CENTRAL BUSINESS DISTRICT (CBD) TOLLING PROGRAM

Appendix 4A.1, Transportation: Implementation of Tolls in the Best Practice Model

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Acronyms

BPM .... Best Practice Model
CBD .... Central Business District
CTPP .... Census Transportation Planning Package
EA .... Environmental Assessment
FHV .... For-Hire Vehicle
HOV .... High-Occupancy Vehicle
MTA .... Metropolitan Transportation Authority
NYCDOT .... New York City Department of Transportation
PANYNJ .... Port Authority of New York and New Jersey
SOV .... Single-Occupancy Vehicle
TBTA .... Triborough Bridge and Tunnel Authority
TLC .... Taxi and Limousine Commission

Appendix 4A.1 Transportation: Implementation of Tolls in the Best Practice Model

4A.1-1 IMPLEMENTATION OF CROSSING CREDITS

Tolling Scenario A represents the tolling scenario under the CBD Tolling Alternative most closely defined by the New York State Legislature in enacting the MTA Reform and Traffic Mobility Act. The subsequent tolling scenarios represent variations on Tolling Scenario A, most notably in the application of crossing credits to drivers crossing bridges or tunnels into Manhattan that are already tolled and varying toll rates. **Chapter 2, "Project Alternatives,"** describes these credit tolling scenarios.

For implementation in the Best Practice Model (BPM), crossing credits relative to the amount currently paid on the Port Authority of New York and New Jersey (PANYNJ) and TBTA facilities were added to trips in the BPM that are identified as crossing a PANYNJ or TBTA facility and also entering the Manhattan CBD.

To reflect the tolling scenarios for the CBD Tolling Alternative, the BPM required certain formulas to mimic crossing credits. For example, the BPM uses tolls as a general calibration value for the Hudson River and East River crossings, resulting in modeled toll values that vary slightly from observed values for each crossing. Crossing credits for the CBD Tolling Alternative needed to be consistent with the observed toll values, rather than the modeled toll values.

To overcome this issue for PANYNJ and TBTA facilities within the Manhattan CBD, the crossing credits were applied directly to the BPM's relevant toll links where the vehicle would enter the Manhattan CBD. For example, a one-way credit on the Queens-Midtown Tunnel was implemented by removing the Manhattan CBD toll link at the exit of the Queens-Midtown Tunnel. The Queens-Midtown Tunnel toll value was used as a proxy value for crediting tolls paid at the Hugh L. Carey Tunnel, the PANYNJ Manhattan Hudson River crossings, and the Robert F. Kennedy Bridge.

For PANYNJ and TBTA facilities in Upper Manhattan, a select link analysis was conducted to identify origins and destinations of trips that accessed the Manhattan CBD via the George Washington Bridge, Henry Hudson Bridge, or the Robert F. Kennedy Bridge. Trips identified by this select link analysis were then placed in unique trip tables and assigned to the network using discounted Manhattan CBD tolling rates based on the appropriate crossing credits for each tolling scenario.

4A.1-2 PUBLIC TRANSIT VEHICLES

In the BPM, all public transit vehicles (e.g., MTA New York City Transit, MTA Bus Company, and New Jersey Transit) and private commuter buses were considered insensitive to Manhattan CBD tolling, because such buses were assigned a fixed route and headway based on existing or planned service. Transit vehicles in the model were not allowed to deviate from those routes or headways based on tolls or congestion.

The BPM analysis did not adjust fares for public transit. This analysis assumed that if public transit vehicles were to pay the Manhattan CBD toll, the additional cost would not be passed to the customer. Thus, no additional cost was added in the BPM to the fares for transit passengers entering the Manhattan CBD.

4A.1-3 DESTINATION CHOICE AND MODE CHOICE UPDATES

Prior to the analysis in this EA, MTA and its consultants updated the destination and mode choice calibration in the BPM. The changes were introduced to better match 2012–2016 Census Transportation Planning Package (CTPP) worker travel flows from the U.S. Census Bureau and American Association of State Highway and Transportation Officials. The CTPP is derived from the U.S. Census Bureau's annual American Community Survey, and it reveals key information about how and where people travel to work.

The updated calibration was done by changing mode choice parameters, which indirectly change destination choice probabilities to better match observed data from the CTPP. The updates focused primarily on worker flows from Kings (Brooklyn) and Queens County into the Manhattan CBD. Table 4A.1-1 shows the worker flows from before and after the mode and destination choice adjustments compared to low and high estimates from the CTPP. The calibration was completed at a county level except for New York County (Manhattan), which was split between the Manhattan CBD and non-Manhattan CBD portion of the county. The high and low estimates from the CTPP represent the estimates from the U.S. Census Bureau plus or minus the reported margin of error.

Table 4A.1-1 Worker Flow Calibration to the Manhattan CBD

WORKER FLOWS (by Residency)	TARGET (Source: 2012–2016 CTPP)		CALIBRATION SCENARIO	
	Low	High	2017S	2017J7.1
New York City Counties	**1,050,720**	**1,117,785**	**1,187,255**	**1,079,639**
Bronx	100,194	108,994	143,016	81,541
Kings (Brooklyn)	280,015	291,057	91,492	255,552
New York (Manhattan CBD)	233,052	249,574	266,746	230,695
New York (Manhattan - Other)	196,029	211,499	276,514	224,101
Queens	212,049	223,067	389,958	255,571
Richmond (Staten Island)	29,381	33,594	19,529	32,179
Long Island	**93,322**	**104,074**	**126,898**	**145,995**
Nassau	67,875	74,273	123,153	96,937
Suffolk	25,447	29,801	3,745	49,058
New York Counties North of New York City	**82,091**	**92,579**	**69,180**	**94,084**
Westchester	61,142	67,446	36,487	65,442
Other New York Counties North of NYC	20,949	25,133	32,693	28,642
Portions of Northern and Central New Jersey	**148,572**	**162,640**	**199,272**	**214,733**
Hudson County	54,714	60,230	27,756	55,685
Other New Jersey Counties	93,858	102,410	171,516	159,048
Connecticut counties	**24,671**	**28,335**	**21,713**	**45,689**
TOTAL	**1,399,376**	**1,505,413**	**1,604,318**	**1,580,140**

Source: Best Practice Model, WSP 2021

4A.1-4 TAXIS AND OTHER FOR-HIRE VEHICLES

The BPM includes trips completed in taxis and for-hire vehicles (FHVs) like Uber, Lyft, and Via, in trip tables separate from other private autos. The BPM was updated to better reflect the most recent trends in taxi and FHV travel behavior in Manhattan. The BPM mode choice parameters were updated to match taxi and

FHV travel characteristics from the New York City Taxi and Limousine Commission (TLC) October 2017 data. Table 4A.1-2 includes a comparison of modeled and targeted 2017 taxi and FHV trips. Any changes in the calibration of taxis and FHVs largely came at the expense of reduced transit ridership.

Table 4A.1-2 Taxi and For-Hire Vehicle Model Results Compared with Target Data

MODEL	MANHATTAN	NON-MANHATTAN	TOTAL
Manhattan	306,742	1,742	308,484
Non-Manhattan	26,377	84,845	111,222
TOTAL	**333,119**	**86,587**	**419,706**

TARGETS	MANHATTAN	NON-MANHATTAN	TOTAL
Manhattan	310,640	1,734	312,374
Non-Manhattan	26,362	84,536	110,898
TOTAL	**337,002**	**86,270**	**423,272**

Sources: “Model” derived from Best Practice Model, WSP 2021; “Targets” derived from New York City Taxi and Limousine Commission October 2017 data

Note: Rows represent origins and columns represent destinations. For example, in the lower left of the top table, 26,377 taxi and FHV vehicle trips are modeled from locations outside of Manhattan to locations in Manhattan.

Unlike private autos, for the purpose of the model, each taxi or FHV entry into the Manhattan CBD would be assessed the Manhattan CBD toll in some tolling scenarios, and as a result, taxis and FHVs would be charged the full toll each time they would cross the 60th Street Manhattan CBD boundary for those tolling scenarios. For the actual implementation of the CBD Tolling Program, the Traffic Mobility Review Board will make recommendations on the treatment of taxis and FHVs, which will be considered by TBTA. Taxis and FHVs would potentially be exempt from the Manhattan CBD toll, receive a toll discount, or be subject to some other toll reduction such as a cap.

This EA evaluates taxi and FHV tolling policy by using a blended toll rate based on observed number of entries into the Manhattan CBD, toll policy, and Manhattan CBD toll rates by vehicle class. NYCDOT provided observed data from October 2017 that, on average, taxis enter the Manhattan CBD seven times per day, and FHV vehicles enter the Manhattan CBD two times per day. NYCDOT also provided data on total entries into the Manhattan CBD by vehicle class, indicating 83,000 taxi daily entries and 70,000 FHV daily entries into the zone. These two data points were then used to derive a weighted average of entries of 4.72 vehicle entries per day. The Manhattan CBD toll values used in the BPM used these observed data points to develop a weighted toll average for taxi and FHV vehicle class.

4A.1-5 BEST PRACTICE MODEL NETWORK UPDATES

The BPM networks were updated to add additional projects implemented since the adoption of New York Metropolitan Transportation Council Regional Transportation Plan in 2017. Table 4A.1-3 includes a complete list of the network coding changes implemented for this EA.

Table 4A.1-3 Best Practice Model Network Coding Changes for Projects after New York Metropolitan Transportation Council 2017 Regional Transportation Plan

	DESCRIPTION
1.	Fixed two-way coding of 63rd Street near Queensboro Bridge
2.	Fixed off-ramp on Queensboro from upper to lower roadway
3.	Corrected Queensboro Bridge lower level/upper roadway ramp on the Queens side
4.	Connected Queensboro upper/lower roadway to the correct on-ramps
5.	Dualized and tolled cordon links
6.	Moved the toll links north of 60th Street on the east side of Manhattan
7.	Updated HWYTRANS.DBF based on all the network changes
8.	Lowered the inbound Williamsburg Bridge capacity on the span
9.	Lowered West Side Highway/Route 9A hub bound link capacity
10.	Fixed two-way coding of 61st Street near Queensboro Bridge
11.	Added 60th Street between the ramp and First Avenue
12.	Connected Queensboro upper high-occupancy vehicle lane to 57th Street
13.	Updated Queensboro Bridge on-ramps lane attributes (due to the changes in item 4 of this list)
14.	Recoded 14th Street in Manhattan based on recent transit lane conversion
15.	Incorporated two-way tolling for the Verrazzano-Narrows Bridge
16.	SPDMOD (speed modification) update on High-Capacity Transit links
17.	Extended northbound L train to Canarsie-Rockaway Parkway Station
18.	Updated northbound L train headway and capacity
19.	Updated AM capacity on Long Island Rail Road Ronkonkoma branch
20.	Updated Queensboro Bridge capacity and high-occupancy vehicle lane calibration
21.	Updated Central Business District centroid connectors
22.	Removed 72nd Street traversal
23.	Incorporated Brooklyn Bridge bike lanes
24.	Incorporated Queensboro Bridge bike lanes
25.	Updated Fifth Avenue busway
26.	Updated 14th Street bus and truck lanes
27.	Incorporated Brooklyn-Queens Expressway modifications
28.	Updated Jay/Smith/Tillary bus and truck lanes
29.	Incorporated 21st Street (Queens) bus lane
30.	Updated Queensboro Bridge lower level links on Queens side
31.	Incorporated Queensboro Bridge high-occupancy vehicle and general-purpose lane swap (only in tolling scenarios)

Source: Best Practice Model, WSP 2021

4A.1-6 BEST PRACTICE MODEL ASSIGNMENT PROCEDURES

The BPM derives roadway volumes from a Multi-Modal, Multi-Class assignment routine in Caliper's TransCAD software. This is a capacity constrained roadway assignment process. The multiclass traffic assignment process assigns different user classes (e.g., income groups) and modes of traffic to a network simultaneously. In practice, this replicates the behavior that car, taxi, truck, and bus volumes affect travel speeds for everyone. This also allows for the model to replicate certain vehicle type restrictions like truck prohibitions and different toll policies by vehicle type.

Transit demand is derived using a TransCAD Equilibrium Pathfinder Assignment. This procedure minimizes the generalized cost of each traveler across all possible transit paths. The generalized cost for transit assignment is a combination of fares, travel time, and crowding. Transit assignment, like roadway assignment, use a multiclass assignment procedure to segment commuter rail and noncommuter rail transit markets.

Fares for all transit service in 2023 and 2045 are consistent with the NYMTC 2045 Regional Transportation Plan.

On-road vehicle and transit travel demand is a function of total person-level travel demand and mode choice. The BPM determines the total level of travel expected by purpose and income based on population and economic activity and then segments that travel into mode and time of day. These demand tables segmented by mode, purpose, income, and time of day are provided to the TransCAD assignment methods described above.

The BPM assignment procedures for roadway and transit both include capacity constraints on each facility. These capacity constraints vary based on the type of facility, so highways have more capacity than a local street and a subway has more capacity than a commuter bus. Because the model assigns roadway and transit traffic in iterative cycles, assigned volumes are compared to facility capacities and travel times on the facility are updated in successive iterations. This process represents the real-world conditions of congestion on roadways and the perceived travel time due to discomfort on transit vehicles. Through successive iterations, traffic finds new routes to complete their journeys. A completed or equilibrium assignment is one that has converged where no traveler is better off by choosing an alternative path.

4A.1-7 VALUE OF TIME

In this EA, the BPM stratifies the value of time across a journey's purpose and income. Value of time is the monetary value that a person considers their time is worth while traveling. This value varies by trip purpose and income. Work trips have the highest value of time while discretionary travels have lower values of time. High-income travelers have increased values of time than low-income travelers. This approach is consistent with Federal Highway Administration's *The Value of Travel Time Savings: Departmental Guidance for Conducting Economic Evaluations Revision 2 (2014 Update)*.

The BPM uses the following stratification for value of time in this environmental analysis (**Table 4A.1-4**). The BPM segments income into three categories:

- 15 percent lowest-income households
- 70 percent middle-income households
- 15 percent highest-income households

Table 4A.1-4 Value of Time Stratification

INCOME	PURPOSE	OCCUPANCY	VALUE ($/HOUR, 2010 DOLLARS)	VALUE ($/HOUR, 2019 DOLLARS)
Low	Work	SOV	$14.04	$18.39
Low	Work	HOV2	$22.81	$29.88
Low	Work	HOV3+	$31.00	$40.60
Low	Non-Work	SOV	$7.02	$9.20
Low	Non-Work	HOV2	$10.64	$13.94
Low	Non-Work	HOV3+	$13.84	$18.13
Med	Work	SOV	$21.94	$28.74
Med	Work	HOV2	$35.64	$46.69
Med	Work	HOV3+	$48.44	$63.46
Med	Non-Work	SOV	$10.97	$14.37
Med	Non-Work	HOV2	$16.63	$21.78
Med	Non-Work	HOV3+	$21.63	$28.33
High	Work	SOV	$35.78	$46.87
High	Work	HOV2	$58.13	$76.14
High	Work	HOV3+	$79.00	$103.48
High	Non-Work	SOV	$17.89	$23.44
High	Non-Work	HOV2	$27.12	$35.52
High	Non-Work	HOV3+	$35.27	$46.21

Note: SOV = Single-Occupancy Vehicle; HOV= High-Occupancy Vehicle

As one example of how income stratification affects travel into the Manhattan CBD, **Table 4A.1-5** reveals how drive-alone work-vehicle trips would decline at different rate by income class. Note that from **Table 4A.1-4**, the value of time in 2019 dollars for using a single-occupancy vehicles for work purpose is assumed as the following:

- $18.39/hour for the lowest-income households
- $28.74/hour for middle-income households
- $46.87/hour for highest-income households

Low-income work-vehicle trips into the Manhattan CBD would be reduced between 49 percent and 53 percent while high-income work-vehicle trips into the Manhattan CBD would be reduced between 32 percent and 40 percent. Because high-income travelers have a higher value of time, the BPM assumes that they would be less likely to switch modes or switch paths than lower-income households.

Table 4A.1-5 Daily Drive-Alone Work-Vehicle Trips by Income Entering the Manhattan CBD (2023)

INCOME CATEGORY		NO ACTION	SCENARIO A	SCENARIO B	SCENARIO C	SCENARIO D	SCENARIO E	SCENARIO F	SCENARIO G
Lowest Income		5,234	2,614	2,566	2,608	2,652	2,468	2,452	2,517
	Difference		-2,620	-2,668	-2,626	-2,582	-2,766	-2,782	-2,717
	Percentage		-50.1%	-51.0%	-50.2%	-49.3%	-52.8%	-53.2%	-51.9%
Medium Income		209,971	122,856	120,637	118,821	116,793	112,310	114,648	117,643
	Difference		-87,115	-89,334	-91,150	-93,178	-97,661	-95,323	-92,337
	Percentage		-41.5%	-42.5%	-43.4%	-44.4%	-46.5%	-45.4%	-44.0%
Highest Income		111,053	76,074	74,472	72,976	71,215	67,233	69,071	73,252
	Difference		-34,978	-36,580	-38,077	-39,838	-43,820	-41,982	-37,801
	Percentage		-31.5%	-32.9%	-34.3%	-35.9%	-39.5%	-37.8%	-34.0%
TOTAL		**326,258**	**201,545**	**197,675**	**194,405**	**190,659**	**182,012**	**186,171**	**193,403**
	Difference		**-124,713**	**-128,583**	**-131,853**	**-135,599**	**-144,246**	**-140,087**	**-132,855**
	Percentage		**-38.2%**	**-39.4%**	**-40.4%**	**-41.6%**	**-44.2%**	**-42.9%**	**-40.7%**

Source: Best Practice Model, WSP 2021