Simulating the Effects of a Short-Term Closure of the American Legion Bridge on Regional Travel

A Hypothetic Scenario Analysis using MWCOG's Gen3 Travel Demand Model

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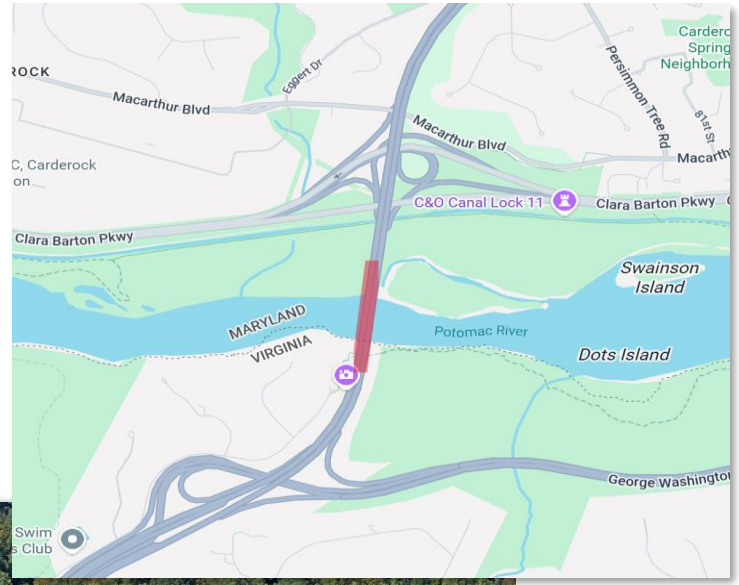
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INTRODUCTION

- Hypothetical closure of the **American Legion Bridge on the Capital Beltway (I-495),** a critical stretch of roadway linking **Fairfax County, VA** and **Montgomery County, MD**

- Main objective is to test and simulate a **short-term network disruption**, as part of the usability testing in ensuring Gen3's readiness for regional planning and resilience studies

- **Geographies studied:** TPB Modeled Region, Montgomery County, Fairfax County





REGIONAL CONTEXT + QUESTIONS

Many cross-jurisdictional trips dependent on driving, with the Fairfax Connector Bus route 798 the only direct transit route linking the two counties. Hence, travel between Fairfax and Montgomery is heavily reliant on the bridge.

Will residents in both counties change the destinations of their activities in response to the bridge closure: discretionary activities? workplace/school locations?

Montgomery County residents often use the bridge to bypass surface arterials in DC by accessing the George Washington Parkway on the Viriginia side of the Potomac River.

With this access point removed, will Montgomery County residents be more adversely affected by such a closure? How will this affect traffic on the DC/MD side of the Potomac River? Will Montgomery County residents switch to alternate modes of transport?

SCENARIOS + MODEL RUNS

GEN 3 ACTIVITY-BASED MODEL

- 2025 Baseline
- Long-Term Bridge Closure (LT)
- Short-Term Bridge Closure, with Flexible Telecommuting (ST Flex)
- Short-Term Bridge Closure, with Fixed Telecommuting (ST Fixed)

GEN 2 TRIP-BASED MODEL

- 2025 Baseline
- Long-Term Bridge Closure (LT)
- Short-Term Bridge Closure (ST)

SCENARIOS + MODEL RUNS

GEN 3 ACTIVITY-BASED MODEL

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*Because ABMs explicitly model choices at a disaggregate level, **telecommuting behavior (and other more granular travel choices) can be inferred upon.** We can also better control which sub-models to "freeze" by **differentiating between long-term versus short-term choices to set up the ST scenarios.***

GEN 2 TRIP-BASED MODEL

- 2025 Baseline
- Long-Term Bridge Closure
- Short-Term Bridge Closure

*To simulate a ST closure, we must **freeze the HBW table generated under the baseline scenario and copy it over into the ST scenario directory.** All other trip distribution tables are calculated as is.*

GEN 3 LONG TERM SCENARIO SETUP

- **Modify the highway network/transit specifications** to reflect the bridge closure

- Run the ActivitySim model on those changes. **No need to change the ActivitySim configs themselves**.

- We need to **re-evaluate all choices with the bridge closure in place**, including simulating the **changes in workplace/school locations** assuming individuals are aware that the bridge closure is permanent.

GEN 3 SHORT TERM SCENARIO SETUP

Long-Term "Frozen" Choices

- School/Workplace Locations
- Mobility Choices
- Telecommute Behavior**

Short-Term Choices

- Telecommute Behavior**
- Coordinated Daily Activity Pattern
- Tour/Trip-level Choices

GEN 3 SHORT TERM SCENARIO SETUP

Long-Term "Frozen" Choices

- School/Workplace Locations
- Mobility Choices
- Telecommute Behavior**

These sub-model outputs are **recycled** from the baseline run via their **pipeline files**.

Short-Term Choices

- Telecommute Behavior**
- Coordinated Daily Activity Pattern
- Tour/Trip-level Choices

These sub-models are **re-evaluated with the network change** (the elimination of the bridge links) taken into effect.

GEN 3 SHORT TERM SETUP

Long-Term "Frozen" Choices

- School/Workplace Locations
- Mobility Choices
- Telecommute Behavior**

Short-Term Choices

- Telecommute Behavior**
- Coordinated Daily Activity Pattern
- Tour/Trip-level Choices

The **ST Fixed scenario assumes telecommute_frequency to be a long-term choice, while the **ST Flex scenario** assumes telecommute_frequency to be a short-term choice

ANALYSES

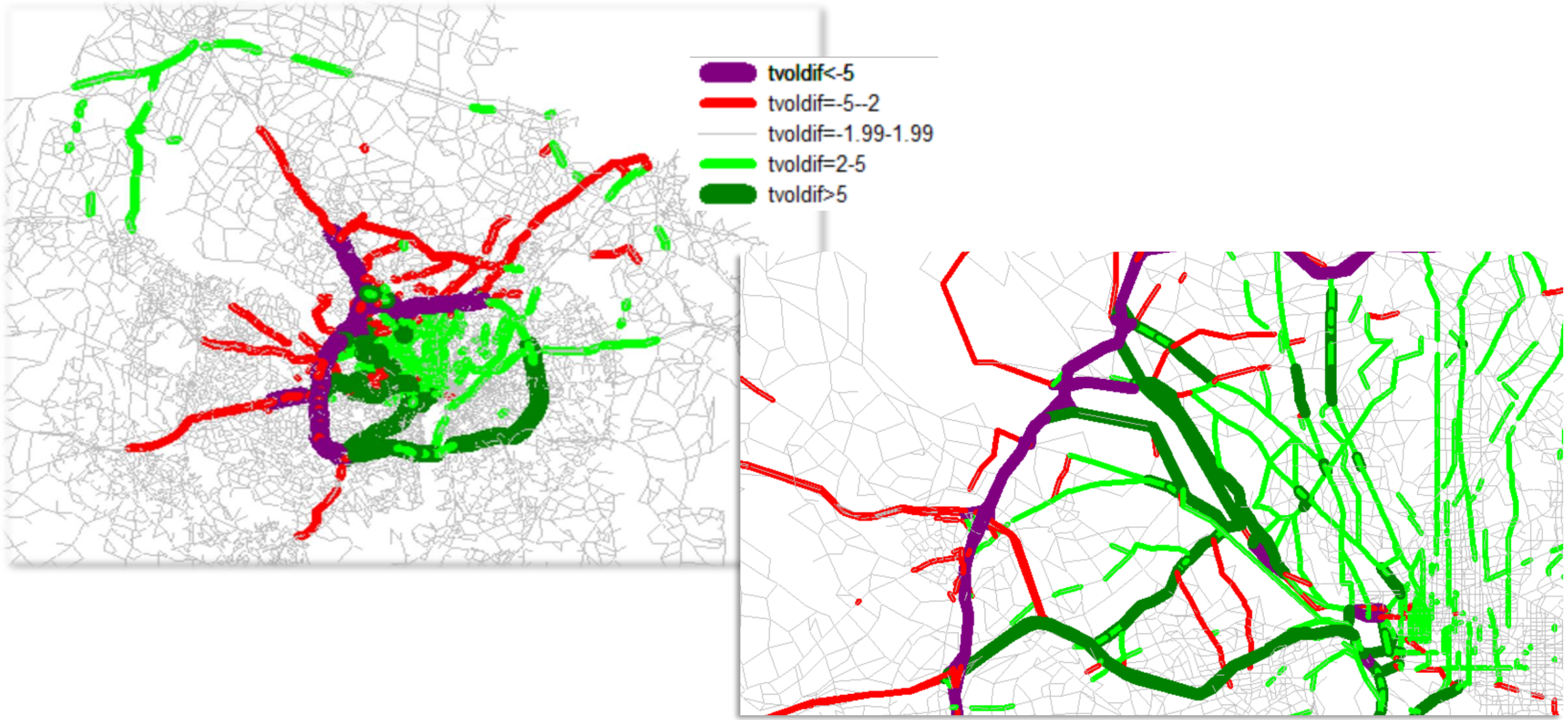
- Measuring the systemwide travel impacts for the TPB Modeled Region and Fairfax/Montgomery Counties under the **LT and ST scenarios**, relative to the 2025 Baseline scenario.

- Performing **sensitivity tests on freezing and unfreezing telecommuting** under a ST scenario.

- A **comparison of Gen3 model outputs to Gen2** in the ST and LT scenarios to evaluate the reasonableness of the responses of an ABM in modeling a network disruption.

- A **disaggregate analysis** of output school/workplace locations and tour behavior [IN PROGRESS].

DAILY TRAFFIC VOLUME DIFFERENCE PLOTS (in 000s): ST Flex minus Baseline



GEN3 JURISDICTION-LEVEL O/D TRIP DIFFERENCES

Long-Term Closure (LT) minus Baseline

Work Trips *(work)*

Orig. ↓ Dest. →	MTG	FFX	DC CR	ARLCR	Total
MTG	+10,983	-12,361	-859	+324	-1,913
FFX	-12,885	+11,797	-118	+69	-1,137
DC CR	-369	+86	-509	-359	-1,151
ARLCR	+290	+45	-446	+93	-18
Total	-1,981	-433	-1,932	+127	-4,219

All-Purpose Trips *(all purposes combined)*

Orig. ↓ Dest. →	MTG	FFX	DC CR	ARLCR	Total
MTG	+19,874	-19,924	-2,105	+364	-1,791
FFX	-20,433	+18,429	-241	-166	-2,411
DC CR	-1,619	-30	-867	-805	-3,321
ARLCR	+384	-9	-1,055	+740	+60
Total	-1,794	-1,534	-4,268	+133	-7,463

Discretionary Trips *(eatout + social + othdiscr)*

Orig. ↓ Dest. →	MTG	FFX	DC CR	ARLCR	Total
MTG	+2,926	-1,671	-350	-37	+868
FFX	-1,603	+2,675	-189	-36	+847
DC CR	-383	-134	-240	-162	-919
ARLCR	-29	+12	-165	+214	+32
Total	+911	+882	-944	-21	+828

Short-Term Closure (ST Flex) minus Baseline

Work Trips *(work)*

Orig. ↓ Dest. →	MTG	FFX	DC CR	ARLCR	Total
MTG	-1,512	-3,122	-214	+77	-4,771
FFX	-3,762	-1,368	+681	+90	-4,359
DC CR	-64	+916	+384	-205	+1,031
ARLCR	+118	+11	-216	+155	+68
Total	-5,220	-3,563	+635	+117	-8,031

All-Purpose Trips *(all purposes combined)*

Orig. ↓ Dest. →	MTG	FFX	DC CR	ARLCR	Total
MTG	+11,024	-9,334	-1,445	-98	+147
FFX	-10,025	+6,387	+299	-24	-3,363
DC CR	-1,487	+612	+1,355	-573	-93
ARLCR	+55	-30	-801	+391	-385
Total	-433	-2,365	-592	-304	-3,694

Discretionary Trips *(eatout + social + othdiscr)*

Orig. ↓ Dest. →	MTG	FFX	DC CR	ARLCR	Total
MTG	+4,516	-1,789	-450	-103	+2,174
FFX	-1,733	+3,125	-255	-51	+1,086
DC CR	-517	-142	+81	-93	-671
ARLCR	-54	-6	-147	+91	-116
Total	+2,212	+1,188	-771	-156	+2,473

Fewer trips than Baseline More trips than Baseline Darker = larger change (same scale for LT and ST Flex within each trip type). Bold diagonal = trips within the same jurisdiction.

[GEN 3] TRIPS BY TRIP MODE (Auto and Transit Sub-modes)

		Scenario				Percent Change		
REGION	VARIABLE	B	LT	ST (Flex Telecommute)	ST (Fixed Telecommute)	LT / B	ST Flex / B	ST Fixed / B
TPB	AUTO SOV	10,737,000	10,716,000	10,710,000	10,710,000	-0.2%	-0.3%	-0.2%
	AUTO HOV2	5,344,000	5,328,000	5,330,000	5,330,000	-0.3%	-0.3%	-0.3%
	AUTO HOV3+	3,368,000	3,359,000	3,360,000	3,361,000	-0.3%	-0.2%	-0.2%
	WALK-TRANSIT	**780,000**	**790,000**	**797,000**	**798,000**	**1.3%**	**2.3%**	**2.3%**
	PNR-TRANSIT	**205,000**	**213,000**	**216,000**	**216,000**	**4.0%**	**5.5%**	**5.4%**
	KNR-TRANSIT	**57,000**	**58,000**	**59,000**	**59,000**	**2.5%**	**3.5%**	**3.4%**
MTG	AUTO SOV	1,458,000	1,451,000	1,450,000	1,450,000	-0.5%	-0.6%	-0.6%
	AUTO HOV2	756,000	751,000	751,000	751,000	-0.6%	-0.6%	-0.6%
	AUTO HOV3+	474,000	473,000	473,000	473,000	-0.3%	-0.2%	-0.2%
	WALK-TRANSIT	**121,000**	**125,000**	**126,000**	**126,000**	**3.0%**	**4.0%**	**4.1%**
	PNR-TRANSIT	**34,000**	**36,000**	**37,000**	**37,000**	**6.3%**	**10.0%**	**10.0%**
	KNR-TRANSIT	**10,000**	**11,000**	**11,000**	**11,000**	**7.4%**	**10.9%**	**10.4%**
FFX	AUTO SOV	1,815,000	1,814,000	1,811,000	1,811,000	0.0%	-0.2%	-0.2%
	AUTO HOV2	870,000	866,000	868,000	868,000	-0.5%	-0.3%	-0.3%
	AUTO HOV3+	552,000	550,000	551,000	551,000	-0.3%	-0.2%	-0.1%
	WALK-TRANSIT	**73,000**	**73,000**	**74,000**	**74,000**	**0.5%**	**1.6%**	**1.8%**
	PNR-TRANSIT	**48,000**	**50,000**	**51,000**	**51,000**	**3.7%**	**5.9%**	**5.8%**
	KNR-TRANSIT	**9,000**	**9,000**	**10,000**	**10,000**	**2.7%**	**5.2%**	**5.3%**

There seems to be a pronounced increase in transit trips (across all sub-modes) due to the bridge closure, regardless of magnitude. **Montgomery County (MTG)** is particularly of note here (~+10% for PNR/KNR+transit trips). Auto usage is on a slight decline, in terms of the number of trips performed.

[GEN 3] NUM. WORKERS BY TELECOMMUTE FREQUENCY

		SCENARIOS				Percent Change		
REGION	VARIABLE	B	LT	ST (Flex Telecommute)	ST (Fixed Telecommute)	LT / B	ST Flex / B	ST Fixed / B
TPB REGION	1 DAY	359,000	358,000	360,000	359,000	-0.2%	0.3%	0.0%
	2-3 DAYS	**250,000**	**249,000**	**251,000**	**250,000**	**-0.2%**	**0.7%**	0.0%
	4+ DAYS	119,000	119,000	119,000	119,000	0.0%	0.0%	0.0%
	NO TELECOMMUTE	3,174,000	3,175,000	3,171,000	3,174,000	0.0%	-0.1%	0.0%
MTG	1 DAY	46,000	46,000	46,000	46,000	-0.3%	0.6%	0.0%
	2-3 DAYS	**31,000**	**31,000**	**31,000**	**31,000**	**0.0%**	**1.6%**	0.0%
	4+ DAYS	16,000	16,000	16,000	16,000	-0.2%	0.1%	0.0%
	NO TELECOMMUTE	442,000	442,000	442,000	442,000	0.0%	-0.2%	0.0%
FFX	1 DAY	55,000	55,000	55,000	55,000	-0.6%	0.3%	0.0%
	2-3 DAYS	**35,000**	**35,000**	**36,000**	**35,000**	**-0.3%**	**0.6%**	0.0%
	4+ DAYS	19,000	19,000	19,000	19,000	-0.1%	0.0%	0.0%
	NO TELECOMMUTE	512,000	512,000	511,000	512,000	0.1%	-0.1%	0.0%

Increased telecommute frequencies when commuters/employers adjust to the bridge closure **under a short-term scenario (ST Flex).** Note that the total number of workers who telecommute at least once a week is probably **not reflective of post-COVID reality**, as this sub-model was estimated based on the **2018 Regional Travel Survey.**

OVERVIEW STATISTICS: GEN 2 vs GEN 3

		SCENARIOS			Percent Change	
MODEL	VARIABLE	B	LT	ST	LT / B	ST / B
GEN2	VMT	176,451,000	175,009,000	175,949,000	-0.8%	-0.3%
	VHD	1,357,000	1,375,000	1,438,000	1.3%	5.9%
GEN3	VMT	175,660,000	174,388,000	174,882,000	-0.7%	-0.4%
	VHD	1,766,000	1,795,000	1,803,000	1.6%	2.1%

Slight decrease in VMTs with an increase in VHD under any bridge closure scenario, though VHD is notably higher under a short-term disruption.

OVERVIEW STATISTICS: GEN 2 vs GEN 3

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	VHD	1,357,000	1,375,000	1,438,000	1.3%	5.9%
GEN3	VMT	175,660,000	174,388,000	174,882,000	-0.7%	-0.4%
	VHD	1,766,000	1,795,000	1,803,000	1.6%	2.1%

It appears that **the Gen 3 model is a little bit more conservative** in terms of estimating ST impact on regionwide VHD, at least compared to Gen 2.

NOTABLE FINDINGS

- More congestion, hence, more work-related trips occurring during **fringe hours of the day (especially in the early morning, NT1)**
- **Transit boardings are up** across all scenarios (+2% under LT, +4% under ST), across the entire modeled region
- **Increased congestion along surface arterials around Inner-Beltway suburbs**, particularly on the MD side of the Potomac River. Outer Beltway suburbs on both sides of the river see less traffic under both bridge closure scenarios.
- **More frequent, internal jurisdiction trips** under a long-term scenario, regardless of trip purpose.
- Allowing telecommuting under a short-term disruption (ST Flex) **yields a collective -0.04% reduction in VMTs across the region** compared to a frozen scenario (ST Fixed)
- Gen3 model sensitivities **largely agree with Gen2** at the aggregate level

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