50) DW_{avg} \frac{RD}{5280} dr$ <p>where;</p> $K = K_{car} + K_{truck}$ $K = \frac{F_c}{V_c} \left( r^{4.174} .10^{0.115} + 10^{5.03} F_{ac} + (1 - F_{ac}) r^{6.7} \right) + \frac{F_{tr}}{V_{tr}} \left( r^{3.588} .10^{2.102} + 10^{7.43} F_{atr} + (1 - F_{atr}) r^{7.4} \right)$ $L_{eq} = 10 \log(Q) + 10 \log(K) - 10 \log(r) + 1.14$	Q = Volume (veh/day) r = distance to highway K = Noise-energy emis. K <sub>car</sub> = Auto emission K <sub>truck</sub> = Truck emission F <sub>c</sub> = % of autos, F <sub>tr</sub> = % of trucks F <sub>ac</sub> = % const. speed autos F <sub>atr</sub> = % of const. speed tr. V <sub>c</sub> = Auto Speed (mph) V <sub>tr</sub> = Truck Speed (mph)	Delucchi and Hsu <sup>(13)</sup>

Maintenance	$C_M = \frac{796.32M^{0.40}L^{0.39}}{P}$ <p>where;</p> $P = \frac{N}{ESAL}$ $ESAL = Q \times 365 \times P_t \times T_f$	<i>M</i> : roadway length (miles) <i>L</i> : number of lanes <i>P</i> : design cycle period <i>ESAL</i> : Equivalent single axle load <i>N</i> : number of allowable repetitions (1,500,000) <i>Q</i> : Traffic volume (veh/day) <i>P<sub>t</sub></i> : Percentage of trucks in traffic <i>T<sub>f</sub></i> : Truck Factor	Ozbay et al. <sup>(14)</sup>
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The following subsections describe the areas in which benefits are expected, and how they are calculated. USDOT guidelines for TIGER II Discretionary Grant applications call for special attention to the following areas:

6. State of good repair
7. Economic impacts
8. Environmental sustainability
9. Livability
10. Safety

These criteria are met in cost-benefit analysis by monetizing the estimates of the regional transportation model using the functions in Table 1.

### State of Good Repair

The state of roadway infrastructure is critical to vehicle operators and agencies tasked with maintaining it. The benefits to the infrastructure resulting from this project are immediately realized by the reconstructed roadway and pavement. In addition to this benefit, maintenance costs attributable to vehicles using all roadways in the network are calculated. The needs and costs for resurfacing were studied <sup>(14)</sup> to monetize the maintenance costs of links in the network, and are calculated for base and modified modeled networks. The difference in the maintenance costs (i.e. benefits) arise from changes between traffic conditions and travel patterns between the two networks.

## Economic Effects

The transportation network-related effects to the economy are largely on individuals' and businesses' travel times and productivity in commuting and shipping. Transportation models calculate vehicular flows and travel times on network links, which are used as measures of congestion and vehicle hours traveled. These estimates are monetized as congestion costs by a value of time (VOT) multiplying factor, which can be different for cars, trucks, and other modes. The congestion costs for the base and modified networks are then compared to find the congestion savings brought on by the project, the most critical valuation component in cost-benefit analysis. These congestion changes can occur in the project corridor, and can spread out to parallel roadways and throughout the network. In addition, vehicle operating costs for all users are calculated.

## Livability & Environmental Sustainability

Environmental effects are a critical component of transportation, and model output can be used to calculate probable environmental impacts due to changes in traffic conditions brought about by the project. In this study noise and air pollution costs are estimated for all links in the base and modified networks. These costs are estimated based on volume and speed estimates generated by the model for both cases, with the difference equaling the environmental benefit of the project.

## Safety

Safety improvements are a critical component of most transportation projects. In this analysis, model estimates are compared to estimate accident costs attributable to traffic using all roadways in the network. These accident costs are calculated based on volumes and physical roadway characteristics.

## **Cost-Benefit Analysis**

Even though most transportation policies are local, their influence often spreads out beyond the area of implementation. Responding to road changes, traffic will shift from the impacted part of the network to other areas, and the intensity of the shift will depend

on several factors, such as road characteristics, demand structure, and network configuration <sup>(15)</sup>. Thus, quantification of the likely changes in transportation benefits and costs associated with the capacity expansion is crucial for policy planners in order to determine the net benefits from capacity expansion projects. Such information can be used in the process to select the projects that are most likely to generate highest return to society.

In economic evaluation of projects, there are several commonly used economic indicators that can be placed in a final comparable format. The Cost-Benefit ratio (B/C) is one of the most commonly used performance measure. The B/C ratio can be calculated using the following formula,

$$\frac{PVB}{PVC} = \frac{\sum_{t=0}^T \frac{B_t}{(1+d)^t}}{\sum_{t=0}^T \frac{C_t}{(1+d)^t}}$$

Where, PVB = Present value of future benefits, PVC = Present value of future costs, d = Discount Rate, t = time of incurrence (year), T = Lifetime of the project or Analysis period (years)

The most significant parameters in the analysis that should be tested for sensitivity are:

1. Discount rate
2. Timing of future rehabilitation activities
3. Traffic growth rate
4. Unit costs of the major construction components.

Given the cost of the project, and then also given that the benefits are estimated, the net present value of the project can be calculated. A discount rate is used to convert future costs and benefits to present values. Various discount rates recommended by the U.S. Office of Management and Budget (USOMB) <sup>(16)</sup> are shown in Table 2. Table 3 shows the VOT ranges, as suggested by USDOT <sup>(17)</sup>, used in the analysis.

**Table 2 - Real discount rates for cost-benefit analysis <sup>(16)</sup>**

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
0.9	1.6	1.9	2.4	2.9	2.7

**Table 3 - Range of Value of Time (VOT) <sup>(17)</sup>**

Time Period	Passenger Cars	Trucks
Peak	\$18.10 - \$27.20	\$19.90
Off- Peak	\$7.90 - \$13.60	\$19.90

## RESULTS

The resulting outputs of NJRTM-E are compared in ASSIST-ME against the base case NJRTM-E model run. The daily costs and benefits resulting from the improvements due to the improvement on Hoes Lane are presented in Table 4. It should be noted that the congestion costs shown in Table 4 are estimated based on the lower bound of the VOT assumption shown in Table 3, and for a high capacity increase assumption of 120%. The capacity increase expected from this project is difficult to predict, and for this analysis is estimated between 25-120%. The results of Table 4 assume a high increase scenario. Based on the estimation results shown in Table 4, a daily benefit attributable to the Route 18 Hoes Lane project is estimated at \$2.58 million. The annual benefits of this project can be calculating by multiplying this estimate by 250 workdays, and equal \$646.60 million. Assuming that the benefit will linearly decrease to zero at the end of 25 years due to expected traffic increase, the net present value of the total benefits is calculated as \$6.82 billion in 2009 dollars, assuming a 2.8% discount rate. Therefore, the benefit cost ratio of this project is 138.06 (\$6,829.81m/\$49.47m), and the project is economically efficient based on the assumptions.

**Table 4 - Estimated total daily costs (\$) of original and modified networks for  
Route 18 Hoes Lane Improvement Project**

<b>Morning Peak</b>							
<i>Cost Categ.</i>	<i>Economic Effects</i>		<i>Safety</i>	<i>Environmental Sustainability</i>		<i>State of Good Repair</i>	<b>Total</b>
	<b>Vehicle Operating</b>	<b>Congestion</b>	<b>Accident</b>	<b>Air Pollution</b>	<b>Noise</b>	<b>Maintenance</b>	
Original	12,269,130.00	39,133,860.00	3,090,104.00	1,866,980.00	42,316.23	688,671.80	57,091,062.03
Modified	12,180,070.00	37,421,850.00	3,047,125.00	1,864,988.00	42,216.12	731,138.70	55,287,387.82
<b>Benefit</b>	<b>89,060.00</b>	<b>1,712,010.00</b>	<b>42,979.00</b>	<b>1,992.00</b>	<b>100.11</b>	<b>-42,466.90</b>	<b>1,803,674.21</b>
<b>Midday Off-peak</b>							
Original	13,290,220.00	14,092,140.00	4,131,657.00	2,538,840.00	65,369.86	1,584,298.00	35,702,524.86
Modified	13,290,610.00	14,099,900.00	4,131,771.00	2,538,690.00	65,368.71	1,583,974.00	35,710,313.71
<b>Benefit</b>	<b>-390.00</b>	<b>-7,760.00</b>	<b>-114.00</b>	<b>150.00</b>	<b>1.15</b>	<b>324.00</b>	<b>-7,788.85</b>
<b>Afternoon Peak</b>							
Original	13,737,490.00	45,214,080.00	3,422,373.00	2,054,029.00	45,853.54	740,909.60	65,214,735.14
Modified	13,704,140.00	44,652,880.00	3,407,163.00	2,052,434.00	45,828.50	741,115.40	64,603,560.90
<b>Benefit</b>	<b>33,350.00</b>	<b>561,200.00</b>	<b>15,210.00</b>	<b>1,595.00</b>	<b>25.04</b>	<b>-205.80</b>	<b>611,174.24</b>
<b>Night Off-peak</b>							
Original	9,350,579.00	9,712,229.00	3,744,627.00	1,805,579.00	46,189.01	2,293,476.00	26,952,679.01
Modified	9,335,332.00	9,562,045.00	3,726,338.00	1,799,943.00	45,674.60	2,303,977.00	26,773,309.60
<b>Benefit</b>	<b>15,247.00</b>	<b>150,184.00</b>	<b>18,289.00</b>	<b>5,636.00</b>	<b>514.41</b>	<b>-10,501.00</b>	<b>179,369.41</b>
<b>Total Daily Benefit</b>							<b>2,586,429.01</b>

### Sensitivity Analysis

To evaluate the economic benefits for various combinations of ranges of VOT and capacity improvements, a sensitivity analysis is performed. This section investigates the variation in the benefit-cost ratio for the Route 18 corridor project for two values of time and capacity increase assumptions. The VOT ranges for passenger cars and trucks during peak and off-peak hours are shown in Table 3. The benefit-cost ratios for each project presented in the previous section are based on the low VOT range.

The increase in capacity due to each project is reflected in the NJRTM-E CUBE model by multiplying the base capacity by a factor that is estimated based on the project specifications, such as the increase in number of lanes and addition of shoulders. The benefit-cost ratios presented in the previous section are based on the assumption of a high capacity increase (120%). The variation in benefit-cost ratios assuming a lower

increase in capacity than initially assumed is investigated. Therefore, the factors used to increase capacity are lowered by 50% in the CUBE model, and new results are obtained accordingly (lower capacity). It should be noted that NJTRM-E model is a macroscopic model and cannot capture operational level improvements beyond capacity improvements.

The B/C ratios shown in Table 5 can be considered as an indication of the long-term economic viability of these projects, not necessarily as point estimates of their exact economic value. Moreover, over-interpretation of these B/C ratios should be avoided since there are many modeling and estimation assumptions that can affect these. A positive B/C ratio greater than an arbitrary threshold of 5 can be interpreted as a highly beneficial project.

**Table 5 - Benefit/Cost ratios as a result of sensitivity analyses**

High Capacity		Low Capacity	
<i>Low VOT</i>	<i>High VOT</i>	<i>Low VOT</i>	<i>High VOT</i>
138.06	206.69	107.65	162.03

## SUMMARY AND CONCLUSIONS

The NJRTM-E network is run *with and without the capacity improvements* resulting from the proposed Route 18/Hoes Lane corridor improvement project, and the network-wide traffic flows are obtained from CUBE. The results are compiled and analyzed using ASSIST-ME, a tool capable of calculating link costs that include accident, vehicle operating, maintenance and environmental costs (e.g. noise and air pollution), based on NJ-specific data. Using the before and after results, the benefits of each project are estimated as reductions in various cost categories. A cost-benefit analysis is then conducted using USOMB and USDOT guidelines, over a lifespan for the project of 25 years. Accordingly, the proposed methodology combines sound economic theory with the output of a highly detailed transportation demand model for estimating the costs and benefits of selected highway projects.

Based on the model output, this project is highly beneficial in terms of both direct user costs such as travel times, and externalities such as air and noise pollution. The results show that that the majority of benefits accrue through reduced travel times. Therefore, the benefits vary with high margins with respect to value-of-time assumptions. Sensitivity analyses conducted with respect to two variables, capacity increase and value-of-time, show that the project has a highly positive benefit-cost ratio for all cases within the range of assumptions.

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## APPENDIX

Reductions in each cost category attributable to a project were estimated using data obtained from NJDOT and other state and national sources. Data on vehicle operating costs, accident costs, and infrastructure costs are NJ-specific. STATA software is used to estimate the parameters of each cost function. Congestion and environmental costs, however, were based on relevant studies in the literature. The parameters of the cost functions were modified to reflect NJ-specific conditions. The individual cost reduction functions are discussed below.

### Vehicle Operating Costs

Vehicle operating costs are directly borne by drivers. These costs are affected by many factors, such as road design, type of the vehicle, environmental conditions, and flow speed of traffic. In this study, vehicle operating costs depend on depreciation cost, cost of fuel, oil, tires, insurance, and parking/tolls. Depreciation cost is itself a function of mileage and vehicle age; other costs are unit costs per mile. In this study, we employed the depreciation cost function estimated by Ozbay *et al.* <sup>(18)</sup>

The other cost categories, namely, cost of fuel, oil, tires, insurance, parking and tolls are obtained from appropriate AAA report <sup>(5)</sup> and USDOT report <sup>(6)</sup>. The unit operating costs given in Table A1 are in 2005 dollars.

**Table A1 - Operating costs (in 2005 dollars) <sup>(5,6)</sup>**

<b>Operating Expenses</b>	<b>Unit Costs</b>
Gas & oil	0.087 (\$/mile)
Maintenance	0.056 (\$/mile)
Tires	0.0064 (\$/mile)
Insurance Cost	1,370(\$/year)
Parking and Tolls	0.021 (\$/mile)

## Congestion Costs

Congestion cost is defined as the time-loss due to traffic conditions and drivers' discomfort, both of which are a function of increasing volume to capacity ratios. Specifically,

- **Time loss** can be determined through the use of a travel time function. Its value depends on the distance between any OD pairs ( $d$ ), traffic volume ( $Q$ ) and roadway capacity ( $C$ ).
- **Users' characteristics:** Users traveling in a highway network are not homogeneous with respect to their value of time.

Since all these cost categories are directly related to travel time, the monetary value of time (VOT) is a crucial determinant of cost changes. Depending on the mode used by the traveler, travel time costs may include time devoted to waiting, accessing vehicles, as well as actual travel.

In a study of congestion costs in Boston and Portland areas, Apogee Research estimated congestion costs using VOT values based on 50% of the average wage rate for work trips and 25% for other trip purposes<sup>(19)</sup>. Based on a review of international studies, K. Gwilliam<sup>(20)</sup> concluded that work travel time should be valued at 100% wage rate, whereas non-work travel time should be valued at 30% of the hourly wage rate, given the absence of superior local data. Similarly, the USDOT<sup>(17)</sup> suggests VOT values between 50% and 100% of the hourly wage rate depending on travel type (personal, business). In these studies, user characteristics, mode of travel, or time of day choices are not included in the VOT estimation. To address these issues, stated preference surveys are conducted in some studies to estimate VOT for different modes and trip types<sup>(21, 22, 23)</sup>.

In this study, we adopt the VOT ranges based on average hourly wages as recommended by the USDOT<sup>(17)</sup>. Following the USDOT, we assume two vehicle types: passenger cars and trucks. For passenger cars, the VOT range, based on the hourly wage, is assumed to be between 80% and 120% of the average hourly wage within peak period, and between 35% and 60% of the average hourly wage within off-peak periods, respectively. For trucks, the VOT range, based on the hourly wage, is assumed to be 100% within both off-peak and peak periods.

U.S. Department of Labor <sup>(24)</sup> reported average hourly wages for all occupations in New Jersey. The report indicates that, in 2007, the average hourly wage for all occupations was \$22.64 per hour. The hourly wage in trucking was \$19.90 per hour.

Table A2 shows the VOT ranges, as suggested by USDOT <sup>(17)</sup>, used in our analysis.

**Table A2 - Value of Time Ranges**

<b>Time Period</b>	<b>Passenger Cars</b>	<b>Trucks</b>
Peak	\$18.10 - \$27.20	\$19.90
Off- Peak	\$7.90 - \$13.60	\$19.90

The Bureau of Public Roads travel time function was used to calculate time loss. Thus, the total cost of congestion between a given OD pair can be calculated by the time loss of one driver along the route, multiplied by total traffic volume (Q) and the average value of time (VOT).

### **Accident Costs**

Accident costs are the economic value of damages caused by vehicle accidents/incidents. These costs can be classified in two major groups: (1) cost of foregone production and consumption, which can be converted into monetary values, and (2) life-injury damages, which involves more complex techniques to convert into monetary values. Costs associated with these two categories are given in Table A3.

The accident cost function estimates the number of accidents that occur over a period of time, and converts the estimated number of accidents into a dollar value by multiplying the number of accidents by their unit cost values. The cost of any specific accident varies of course with individual circumstances. However, similar accidents typically have costs that fall within the same range.

**Table A3 - Accident Cost Categories**

<b>Pure Economic Costs</b>	
<b>Major costs</b>	<b>Description</b>
Medically related costs	Hospital, Physician, Rehabilitation, Prescription
Emergency services costs	Police, Fire, ambulance, helicopter services, incident management services
Administrative and legal costs	Vehicle repair and replacement, damage to the transportation infrastructure
<b>Life Injury Costs</b>	
Employer costs	Wages paid to co-workers and supervisors to recruit and train replacement for disabled workers, repair damaged company vehicles, productivity losses due to inefficient start-up of substitute workers
Lost productivity costs	Wages, fringes, household work, earnings lost by family and friends caring for the injured
Quality of life costs	Costs due to pain, suffering, death and injury
Travel delay costs	Productivity loss by people stuck in crash related traffic jams

Accidents were categorized as fatal, injury and property damage accidents. Accident occurrence rate functions for each accident type were developed using the traffic accident database of New Jersey. Historical data obtained from NJDOT show that annual accident rates, by accident type, are closely related to traffic volume and roadway geometry.

Traffic volume is represented by the average annual daily traffic. The **roadway geometry** of a highway section is based on its engineering design. There are various features of a roadway geometric design that closely affect the likelihood of an accident occurrence. However, these variables are too detailed to be considered in a given function. Thus, highways were classified on the basis of their functional type, namely Interstate, freeway-expressway and local-arterial-collector. It was assumed that each highway type has its unique roadway design features. This classification makes it

possible to work with only two variables: **road length** and **number of lanes**<sup>1</sup>. There are three accident occurrence rate functions for each accident type for each of the three highway functional types. Hence, nine different functions were developed. Regression analysis was used to estimate these functions. The available data consists of detailed accident summaries for the years 1991 to 1995 in New Jersey. For each highway functional type, the number of accidents in a given year is reported.

The unit cost of each type of accident directly affects the cost estimates. The National Safety Council <sup>(25)</sup> reported the average unit cost per person for three accident types, as shown in Table A4. These values are comprehensive costs that include a measure of the value of lost quality of life which was obtained through empirical studies based on observed willingness to pay by individuals to reduce safety and health risks.

**Table A4 - Average Comprehensive Cost per person by accident type <sup>(25)</sup>**

<b>Accident Type</b>	<b>Cost</b>
Death	\$4,100,000
Incapacitating Injury	\$208,500
Non-incapacitating Injury	\$53,200
Possible Injury	\$25,300
Property Damage	\$2,300

Accident cost estimation is not exact, it can only be approximated. The studies in the relevant literature show varying unit costs for accidents. A NHTSA study <sup>(26)</sup> reports the lifetime economic cost of each fatality as \$977,000. Over 80% of this amount is attributable to lost workplace and household productivity. The same study reports that the cost of each critically injured survivor is \$1.1 million <sup>(26)</sup>.

A study by FHWA <sup>(27)</sup> reported the comprehensive cost of each accident by severity, as shown in Table A5.

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<sup>1</sup> This approach is also consistent with previous studies e.g., Mayeres et al. (**Error! Reference source not found.**)

**Table A5 - Average comprehensive cost by accident type** <sup>(27)</sup>

<b>Accident Type</b>	<b>Cost</b>
Fatal	\$3,673,732
Incapacitating	\$254,335
Evident	\$50,867
Possible	\$26,847
Property Damage	\$2,826

**Note:** All costs are in 2008 dollars, converted from 1994 values using 2.5% discount rate.

A recent poll conducted by AASHTO <sup>(28)</sup> reported accident costs by severity. The reported figures shown in Table A6 reflect the average accident costs used by 24 states for prioritizing safety projects.

**Table A6 - Average cost by accident type** <sup>(28)</sup>

<b>Accident Type</b>	<b>Cost</b>
Fatality	\$2,435,134
Major Injury	\$483,667
Incapacitating Injury	\$245,815
Minor Injury	\$64,400
Non-incapacitating Evident Injury	\$46,328
Injury	\$59,898
Possible or Unknown injury	\$23,837
Property Damage	\$6,142

In our analysis, we use the unit accident costs reported by the FHWA <sup>(27)</sup> (see Table A5). In order to align the cost estimates based on the accident types available in NJDOT accident database, we regroup accident types in FHWA <sup>(27)</sup> into fatality, injury (incapacitating) and property damage accidents. The accident cost functions are based on unit accident cost for each accident type. The accident cost functions used in this study were first developed by Ozbay *et al.* <sup>(14)</sup>, and later improved by Ozbay *et al.* <sup>(29, 18)</sup> with a new accident database. The statistical results of the estimation of accident occurrence rate functions can be found in Ozbay *et al.* <sup>(18)</sup>.

## Environmental Costs

Environmental costs due to highway transportation are categorized as air pollution and noise pollution costs.

### Air Pollution Costs

Highway transportation accounts for the air pollution due to the release of pollutants during motor vehicle operations. This occurs either through the direct emission of the pollutants from the vehicles, or the resulting chemical reactions of the emitted pollutants with each other and/or with the existent materials in the atmosphere. The pollutants included in estimating air pollution costs in this study are volatile organic compounds (VOC), carbon monoxide (CO), nitrogen oxide (NO<sub>x</sub>), and particulate matters (PM<sub>10</sub>).

Estimating the costs attributable to highway air pollution is not a straightforward task, since there are no reliable methods to precisely identify and quantify the origins of the existing air pollution levels. The constraints for estimating the costs attributable to air pollution are listed as follows:

- Air pollution can be *local*, *trans-boundary* or *global*. As the range of its influence broadens, the cost generated increases, and after a certain point the full cost impact becomes difficult to estimate.
- Air pollution effects are typically chronic in nature. Namely, unless the pollution level is at toxic levels, the damage imposed on human health, agricultural products and materials may be detectable only after years of exposure.

Even if the influence of specific sources of air pollution could be isolated with precision, quantifying the contribution of highway transportation requires several assumptions. Emission rates depend on multiple factors, such as topographical and climatic conditions of the region, vehicle properties, vehicle speed, acceleration and deceleration, fuel type, *etc.* The widely used estimation model is available in US MOBILE software, which requires, as inputs, the above listed factors. Based on the input values, the program estimates emissions of each pollutant. However, the accuracy of this specific model and the other current models is, as noted, imprecise (see Small, *et*

al. <sup>(30)</sup>). Cost values attributable to differing levels of air pollution require a detailed investigation and an evaluation of people's preferences and their willingness to pay in order to mitigate or avoid these adverse effects.

There is extensive literature that attempts to measure the costs of air pollution (e.g., Small <sup>(31)</sup>, Small and Kazimi al.<sup>(30)</sup>, Mayeres et al. <sup>(21)</sup>). There are three ways of estimating the costs of air pollution: *Direct estimation of damages*, *hedonic price measurement* (relates price changes, demand, and air quality levels) and *preference of policymakers* (pollution costs are inferred from the costs of meeting pollution regulations), (Small and Kazimi <sup>(30)</sup>).

Small and Kazimi <sup>(30)</sup> adopt the direct estimation of damages method to measure the unit costs of each pollutant. The study differentiates the resulting damages in three categories: *mortality from particulates*, *morbidity from particulates* and *morbidity from ozone*. It is assumed that human health costs are the dominant portion of costs due to air pollution rather than the damage to agriculture or materials. *Particulate Matter* (PM<sub>10</sub>) which is both directly emitted and indirectly generated by the chemical reaction of VOC, NO<sub>x</sub>, and SO<sub>x</sub>, is assumed to be the major cause of health damage costs. Ozone (O<sub>3</sub>) formation is attributed to the chemical reaction between VOC and NO<sub>x</sub>. In this study, we adopt the unit cost values suggested by Small and Kazimi <sup>(30)</sup>.

### Noise Costs

The external costs of noise are most commonly estimated as the rate of depreciation in the value of residential units located at various distances from highways. Presumably, the closer a house to the highway the more the disamenity of noise will be capitalized in the value of that house. While there are many other factors that are also capitalized in housing values, "closeness" is most often utilized as the major variable explaining the effect of noise levels. The Noise Depreciation Sensitivity Index (*NDSI*) as given in Nelson <sup>(32)</sup> is defined as the ratio of the percentage reduction in housing value due to a unit change in the noise level. Nelson <sup>(32)</sup> suggests the value of 0.40% for *NDSI*.

The noise cost function indicates that whenever the ambient noise level at a certain distance from the highway exceeds 50 decibels, it causes a reduction in home values of

houses. Thus, the change in total noise cost depends both on the noise level and on the house value. Detailed information is presented in Ozbay *et al.* <sup>(14)</sup>.

### Maintenance Costs

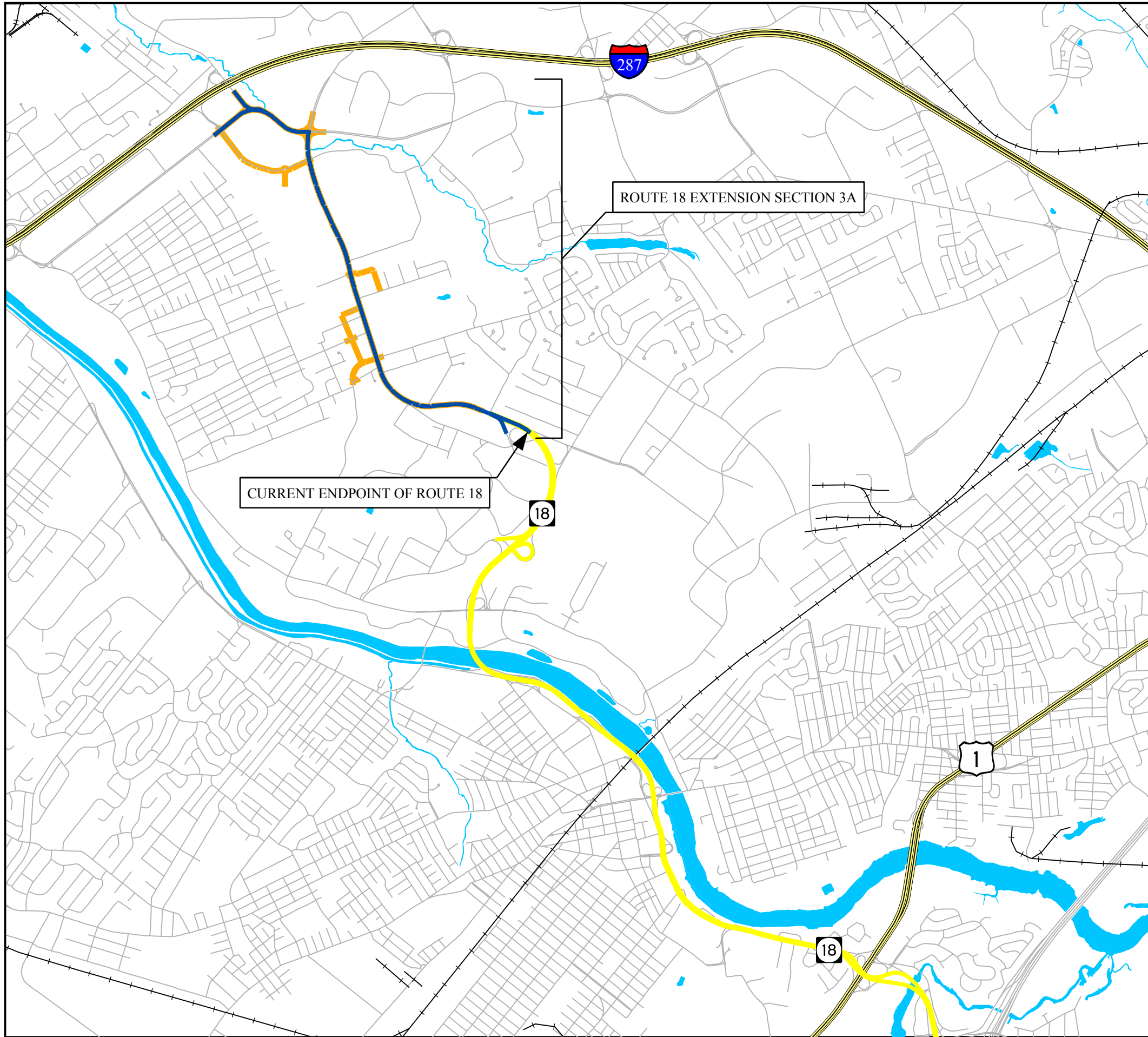
Infrastructure costs include all long-term expenditures, such as facility construction, material, labor, administration, right of way costs, regular maintenance expenditures for keeping the facility in a state of good repair, and occasional capital expenditures for traffic-flow improvement. Network properties represent the physical capabilities of the constructed highway facility, which include the number of lanes, lane width, pavement durability, intersections, ramps, overpasses, and so forth.

Maintenance and improvement constitute the only cost category that remains in our marginal infrastructure cost function. We attempt to express the maintenance cost in terms of input and output. Input in this context includes all components of maintenance work, such as equipment usage, earthwork, grading, material, and labor. Output implies the traffic volume on the roadway. The data employed include completed or ongoing resurfacing works between 2004 and 2006 in New Jersey.

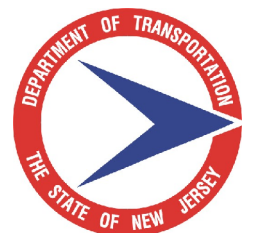
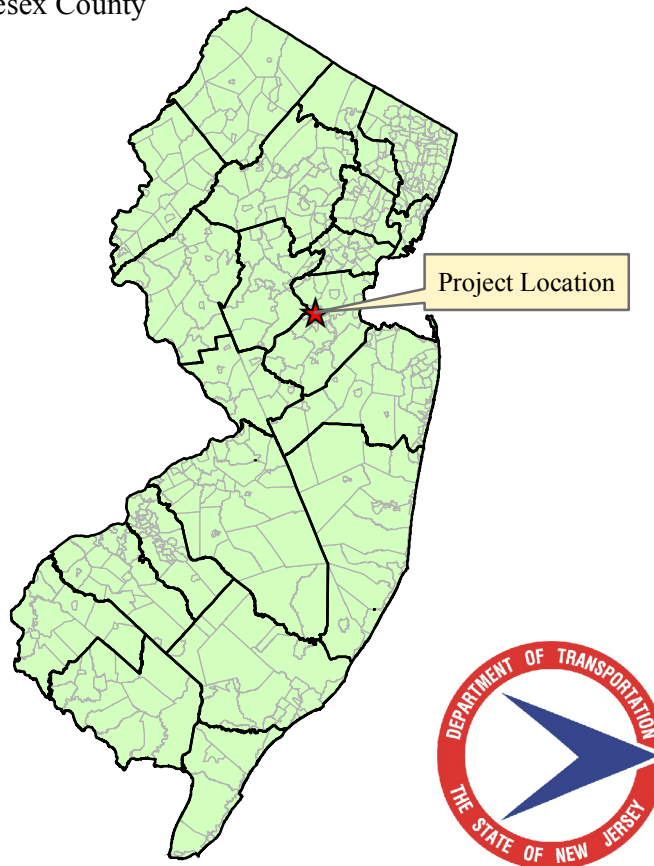
*P* factor represents the time period (in years) between two consecutive resurfacing improvement works. *ESAL* converts the axle loads of various magnitudes and repetitions to an equivalent number of “standard” or “equivalent” loads based on the amount of damage they do the pavement (57). Truck factor changes with respect to different road types. Values for various road types are provided in Table A7.

**Table A7 – Truck factor values**

Road Type	Area Type	
	Rural	Urban
Interstate	0.52	0.39
Freeway	-	0.23
Principal	0.38	0.21
Minor Arterial	0.21	0.07
Major Collector	0.3	0.24
Minor Collector	0.12	



Piscataway Township  
Middlesex County



**LEGEND**

- Secondary Roads
- Interstate Highway
- Existing Route 18
- Proposed Local Road Improvements
- Proposed Route 18 Alignment
- Water

This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state authorized.

Street Centerlines: NJDOT Statewide Public Road Network (1:2400)  
Prepared by the New Jersey Department of Transportation (NJDOT),  
Bureau of Transportation Data Development (BTDD) - Trenton, NJ, 2002  
Roads digitized by Michael Baker, Jr. Inc.

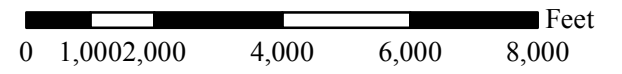
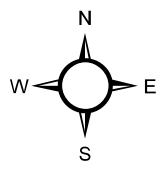
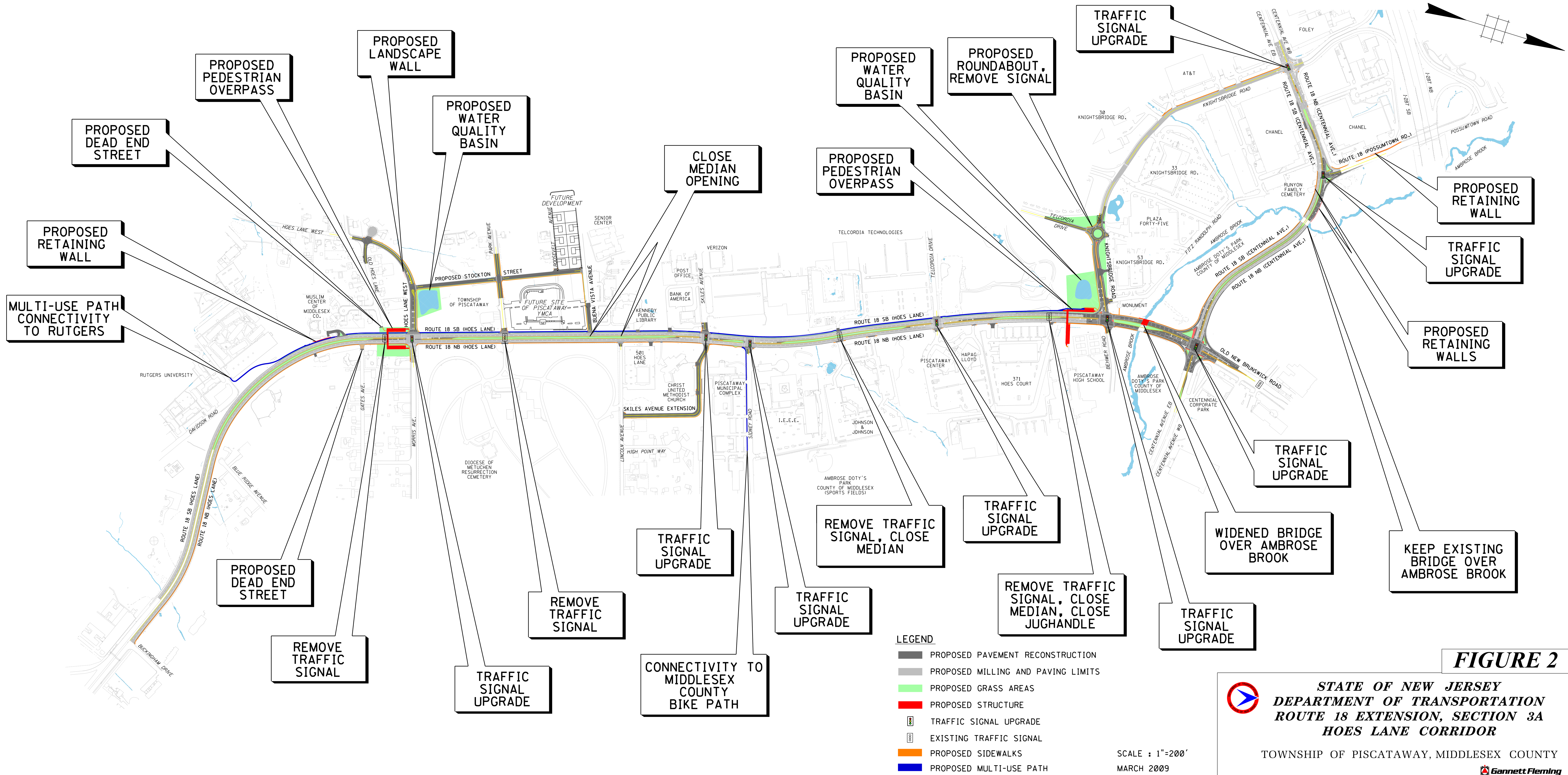


FIGURE 1



ROUTE 18 EXTENSION, SECTION 3A PISCATAWAY TOWNSHIP MIDDLESEX COUNTY, NJ	
<b>PROJECT LOCATION MAP</b>	
	SCALE 1:36000
	AUGUST 2009



**FIGURE 2**

**Be It Resolved,** By the Township Council of Piscataway Township,  
(Seal) New Jersey, that:

**WHEREAS**, the State of New Jersey, Department of Transportation is finalizing the design and construction of the Route 18 Extension, Section 3A located in the Township of Piscataway, County of Middlesex, State of New Jersey (hereinafter the "Project"); and

**WHEREAS**, the design includes two pedestrian bridges above the roadway, located near Morris Avenue and the Piscataway Township High School; and

**WHEREAS**, the State of New Jersey has agreed to bear all costs associated with the design and construction of these pedestrian bridges; and

**WHEREAS**, the construction of these pedestrian bridges is in the best interest of the citizens of the Township of Piscataway;

**NOW, THEREFORE, BE IT RESOLVED** by the Township Council of the Township of Piscataway, that it endorses the inclusion of these two pedestrian bridges as part of the final design of the Project.

PASSED AS A PART OF THE CONSENT AGENDA: **October 2, 2007**

MOTION MADE BY: **Mrs. Lombardi**                      SECONDED BY: **Mr. Cahn**

PASSED ON THE FOLLOWING VOTE:

YEAS: **Messrs. Armwood, Cahn, Hardenburg, Lombardi, & Keimel.**

NAYS: **—**

  
\_\_\_\_\_  
Clerk of Piscataway Township  
**ANN NOLAN**

  
\_\_\_\_\_  
President of Township Council  
**LORETTA KEIMEL**

I certify the foregoing to be a true and correct abstract of a resolution regularly passed at a meeting of the Township Council of Piscataway Township held on **October 2, 2007.** and in that respect is a true and correct copy of its minutes.

  
\_\_\_\_\_  
Clerk of the Township of Piscataway  
**ANN NOLAN**



## State of New Jersey

OFFICE OF THE GOVERNOR  
PO Box 001  
TRENTON, NJ 08625-0001

CHRIS CHRISTIE  
*Governor*

August 16, 2010

Ray LaHood  
Secretary of Transportation  
Office of the Secretary of Transportation  
U.S. Department of Transportation  
1200 New Jersey Ave, SE  
Washington, DC 20590

Re: New Jersey Department of Transportation  
National Infrastructure Investment  
"TIGER II" Grants Program Application  
Route 18 (Hoes Lane) Extension

Dear Secretary LaHood,

I am writing to express my support of the New Jersey Department of Transportation's application for funding the Route 18 (Hoes Lane) Extension project under the National Infrastructure Investment "TIGER II" Grants Program.

This project will extend the current northern terminus of State Route 18 by approximately 2.5 miles to Interstate 287, completing the total extension of NJ Route 18 through Middlesex County. This existing corridor, which is a key part of the Rutgers University campuses as well as several growing high technology and research firms, experiences major operational delays and queuing throughout the morning and evening peak commuter time as well as during major events taking place at the University. There has been an overriding need for many years to complete this "gap" in the system, and we are moving forward to accomplish that as expeditiously as possible.

In addition, the Department has recently completed a \$200 million reconstruction of Route 18 in New Brunswick. The level of investment that the State of New Jersey has already made on Route 18 signifies the importance of this highway to the quality of life and economic growth needs for central New Jersey.

**FRANK R. LAUTENBERG**

NEW JERSEY

COMMITTEES:

APPROPRIATIONS

COMMERCE, SCIENCE, AND  
TRANSPORTATION

ENVIRONMENT AND  
PUBLIC WORKS

**United States Senate**

WASHINGTON, DC 20510

August 23, 2010

The Honorable Ray LaHood  
U.S. Department of Transportation  
1200 New Jersey Avenue, SE  
Washington, DC 20590

Dear Secretary LaHood,

I am pleased to support the New Jersey Department of Transportation's (NJDOT) endeavor to secure a TIGER II Grant application for the Route 18 (Hoes Lane) Extension project.

If awarded, this project will extend the current northern terminus of State Route 18 by approximately 2.5 miles to Interstate 287, completing the total extension of Route 18 through Middlesex County. This extension corridor, which services Rutgers University campuses and several growing technology and research firms, experience major delays throughout morning and evening peak commute time as well as during major events taking place at the University.

Moreover, this project has the ability to make the necessary operational improvements needed for the continued use of the Route 18 in Middlesex County. Operational improvements are extremely important to continue the proper flow of traffic during all hours of the day.

Thank you for your consideration of this important request that will greatly improve the Route 18 road system.

Sincerely,

