I-495 & I-270 P3 Program

Toll rate setting + escalation

CONFIDENTIAL – PRE-DECISIONAL – DELIBERATIVE

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495 270 P3 PROGRAM

MARYLAND DEPARTMENT OF TRANSPORTATION

MDTA

Considerations for toll rate setting + escalation

- This document provides considerations for toll rate ranges, an interim “soft rate cap”, and escalation rates. The project configuration assumed for the analysis included is NEPA Alternative 9; note there are other alternatives under consideration in the environmental study.
- Under dynamic pricing, the setting of the toll rate range is necessary to provide the Phase Developer with key parameters to develop traffic and revenue forecasts for their financial analysis and congestion relief estimates for the P3 Program.
- It is understood that there are numerous financial, legal, commercial, technical and social factors to consider in setting the toll rate range.
- This document focuses solely on the financial, commercial and technical factors for toll rate range setting related to the revenue risk P3 Program and the objective for no net costs to the state.

Dynamic pricing overview

- Tolls will be adjusted dynamically according to an algorithm that accounts for traffic conditions and revenue on the managed lanes as seen in Figure 1.
- When traffic reaches certain levels, tolls must increase to maintain a free-flowing volume and/or speed of traffic as seen in Figure 2. Toll adjustments will likely be different at different gantries along the project as congestion and demand vary along the corridor.
- Many factors enter into a driver's decision to pay a toll on a specific day and time, including:
  - driver's willingness to pay at that specific time for that specific trip,
  - travel time savings, and
  - travel time reliability.

Figure 1: Revenue Elasticity

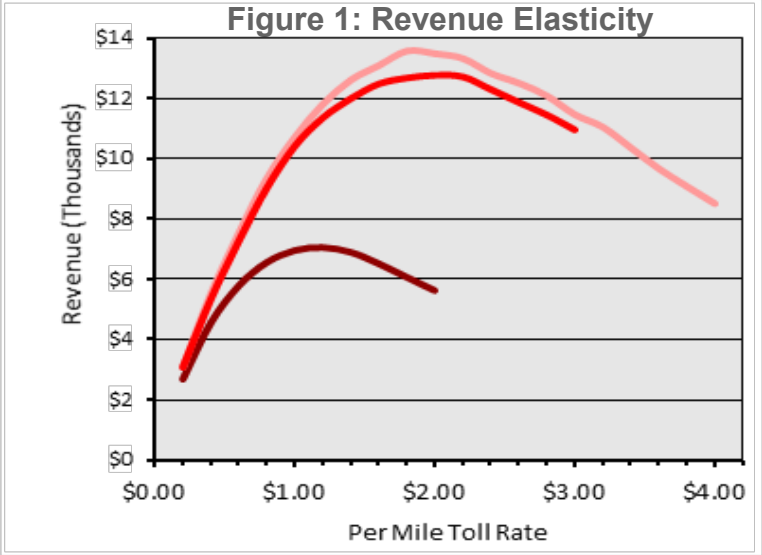
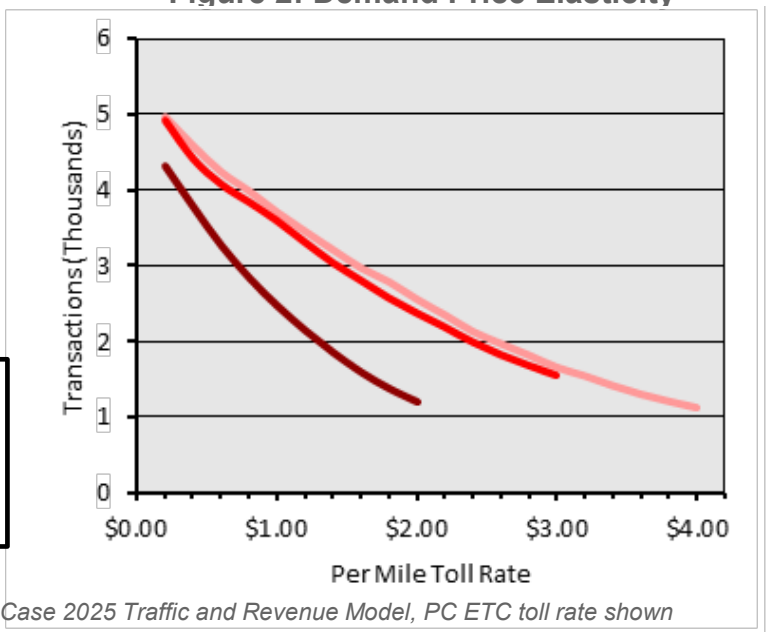


Figure 2: Demand Price Elasticity



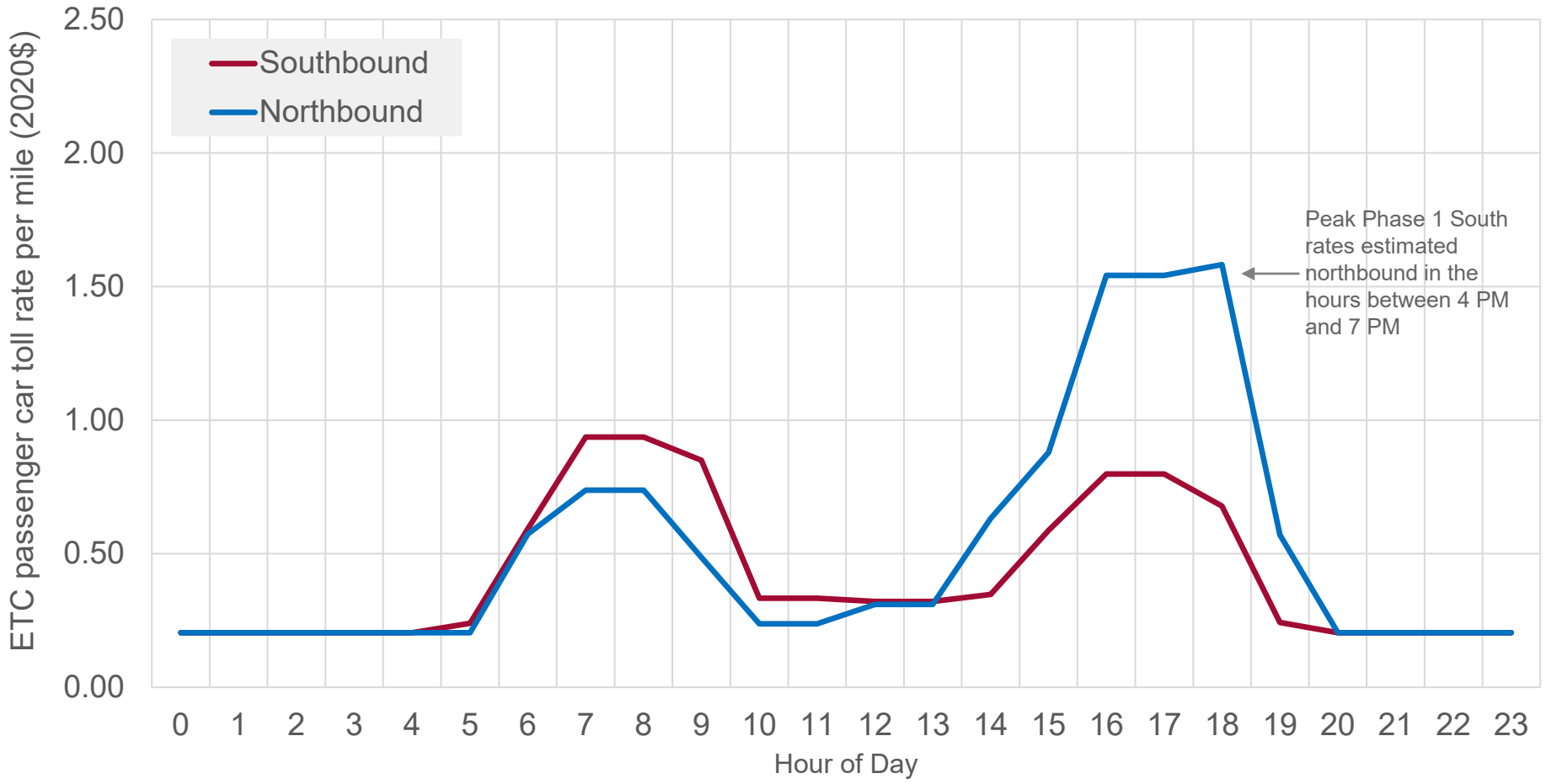
Northbound gantry on I-270 south of Wootton Pkwy from Phase 1 South (ALB to I-370) Equity Case 2025 Traffic and Revenue Model, PC ETC toll rate shown

Dynamic pricing overview (Continued)

- The current price to a few major destinations is displayed on electronic signs prior to entrance to the managed lanes. Example: VA I-495 near initial southbound entrance.
- Customers will be charged the toll displayed when entering the managed lanes even if the per mileage toll rate at the gantries increases/decreases to adjust for traffic.
- When customers drive distances beyond the displayed toll rates, additional toll rates will be displayed for customers to choose to continue using the managed lanes or exit.

Estimated average rates throughout a day (2025 model)

Figure 3: Phase 1 South (ALB to I-370) Avg. Toll Rates by Time of Day



Estimated Hourly Average Per Mile Toll Rates Per Trip from Phase 1 South (ALB to I-370) Equity Case 2025 Traffic and Revenue Model

See Appendix for conversion to estimated toll paid by customers per trip

Toll rate range

- The MDTA Board, through a public process outlined in COMAR, is required to establish the toll rate range (minimum and maximum per mile).
- Customers can be charged any toll rate at any gantry within the established toll rate range.
- Focusing solely on the commercial and technical objectives of the P3 Program, the toll rate range should be set to provide developers with adequate flexibility to select toll rates as necessary to manage congestion and achieve the commercial objectives of the program.
- Attaching escalation factors to the toll rate range is legally permissible provided the communication to potential customers is clear.
- In order to reduce risk to the developer and MDTA a toll rate range, consisting of a minimum, a maximum and any associated escalation rates consisting of inflation, plus an escalation rate that reflects real growth is recommended.
- The approved toll rate range and escalation rates provided to developers should provide flexibility to set dynamic pricing algorithms to meet goals.
- The maximum toll rate in any given year would be calculated as follows:

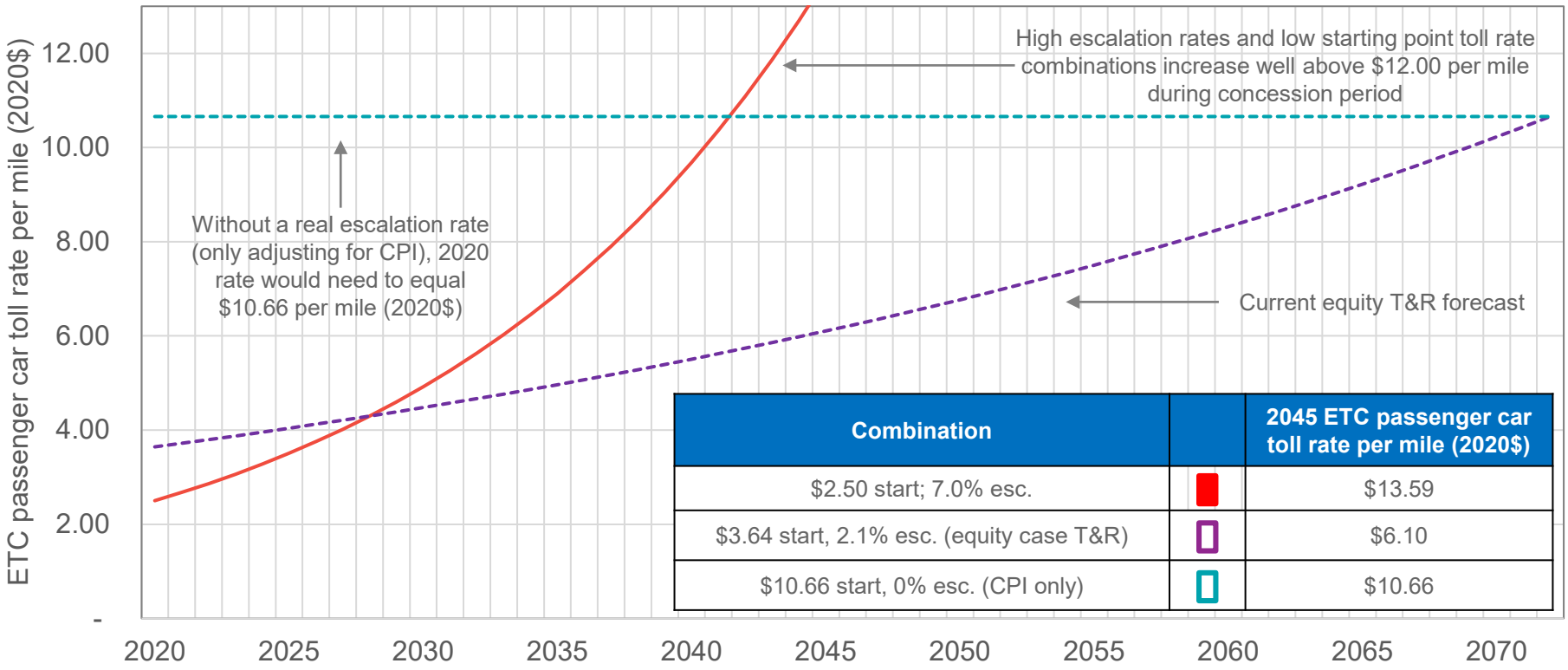
$$Rate_x = Rate_{2020} * (1 + Esc)^{(x - 2020)} * CPI_x / CPI_{2020}$$

Where: $Rate_x$ = maximum toll rate in year x
$Rate_{2020}$ = maximum toll rate established in the 2020 toll setting
Esc = real growth escalation rate established in the 2020 toll setting
CPI_x = consumer price index in year x
CPI_{2020} = consumer price index in 2020

Maximum in toll rate range

- Ideally, the maximum in the toll rate range and real escalation rate combination should be set at a level developers may rely on for the life of the agreement.
- The initial maximum and real escalation factor chosen significantly affects the slope of the toll rate range values.

Figure 4: Time series of 2020 toll rates and real escalation rates



Combination		2045 ETC passenger car toll rate per mile (2020$)
$2.50 start; 7.0% esc.		$13.59
$3.64 start, 2.1% esc. (equity case T&R)		$6.10
$10.66 start, 0% esc. (CPI only)		$10.66

Note: equity case T&R forecast assumes Alternative 9 configuration; other alternatives are under consideration in the NEPA process; figures presented in 2020$ and assume additional CPI-based escalation as referred to in Page 5 equation

Minimum in toll rate range

- MDTA should set a minimum in the toll rate range that will at least equal the back office costs incurred to collect tolls:

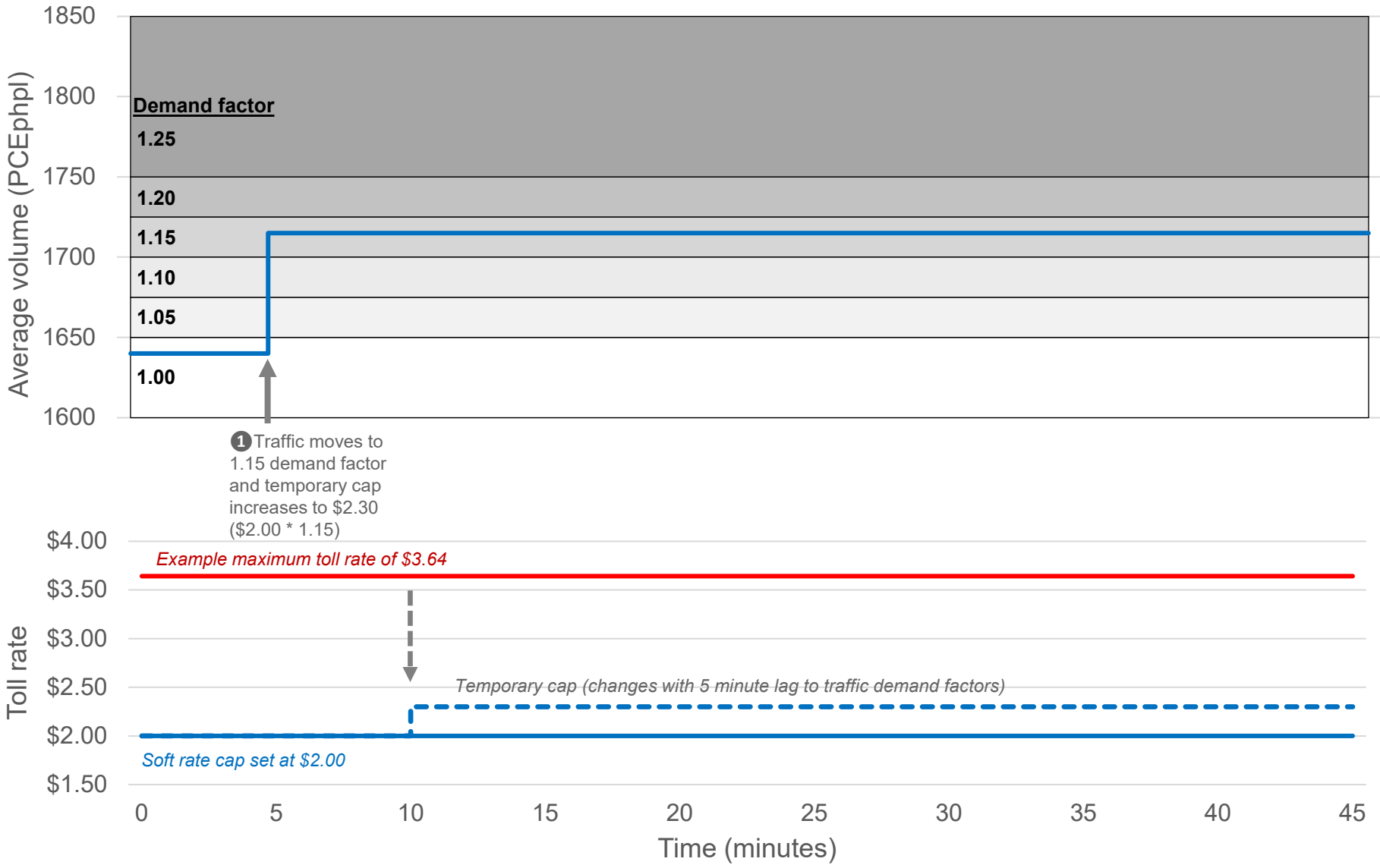
Minimum Toll – Back Office Costs ≥ 0

  - Minimum end of the toll rate range should include both a minimum toll rate per mile and a per trip minimum charge to account for shorter trips.
  - Minimum toll per trip should be increased annually with inflation to cover potential increases in back office costs incurred by MDTA.
  - If MDTA chooses, the minimum toll may be reviewed after a reasonable period of performance to determine whether back office processes have increased or decreased in volume or efficiency, and whether an annual increase remains necessary.

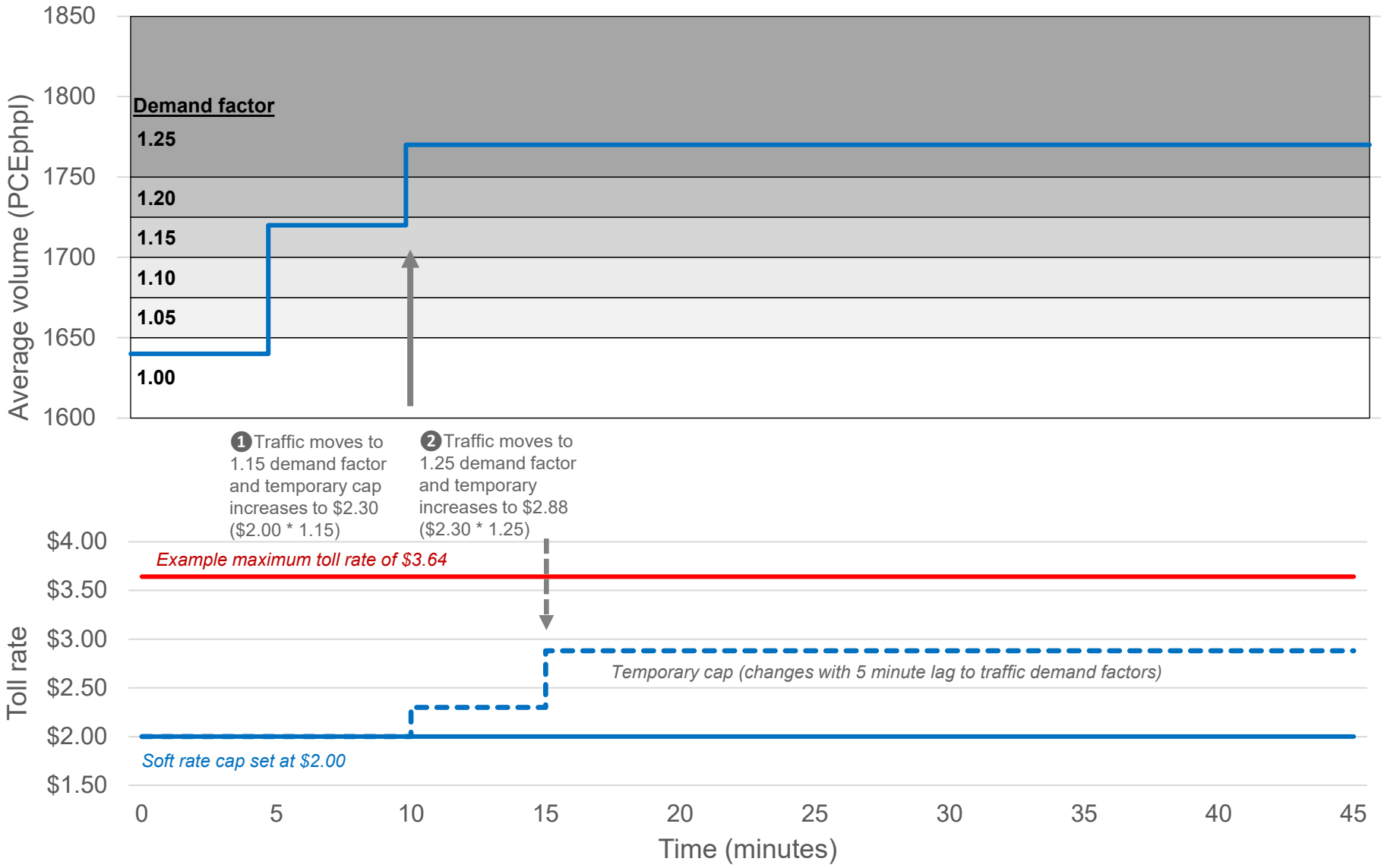
Soft rate cap

- This topic is presented for your consideration and future decision
- Soft rate cap parameters (performance criteria, triggers and demand factors) would be set by the Executive Director in accordance with the pending COMAR changes. The soft rate cap should be disclosed to the developer to allow them to properly forecast traffic and revenue.
- Similar to maximum toll rates, different combinations of 2020 soft rate cap and escalation factors would be possible to achieve similar outcomes, based on achieving P3 Program goals.
- Triggers should be set to allow the developer to temporarily set rates above soft rate cap, based on performance criteria including volumes and/or speeds that would be converted to rate adjustments according to a set of demand factors.
- Subsequent rate increases above the soft rate cap should be allowed on a timed interval if performance criteria are still not being met.
- Rates should be required to return below the soft rate cap after performance criteria have improved.

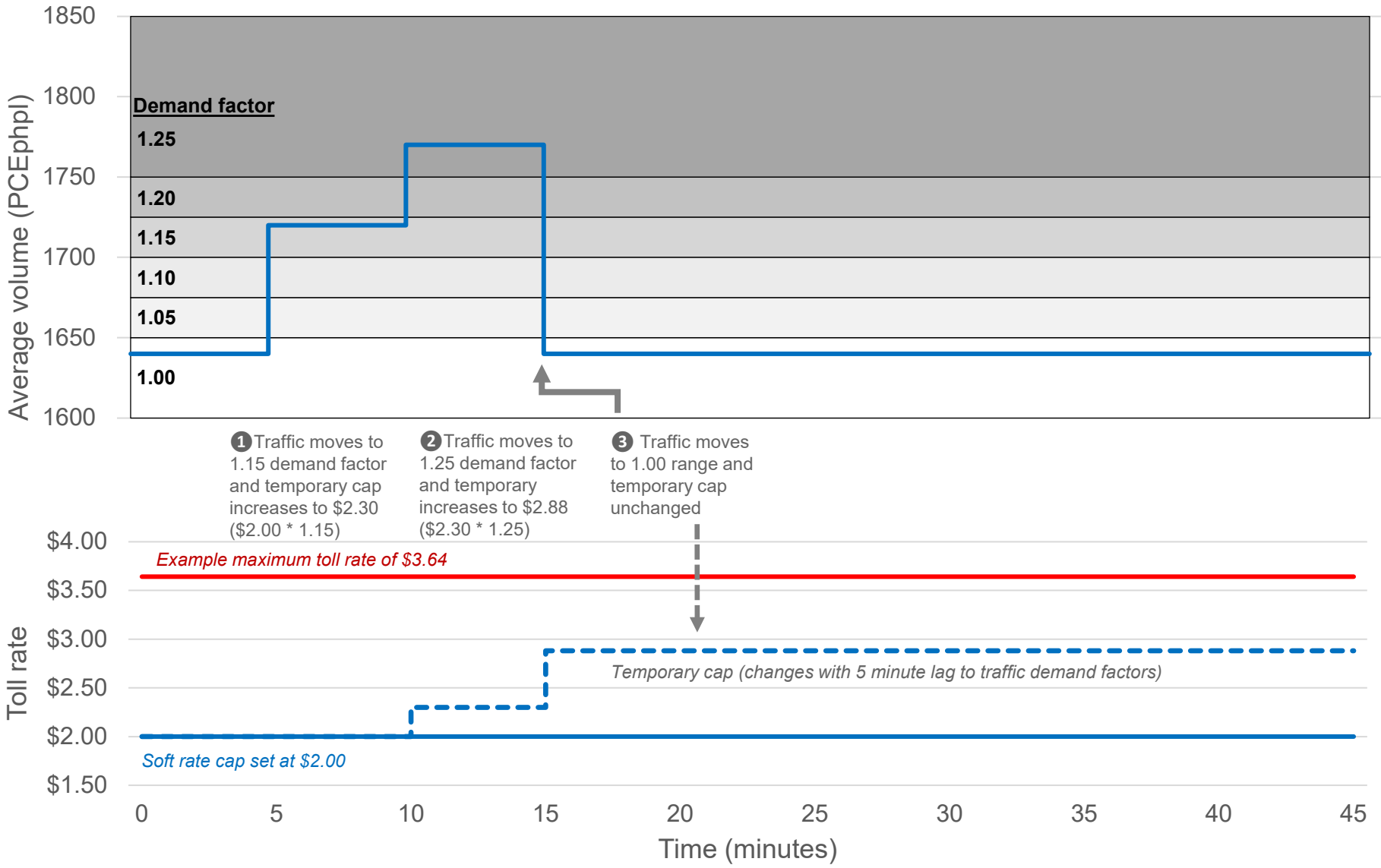
Soft rate cap example: step 1



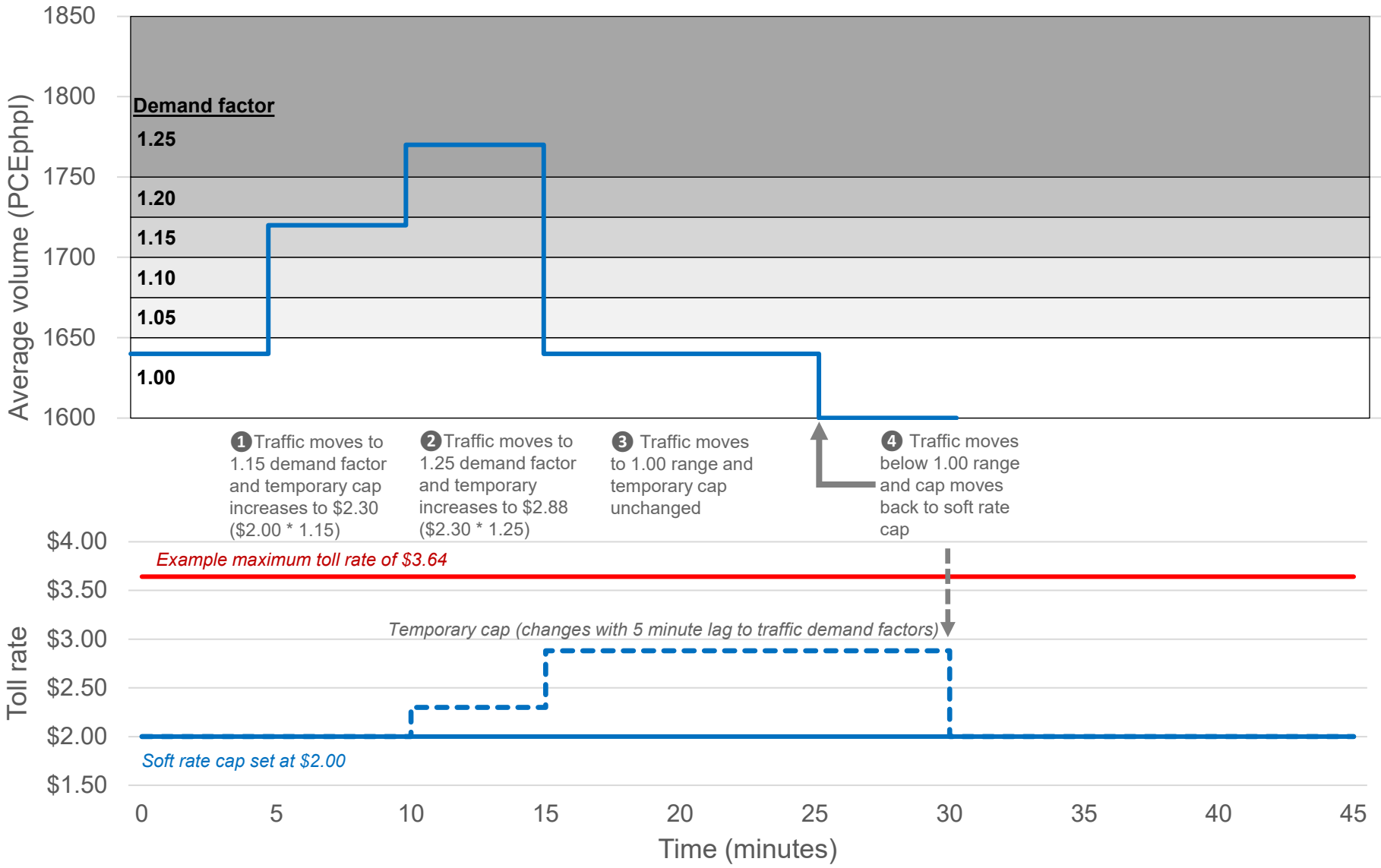
Soft rate cap example: step 2



Soft rate cap example: step 3



Soft rate cap example: step 4



Next Steps

- Adjust specific range and soft rate cap recommendations as forecasts change
- Adjust recommendations as Recommended Preferred Alternative is identified

Appendix

(Appendix) Estimated Average Toll Rates

- From traffic and revenue estimates from Phase 1 south (ALB to I-370), Equity case

Year	NB / SB	5-6 AM	6-7 AM	7-9 AM	9-10 AM	10 AM-12 PM	12-2 PM	2-3 PM	3-4 PM	4-6 PM	6-7 PM	7-8 PM	8 PM-12 AM	12-5 AM	Daily Avg.
Average Trip Length (miles)															
2025	NB	5.57	6.00	5.76	5.79	6.75	6.68	6.51	6.81	7.03	7.34	7.10	6.12	2.42	6.63
	SB	8.43	7.41	7.15	6.82	7.18	6.63	6.13	6.28	6.55	6.61	7.02	4.97	3.52	6.86
2045	NB	6.34	6.54	5.86	6.06	6.88	6.76	6.67	7.17	7.32	7.75	7.22	6.89	2.96	6.84
	SB	8.43	7.71	7.29	6.95	7.41	6.94	6.31	6.29	6.67	6.99	7.48	5.55	4.00	7.02
Average Toll Paid Per Trip (2020$)															
2025	NB	1.14	3.44	4.25	2.82	1.60	2.07	4.11	5.98	10.83	11.61	4.05	1.25	0.49	4.96
	SB	2.02	4.39	6.70	5.79	2.39	2.13	2.13	3.69	5.23	4.49	1.71	1.01	0.72	3.94
2045	NB	1.29	4.73	6.40	3.89	2.70	2.84	7.31	12.34	20.07	20.70	7.01	2.28	0.60	8.48
	SB	2.86	8.41	13.09	9.68	4.47	3.37	3.73	5.83	8.47	8.13	2.98	1.13	0.82	6.85
Average Toll Paid Per Trip Per Mile (2020$)															
2025	NB	0.20	0.57	0.74	0.49	0.24	0.31	0.63	0.88	1.54	1.58	0.57	0.20	0.20	0.75
	SB	0.24	0.59	0.94	0.85	0.33	0.32	0.35	0.59	0.80	0.68	0.24	0.20	0.20	0.57
2045	NB	0.20	0.72	1.09	0.64	0.39	0.42	1.10	1.72	2.74	2.67	0.97	0.33	0.20	1.24
	SB	0.34	1.09	1.80	1.39	0.60	0.49	0.59	0.93	1.27	1.16	0.40	0.20	0.20	0.98

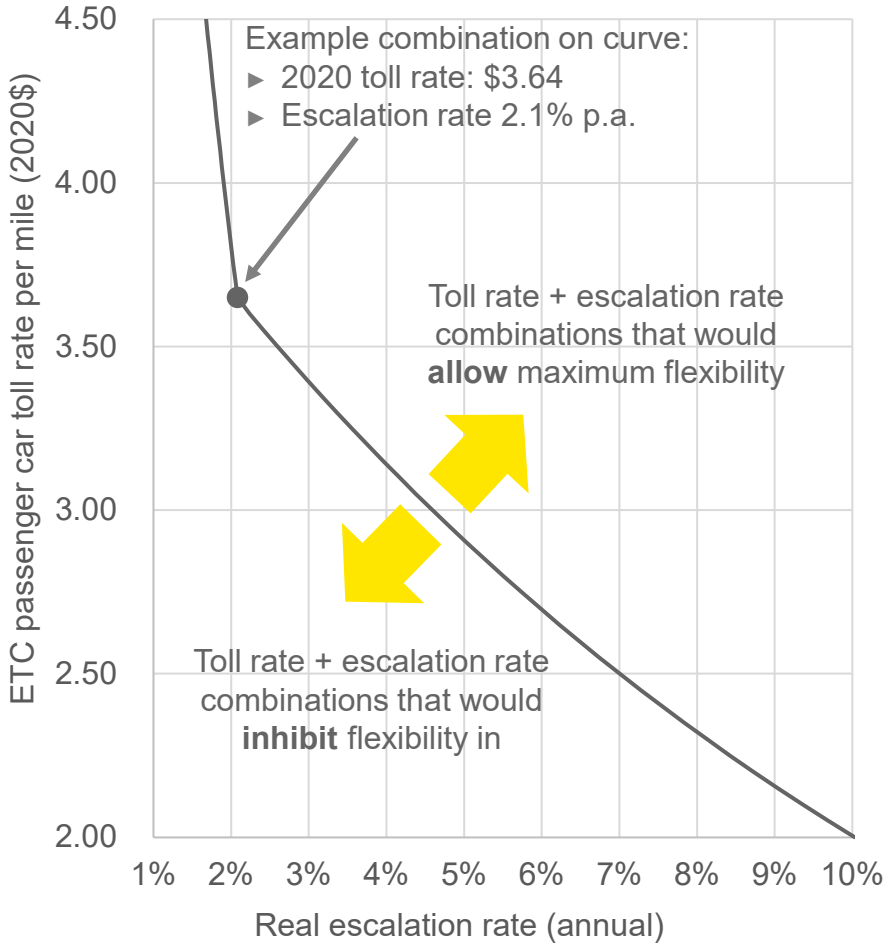
Note: 2% inflation assumed to convert 2019$ model results to 2020$

(Appendix) Maximum toll rate options

2020 Toll rate + real growth escalation rate combination options

- To allow for maximum flexibility, MDTA can set toll rate ranges that have a combination of 2020 toll rate and real growth escalation rate that meet the Phase 1 south (GW Parkway to I-370) Level III equity case forecast toll rates.
- MDTA could set this combination along the curve in Figure 2 and accommodate these forecast rates.
- A combination set outside of the curve in Figure 2 would allow for adequate developer flexibility, while a combination set inside the curve would limit developer flexibility and invite compensation events without subsequent rate setting hearings (i.e., fail to deliver project at zero net cost).

Figure A1: Rate combinations



Note: assumes 2028 as first year of tolling service

(Appendix) Maximum toll rate escalation calculation

- The maximum toll rate in the range would include an escalation rate consisting of inflation (measured by changes in regional consumer price index) plus an escalation rate that reflects real growth. The maximum toll rate in any given year would be calculated as follows:

$$Rate_x = Rate_{2020} * (1 + Esc)^{(x - 2020)} * CPI_x / CPI_{2020}$$

Where:

$Rate_x$ = maximum toll rate in year x
$Rate_{2020}$ = maximum toll rate established in the 2020 toll setting
Esc = real growth escalation rate established in the 2020 toll setting
CPI_x = consumer price index in year x
CPI_{2020} = consumer price index in 2020

(Appendix) Soft rate cap

Recommendations:

- The soft rate cap considered is $2.00 (2020 passenger car ETC rate in 2020$) to be increased annually based on the same inflation and real growth escalation rates as the maximum toll rates.
- Similar to the maximum toll rates, different combinations of 2020 soft rate cap and escalation factors would be possible to achieve similar outcomes, based on achieving P3 Program goals.
- Triggers should be set to allow the Developer to temporarily set rates above soft rate cap, based on performance criteria including volumes and/or speeds.
  - As a starting point, this analysis considers a threshold of 1,650 passenger car equivalent vehicles per hour per lane (PCEphpl) to allow temporary increases to toll rates above the soft rate cap to manage demand. 1,650 is a sustainable maximum flow on a managed lane considering the time interval required to raise the soft rate cap to manage demand.
  - The time interval for exceeding the soft rate cap should be no more frequent than once every 5 minutes to ensure rates can increase in response to traffic levels, and the allowed increase above soft rate cap should be controlled by specific demand factors for observed levels of traffic in excess of the threshold.
  - Rates should be required to return below the soft rate cap as traffic volumes decrease in accordance with specific demand factors.

(Appendix) Soft rate cap revenue and travel time impacts

- Potential revenue and travel time impacts of different soft rate caps for Phase 1 south

Year		Soft rate cap (2020 rates/mile in 2020$ assuming 2.1% annual real growth escalation) Using threshold of 1,650 PCE vehicles per hour per lane				
		No soft rate cap	**$2.00**	**$1.50**	**$1.00**	**$0.75**
2025	% Revenue Impact vs. No soft rate cap	n/a	0.0%	-1.1%	-3.8%	-4.5%
	Example Travel Time Impact vs. No soft rate cap (PM peak in minutes)[1]	n/a	0.0	-0.6	-1.9	-2.0
2045	% Revenue Impact vs. No soft rate cap	n/a	0.0%	0.0%	-1.3%	-1.9%
	Example Travel Time Impact vs. No soft rate cap (PM peak in minutes)[1]	n/a	0.0	0.0	-0.4	-0.4

[1]Estimated change in general purpose lane travel time for full-length Phase 1 trips (about 12.9 miles) for the northbound travel direction in the 4-6 PM time period. Estimated changes are taken from the traffic and revenue model.

Note:

- *Results shown are estimated using interpolation or extrapolation of various soft rate cap tests in the Phase 1 south equity case T&R model*
- *2% inflation assumed to convert 2019$ model results to 2020$*

(Appendix) Frequency of exceeding soft rate cap

Share of project[1] and number of hours exceeding the soft rate cap

- Model results estimate average weekday conditions. Thus, exceeding the soft rate cap in the model would translate into exceeding the base soft rate cap in at least 50% of estimated weekdays.
- Results indicate a soft rate cap set in the range of $2.00 per mile (2020$) with 2.1% annual real escalation would satisfy a significant majority of anticipated traffic conditions (see below).

Year		Soft rate cap (2020 rates/mile in 2020$ assuming 2.1% annual real growth escalation) Using threshold of 1,650 PCE vehicles per hour per lane				
		No soft rate cap	$2.00	$1.50	$1.00	$0.75
2025	Share of project exceeding soft rate cap - peak hour[1]	n/a	0%	8%	22%	30%
	Hours per day exceeding soft rate cap in at least one gantry	n/a	0	2	3	5
2045	Share of project exceeding soft rate cap - peak hour[1]	n/a	8%	22%	30%	38%
	Hours per day exceeding soft rate cap in at least one gantry	n/a	2	3	5	6

[1]Share of project calculated by dividing the total number of miles of segments exceeding the soft rate cap by the total mileage of Phase 1 south (about 16.5 miles per direction times two directions equals about 33 miles) in the time period with the most gantries exceeding the soft rate cap.

Note:

- *Results shown are estimated based on various soft rate cap tests in the Phase 1 south equity case T&R model*
- *2% inflation assumed to convert 2019$ model results to 2020$*

(Appendix) Example soft rate cap North Tarrant Expressway Seg. 1 and 2 (TX)

- **$Rate_{Year} = \$0.75 * CPI_{Dec.\ Year-1} / CPI_{Dec.\ 2008}$**
  Where:

  $Rate_{Year}$ = Base Toll Rate Cap (soft rate cap) in year x
  $0.75 per mile = Base Toll Rate Cap for SOVs and non-discounted HOVs as of concession agreement in 2009
  $CPI_{Dec.\ Year-1}$ = consumer price index in Dec. of the prev. year from year x
  $CPI_{Dec.\ 2008}$ = consumer price index in Dec. 2008
- Note that TxDOT does not apply a maximum toll rate restriction on North Tarrant Expressway.
- Base Toll Rates are updated at most once every five minutes to increase or decline from the Base Toll Rate Cap (or most recent Base Toll Rates) by a Demand Factor.
- Feedback from TXDOT on soft rate cap received via email:
  - *"The long and short is that it works and we've not had major interpretation issues, mainly PR issues"*
  - *"Any new contract should be written so that the prices come down a lot faster than ours allow. It takes too long."*

  TXDOT feedback needs to be balanced with our project objectives.
- The more recent SH 288 concession in TX uses the greater of (a) 3% annually or (b) ratio of GSP per capita for year x and 2012 instead of consumer price index for annual escalation of the soft rate cap.

(Appendix) 2020 per mile toll rates for consideration (2020$)

- Maximum toll and soft rate cap would be subject to annual real growth escalation and inflation escalation

Vehicle type	Payment type	Minimum toll	Soft rate cap	Maximum toll	Notes
Passenger Car (2-axle)	ETC	$0.20	$2.00	$3.64	Minimum toll also subject to per trip minimum
Motorcycle[1]		$0.10	$1.00	$1.82	
3-axle Light		$0.30	$3.00	$5.46	
3-axle Heavy		$0.40	$4.00	$7.28	
4-axle Light		$0.50	$5.00	$9.10	
4-axle Heavy		$0.60	$6.00	$10.92	
5-axle		$1.20	$12.00	$21.84	
6+-axle		$1.50	$15.00	$27.30	
Passenger Car (2-axle)	Unregistered Video	$0.30	$3.00	$5.46	Minimum toll also subject to per trip minimum; Unregistered Video toll rates capped at a maximum $15 surcharge (real dollars) vs. ETC.
Motorcycle[1]		$0.15	$1.50	$2.73	
3-axle Light		$0.45	$4.50	$8.19	
3-axle Heavy		$0.60	$6.00	$10.92	
4-axle Light		$0.75	$7.50	$13.65	
4-axle Heavy		$0.90	$9.00	$16.38	
5-axle		$1.80	$18.00	$32.76	
6+-axle		$2.25	$22.50	$40.95	

[1]*Project alternatives that include HOV3+ free travel on the managed lanes also assume motorcycles would also travel for free*