APPENDIX A

Tremley Point Connector Road Traffic Analysis

NEW JERSEY TURNPIKE AUTHORITY

OPS 1950

INTERCHANGE 12 IMPROVEMENTS

Tremley Point Connector Road

Traffic Report

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Project Overview

The "Brown Fields" areas located on the north side of the Rahway River approximately 2 miles to the north of the Interchange 12-toll plaza is in the process of being redeveloped.. The anticipated land use in this redevelopment area will generate a significant amount of truck traffic, most of which will be destined to the New Jersey Turnpike. Use of the existing local road network to convey this new traffic to the Turnpike would require routing this increased traffic volume through the already congested and predominately residential areas of Linden. Union County has formally requested that the Turnpike Authority investigate a direct connection between the Turnpike and Tremley Point Road. In response to this request, the Turnpike Authority proposed to deliver the traffic from the Tremley Point area to the Turnpike via a new roadway between Tremley Point Road in Linden and Industrial Road in Carteret. This new road will allow traffic to conveniently enter the Turnpike via the proposed improved toll plaza at Interchange 12. The proposed roadway referred to as the "Connector Road" in this and other documents related to this project, includes the construction of a viaduct over the Rahway River and associated roadway approaches supported by walls and embankments.

On the Carteret side of the Rahway River, the former landfill area located between Industrial Road and the river is also in the process of being redeveloped. This area is referred to as the Slayton Development. This redevelopment combined with the existing Kinder Morgan site, located on the eastern side of the land between the river and Industrial Road, will add another traffic component to the Connector Road.

The proposed Connector Road will address the projected traffic volumes generated by both the proposed developments in Carteret and the anticipated traffic generated from the proposed development in the nearby Tremley Point "Brown Fields" areas of Linden. The analysis of the lane requirements and Level of Service evaluations at the intersections at the ends of theroadway are based on traffic data provided by the local governments within the project area and the developers of the proposed redevelopment areas.

Traffic Analysis

A traffic analysis was performed for the Connector Road in conjunction with the work that was performed for the Interchange 12 Improvements Alternatives Analysis. The following are the portions of that work that pertain to the Connector Road.

Existing Traffic Data

A TRANPLAN model was created for the project representing the existing conditions. To develop and calibrate the model, existing traffic volumes were collected for the study area. Data collection included six (6) Automatic Traffic Recorder (ATR) locations and five (5) manual traffic classification counts. ATR's were placed at the following locations.

A1. Roosevelt Ave just east of Industrial Ave
A2. Roosevelt Ave just west of the Holiday Inn driveway
A3. Interchange 12 on-ramp just north of Roosevelt Ave
A4. Interchange 12 off-ramp just north of Roosevelt Ave
A5. Industrial Rd just east of Salt Meadow Road
A6. Tremley Point Rd just east of the New Jersey Turnpike (NJTP)

The five manual traffic counts were performed at the following intersections:

M1. Roosevelt Ave and NJTP ramps/Wedgewood Dr
M2. Roosevelt Ave and Post Blvd
M3. Industrial Ave and Salt Meadow Rd
M4. Roosevelt Ave and Harrison Ave
M5. Roosevelt Ave and Holiday Inn driveway

This data was used to create four networks (autos and trucks for AM and PM peak periods). The raw volumes were then adjusted to obtain a balanced network (volumes exiting an intersection up stream match the volumes entering the downstream intersection).

Traffic Model and Calibration

The extent of the TRANPLAN model for the existing traffic is schematically shown in the appendix. Fifteen (15) centroids represent the loading points for the model. The turnpike is represented by four centroids. Vehicles originating from the toll plaza and destined to points north on the turnpike are split between the outer and inner roads (2 centroids) and vehicles originating from the toll plaza and destined to points south on the turnpike are split between the outer and inner roads (2 centroids). The splits for north and south as well as the splits between inner and outer roadways are based on data obtained from the NJTP. The centroids are described as follows:

1. Turnpike North – Outer
2. Turnpike North – Inner
3. Turnpike South – Inner
4. Turnpike South – Outer
5. Roosevelt Ave East
6. Salt Meadow Rd
7. Tremley Point Connection
8. Industrial Rd East
9. Post Blvd
10. Roosevelt Ave West
11. Minue St.
12. Access Drive (Warehouse)
13. Access Drive (Holiday Inn)
14. Wedgewood Dr
15. Harrison Ave

Turning movement percentages were derived from the balanced networks and then used to help facilitate the creation of the four trip tables to be assigned to the model. A comparison to the link volumes shown on the balanced network diagrams reveals that the model has been calibrated almost to 100%. The following table compares the balanced volumes to the results of the assignments at three locations.

Calibration		AM Autos		AM Trucks		PM Autos		PM Trucks	
		Counts	Model	Counts	Model	Counts	Model	Counts	Model
Roosevelt West	In	571	573	70	69	815	816	37	36
	Out	681	681	111	113	713	714	34	34
Industrial East	In	125	124	104	105	253	252	30	29
	Out	183	183	44	44	164	164	60	60
NJTP	In	823	823	262	265	919	923	163	163
	Out	1006	1005	273	273	909	909	104	105

Future Traffic

Future traffic in the study area will be made up of two components: background growth and traffic generated by new and planned developments. Background growth, was based on an estimate of the local users of the Roosevelt Avenue corridor and the population and employment projections for nearby areas as provided by the State Planning Office (SPO). Table 1 indicates the estimated users of the study corridor based on the information provided by SPO for the years 2002 and 2020 population and employment projections. For the communities listed, the resulting composite growth factor is 1.03 giving equal weight to population and employment. The population and employment projections are based on the 2000 census that indicated a moderate employment increase of 1,946 job positions for Carteret between 2002 and 2020 for a growth of 1.27. However, since the anticipated growth in employment due to the various developments considered for this study exceeds the SPO projections, the employment growth factor for Carteret in Table 1 was set to unity.

Table 1

Background Traffic Growth

Area	Part	2002 POP	2020 POP	POP GF	2002 EMP	2020 EMP	EMP GF
Cartaret	70%	19608	20523	1.05	7291	9237	1.00
Woodbridge	25%	98171	100596	1.02	58568	61157	1.04
Rahway	5%	25291	24744	0.98	17485	18614	1.06
Composite	1.03			1.04			1.01

The modest background growth in the immediate Interchange 12 area was further augmented by background growth in regional travel as determined by traffic studies conducted for the Turnpike Authority. This increase was applied to car and truck traffic entering and leaving the turnpike and distributed to local roadways based on observed travel patterns. Based on meetings with the Borough of Carteret, City of Linden, and Middlesex and Union Counties, a list of proposed developments was compiled. Table 2 lists these developments and indicates the numbers of car and truck trips each development is projected to generate during the morning and evening peak hour. Traffic impact studies and / or future traffic estimates were available for the Port Carteret Expansion and for the expansion of various Tremley Point properties. Future traffic estimates for the other developments were based on the Institute of Transportation Engineers (ITE) trip generation rates as well as traffic generation patterns from similar projects. Only traffic volumes that will use the New Jersey Turnpike or any part of the study corridor are included. As indicated in Table 2, slightly over 4,600 trips will be added during the morning peak hour. Of this volume, approximately 22 percent are trucks. During the evening peak hour, the volume will increase to 5,000 trips of which about 20 percent are truck trips.

In addition to the new trips generated by future developments and expansions, a substantial part of the existing traffic on Tremley Point Road is likely to be diverted to Interchange 12 once the Connector Road is constructed. Based on automatic traffic recorder (ATR) counts, vehicle classification data and perceived routing preferences, approximately 540 morning and 470

evening peak hour vehicles are likely to be diverted. Of these volumes, the truck percentages are 29 and 24 for AM and PM peak hours respectively.

Table 2

Full Build Development Trips

Category	AM Cars	AM Trucks	AM Total	PM Cars	PM Trucks	PM Total
OENJ Car Port	150	14	164	150	14	164
Lower Roosevelt RDA	260	7	267	584	18	602
Ferry Terminal	174	0	174	130	0	130
Port Cartaret	282	108	390	294	78	372
Bulk Carriers	140	226	366	152	228	380
Slayton	348	146	494	476	154	630
ISP	1436	131	1567	1430	141	1571
Tremley Expansions	847	365	1212	776	386	1162
SUB-TOTAL	3637	997	4634	3992	1019	5011
Exiting Tremley Traffic	383	159	542	356	114	470
TOTAL	4020	1156	5176	4348	1133	5481

Excluding Kinder-Morgan, a high percentage (74% AM and 70% PM) of the generated future traffic is oriented to the proposed Connector Road. Should all of these developments not be implemented as initially planned, or the development levels or land use downgraded, the intersection / interchange between the proposed Connector Road and Industrial Road would be over designed. To establish a reasonable estimate of the peak traffic volume that will be connected through the Connector Road for the design year of the study, a factor of 60% of the maximum peak hour traffic volume for all of the currently proposed developments was used. This factor accounts for the probability that some of the anticipated developments will take place after 2020 or that some of the proposed land uses may change. In addition, the operating hours of all the anticipated trucking and warehousing occupants of the new developments are not likely to coincide with peak roadway traffic. Table 3 indicates the new development traffic and diverted existing Tremley Point traffic with the new, Connector Road oriented developments (ISP, other Tremley Point industry expansions and the Slayton Development) at 60 percent of full build-out. During the morning peak hour, 3,328 trips will be added to the study area traffic while during the evening peak hour, the volume increases to 3,665 trips. Diverted existing Tremley Point traffic volumes do not change. These volumes, combined with future background traffic, were used for design purposes.

Table 3

Design Level Development Trips

Category	AM Cars	AM Trucks	AM Total	PM Cars	PM Trucks	PM Total
OENJ Car Port	150	14	164	150	14	164
Lower Roosevelt RDA	260	7	267	584	18	602
Ferry Terminal	174	0	174	130	0	130
Port Cartaret	282	108	390	294	78	372
Bulk Carriers	140	226	366	152	228	380
Slayton	209	88	297	285	93	378
ISP	861	79	940	858	85	943
Tremley Expansions	510	220	730	465	231	696
SUB-TOTAL	2586	742	3328	2918	747	3665
Exiting Tremley Traffic	383	159	542	356	114	470
TOTAL	2969	901	3870	3274	861	4135

Not all of the new generated and diverted traffic is New Jersey Turnpike oriented. Table 4 indicates the number of future cars and trucks entering and exiting the Turnpike during the peak hours. A comparison to the volumes listed on Table 3 indicates that 68 percent of the AM and 71 percent of the new PM peak hour volumes are Turnpike oriented. The TRANPLAN model with the projected traffic volumes and distributions for the full amount of the proposed developments is shown in the Appendix.

Table 4

Turnpike Oriented Traffic

DESIGN LEVEL

AM Peak	ENTRY Cars	ENTRY Trucks	ENTRY Total	EXIT Cars	EXIT Trucks	EXIT Total	Total In/Out
Background	1181	393	1574	1077	342	1419	2993
Generated*	284	405	689	1477	464	1941	2630
Total	1465	798	2263	2554	806	3360	5623

PM Peak	ENTRY Cars	ENTRY Trucks	ENTRY Total	EXIT Cars	EXIT Trucks	EXIT Total	Total In/Out
Background	738	245	983	1094	345	1439	2422
Generated*	1539	389	1928	507	443	950	2878
Total	2277	634	2911	1601	788	2389	5300

FULL BUILD-OUT

AM Peak	ENTRY Cars	ENTRY Trucks	ENTRY Total	EXIT Cars	EXIT Trucks	EXIT Total	Total In/Out
Background	1181	393	1574	1077	342	1419	2993
Generated*	366	537	903	2018	587	2605	3508
Total	1547	930	2477	3095	929	4024	6501

PM Peak	ENTRY Cars	ENTRY Trucks	ENTRY Total	EXIT Cars	EXIT Trucks	EXIT Total	Total In/Out
Background	738	245	983	1094	345	1439	2422
Generated*	2086	499	2585	623	605	1228	3813
Total	2824	744	3568	1717	950	2667	6235

* Includes Diverted Existing Tremley Point Traffic

Connector Road Lane Requirements

The proposed Connector Road will cross over the Rahway River and provide a link between Industrial Road in Carteret and Tremley Point Road in Linden. With respect to traffic characteristics this roadway link is made up of two segments with differing traffic volume levels. The southern segment extends from Industrial Road to a point where Kinder Morgan and the proposed Slayton Development will have access. The northern segment includes the bridge over the Rahway River and extends from the aforementioned access drives for Kinder Morgan and the Slayton Development in Carteret to Tremley Point Road.

Traffic lane requirements for these segments are based on two levels of development at Tremley Point. The Design Level includes the anticipated growth of existing industries and new facilities during the next 15 to 20 years. The Full Build Level includes the continued growth of existing industries and the full build-out of the Tremley Point Redevelopment area beyond the Design Level period. Estimated peak hour traffic volumes by segment, type and development level are listed in Table 5.

Table 5

Projected Traffic Volumes

Development Level	Period	Direction	Cars	Trucks	Total	% Trucks
(South Segment)						
Design Level	AM	NB	1858	300	2158	14
		SB	302	292	594	49
	PM	NB	382	317	699	45
		SB	1772	268	2040	13
Full Build	AM	NB	2774	423	3197	13
		SB	437	424	861	49
	PM	NB	550	479	1029	47
		SB	2678	378	3056	12
(North Segment)						
Design Level	AM	NB	1570	238	1808	13
		SB	239	220	459	48
	PM	NB	270	247	517	48
		SB	1474	186	1660	11
Full Build	AM	NB	2370	329	2699	12
		SB	351	326	677	48
	PM	NB	382	379	761	50
		SB	2245	265	2510	11

The morning northbound and afternoon southbound direction peak volumes contain a substantial number of commuter vehicles while the off-peak direction volumes contain a high percentage of trucks. A cursory evaluation of the full build volumes clearly indicates that a single lane capacity is exceeded in the peak direction both during the AM and PM peak hours.

The Connector Road was analyzed with the design level volumes as a two-lane highway using the Highway Capacity Software (HCS) release 4.1c and the following parameters for the roadway: one 12 foot lane and a three foot shoulder in each direction of travel; maximum grade of 3 percent for distance of 0.25 miles (HCS default minimum) for the north segment; free flow speed of 50 miles per hour (mph); and a peak hour factor (PHF) of 0.90. The analysis was conducted for the peak direction only. The results for the four scenarios analyzed (north segment – AM, north segment – PM, south segment – AM, south segment – PM), revealed levels of service (LOS) "F" with volume to capacity (v/c) ratios between 1.14 and 1.51. Printouts of the two-lane HCS analysis are included in the appendix. The analyses presented show that a two-lane roadway does not accommodate effective operations at design level volumes. A four-lane roadway will be required to accommodate the design level volumes.

Next, the operations of the roadway were tested as an undivided, four-lane highway with a 12-foot inner lane and a 15-foot shoulder lane in each direction of travel. (HCS analysis was conducted for two 12-foot lanes and a three-foot shoulder in each direction). In the northbound direction, there will be a grade of 3 percent for a distance of approximately 1,100 feet, while in the southbound direction a 3 percent grade extends for about 800 feet. A PHF of 0.90 and a free flow speed of 50 mph were also used for the multi-lane highway analysis. Since the multi-lane highway module of HCS limits truck percentages to 25 percent and the off-peak direction truck percents are in the 48-50 percent range, the truck percentage was set to 25 and the remaining trucks over 25 percent converted to cars at a truck equivalency factor (ET) of 1.5 which is consistent with the grades.

The results of the analysis are indicated in Table 6. Overall, the vehicular operations of the north segment, which includes the bridge crossing over the Rahway River, are more efficient than those of the south segment. Under design level conditions, the roadway operates at LOS "C" in the peak direction during both the AM and PM periods. The off-peak direction during both the AM and PM periods operates at LOS "A." The HCS printouts for the multi-lane highway capacity analysis are included in the appendix.

Table 6

Connector Road HCS Analysis Results

Period	Direction	LOS	Density*
	(South Segment)		
AM	NB	C	24.3
	SB	A	7.9
PM	NB	A	9.1
	SB	C	22.9
	(North Segment)		
AM	NB	C	20.3
	SB	A	6.1
PM	NB	A	6.8
	SB	C	18.4

* passenger cars / mile / lane

As shown in the first portion of Table 6, the south segment vehicle operations are slightly more dense than those of the north segment. Under design level conditions, the south segment operates at LOS "C" or better in the peak direction during the AM and PM periods. The off-peak direction operates at LOS "A" during the AM and PM peaks.