JACOBS®

YORK TOLL PLAZA

MAINE TURNPIKE AUTHORITY

AIR QUALITY REPORT

September 28, 2016

(Cover photograph provided by MTA)

TABLE OF CONTENTS

FIGURE

TABLE

(This page intentionally left blank)

1.0 EXECUTIVE SUMMARY

The Maine Turnpike Authority (MTA) proposes to construct a new highway speed Open Road Tolling (ORT) Plaza at mile 8.8 and demolish the existing barrier toll plaza at Mile 7.3. Approximately 70 percent of the total existing toll booth traffic (and 85 percent of truck traffic) is anticipated to use the ORT lanes at free-flow highway speeds, the operating efficiency of the proposed York Toll Plaza would be substantially increased with a corresponding improvement in ambient air quality.

To assess the overall impact of the York Toll Plaza Replacement Project on ambient air quality, a vehicular pollutant analysis was performed for emissions of carbon monoxide (CO), coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and the combination of volatile organic compounds and nitrogen oxides (VOC and NOx) which react to form ground-level ozone. The latest state-of-the-science and USEPA-approved Motor Vehicle Emission Simulator (MOVES version 2014a), in concert with the latest version of our traffic simulation model VISSIM (Version 8) was used to calculate the total pollutant burden for both the No Build and Build scenarios in the form of project-level emission inventories

As will be shown below, the proposed ORT plaza would result in substantial ambient air quality improvement at Mile 7.3 and have a near net-zero effect on pollutant emissions at Mile 8.8. Accordingly, the net effect on overall air quality from this project is a sixteen percent (16%) reduction in total pollution burden..

As a result, the York Toll Plaza Replacement Project would not have an unreasonable adverse effect on ambient air quality.

2.0 INTRODUCTION

The Maine Turnpike Authority (MTA) retained Jacobs Engineering Group (Jacobs) to conduct an air quality modeling study to quantify the potential effect of the York Toll Plaza Replacement Project on vehicular pollutant emissions. The Maine Turnpike Authority (MTA) proposes to construct a new ORT Toll Plaza at Mile 8.8 and demolish the existing barrier Toll Plaza at Mile 7.3. Approximately 70 percent of the total existing toll booth traffic (and 85 percent of truck traffic) is anticipated to use the ORT lanes at free-flow highway speeds; the increased operating efficiency of the proposed York Toll Plaza would be substantial. Through the use of the latest available emissions modeling system Motor Vehicle Emissions simulator (Moves), and the latest guidance from DEP this study will quantify and compare peak hour pollutant burdens to demonstrate the extent of ambient air quality benefits that would be realized as a result of reconstructing the existing barrier toll plaza into a high speed ORT facility and demolishing the existing barrier toll plaza.

3.0 REGULATORY FRAMEWORK

The proposed York Toll Plaza Replacement project is located in an air quality region designated by the United States Environmental Protection Agency (USEPA) as an attainment area, signifying that no exceedances of national or state ambient air quality standards are present in York County, Maine. In addition, MTA does not receive federal funds for its construction and maintenance activities. Therefore, conformity provisions and related requirements (e.g., hot-spot analyses at the project level, regional conformity demonstration) based on National Ambient Air Quality Standards (NAAQS), at the federal level per the Clean Air Act or its associated state ambient air quality standards per Chapter 110 of the State of Maine Air Rules do not apply to the proposed project. Since the project is located within an attainment area, where air pollution levels are not in violation of NAAQS, a pollutant emissions burden analysis was performed to highlight the improvement in air quality from transportation related pollutants that would result from the proposed project.

On the state level, this project (aka development) is subject to Maine Site Location of Development Act (SLODA), 38 MRSA §§481-490. Pursuant to 38 MRSA §§486-B, the Maine Department of Environmental Protection (MDEP) issued the MTA a General Permit for SLODA projects. Section II(B)(6) of this General Permit provides that if the applicable MTA project is not included in a Maine DOT Statewide Transportation Improvement Program (STIP) that has undergone air quality analysis, the MTA will comply with Chapter 375, Section 1 of the DEP rules, 06-096 CMR Chapter 375, which may require, among other things, modeling of non-point sources and submittal of results. This project is not contained in a Maine DOT STIP. This analysis provides such modelling.

4.0 METHODOLOGY

To demonstrate no unreasonable adverse air quality effects from the proposed project, vehicular emissions inventories during peak travel hours were calculated for the future No Build and future Build scenarios in year 2043, as follows:

- No Build pollutant burden
  - Existing barrier toll plaza remains at Mile 7.3; and,
  - No toll plaza at Mile 8.8.
- Build pollutant burden
  - No toll plaza at Mile 7.3; and,
  - ORT plaza constructed at Mile 8.8.

As described in further detail in this chapter below, the emissions inventories predict the total vehicular pollutant burden associated with the No Build and Build toll plaza scenarios at Mile 7.3 and Mile 8.8 during peak travel hours. Each inventory represents the sum of all pollutants that are emitted into the local atmosphere as a result of different vehicle activities associated with each plaza design. The inventories are then summed to present the total pollutant burden for the No Build and Build scenarios. As such, the pollutant burdens calculated in this study provide comparative evidence directly linking the removal of the barrier toll plaza at Mile 7.3 and the addition of the more efficient ORT plaza at Mile 8.8 to the effects of those actions on the total amount of pollutants emitted into the local atmosphere.

As the proposed project affects only highway vehicular emissions, the criteria pollutants of concern are carbon monoxide (CO), coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and the combination of volatile organic compounds and nitrogen oxides (VOC and NOx) which react to form ground-level ozone.

4.1 TRAFFIC MODELING METHODOLOGY

Traffic flow microsimulation software, VISSIM version 8.0, was used to simulate the traffic operations in the No Build and Build scenarios during peak travel hours throughout the 30th worst travel day in year 2043, which represents a summer weekend in July. The evaluation metrics derived include the physical lengths of vehicle cruise, queue, deceleration, and acceleration activity segments, as well as the average travel speed for each segment representing an aggregate mix of those activities. In addition, the traffic evaluation No Build and Build year of 2043 accounts for long-term traffic volume growth in the air quality analysis horizon.

Per USEPA air quality modeling guidance, the four worst traffic hours for both peak and off-peak traffic periods were modeled—morning peak, midday peak, evening peak, and overnight peak—to capture emission rate variability across the day. For each of the peak hours analyzed, ten 60-minute simulations were performed. A seeding time of 900 seconds was used for each simulation. Passenger vehicles and heavy trucks were included in the vehicle inputs.

4.2 AIR QUALITY MODELING METHODOLOGY

The latest state-of-the-science and USEPA-approved Motor Vehicle Emission Simulator (MOVES version 2014a), was used to calculate the total pollutant burden for both the No Build and Build scenarios in the form of project-level emission inventories. The MOVES model calculates emission inventories (referred to in this study as pollutant burdens) by performing a series of calculations that reflect real-world vehicle operating processes in order to estimate total exhaust and evaporative emissions over a twenty four hour period, as well as brake and tire wear emissions for all on-road vehicles including cars, trucks, motorcycle, and buses. Contextual MOVES data specific to York County—such as vehicle mix classification, fleet age distribution, formulation and market share of fuel types, and meteorology—are consistent with the latest planning assumptions developed by the Maine Department of Environmental Protection (MEDEP) for air quality goal conformity determinations made in York County.

All aspects of the traffic data were pre-processed in MOVES, including total vehicle miles traveled, evaluation timeframes, flow characteristics, road grades, as well as vehicle drive-activity cycles. Each roadway segment in MOVES is associated with a drive-activity cycle as defined by an average operating speed, which is calculated by VISSIM on a per-vehicle basis. Based on an average operating speed, MOVES extrapolates a drive cycle distribution appropriate to the defined roadway type. For example, highway segments defined by a low average operating speed would cause vehicle idling activity typical of heavy bumper-to-bumper congestion to dominate the MOVES drive cycle distribution, which would also include some acceleration and deceleration activities at near-idling speeds; highway segments defined by a high average operating speed would cause steady-state cruise activity to dominate the MOVES drive cycle distribution, which would also include a small amount of acceleration and deceleration activities near free-flow speeds.

4.3 ANALYSIS TIMEFRAME

Per USEPA modeling guidance, to account for seasonal variability in the emission rate of each pollutant, four representative pollutant inventories were individually calculated for January, April, July, and October as based on temperature and relative humidity data used by MEDEP for conformity determinations in York County. Additional pollutant inventories were individually calculated for the four peak and off-peak traffic analysis hours to account for emission rate variability across the 30th worst travel day of year 2043, as described in Section 4.1 above. These traffic data are assumed to be identical for all quarters of the year.

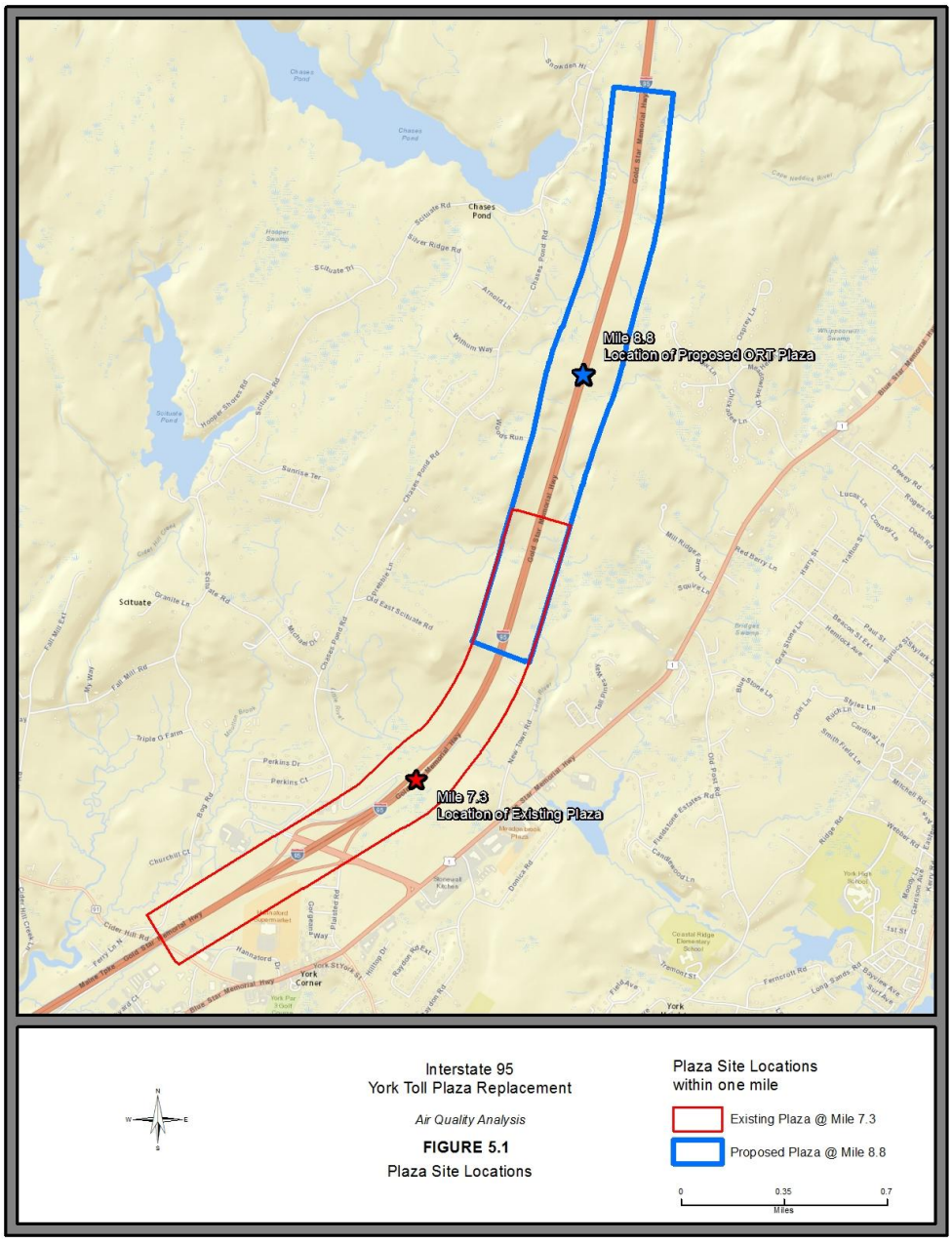
As recommended by USEPA for project-level hourly emissions modeling, the combination of four traffic hours over a four-month emissions analysis horizon—for a total of 16 MOVES inventory calculations in each plaza scenario—is sufficient to represent the maximum pollutant emissions (in kilograms) that may reasonably be experienced during peak travel hours throughout the analysis year.

For ease of comparison, all MOVES pollutant inventories have been summed and expressed in this air quality study as a single quantity.

4.4 AREAS OF STUDY

To isolate the change in pollutant emissions that would directly result from the proposed ORT plaza (and the change in associated traffic patterns), pollutant burden calculations in this study include all highway pollutants that would be emitted by vehicles traveling along the turnpike from 1 mile south of mile 7.3 and 1 mile north of mile 8.8. This is approximately from Mile 6.3 to 9.8. This area is depicted in Figure 4.1. This study area captures all the variations in the rate of pollutant emission associated with different vehicular travel speeds and activities (e.g., acceleration, deceleration, cruise, and queue) that are associated with toll plaza operations and travel within the length of turnpike included in the study.

FIGURE 4.1 – PLAZA SITE LOCATIONS



5.0 ANALYSIS OF FUTURE POLLUTANT BURDENS

The following table assesses the net effect of plaza relocation in year 2043 on both the existing Mile 7.3 and proposed Mile 8.8 site locations as shown in Figure 5.1. The horizon year of 2043 was chosen to coincide with the same horizon year that the future toll plaza sizing study was performed. The future traffic analysis and resultant air quality analysis was based a significant increase (1.4%/per year) in travel predicted for the turnpike based on a separate traffic study performed by Jacobs to size the new ORT toll plaza. The air quality study recognizes the impact that the queuing behavior at the existing barrier toll plaza contributes to air pollutants as well as the reduction in queues that would be realized by the efficiency of the new ORT facility. The traffic modelling and associated air study does not account for influences outside the study area such as the capacity restraint of the Piscataqua River Bridge in Portsmouth. To calculate pollutant burdens for these relocation scenarios, the coverage of both No Build and Build models were extended to create a one-mile analysis overlap at Mile 7.3 and at Mile 8.8. This configuration allows MOVES to calculate emission burdens comparing No Build and Build scenarios specific to a site location, as opposed to comparing scenarios specific to a plaza design.

TABLE 5.1 – NET EMISSIONS AT MILE 7.3 AND MILE 8.8

Pollutant	Mile 8.8 Emission Burden (kg)			Mile 7.3 Emission Burden (kg)			Net Emission Burden (kg)	
	No Plaza	ORT Plaza	+/- %	Existing Plaza	No Plaza	+/- %	ORT Plaza	+/- %
CO	163	168	+3%	192	149	-22%	-38	-11%
NOx	24	23	-3%	28	20	-29%	-9	-17%
VOC	14	15	+9%	19	8	-55%	-9	-28%
PM_{10}	9	5	-51%	12	2	-83%	-14	-69%
$PM_{2.5}$	2	1	-38%	2	1	-69%	-2	-55%
Grand Total	**212**	**212**	**+0.18%**	**252**	**180**	**-29%**	**-73**	**-16%**

With the removal of the existing toll plaza at Mile 7.3, the change in ambient air quality within a one-mile vicinity would be 29 percent fewer pollutants emitted. In this scenario, Mile 7.3 would benefit from free-flow speeds at all times throughout the day; operating speeds are nearly doubled and pollutant emissions are substantially reduced.

With a new ORT toll plaza at Mile 8.8 and the removal of a barrier toll at mile 7.3, the change in pollutant emissions within a one-mile vicinity of Mile 8.8 would be negligible. The largest improvements would occur throughout the day in the southbound direction, where the ORT plaza would relieve severe congestion in traffic previously constrained by the existing barrier toll booth plaza at Mile 7.3. These improvements, however, are offset by increased emissions in the northbound direction, where traffic already traveling at near free-flow speeds in the No Build scenario would be affected by new acceleration, deceleration and idling activities introduced by the addition of the ORT plaza. Overall, with the predicted offset in emissions from

northbound and southbound vehicles, Mile 8.8 within a one-mile radius would experience a near net-zero (0.18 percent) increase in pollutants emitted as a result of the ORT plaza construction.

The ORT plaza at Mile 8.8 would substantially reduce emissions of PM by relieving congestion and virtually eliminating deceleration and braking activities at Mile 7.3. Although emissions of CO are predicted to increase by 3 percent at Mile 8.8, this increase is marginal and would not affect local ambient air quality. While emissions of VOC would also increase by 9 percent at Mile 8.8, the increase would be mitigated by a 28 percent system-wide net decrease in VOC emissions, thereby ensuring that no new area ozone formation would occur. Overall, the net effect of the ORT plaza on ambient air quality at the Mile 7.3 and Mile 8.8 locations is a 16 percent reduction in total pollutants emitted.

6.0 SUMMARY OF FINDINGS

The proposed ORT plaza design at Mile 8.8 would result in substantially more efficient operations than the existing barrier toll plaza design at Mile 7.3. This effect has a corresponding improvement on ambient air quality, as the total pollutant burden would decrease by 16 percent with more than 50 percent reduction in particulate matter emissions, particularly from brake-wear (see section 5.1). The reconstruction of the plaza at Mile 8.8 would relieve severe traffic congestion in the southbound direction, although the 7 percent improvement in ambient air quality would be offset by 8 percent increased emissions from northbound traffic. When considering the total pollutant burden in both travel directions, however, the proposed ORT plaza scenario would have a near net-zero effect on ambient air quality at Mile 8.8 while reducing total pollutant emissions by 29 percent at Mile 7.3.

Construction of the proposed ORT plaza would result in substantial ambient air quality improvement at Mile 7.3, and have a near net-zero effect on pollutant emissions at Mile 8.8. As a result, the proposed York Toll Plaza Replacement Project would not result in any unreasonable adverse effect on air quality and would result in an overall improvement in air quality for York County.

7.0 EFFECT OF CONSTRUCTION ON AIR QUALITY

Although local inhalable PM, CO, and dust concentrations are concerns stemming from construction activities, the temporary increase in emissions would be self-correcting once the project is completed. Therefore, modeling analyses of short-term elevated emissions are not warranted, and the temporary effects of project construction on local and regional air quality would not be significant. During the construction phase of the project, effective control measures to limit airborne PM and dust during construction would be taken, including the wetting of exposed soil, covering of trucks and other dust sources, and other best practice means as applicable.