



MEMORANDUM

FROM: JOSEPH BLASI, HNTB

TO: CITY OF KANSAS CITY

SUBJECT: TRAFFIC ANALYSIS & ASSUMPTIONS OF TRUMAN RD

DATE: SEPTEMBER 6, 2024

Introduction

The purpose of this memo is to summarize the traffic analysis performed on Truman Rd from Baltimore Ave to Grand Blvd (approximately 0.30 miles) in Kansas City, Missouri. The study evaluates existing conditions, 2050 No-Build conditions, and 2050 build conditions for several alternatives. These findings will be used as input into the determination of a preferred alternative for the South Loop Project. The analysis was conducted in two levels. Level one analysis used Vistro software to initially look at a large number of alternatives (26). With feedback from KCMO and other project disciplines, the level two analysis used Synchro/SimTraffic software to analyze eight alternatives that advanced in the screening process.

Project Study Area

The project study area includes seven signalized intersection and one all-way stop controlled (AWSC) intersection at S Truman Rd and Baltimore Ave. The project study area is shown in more detail in **Figure 1**. The project study area for this traffic analysis includes the following locations:

- 1. N Truman Rd & Baltimore Ave
- S Truman Rd & Baltimore Ave (AWSC)
- 3. N Truman Rd & Main St
- 4. S Truman Rd & Main St
- 5. N Truman Rd & Walnut St
- 6. S Truman Rd & Walnut St
- 7. N Truman Rd & Grand Blvd
- 8. S Truman Rd & Grand Blvd





Figure 1: Location Map

Data Collection

The following data was collected to complete the traffic analyses for this project.

- Intersection Turning-Movement Volumes: The HNTB team utilized Miovision cameras to collect intersection videos that were then converted into turning movement counts by Miovision. The counts were collected on February 2nd, 2023 from 6:00 9:00 AM and 3:00 6:00 PM for the eight locations in the study area listed above.
- I-670 Mainline Traffic Volumes: Mainline traffic volumes were collected at two locations within the study corridor at I-670 between Main St and Walnut St. Counts were conducted using Miovision traffic data collection cameras for a period of two days on February 22nd and 23rd, 2023. Data was collected in 15-minute increments for a forty-eight-hour period.
- **Traffic Signal Timings:** HNTB requested signal timing sheets from the City of Kansas City for each signalized intersection in the project study area to collect programmed



cycle lengths, phase settings, offsets, coordination parameters, and other signal timing data for input into the existing conditions Vistro models.

• **Geometry Data:** The number of lanes and traffic control were obtained from Google Earth aerial imagery and field data collection by using drone footage.

Traffic Evaluation Methodology

The Highway Capacity Manual defines Level-of-Service (LOS) in order to characterize traffic performance at intersections. For signalized intersections, LOS is based on the average delay per vehicle for all vehicles entering the intersection. At unsignalized intersections, LOS is often reported for the worst movement. An acceptable LOS for an intersection is considered to be LOS D or better (i.e. A, B, C or D).

The procedures outlined in the Highway Capacity Manual, 6th Edition were used as guidelines for the analysis of the study area intersections. This manual provides procedures for the analysis of both signalized and unsignalized intersections. LOS categories range from LOS "A" (best) to "F" (worst) as shown in **Table 1**.

Table 1: HCM LOS Description for Signalized and Unsignalized Intersections

	Signalized	Unsignalized	
Level	Intersection	Intersection	
of	Control Delay	Control Delay	
Service	(sec/veh)	(sec/veh)	Traffic Flow Characteristics
Α	≤ 10.0	≤ 10.0	Free flow, insignificant delays.
В	> 10.1-20.0	> 10.1-15.0	Stable operation, minimal delays.
С	> 20.1-35.0	> 15.1-25.0	Stable operation, acceptable delays.
D	> 35.1-55.0	> 25.0-35.0	Restricted flow, common delays.
Е	> 55.1-80.0	> 35.1-50.0	Maximum capacity, extended delays. Volumes at or near
			capacity. Long queues form upstream from intersection.
			Forced flow, excessive delays. Represents jammed
F	> 80.0	> 50.0	conditions. Intersection operates below capacity with low
			volumes. Queues may block upstream intersections.

Growth Projections

Existing turning movement counts were taken in February 2023. These were compared to other available counts taken in 2018 and 2019 and the larger values were balanced and used for existing volumes to be conservative. In order to develop forecasted turning movement volumes for 2050 no-build, future traffic growth was extracted from the Mid-America Regional Council (MARC) Travel Demand Model. This was achieved by calculating the growth rate between the 2016 Base Year model volumes and the 2045 committed model volumes, which are based on



assumed future socio-economic data. The calculated growth rate of 1.5% per year was applied to the existing volumes to arrive at 2050 no-build forecast volumes for both the AM and PM peak period models.

The traffic team used a regional Dynameq mesoscopic model to determine future 2050 build traffic volumes. The Dynameq model contains a subarea of the MARC model. Each build scenario was coded into the Dynameq model (considering all the geometric changes), then the model runs were exported. A delta volume for each approach was developed by subtracting the future no-build volumes from the build volumes. The volume factor was then applied to the future no-build forecasts to generate the build volumes for each scenario.

Level One Analysis

The section contains the initial approach that was used to evaluate the study which was submitted to the city. All the analysis of the section was based on Vistro software. Existing conditions models were developed for the 2023 AM and PM peak-periods for the project corridor utilizing Vistro software, Version 2021, Service Pack (SP 0-6). Vistro is a traffic engineering software used to determine intersection delay, LOS, queue lengths, and other operational metrics that drivers could typically encounter while driving through the intersections being analyzed. In addition to delay and LOS, the 95th percentile queue length was used to evaluate the traffic performance of the intersection.

Scenarios Developments

In total, twenty-six scenarios, described in **Table 2**, were developed to evaluate the traffic operation along Truman Rd.

Peak No. **Scenarios** Year **Description** Period 1 Existing (2023) 2023 Existing geometry Existing geometry 2 No-Build Implementing a single lane along Truman Rd (one westbound lane 3 Build (Rd Diet) on N Truman Rd and one eastbound lane on S Truman Rd) Build (Rd Diet) Implementing two lanes along Truman Rd (two westbound lanes on 4 two lanes N Truman Rd and two eastbound lane on S Truman Rd) AM Implementing a single lane along Truman Rd plus mitigations Build (Rd Diet) 2050 5 (additional lanes at the S Truman Rd and Grand Blvd intersection) Mitigation Build (Rd Diet) Implementing a single lane along Truman Rd and reducing the 6 & Reduced turning movement volumes due to reduced capacity Volumes Implementing a single lane along Truman Rd and reducing the Build (Rd Diet) 7 Mitigation & turning movement volumes plus mitigations

Table 2: Studied Scenarios Descriptions



No.	Scenarios	Year	Peak Period	Description
	Reduced Volumes			
8	Build (Rd Diet) Mitigation & Walnut Closure			Implementing a single lane along Truman Rd plus mitigations. Closing Walnut Bridge
9	Build (Baltimore Ave Closure)			Closing Baltimore bridge
10	Build (Main St Closure)			Closing Main bridge
11	Build (Walnut St Closure)			Closing Walnut bridge
12	Build (Event)			Closing several roads due to event (portions of Grand Blvd, Walnut, and 14th St)
13	Build (Event & Walnut Closure)			Closing several roads due to event plus closing Walnut bridge
14	Existing (2023)	2023		Existing geometry
15	No-Build			Existing geometry
16	Build (Rd Diet)			Implementing a single lane along Truman Rd (one westbound lane on N Truman Rd and one eastbound lane on S Truman Rd)
17	Build (Rd Diet) two lanes			Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd)
18	Build (Rd Diet) Mitigation			Implementing a single lane along Truman Rd plus mitigations (additional lanes at the S Truman Rd and Grand Blvd intersection)
19	Build (Rd Diet) & Reduced Volumes			Implementing a single lane along Truman Rd and reducing the turning movement volumes due to reduced capacity
20	Build (Rd Diet) Mitigation & Reduced Volumes	2050	PM	Implementing a single lane along Truman Rd and reducing the turning movement volumes plus mitigations
21	Build (Rd Diet) Mitigation & Walnut Closure			Implementing a single lane along Truman Rd plus mitigations. Closing Walnut Bridge
22	Build (Baltimore Ave Closure)			Closing Baltimore bridge
23	Build (Main St Closure)			Closing Main bridge
24	Build (Walnut St Closure)			Closing Walnut bridge
25	Build (Event)			Closing several roads due to event (portions of Grand Blvd, Walnut, and 14th St)
26	Build (Event & Walnut Closure)			Closing several roads due to event plus closing Walnut bridge



Existing and Future No-Build Scenario Results

The AM peak model addressed 7:45 AM to 8:45 AM on a typical weekday, while the PM peak model addressed 4:30 PM to 5:30 PM. These two hours are the representative of the peak hours for the facilities in the study area. The models were populated with peak hour volumes, peak hour factors, and heavy vehicle percentages.

During the AM peak hour, the results of the intersection analysis show that all the signalized intersections are operating with acceptable level of service, LOS C or better. Also, the unsignalized intersection at S Truman Rd & Baltimore Ave operates at LOS A. The results of the 95th percentile queue length of all junctions were maintained within the storage capacity.

During the PM peak hour, the results of the intersection analysis show that all of the signalized intersections are operating at LOS C or better. Also, the un-signalized intersection at S Truman Rd & Baltimore Ave operates at LOS A. The results of the 95th percentile queue length of all junctions were maintained within the storage capacity. The results of the traffic analysis can be found in the attached excel file in the L1_Results_Vistro tab.

For the future No-Build scenario, the results of the intersection analysis show that all the signalized intersections are operating with acceptable level of service, LOS C of better during AM and PM peak hours. Also, the un-signalized intersection is operating with LOS B or better during the AM and PM peak hours. The results of the 95th percentile queue lengths were less than 300 feet and within storage capacity during the AM peak hour. However, in the PM the 95th percentile of the queue length began to extend to upstream intersections at a couple of intersections. These locations are the WBT at N Truman Rd & Baltimore Ave, the SBT at N Truman Rd & Main St, and the NBR and EBT at S Truman Rd & Grand Blvd.

Future Build Scenario Results

The road diet scenario reduces lanes on Truman Rd to one in each direction. It results in all but two intersections operating with acceptable level of service, LOS D or better. The operation at S Truman Rd & Baltimore Ave is projected to operate at LOS E during the AM peak. The operation at S Truman Rd & Grand Blvd is projected to operate at LOS F during the PM peak. The 95th percentile of a couple of intersections begins to extend to the upstream intersections. The 95th percentile of the queue length were more than 900 ft for the EB approach at S Truman Rd & Grand Blvd during the AM peak and more than 2200 ft during the PM peak.

The road diet scenario (two lanes only on Truman Rd in each direction) results in all the intersections to operate with acceptable level of service, LOS C or better during the AM and PM peak hours. The un-signalized intersection is projected to operate with acceptable level of service, LOS B or better during the AM and PM peak hours. The 95th percentile of a couple of intersections are more than 360 ft like the EB approach at S Truman Rd & Grand Blvd during the AM peak and more than 470 ft during the PM peak.



For the mitigated road diet scenario (turn lanes were added at S Truman and Grand), all intersections are operating with acceptable level of service, LOS D or better during the AM & PM peak hours. The un-signalized intersection is projected to operate with acceptable level of service, LOS B or better during the AM and PM peak hours. The 95th percentile of the queue length was more than 360 ft for the EB approach at S Truman Rd & Grand Blvd during the PM peak.

For the road diet (single lane) scenario with reduced volumes (due to reduced capacity), all but one of the signalized intersections are operating with acceptable level of service, LOS D or better during the AM & PM peak hours. The operation at S Truman Rd & Grand Blvd is projected to operate at LOS F during the PM peak. The 95th percentile of the queue length is more than 1400 ft for the NB and EB approach for the same intersection during the PM peak. Also, the queue length begins to extend through the upstream intersections for a couple of intersections.

For the mitigated road diet scenario (single lane on Truman plus one turn lane is added at S Truman & Grand) with reduced volumes (due to reduced capacity), all the signalized intersections and the un-signalized intersections are projected to operate with acceptable level of service, LOS D or better during the AM and PM peak hours. The 95th percentile of the queue length is more than 800 ft for the SB approach at N Truman Rd & Main St and the NB approach at S Truman Rd & Grand Blvd during the PM peak.

For the mitigated road diet scenario (single lane on Truman plus one turn lane is added at S Truman & Grand) and Walnut bridge closure, all but one of the intersections are operating with acceptable level of service, LOS D or better. During the PM peak, the intersection of N Truman Rd & Main St is projected to operate with LOS E. The 95th percentile of the queue length is more than 360 ft for the EB approach at S Truman Rd & Grand Blvd during the AM peak and more than 900 ft for the SB approach at N Truman Rd & Main St during the PM peak.

For the road closure scenario along Baltimore Ave bridge, all the signalized and un-signalized intersections are operating with acceptable level of service, LOS D or better during the AM and PM peak hours. The 95th percentile of the queue length is more than 700 ft SB approach at N Truman Rd & Main St during the PM peak.

For the road closure scenario along Main St bridge, all the signalized intersections are operating with acceptable level of service, LOS C or better during the AM and PM peak hours. During the AM peak, the 95th percentile of the queue length is more than 500 ft for the SB approach at S Truman Rd & Grand Blvd. The results of the 95th percentile of the queue length is more than 400 ft for the EB approach at S Truman Rd & Walnut St and for the NB approach at S Truman Rd & Grand Blvd during the PM peak.

For the road closure scenario along Walnut St bridge, all the signalized and un-signalized intersections are operating with acceptable level of service, LOS C or better during the AM and PM peak hours. The results of the 95th percentile of the queue length is maintained within the storage capacity, less than 340 ft.



For the event scenario, all but one of the signalized and un-signalized intersections are operating with acceptable level of service, LOS D or better during the AM and PM peak hours. The operation of N Truman Rd & Main St is projected to operate at LOS F during the PM peak. The 95th percentile of the queue length is more than 1700 ft for the SB approach at N Truman Rd & Main St during the PM peak. Also, the 95th percentile of the queue length is more than 500 ft for the WB approach at N Truman Rd & Walnut St and for the EB approach at S Truman & Grand Blvd during the PM peak.

For the event scenario and Walnut St bridge closure, all but one of the signalized and unsignalized intersections are operating with acceptable level of service, LOS D or better during the AM and PM peak hours. The operation of N Truman Rd & Main St is projected to operate at LOS F during the PM peak. The 95th percentile of the queue length is more than 1650 ft for the SB and approach at N Truman Rd & Main St and more than 400 ft for the EB approach at S Truman Rd & Grand Blvd during the PM peak.

Analysis of Results

The analysis leads to several findings:

- Existing conditions exhibit acceptable LOS and short queues
- With the projected volume growth, future no-build LOS remains acceptable, but some queues begin to extend through upstream intersections, particularly in the PM peak
- Reducing Truman Rd to a single lane in each direction under future traffic volumes contributes to undesirable LOS and longer queues
- Adding turn lanes to the S Truman Rd & Grand Blvd intersection improves LOS and shortens queues for that intersection
- Two lanes in each direction on Truman Rd (plus improvements at S Truman Rd & Grand Blvd) is anticipated to operate acceptably
- Peak hour LOS at the study intersections remain at acceptable levels when a bridge over I-670 is removed at Baltimore, Main, OR Walnut
- Compared to the peak hour operations during event road closures, also closing the Walnut bridge has a minimal incremental impact to traffic operations. The N Truman & Main intersection operates at LOS F with a queue of ~1,700 feet in both scenarios. All other intersections operate at LOS D or better in both scenarios.

Level Two Analysis

This section contains the second approach that was used to evaluate the study. As requested by the City of Kansas City, all the analysis of this section was based on Synchro/SimTraffic software. To characterize traffic performance at intersections, the Synchro results were used to define the Level-of-Service (LOS). SimTraffic is used report the 95th percentile of the queue lengths.



Scenarios Developments

In total, twelve scenarios, described in **Table 3**, were developed to evaluate the traffic operation along Truman Rd.

Table 3: Studied Scenarios Descriptions

No.	Scenarios	Year	Peak Period	Description
1	Existing	2023		Existing geometry
2	No-Build			Existing geometry
3	Build (Rd Diet) two lanes & Walnut St Closure			Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd) plus closing Walnut bridge to vehicular traffic. Adding all-way stop signs at intersections along Baltimore Ave and Walnut St and adding exclusive eastbound left lane at S Truman & Grand Blvd
4	Build (Rd Diet) two lanes & Walnut St Open	2050	AM	Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd) plus keeping Walnut bridge open to vehicular traffic. Adding all-way stop signs at intersections along Baltimore Ave and Walnut St and adding exclusive eastbound left lane at S Truman & Grand Blvd
5	Build (Rd Diet) two lanes & Walnut St & Baltimore Ave Closure			Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd) plus closing Walnut & Baltimore bridges to vehicular traffic. Adding all-way stop signs at intersections along Baltimore Ave and Walnut St and adding exclusive eastbound left lane at S Truman & Grand Blvd
6	Build (Rd Diet) two lanes & Baltimore Closure			Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd) plus closing Baltimore bridges to vehicular traffic. Adding all-way stop signs at intersections along Baltimore Ave and Walnut St and adding exclusive eastbound left lane at S Truman & Grand Blvd
7	Existing	2023		Existing geometry
8	No-Build			Existing geometry
9	Build (Rd Diet) two lanes & Walnut St Closure		PM	Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd) plus closing Walnut bridge to vehicular traffic. Adding all-way stop signs at intersections along Baltimore Ave and Walnut St and adding exclusive eastbound left lane at S Truman & Grand Blvd
10	Build (Rd Diet) two lanes & Walnut St Open	2050	r IVI	Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd) plus keeping Walnut bridge open to vehicular traffic. Adding all-way stop signs at intersections along Baltimore Ave and Walnut St and adding exclusive eastbound left lane at S Truman & Grand Blvd
11	Build (Rd Diet) two lanes &			Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd) plus closing



No.	Scenarios	Year	Peak Period	Description
	Walnut St & Baltimore Ave Closure			Walnut & Baltimore bridges to vehicular traffic. Adding all-way stop signs at intersections along Baltimore Ave and Walnut St and adding exclusive eastbound left lane at S Truman & Grand Blvd
12	Build (Rd Diet) two lanes & Baltimore Closure			Implementing two lanes along Truman Rd (two westbound lanes on N Truman Rd and two eastbound lane on S Truman Rd) plus closing Baltimore bridges to vehicular traffic. Adding all-way stop signs at intersections along Baltimore Ave and Walnut St and adding exclusive eastbound left lane at S Truman & Grand Blvd

Existing and Future No-Build Scenario Results

During the AM peak hour, the results of the intersection analysis show that all the signalized intersections are operating with acceptable level of service, LOS C or better. Also, the unsignalized intersection at S Truman Rd & Baltimore Ave operates at LOS B. The results of the 95th percentile queue length of all junctions were maintained within the storage capacity (under 250 feet).

During the PM peak hour, the results of the intersection analysis show that all of the signalized intersections are operating at LOS C or better. Also, the un-signalized intersection at S Truman Rd & Baltimore Ave operates at LOS A. The results of the 95th percentile queue length of all junctions were maintained within the storage capacity (under 250 feet). The results of the traffic analysis can be found in the attached excel file in the L2_Results_Synchro tab.

For the future No-Build scenario, the results of the intersection analysis show that all the signalized intersections are operating with acceptable level of service, LOS D or better during AM and PM peak hours. Also, the un-signalized intersection is operating with LOS C or better during the AM and PM peak hours. The results of the 95th percentile queue lengths in the AM were more than 250 feet and began to extend to upstream intersections at the EB approach at S Truman Rd & Baltimore Ave, the WB at N Truman Rd & Main St, the EB at S Truman Rd & Main St and the WB at N Truman Rd & Grand Blvd. In the PM the 95th percentile of the queue length began to extend to upstream intersections at the SB approach at N Truman Rd & Main St, the NB at S Truman Rd & Main St, and the NB at S Truman Rd & Grand Blvd.

Future Build Scenario Results

The build scenario where Walnut remains open (two lanes only on Truman Rd in each direction, plus adding an exclusive eastbound left turn lane at S Truman Rd & Grand Blvd, keeping the Walnut bridge open, and adding stop signs at the Baltimore Ave and Walnut St intersections) results in all the intersections operating with acceptable level of service, LOS D or better during the AM and PM peak hours. The un-signalized intersections are projected to operate with acceptable level of service, LOS C or better during the AM and PM peak hours. During the AM



peak, the 95th percentile of the queue length for a couple of locations are more than 250 ft and may extend to upstream intersections. These locations are the EB approach at S Truman Rd & Baltimore Ave, the WB approach at N Truman Rd & Main St, the EB approach at S Truman Rd & Main St and the WB approach at N Truman Rd & Grand Blvd. During the PM peak, the 95th percentile of the queue length for a couple of locations are more than 250 ft. These locations are the SB approach at N Truman Rd & Main St, the EB and NB approaches at S Truman Rd and Main St and the NB approach at S Truman Rd and Grand Blvd.

The Walnut road closure build scenario (two lanes only on Truman Rd in each direction, plus adding an exclusive eastbound left turn lane at S Truman Rd & Grand Blvd, closing the Walnut bridge, and adding stop signs at the Baltimore Ave and Walnut St intersections) results in all the intersections operating with acceptable level of service, LOS D or better during the AM and PM peak hours. The un-signalized intersections are projected to operate with acceptable level of service, LOS C or better during the AM and PM peak hours. During the AM peak, the 95th percentile of the queue length for a couple of locations are more than 250 ft and may extend to upstream intersections. These locations are the EB approach at S Truman Rd & Main St and the WB approach at N Truman Rd & Grand Blvd. During the PM peak, the 95th percentile of the queue length for a couple of locations are more than 250 ft. These locations are the SB approach at N Truman Rd & Main St, the EB and NB approaches at S Truman Rd and Main St and the NB and EB approaches at S Truman Rd and Grand Blvd.

The Walnut and Baltimore road closure build scenarios (two lanes only on Truman Rd in each direction, plus adding an exclusive eastbound left turn lane at S Truman Rd & Grand Blvd, closing the Walnut & Baltimore bridges, and adding stop signs at the Baltimore Ave and Walnut St intersections) results in all but one of the intersections operating with acceptable level of service, LOS D or better during the AM and PM peak hours. The operation at S Truman Rd and Main St is projected to operate with LOS E during the PM peak hour. The un-signalized intersections are projected to operate with acceptable level of service, LOS C or better during the AM and PM peak hours. During the AM peak, the 95th percentile of the queue length for a couple of locations are more than 250 ft and may extend to the upstream intersections. These locations are WB approach at N Truman Rd & Main St, the EB approach at S Truman Rd and Main St and the WB approach at N Truman Rd and Grand Blvd. During the PM peak, the 95th percentile of the queue length for a couple of locations are more than 250 ft and may extend to the upstream intersections. These locations are the NB approach at S Truman Rd & Baltimore Ave, the SB and WB approaches at N Truman Rd & Main St, the NB and EB approaches at S Truman Rd & Main St and the NB approach at S Truman & Grand Blvd.

The Baltimore road closure build scenario (two lanes only on Truman Rd in each direction, plus adding an exclusive eastbound left turn lane at S Truman Rd & Grand Blvd, closing the Baltimore bridges, and adding stop signs at the Baltimore Ave and Walnut St intersections) results in all of the intersections operating with acceptable level of service, LOS D or better during the AM and PM peak hours. The un-signalized intersections are projected to operate with acceptable level of service, LOS C or better during the AM and PM peak hours. During the AM peak, the 95th percentile of the queue length for a couple of locations are more than 250 ft and may extend to the upstream intersections. These locations are EB approach at S Truman Rd &



Baltimore Ave, the WB approach at N Truman Rd and Main St, the EB approach at S Truman Rd and Main St, and the WB approach at N Truman and Grand Blvd. During the PM peak, the 95th percentile of the queue length for a couple of locations are more than 250 ft and may extend to the upstream intersections. These locations are the SB approach at N Truman Rd & Main St, the NB and EB approaches at S Truman Rd & Main St and the NB and EB approaches at S Truman & Grand Blvd.

Special Events

Downtown Kansas City hosts numerous special events throughout the year. Between the T-Mobile Arena and various other downtown venues, traffic in downtown Kansas City is unique every evening. Therefore, no quantitative traffic analysis of a special event scenario was conducted. However, the study team and its partners have many experiences to draw from to discuss traffic during special events.

Traffic demand in the study area during special events often exceeds traditional peak period demand. In some of the larger events such as the Big 12 Tournament, Grand Blvd (and sometimes Walnut St) will be closed north of Truman Road. Some traffic that typically uses Grand Blvd and S Truman to access I-670 EB is shifted to Walnut St and Main St. This can result in heavy southbound left turn movements, especially at S Truman and Main. Traffic spills out of its short turn bay and blocks other southbound traffic on Main Street, including the Streetcar, into which Kansas City has invested greatly over the last several years. In the Walnut road closure build scenario, even more traffic would be shifted to Main St. One potential mitigation measure, while outside the scope of this project, would be to convert E 13th St to a two-way street east of Main Street. This would give traffic destined to I-670 EB - much of which originates at parking structures along E 13th St - an alternate path out of downtown using the freeway entrance ramp on Charlotte Street near E 13th St.

Analysis of Results

The analysis leads to several findings:

- Existing conditions exhibit acceptable LOS and short queues in the typical AM and PM peak periods
- With the projected volume growth, future no-build LOS remains acceptable, but some queues begin to extend through upstream intersections during the peak periods
- Two lanes in each direction on Truman Rd (plus an eastbound left turn lane at S
 Truman Rd & Grand Blvd) is anticipated to operate acceptably during the peak periods
- Converting signals to all-way stops at the Truman Road intersections with Baltimore and Walnut is anticipated to operate acceptably during the peak periods
- Peak hour LOS at the study intersections remains at acceptable levels when the vehicular bridge over I-670 is removed at Walnut, although some queues extend through upstream intersections



- Peak hour LOS at S Truman Rd & Main St drops to LOS E when the vehicular bridges over I-670 are removed at Walnut & Baltimore; some queues begin to extend through upstream intersections
- Traffic demand in the study area is often highest during special events
- During special events, traffic is often funneled down Main Street, causing delays to the Kansas City Streetcar
- Converting E 13th St from one-way to two-way could relieve traffic pressure on Main St.

During the traditional peak periods, the intersections operate at LOS D or better in all scenarios except the intersection of S Truman Rd & Main St which is projected to operate with LOS E during the PM peak when vehicles are removed from Walnut and Baltimore. The queue length of a handful of approaches may extend into the upstream intersection for short periods of time during the peaks. Operations are expected to be worse during special events.

			Exist	ing 2023		2050 - N	o Build	205	50 - Rd Di	et (Single	Lane)	2050	- Rd Diet	(Two Lanes)	2	050 - Rd D	et (Mitigates	d)	2050 - Rd I Rec	Diet (Single duced Vol.	ane)		Rd Diet (M Reduced V		2050 - R	ld Diet (M Clas		Walnut	2050 - 1	ld Closu	re (Baltim	sore)	2050	- Rd Class	re (Main)	21	250 - Rd Cli	osure (W	(almut)	205	o - Rd Cli	osure (Eve	ent)	2050 -	Rd Closure Walnut	
	Intersection Name	Control Type	LOS (sec/v	Wor wh) Moven Dela	ners LOS	Delay (sec/veh	Morst Movement Delay	E 105	Delay (sec/veh	World N	Movement telay	LOS	Delay (sec/veb)	Worst Movem Delay	ent LOS	Delay (sec/veh	Word Move Delay	enseet t	uos (sec/v	oy Worst N reh) D	overnent lay	LOS (4	Delay Wo sec/veh)	II Movement Delay	LOS	Delay (sec/veb)	Worst Ma Deli	versect by	LOS (Delay sec/seb)	Worst Mos Dela	verseet ly	LOS	Delay V (sec/veb)	ont Movemen Delay	ucs.	Delay (sec/veh)	Workt f	Movement Deby	LOS	Delay (sec/veh)	World Mo Deli	overment lay	LOS (s	Delay Mo	iuest suesse Delay
AM Peak Hour	Truman Rd & Baltimore Ave	Signaland	0 161	10.7		12.7	17.6 80		195	14.7	Mile		16.4	10.0		16.4	10.0	Mile		2 22.2			17.7 21	2 881		12.4	10.7	war		120	20.0	See		19.9	12.1		17.0	34.7	200		17.8	24.2	Mile		17.8 2	15.7 N
2.57	Trumon Rd & Baltimore Ave	All-titlay-Stop	A 3.8	10.9	68s. B	18.1	15.5 690		48.9	63.0	FRY		13.1	15.5 6		18.1	15.5	696	C 18	2 21.1	687	c	18.2 21	1 697		18.6	22.2	OUT		11.3	12.2	ERT :	c	16.6	2.4 680		13.6	16.8	584		16.5	22.8	695			18.6 (1
	Truman Rd & Main St	Signalized	8 10.4		Wilk B	11.9	15.6 WB	8 8	14.6	17.7	SWT		11.8	15.6 W	an a	11.9	25.6	WER	8 133	8 178	war		13.8 17	9 WRT		16.8	17.6	WRT		13.1	15.9	Wilk		13.9	4.6 WH	8	12.3	15.7	WRR		16.4	29.3	SRT			25.0 SI
4.51	Truman Rd & Main St	Signalized	8 117	14.8	SER B	13.3	16.1 686	k c	27.8	31.2	ERT		14.9	16.9 61	8 8	14.9	26.9	EBR	8 141	9 176	NRT		14.9 17	6 NRT		15.1	18.2	NRT		13.8	16.6	SER		22.6	3.8 686		13.2	16.0	SBR		16.6	16.9	ERR			16.7 (1
5.N1	Truman Rd & Walnut St. Truman Rd & Walnut St.	Signalized Signalized	C 23.0	288		25.1	31.0 WB		32.8	28.9	WRT	c	28.3	25.3 W	ER C	28.3	25.2	THE R	C 30		WET	c	20.7 25			37.9	13.9	WRT	c	25.6	31.7	WER	c		11.0 WW		28.8	30.6	wax	D	36.5	43.6	WST			10.5 W
	Truman Rd & Grand Myd		8 184			21.7	28.5 WR		27.4	32.6	WAL		24.3	10 S	1 2	21.7	20.4	-	C 211		wer		21.8 20		1 2	44.6	87.0			21.9	37.9	1000	-		18.7 WH		21.2	40.0	W88		37.4	25.7	WRT			9.7 W
8.57	Truman Rd & Grand Myd	Signalized	8 18.	25.9	ERT C	20.2	28.6 58		49.9	76.2	SRY		24.6	26.6 11	8 6	20.2	28.6	SRT .	0 15	2 41.8	59.7	c	21.8 37			24.9	37.0	100	c	22.0	31.0	ERT :	c	24.6	10 687		20.0	28.0	687		22.5	28.6	FRY	c	20.4	29.3
PM Peak Hour																																														
	Truman Rd & Baltimore Ave	Signalized	8 183		NBL C	23.0		r c	23.7	50.9	NRL		18.8	30.0 N	11 11	18.8	30.0	NRL	C 23.	2 38.7	Nit.	c	23.2 35	2 NRL		21.1	33.7	NR.		17.2	33.1	SBR	c		15.0 NR		21.5	36.4	NRL		23.9		NEL			9.0 N
2.51	Truman Rd & Staltimore Ave Truman Rd & Main St	All-Way-Stop Signalized	A 89	10.0	585. B	10.5	12.5 ER		15.6	209	ERT		10.5	12.5 El 25.9 W		10.5	12.5	100	8 10-		SMT		10.4 13			11.4	27.2	SAT	^	100	50.4	ERT :			13.5 ERG		10.6	12.7 22.4	188		10.6	13.1	SRL SAT			15.7 EI
	Truman Rd & Main St	Signalized	9 171		Cha a	15.0	20.7 586		220	63.6	COX		43.3	22.0 69		17.7	20.0	COO. 1	8 181		1007		10.0 20			24.7	40.4	100		135	34.3	Cha I			5 4 599		40.3	21.0	Chin.		20.7	20.2	500			17.6 N
5.N1	Trumon Rd & Walnut St	Signalized	8 197		was c	21.6	32.0 WB	8 6	27.7	36.7	WHT		26.9	37.9 W	1 6	24.9	17.9	1000	C 267		WRE	č	26.9 31		1 6	33.9	35.6	WRI	e e	21.9	33.0	was :	-		is we		28.6	33.1	W98		31.2	42.4	WHT			5.3 W
6.51	Truman Rd & Walnut St.		8 163	18.7		17.5	28.3 580		24.5	28.1	SBL		18.1	36.1 9		18.1	36.2	SBL	C 22.	3 21.0	SML	c	22.3 25	5 591	· c	20.1	33.0	NER		19.7	29.2	SBL	c	26.4	13.8 581		11.3	33.0	NR	c	23.2	26.0	ERR			19.9 M
2.N1	Truman Rd & Grand Mvd	Signalized	8 163	22.0	WSR B	19.6	39.2 WR		27.4	413	WRT		19.6	39.2 W	at a	19.6	29.2	WER	C 267		war	c	26.7 44			29.4	45.2	WRT	c	21.4	41.1	Wilk			19.2 WW		19.0	38.1	WRR	D	36.8	45.9	WRT	D		11.3 W
8.57	Truman Rd & Grand Mvd	Signalized	C 20.	29.2	ERT C	25.6	36.2 NB	R F	125.4	223.5	SRT	c	31.8	43.8 N	ir c	25.6	36.2	NRR	F 132	6 267.2	NER	D	64.9 10	2 NRR	c	30.7	28.5	ERR	c	283	46.2	NR	c	27.9	14.0 NB	t c	23.5	30.7	SMT	c	26.8	30.7	ERT	c	23.9 2	N-2 N
		_	Daist	ing 2023		2050 - N	o Build	205	50 - Rd Di	et (Single	Lane)	2050	- Rd Diet	(Two Lanes)	2	050 - Rd D	et (Mitigates	d)	2050 - Rd I Rec	Diet (Single duced Vol.	ane)		Rd Diet (M Reduced W		2050 - R	ld Diet (M Clas		Walnut	2050 - 1	ld Closu	re (Baltim	nore)	2050	- Rd Closs	re (Main)	21	250 - Rd Cli	losure (W	(alnut)	205	o - Rd Cli	osure (Eve	ent)	2050 -	Rd Closure Walnut	
	Intersection Name	Control Type	Exist No. so	ing 2023	wa sa	2050 - N	o Build	205 k Nik	50 - Rd Di	et (Single	Lane) we	2050 NB	- Rd Diet	(Two Lanes)	2		et (Mitigates	d) we			ane)				2050 - R			Walnut	2050 - I	ld Closus	re (Baltim	sore) wa	2050 NB	o - Rd Closs	re (Main) sa wa	21	950 - Rd Cli	iosure (W	(alnut)	205 NR	O - Rd Cli	osure (Eve	unt)		Walnut	
AM Peak Hour	Intersection Name		Exist No. 50	ing 2023	wa sa			205 a sa	SO - Rd Di	et (Single sa	Lane) we	2050 NB	- Rd Diet				et (Mitigates	d) ws			ane) we	NB	Reduced W		2050 - R		ure	wa	2050 - I	td Closu sa	re (Baltim	nore) wa	2050 NB	o - Rd Closs	re (Main) sa wa	21 NR	950 - Rd Cli	iosure (W	(alnut)	205 NR	iO - Rd Cli	osure (Eve	-		Walnut	0 sn w
AM Peak Hour	Intersection Name Trumon Rd & Nationare Ave	Signaland	Date 1 1 1 1 1 1 1 1 1	ing 2023 in	WB NO			205 8 NR	50 - Rd Di 58 106	et (Single	wa 155	2050 Na	- Rd Diet		-		et (Mitigates	d) ws			wa 148		Reduced W		2050 - R NB		ure	Walnut wa	2050 - I	nd Closus sa	re (Baltim	wa see	2050 NB	SR SS	re (Main) 18 ws	21 NB	250 - Rd Cli	iosure (W	reinut) we	205 NB	O - Rd Cli	osure (Eve	-		Walnut	0 68 W
AM Floir Hour	Intersection Name Trumon Rd & Baltimore Ave Trumon Rd & Baltimore Ave	Signalized All-Way-Stee	NB 58	ing 2023	109 12 0 2			205	50 - Rd Di	et (Single	wa 155	2050 NB 106 8	- Rd Diet				et (Mitigates	205 :			wa 168	NB	Reduced W		2050 - R NB		ure	wa	2050 - I	sa o	e (Saltim	wa sek	2050 NB	SR SS	o 251	20 NB	250 - Rd Cli	iosure (W	reinut) we	205	SB 138	osure (Eve	-		Walnut	0 11 122 1
AM Polk Hour 1. N 1 2. S 2	Intersection Name Trumon Rd & Raitimore Ave	Signalized All-Way-Stop Signalized	Paint 58 23 57 5 2 28 37 16 90	ing 2023	108 12 0 2 42 60			205	50 - Rd Di	et (Single	155 0 168	2050 NB 106 8 60	58 SS		9 NB		et (Mitigates	205 : 0 73			WB 148 0	NB	Reduced W		2050 - R NB 152 11 83		ure	150 0	2050 - I	SR 0 0 1011	0 73 0 1100	108 0	2050 MB 253 22 83 16	SR SS S	o 251 0 257 0 68 0 63	20 NB 1 567 156 69	90 - Rd Cli	iosure (W	reinut) we	205 NR 114 24 130	0 - Rd Cla 58 138 25 161	osure (Eve	-		Walnut	0 68 W
AM Posit Hour 1. N 1 2. S 1 2. N 1	Intersection Name Trumon Rd & Baltimore Ave Trumon Rd & Baltimore Ave	Signalized All-Way-Stee	NB 58	68 0 66 0 58 0 0	108 12 0 2 42 60 0 63 60 8			205 8 MR 1 129 9 91 1 155 1 11	50 - Rd Di 58 106 11 100 136 21	et (Single sa o ess o ess	155 0 168 0 284	2050 NB 106 8 60 81 8	- Rd Diet		9 NB		et (Mitigates	205 0 70 0 218			WB 148 0	NB	Reduced W		2050 - R NB 152 11 83 92 0		ure	150 0	2050 - I	58 0 0 0 121 72 25	0 73 0 180 0	168 0 0 0 168	2050 MB 253 22 83 16 24	58 58 55 58 0 0	0 251 257 0 63 227 0 127	20 NB 1 567 15 68 60 0	50 - Rd Cle 58 201 11 75 41 2	0 100 0 101	(almut) wa 147 0 81 0 110	205 MR 114 24 130 28	0 - Rd Cla 58 138 25 164 28	0 156 0 168 0	-		Walnut	0 11 122 1
AM Froit Hour 1. N 2. ST 3. N 5. N	Intersection Name Truman Rd & Baltimore Ave Truman Rd & Baltimore Ave Truman Rd & Baltimore Ave Truman Rd & Main's Truman Rd & Main's Truman Rd & Walnut St Truman Rd & Walnut St	Signaland All-Way-Stap Signaland Signaland Signaland Signaland	NB SB 22 S7 5 2 28 27 26 25 6 15 22 22	0 66 0 58 0	108 12 0 2 60 63 60 63 0 63	8 58 3 102 3 11 5 72 7 41 2 23 8 51	0 14: 102 0 0 73 102 0 0 54: 86 0	1 120 1 90 1 155 1 11	106 11 100 126 21 51	et (Single sa o ess o ess o 222	155 0 168 0 284 0	106 8 60 81 8	58 85 11 72 55 28 51	0 10 102 6 0 7 158 6 0 2 160 1	9 NB	81 11 72 55 28	0 100 0 158 0 127	205 0 79 0 218 0	Na 58 147 52 7 3 5 75 10 81 66 22 28 48 46	0 204 6 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	WB 148 0 118 0 204 0	NB 147 7 25 81 22 68	52 6 2 166 2 26 6 2 2	1 W8	152 11 83 92 0	## Clos ## ## ## ## ## ## ## ## ## ## ## ## ##	ure	150 0 128 0 200 0	NB 07 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 0 0 101 72 26 62	0 73 0 100 0 100 0	168 0 92 0 168 0	NB 253 22 83 16 24 64	58 55 18 0 0 23	0 251 257 0 62 227 0 141 127 0 141	1 NB	58 931 11 25 41 8	0 120 0 101 0 91	167 0 81 0 180 0	114 24 130 28 0 53	0 - Rd Cli 58 188 15 164 28 18 5	0 156 0 168 0 188	W8 156 0 186 0 187 0	NB 80 22 264 69 0 28	Walnut	0 11 122 1 0 2 165 1 0 2 177 1
AM Pali Hour 1. N 1 2.5 N 4.5 N 6.5 N 6.5 N	Intersection Name Frumon Rd & Baltimore Ave Frumon Rd & Baltimore Ave Frumon Rd & Baltimore Ave Frumon Rd & Walne St	Signaland All-Way-Stop Signaland Signaland Signaland Signaland Signaland	72 57 5 7 28 27 26 15 6 15 20 28 80 58	0 66 0 58 0	108 12 0 8 0 60 0 63 0 63 0 63 0 63 198 16	8 58 3 102 1 11 2 72 7 41 2 28 8 51 0 99	0 54: 502 0 0 73 503 0 0 54: 86 0	1 120 1 90 1 155 1 11	50 - Rd D6 58 106 11 100 136 31 51 100	et (Single	155 0 168 0 264 0 522	2050 NB 106 8 60 81 8 68 140	58 81 11 72 55 23 51 99	0 10 102 6 0 7 158 6 0 2 160 1	10 NB	81 11 72 55 22 180	0 100 0 158 0 127	205 0 79 0 218 0 0		0 204 6 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	WB 148 0 118 0	NB 547 7 7 75 81 22 48 128	Reduced W	1 W8	2050 - R NB 152 11 83 92 0 69 234		ure	150 0	NB 67 9 68 58 9 64 203	0 0 1011 72 25 62 111	0 78 0 180 0 160 0	568 0 92 0 158 0 0 253	2050 MB 258 22 88 16 24 64 211	58 55 18 0 0 0 23 62	0 251 257 0 62 257 0 62 257 0 141 257 0 141	1 NB 1 567 155 62 60 1 0 0 46	901 11 25 41 3 0	0 100 0 101 0 91 0 0	147 0 81 0 100 0 205	205 MB 114 24 130 80 0 53 11	188 158 160 28 18 5 0	0 156 0 168 0 168 0	-	80 22 164 69 0 28 20	Walnut 58 1 545 15 3 590 64 3 9 0 3 0 0 1	0 11 122 1 0 2 165 1 0 2 177 1
AM Pali Hour 1. N 1 2.5 N 4.5 N 6.5 N 6.5 N	Intersection Name Truman Rd & Baltimore Ave Truman Rd & Baltimore Ave Truman Rd & Baltimore Ave Truman Rd & Main's Truman Rd & Main's Truman Rd & Walnut St Truman Rd & Walnut St	Signaland All-Way-Stop Signaland Signaland Signaland Signaland Signaland	NB SB 22 S7 5 2 28 27 26 25 6 15 22 22	0 66 0 58 0	108 128 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	8 58 3 102 1 11 2 72 7 41 2 28 8 51 0 99	0 14: 102 0 0 73 102 0 0 54: 86 0	1 120 1 90 1 155 1 11	106 11 100 126 21 51	et (Single in 0 els 0 els 0 2 2 0 11	155 0 168 0 284 0	106 8 60 81 8	58 85 11 72 55 28 51	0 10 102 6 0 7 158 6 0 2 160 1	9 NB	81 11 72 55 22 180	0 100 0 158 0 127	205 0 79 0 218 0 0	Na 58 147 52 7 3 5 75 10 81 66 22 28 48 46	0 204 6 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	WB 148 0 118 0 204 0	NB 147 7 25 81 22 68	52 6 2 166 2 26 6 2 2	1 W8	152 11 83 92 0	## Clos ## ## ## ## ## ## ## ## ## ## ## ## ##	ure	150 0 128 0 200 0	NB 07 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 0 0 101 72 26 62	0 0 23 0 130 0 107 0 299	168 0 92 0 168 0	NB 253 22 83 16 24 64	58 55 18 0 0 23	0 251 257 0 62 227 0 141 127 0 141	1 NB	58 931 11 25 41 8	0 100 0 101 0 0 0 101 0 0 0 101 0	167 0 81 0 180 0	114 24 130 28 0 53	100 - Rd Cli 580 158 156 166 298 158 15 16 10 10 10 10 10 10 10 10 10 10 10 10 10	0 156 0 158 0 158 0 158 0 158 0 158 0 158 0 158 158 158 158 158 158 158 158 158 158	W8 156 0 186 0 187 0	80 22 164 69 0 28 20	Walnut 58 1 545 15 3 590 64 3 9 0 3 0 0 1	0 11 122 1 0 2 165 1 0 2 177 1
AM Paul Hour 1. N I 2.5% 5. N I 6.5% 5. N I 8.5%	Intersection Name Frumon Rd & Baltimore Ave Frumon Rd & Baltimore Ave Frumon Rd & Baltimore Ave Frumon Rd & Walne St	Signaland All-Way-Stop Signaland Signaland Signaland Signaland Signaland	72 57 5 7 28 27 26 15 6 15 20 28 80 58	0 66 0 58 0		8 58 3 102 1 11 2 72 7 41 2 28 8 51 0 99	0 54: 502 0 0 73 503 0 0 54: 86 0	1 120 1 90 1 155 1 11	106 11 100 126 21 51	0 est (Single 0 est 1 est 0 est 1 est 0 est 1 es	155 0 168 0 284 0	106 8 60 81 8	58 81 11 72 55 28 51	0 10 102 6 0 7 158 6 0 2 160 1	10 NB	81 11 72 55 22 180	0 100 0 158 0 127	205 0 79 0 218 0 0	Na 58 147 52 7 3 5 75 10 81 66 22 28 48 46	0 204 6 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	WB 148 0 118 0 204 0	NB 547 7 7 75 81 22 48 128	52 6 2 166 2 26 6 2 2	1 W8	152 11 83 92 0	## Clos ## ## ## ## ## ## ## ## ## ## ## ## ##	ure	150 0 128 0 200 0	NB 67 9 68 58 9 64 203	0 0 0 101 72 26 62	0 73 0 130 0 100 100 100 100 100 100 100 10	168 0 92 0 168 0	NB 253 22 83 16 24 64	58 55 18 0 0 23	0 251 257 0 62 227 0 141 127 0 141	1 NB 1 567 155 62 60 1 0 0 46	901 11 25 41 3 0	0 100 0 101 0 91 0 222	167 0 81 0 180 0	114 24 130 28 0 53	100 - Rd Cli 580 158 155 164 298 158 5 0 64	0 156 0 158	W8 156 0 186 0 187 0	80 22 164 69 0 28 20	Walnut 58 1 545 15 3 590 64 3 9 0 3 0 0 1	0 11 122 1 0 2 165 1 0 2 177 1
AM Fedit Hour 1. N 2. S 2. S 5. N 6. S 7. N 6. S 7. N	Intersection Name Trumon Nd & Baltismore Ave Trumon Nd Se Baltismore Ave Trumon Nd Se Naminos Trumon Nd Se	Signaland All-Way-Stop Signaland Signaland Signaland Signaland Signaland Signaland	73 57 5 7 28 27 28 27 35 20 6 15 22 28 80 58 45 160	0 66 0 58 0 99 0	0 71	8 102 1 11 2 72 7 41 2 28 8 51 0 99 1 268	0 54: 502 0 0 73 503 0 0 54: 86 0	1 120 1 90 1 155 1 11	106 11 100 126 21 51	et (Single 88 0 693 0 603 0 222 0 113	155 0 168 0 284 0	106 8 60 81 8	58 81 11 72 55 28 51	0 10 102 6 0 7 158 6 0 2 160 1	10 NB	81 11 72 55 22 180	0 100 0 158 0 127	205 0 79 0 218 0 0	Na 58 147 52 7 3 5 75 10 81 66 22 28 48 46	0 204 6 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	WB 148 0 118 0 204 0	NB 547 7 7 75 81 22 48 128	52 6 2 166 2 26 6 2 2	1 W8	152 11 83 92 0	## Clos ## ## ## ## ## ## ## ## ## ## ## ## ##	ure	150 0 128 0 200 0	NB 67 9 68 58 9 64 203	0 0 0 101 72 26 62	0 0 73 0 0 100 0 100 0 200	168 0 92 0 168 0	NB 253 22 83 16 24 64	58 55 18 0 0 23	0 251 257 0 62 227 0 141 127 0 141	1 NB 1 567 155 62 60 1 0 46 1 135	901 11 25 41 3 0	0 100 0 101	167 0 81 0 180 0	114 24 130 28 0 53	138 158 156 166 178 178 18 5 0 64	0 156 0 188	W8 156 0 186 0 187 0	80 22 164 69 0 28 20	Walnut 58 1 545 15 3 590 64 3 9 0 3 0 0 1	0 11 122 1 0 2 165 1 0 2 177 1
AM Pauli Hour 1. N 2. S 2. N 4. S 5. N 6. S 7. N 8. S 7. N 8. S 7. N 8. S 7. N 8. S 8. S	Intersection Name Fromos M. & Estimane Ave Transon M. & Grand Boyd Transon M. & Grand Boyd Transon M. & Estimane Ave Tran	Signalard Al-Way-Step Signalard Signalard Signalard Signalard Signalard Signalard Signalard Signalard Signalard	72 57 5 7 28 27 26 15 6 15 20 28 80 58	0 66 0 58 0 99 0	0 71	8 102 1 11 2 72 7 41 2 28 8 51 0 99 1 268	0 54: 502 0 0 73 503 0 0 54: 86 0	1 120 1 90 1 155 1 11	106 11 100 126 21 51	et (Single in 0 elsi 0 ess 0 222 0 113	155 0 168 0 284 0	106 8 60 81 8	58 81 11 72 55 28 51	0 10 102 6 0 7 158 6 0 2 160 1	9 NB	81 11 72 55 23 180	0 100 0 158 0 127	205 0 79 0 218 0	Na 58 147 52 7 3 5 75 10 81 66 22 28 48 46	0 204 6 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	WB 148 0 118 0 204 0	NB 167 7 7 75 81 22 48 118 230 231 16	52 6 2 166 2 26 6 2 2	1 W8	152 11 83 92 0	65 1 103 105 8 0	ure	150 0 128 0 200 0	NB 67 9 68 58 9 64 203	0 0 0 101 72 26 62	0 0 130 0 100 0 0 299 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	168 0 92 0 168 0	NB 253 22 83 16 24 64	58 55 18 0 0 23	0 251 257 0 62 227 0 141 127 0 141	1 NB 1 567 155 62 60 1 0 46 1 135	901 11 25 41 3 0	0 100 0 0 101 0 0 0 101 0 0 0 101 0 0 0 101 0 0 0 101 0 0 0 101 0 0 0 101 0 0 0 101 0	167 0 81 0 180 0	114 24 130 28 0 53	100 - Red Clo 588 158 156 156 158 158 158 158 158 158 158 158 158 158	0 166 0 168 0 263 0 260 0 260 0 260 0 260 0 260 0 260 0 260 0 260 0 260 0 260	W8 156 0 186 0 187 0	80 22 164 69 0 28 20	Walnut 145 15 15 15 15 15 15 1	0 11 1222 1 0 22 1455 1 0 22 1277 1 0 22 2282 1
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22. Rd Clos MM BNS-ING	379 ure - Even	855 & Walnut	100	205	290	362			
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8 8 Rd Clock MM INC. Ing. 1 2 2 4 5 6 7 8 Rt Clock PM INC. Ing. 1 2 2 4 5 6 7 2 8 Rt. Rd Clock Ing. 1 2 2 4 6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	378 une - Even 11 22 15 68 28 28 20 30 40 40 51 20 20 20 20 20 20 20 20 20 20 20 20 20	855 8 Walnut 80 19 164 22 93 8 Walnut 8	100 145 5 146 5 190 25 9 28 28 225 27 149 158	35 44	122 85 172 157	114 145 177 292		21 201 200 281 10	267 263 263
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8 II. Rd Clock IM INC. INC. 2 2 3 4 5 6 7 8 R. Rd Clock IM INC. INC. 2 2 3 4 5 6 7 8 8 R Rd Clock IM INC. INC. 1 2 2 3 4 5 6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	3792 une - Even 111 22 22 15 68 29 84 Even 1100 29 45 246 25 246	855 8 Walnut 80 19 19 19 22 22 8 Walnut 8 80 22 22 10 10 10 10 10 10 10 10 10 10 10 10 10	100 145 5 146 5 190 25 9 28 28 225 27 149 158	15 44	172 25 172 157	114 145 177 292 18 29 29	43	21 201 200 281 10	267 263 263

		Control Type		Existin	g 2023			2050 - N	lo Build		2050 -	- Rd Closur Di		ut) + Rd	2050	- Rd Oper Di	ı (Walnu iet	t) + Rd	2050	O - Rd Clos Baltir	ure (Wa nore)	ilnut &	2050	- Rd Closu Rd	ure (Ba Diet
	Intersection Name	Future Build	LOS	Delay (sec/veh)		Aovement elay	LOS	Delay (sec/veh)	Worst Mo		LOS	Delay (sec/veh)		Movement elay	LOS	Delay (sec/veh)		lovement elay	LOS	Delay (sec/veh)		Movement elay	LOS	Delay (sec/veh)	Wor
AM Peak Hour																									
	1. N Truman Rd & Baltimore Ave	All-Way-Stop	В	14.0	30.3	NBT	В	17.5	32.6	NBT	В	10.5	10.9	NBT	A	9.9	10.2	WB	A	8.3	8.4	WB	A	8.3	8.7
	2. S Truman Rd & Baltimore Ave	All-Way-Stop	В	11.4	12.4	EB	c	19.8	24.1	EB	c	17.6	20.2	EB	C	19.8	24.1	EB	В	13.6	16.4	EB	C	18.0	23.
	3. N Truman Rd & Main St	Signalized	c	27.5	37.6	WBT	D	44.6	44.3	WBT	C	21.3	36.1	WBT	D	38.3	59.8	NBT	В	19.7	24.4	WBT	D	45.3	77.
	4. S Truman Rd & Main St	Signalized	c	26.6	49.4	EBL	D	38.4	109.6	EBL	C	29.1	35.2	EBT	C	32.8	45.9	EBT	C	28.4	34.6	EBT	D	54.3	81.
	5. N Truman Rd & Walnut St	All-Way-Stop	c	21.7	37.0	NBT	c	21.3	41.0	NBT	A	9.5	10.3	WB	c	18.4	22.1	WB	В	11.5	13.0	WB	C	18.4	22
	6. S Truman Rd & Walnut St	All-Way-Stop	A	8.0	20.5	NBT	В	10.7	28.8	SBL	В	11.6	13.7	EB	В	14.8	17.8	EB	В	11.9	14.2	EB	В	14.8	17.
	7. N Truman Rd & Grand Blvd	Signalized	C	21.2	35.8	WBT	c	21.0	30.4	WBT	В	17.5	34.0	WBT	C	20.3	30.4	WBT	В	19.2	31.4	WBT	C	20.3	30.
	8. S Truman Rd & Grand Blvd	Signalized	В	12.8	16.9	EBT	В	14.4	18.9	NBT	В	18.7	25.1	EBT	В	18.8	24.6	EBT	В	20.0	27.3	EBT	В	18.8	24.
PM Peak Hour																									
r in r can rious	1. N Truman Rd & Baltimore Ave	All-Way-Stop	R	14.0	31.2	NBT	A	17.7	36.5	NBT		18.3	21.0	WB	c	15.4	17.1	WB	R	10.9	12.0	WB	B	11.2	12.
	2. S Truman Rd & Baltimore Ave	All-Way-Stop	A	9.9	10.7	EB	В	12.9	15.0	EB	B	13.3	15.7	EB	В	12.9	15.0	EB	В	10.5	11.1	EB	В	11.1	12.
	3. N Truman Rd & Main St	Signalized	c	20.7	41.7	WBT	c	24.7	43.9	WBT	C	26.2	40.1	WBT	c	22.6	38.6	WBT	c	34.8	42.7	WBT	c	28.0	42
	4. S Truman Rd & Main St	Signalized	B	19.2	36.2	EBT	c	24.1	40.9	EBT	C	29.0	50.5	EBT	C	26.3	43.5	EBT	E	56.2	82.9	EBT	C	31.3	46.
	5. N Truman Rd & Walnut St	All-Way-Stop	В	19.3	37.4	NBL	B	17.1	33.1	NBL	B	10.2	11.2	WB	B	11.7	12.7	SB	A	9.9	10.8	WB	B	11.7	12
	6. S Truman Rd & Walnut St	All-Way-Stop	Α.	8.3	20.9	SRI	B	10.7	34.1	SBL	C	20.8	27.0	EB	C	18.1	21.2	EB	C	22.4	29.5	EB	C	18.1	21
	7. N Truman Rd & Grand Blvd	Signalized	R	15.0	35.8	WBT	B	17.3	34.1	WBT	B	16.7	34.6	WBT	B	17.2	34.3	WBT	B	17.7	33.6	WBT	B	17.2	34.
	8. S Truman Rd & Grand Blvd	Signalized	R	16.8	23.4	EBT	C	20.6	26.6	NBT	C	22.8	28.4	EBT	C	22.9	28.5	EBT	C	24.4	29.1	NBT	C	22.9	28.
Note:	Method - HCM 6th - AWSC Synchro Results - Signalized	Control Type		Existin	g 2023			2050 - N	lo Build		2050 -	- Rd Closur Di		ut) + Rd	2050	- Rd Oper Di		t) + Rd	2050) - Rd Clos Baltir	ure (Wa nore)	ilnut &	2050	- Rd Closi Rd	ure (Ba
Note:		Control Type	NB	Existin	g 2023 EB	WB	NB	2050 - N	lo Build	WB	2050 - NB			ut) + Rd ws	2050 NB			t) + Rd WB	2050 NB			ilnut &	2050 NB		
	Synchro Results - Signalized Intersection Name					WB	NB			WB		Di	et			Di	et			Baltir	nore)			Rd	Diet
Note:	Synchro Results - Signalized Intersection Name	Future Build								WB 49		Di	et			Di	et			Baltir	nore)	WB		Rd	Diet
	Synchro Results - Signalized Intersection Name	Future Build All-Way-Stop	NB	SB		WB 31	NB 122 60	SB			NB	SB	et	WB	NB	Di SB	et	WB		Baltin	nore)		NB	Rd SB	Diet
	Synchro Results - Signalized Intersection Name 1. N Truman Rd & Baltimore Ave	Future Build	NB 97	SB 80	EB		122	SB 106	EB		NB	SB 53	et EB	WB	NB 45	58 50	et EB	WB	NB	Baltin	more)	WB		Rd SB	Diet
	Synchro Results - Signalized Intersection Name 1. N Truman Rd & Baltimore Ave 2. S Truman Rd & Baltimore Ave	Future Build All-Way-Stop All-Way-Stop	NB 97 48	SB 80 63	EB	31	122 60	SB 106 69	EB	49	NB 53 71	SB 53 50	et EB	WB 88	NB 45 59	58 50 53	et EB	WB 74	NB 80	SB 18	more)	WB 70	NB 82	SB 41	Diet EB
	Synchro Results - Signalized Intersection Name 1. N Truman Rd & Baltimore Ave 2. S Truman Rd & Baltimore Ave 3. N Truman Rd & Main St	Future Build All-Way-Stop All-Way-Stop Signalized	97 48 193	SB 80 63 118	EB 61	31	122 60 226	SB 106 69 204	EB 339	49	NB 53 71 159	58 53 50 161	EB 244	WB 88	NB 45 59 224	50 53 200	EB 383	WB 74	NB 80 227	SB 18 207	more) EB	WB 70	NB 82 223	SB 41 237	Diet EB
	Synchro Results - Signalized Intersection Name 1. N Truman Rd & Baltimore Ave 2. S Truman Rd & Baltimore Ave 3. N Truman Rd & Main St 4. S Truman Rd & Main St	All-Way-Stop All-Way-Stop Signalized Signalized	97 48 193 79	80 63 118 122	EB 61	31 225	122 60 226 146	106 69 204 158	EB 339	49 279	NB 53 71 159	58 53 50 161 191	EB 244	WB 88 179	NB 45 59 224 156	58 50 53 200 160	EB 383	WB 74 259	NB 80 227	58 18 207 198	more) EB	WB 70 262	NB 82 223 170	SB 41 237 201	Diet EB 419 326
	Synchro Results - Signalized Intersection Name 1. N Truman Rd & Baltimore Ave 2. S Truman Rd & Baltimore Ave 3. N Truman Rd & Main St 4. S Truman Rd & Main St 5. N Truman Rd & Walnut St	Future Build All-Way-Stop All-Way-Stop Signalized Signalized All-Way-Stop	97 48 193 79	80 63 118 122 92	EB 61 220	31 225	122 60 226 146 167	106 69 204 158 101	EB 339 297	49 279	NB 53 71 159 122	58 53 50 161 191	EB 244 275	WB 88 179	NB 45 59 224 156 99	58 50 53 200 160 64	EB 383 285	WB 74 259	NB 80 227 153	58 18 207 198	EB 230 295	WB 70 262	NB 82 223 170 104	Rd SB 41 237 201 60	41: 32:
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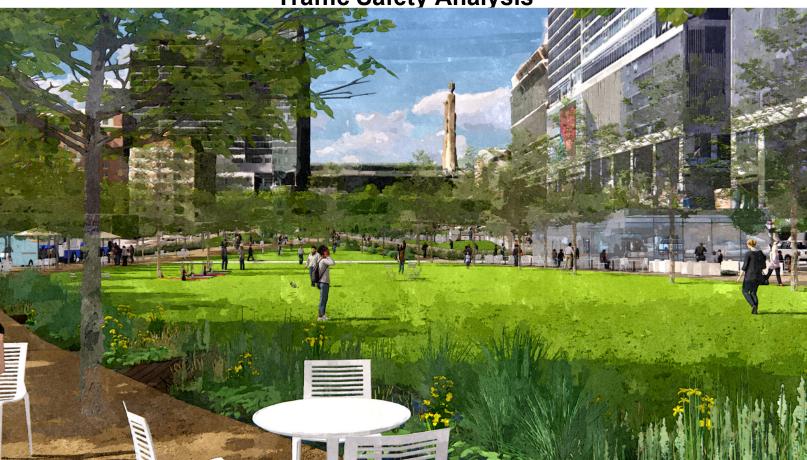






South Loop Project

Traffic Safety Analysis



Kansas City, Missouri

September 2024

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1 Introduction

Port KC is assessing the safety of a stretch of I-670 and arterial corridors for a future park to be added as a deck over I-670. This analysis utilizes crash data obtained from MoDOT for the most complete five-year period available at the time the analysis was completed (February 2023), 2017-2021. The crash analysis is intended to summarize existing crash characteristics (crash severity, crash type, and other prevailing conditions as necessary) and identify high-density crash locations. Additionally, utilizing Highway Safety Manal (HSM) methodology future no-build and build scenarios will be analyzed. This analysis includes a literature review on the impacts of tunnels on traffic crashes.

1.1 Project Background

Port KC and consultant team (HNTB) are creating a design for a park to be added as a deck above I-670. The existing conditions of I-670 divide the Central Business District and the Crossroads Arts District, which both also lack public parks and plazas. I-670 acts as a key route into and out of the downtown area. The arterial roads crossing over I-670 between Baltimore Avenue and Main Street act as important connections between the city districts.

1.2 Project limits

The project is located along I-670 through the downtown area of Kansas City, Missouri from the east facing ramps of the interchange with I-35 to the west facing ramps to the interchange with US-71. Truman Road, running in both eastbound and westbound directions along I-670, between Baltimore Avenue and Grand Boulevard as well as the sections of several arterials crossing over I-670 in that length were included in the studied area. Land use in the analyzed area primarily consists of commercial use, though also includes residential uses. **Figure 1** shows the limits of the existing safety analysis.



Figure 1: Safety Study Limits

Source: ArcGIS

2 Existing Crash Analysis

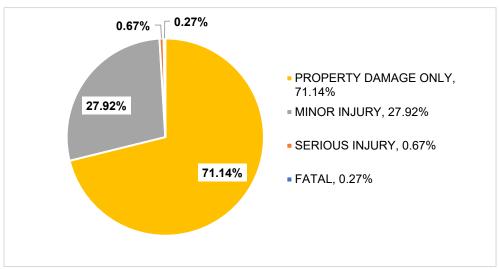
An approximate 2/3rd of a mile segment of I-670 and total 1/2 mile of arterials were evaluated. Each direction of Truman Road measured about 1000' in length, and each crossing road measured about 200'. **Table 1** identifies and classifies each corridor segment.

Table 1: Corridor Segmentation

Interstate	Truman Road	Other Arterial Roads
I-670	Truman Road EB	Grand Boulevard
	Truman Road WB	Walnut Street
		Main Street
		Baltimore Avenue

Between the years of 2017-2021, 745 crashes were reported across all the corridors within the safety study limits. A majority of these crashes, 561 (~75%), occurred along the I-670 corridor which largely influenced the severity and type of crashes. Of the 745 crashes reported, 530 (~71%) resulted in no injury, 213 (~29%) resulted in some form of injury, and 2 crashes resulted in fatality (**Figure 2**). Crashes reported within the project limits were also categorized by type. As shown in **Figure 3**, rear end collisions and passing collisions are the predominant crash types, accounting for 45% and 22% of total crashes respectively.

Figure 2: Total Crash Severity – All Corridor



Source: MODOT Crash Data 2017-2021

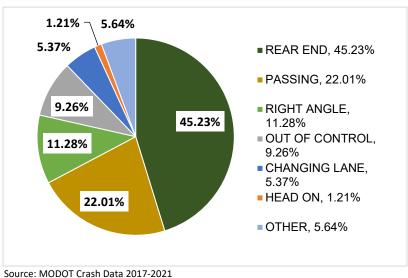


Figure 3: Total Crash Type - All Corridors

Figure 4 shows the location of rear end and passing collisions within the project limits. Both collision types occurred primarily along the I-670 corridor. 85% of total rear end collisions and 92% of total passing collisions occurred along the I-670 corridor.



Figure 4: Rear End and Passing Crash Locations – All Corridors

Source: MODOT Crash Data 2017-2021

Approximately 75% of all crashes occurred during clear weather conditions, 12% of total crashes occurred during cloudy conditions, 5% of total crashes occurred during rain. Although 83% of all crashes occurred on dry roadway surfaces, 14% of crashes occurred on wet, snowy, or icy roads. Weather and road conditions weren't significant influences on crashes.

2.1 **I-670 Corridor Analysis**

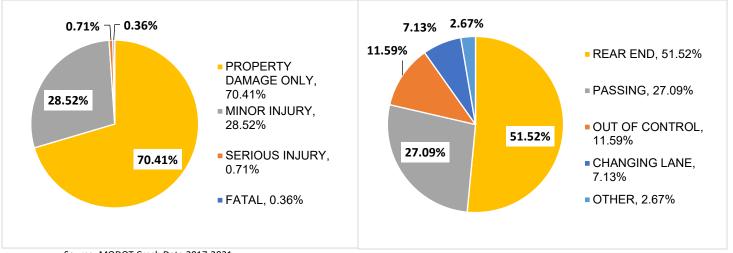
The I-670 corridor within the project limits runs from the crossing underneath Broadway Boulevard (approximately at the east facing ramps for I-35) to the west facing gore areas leading into the I-670/U.S. 71 interchange through the downtown Kansas City, Missouri area. This corridor runs 2/3rds of a mile and is classified as interstate road along the entire length. Both the eastbound and westbound directions are analyzed as one corridor.

2.1.1 Crash Severity and Crash Types

Between the years 2017-2021, 561 crashes were reported on I-670, which represents roughly 75% of all crashes reported within the project limits. Of the 561 crashes reported, 395 crashes (~70%) resulted in property damage only, 164 crashes (~29%) caused some form of injury to vehicle occupants (serious and minor), and two crashes (<1%)) resulted in fatalities (**Figure 5**). Crash types (shown in **Figure 6**) were primarily comprised of rear end (51.5%) and passing (27.1%) collisions. As shown in **Figure 7**, the rear end crashes are spread evenly across the corridor. Passing crashes see higher crash density near entrances and exits from I-670, though still occur across the corridor.

Figure 5: I-670 Crash Severity

Figure 6: I-670 Crash Type



Source: MODOT Crash Data 2017-2021

Figure 7: Rear End and Passing Collisions – I-670 Corridor



Source: MODOT Crash Data 2017-2021

Approximately 88% of all crashes along the I-670 corridor occurred under no adverse weather conditions (Clear or Cloudy). A combined 7% of crashes occurred on either wet, snowy, slushy, or icy roads. The weather and roadway conditions do not appear to have a significant impact on crashes along the corridor based on this data.

2.1.2 Crash Rate

The I-670 corridor is classified solely as an interstate segment. MoDOT provided the statewide total and combined fatal and serious injury crash rates for all types of facilities. The segment crash rate was calculated based off the project area crash data. **Table 2** below compares total and combined fatal and serious injury crash rate for the segment evaluated on the along the I-670 corridor to the statewide crash averages.

Table 2: I-670 Crash Rates

		All Cı	rash Rate	Fatal + Serious Injury		
Segment	Functional Class	Crash Rate	Statewide Average	Crash Rate	Statewide Average	
I-670	Interstate	384.04	78.79	4.11	2.0	

Source: MoDOT statewide averages for similar facilities

Crash rates are calculated with estimated 2019 ADT (120,066) extrapolated from 2023 traffic counts

Crash rates per Hundred Million Vehicle Miles Traveled (HMVMT)

It is important to note that the crash rates shown for I-670 may be skewed due to the short corridor length. Generally, a shorter length (less than one mile) may result in a crash rate higher than expected. Despite this expected skew in data, the segment of I-670 analyzed has a crash rate significantly higher than the statewide average.

2.1.3 Crash Density

The crash density and the locations of fatal and serious injury crashes along the I-670 corridor are shown in **Figure 8**.

W13th 51

W13th 51

E13th 51

E13th 51

E13th 51

E13th 51

Crash Density
Sparse
Dense
Fatal and Serious Injury
Fatal Crashes

Serious Injury Crashes

Serious Injury Crashes

Figure 8: Crash Density & Severity - I-670

Source: MODOT Crash Data 2017-2021

The heat map shows that there is a higher crash density along I-670 under arterial bridges. However, these crashes may not have occurred at those exact locations. Some data points were overlapped on the exact same coordinates, indicating that GPS data was not recorded at the exact place of some of the reported incidents. There are also increases in density at the entrances and exits to the highway. The fatal and serious injury crashes were spread across the corridor with no locations of significant density.

2.1.4 Fatal and Serious Injury Crashes

There were two fatal crashes and four serious injury crashes along the I-670 corridor. These crashes were spread evenly across the corridor with no areas of concentration. One crash (a suspected serious injury) occurred in dark, street-lit conditions while the rest were in daylight. Two crashes (a disabling injury and suspected serious injury) occurred with wet road surface conditions while the rest were dry conditions. All six crashes occurred during clear or cloudy weather. This may indicate that road conditions had an impact on the severity of crashes, but lighting and weather did not. A brief description of the crashes is provided based on their locations along the corridor from east to west.

- A disabling injury crash occurred in the westbound direction of I-670 about 100 ft west of the Baltimore Avenue bridge centerline due to a rear end collision.
- A fatal crash occurred in the eastbound direction of I-670 about 170 ft east of the Baltimore Avenue bridge centerline involving a pedestrian.
- A fatal crash occurred in the eastbound direction of I-670 approximately 160 ft east of the Walnut Street bridge centerline due to a rear end collision.
- A serious injury crash occurred in the westbound direction of I-670 underneath the Oak Street bridge centerline as a result of an out-of-control vehicle. This occurred on a wet road surface.
- A serious injury crash occurred in the eastbound direction of I-670 underneath the Locust Street bridge centerline due to a passing maneuver. This occurred in dark, street-lit conditions.
- A disabling injury crash occurred in the eastbound direction of I-670 approximately 365 ft east of the Locust Street bridge centerline due to a passing maneuver. This occurred on a wet road surface.

2.1.5 Enclosed vs Open Corridor

An evaluation was conducted to analyze the enclosed vs open portions of the I-670 corridor to assess any potential safety concerns. Under Bartle Hall (the enclosed portion) there are 224 crashes over the 5-year period, these occur over an 870 ft segment (Broadway Boulevard to Wyandotte Street). Totaling 1,359 crashes per mile. To the east the uncovered portion (Wyandotte Street to Oak Street) there was 340 crashes over 5 years, over a 1985 ft segment. Totaling 904 crashes per mile. Showing there are more crashes per mile under the current structure. These are primarily rear end and passing crashes with no conclusive evidence from the crash data pointing to a specific cause besides heavy congestion and multiple weaving movements.

2.1.6 **I-670 Corridor Analysis Summary**

A total 561 crashes occurred along the I-670 corridor between 2017-2021. Of those, 395 (~70%) resulted in no injury, 164 crashes (~29%) resulted in some form of injury, and two crashes (<1%) resulted in a fatality. Rear end collisions are the predominant crash type followed by passing collisions. The crash rate of the I-670 corridor was higher than the statewide average, even when accounting for a skewed rate due to short corridor length. Crashes were most frequent at entrances and exits to the interstate. The fatal and serious injury crashes occurred evenly spread across the 2/3 mile stretch of the I-670 corridor. There is concern however that crashes may not have occurred at the exact GPS locations. Some data

points were overlapped on the exact same coordinates, indicating that GPS data was not recorded at the exact place of some of the reported incidents.

2.2 **Truman Road Corridor Analysis**

The Truman Road corridor is a one-way pair that runs between Baltimore Avenue and Grand Boulevard. The corridor considers intersections – defined by the stop bar pavement markings – to be a part of the Truman Road corridor. Each direction of Truman Road runs 970 feet and is entirely classified as a minor arterial roadway.

Crash Severity and Crash Types 2.2.1

Between the years 2017-2021, 178 crashes were reported on both eastbound and westbound Truman Road. 95 crashes (~53%) were along eastbound Truman Road, and 83 crashes (~47%) were along westbound Truman Road. Of the combined 178 crashes, approximately 72% resulted in property damage only, 28% resulted in some form of injury, and no crashes resulted in a fatality (Figure 9). Crash types (shown in Figure 10) were primarily comprised of right-angle collisions (~47%) and rear end collisions (~26%).

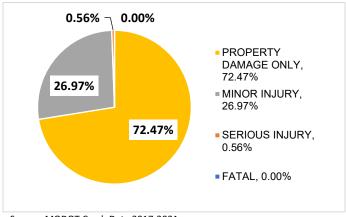


Figure 9: Crash Severity – Truman Road

Source: MODOT Crash Data 2017-2021

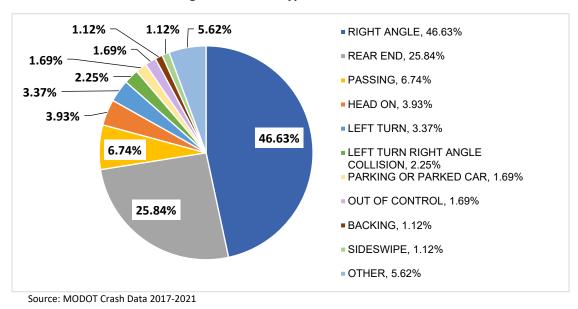


Figure 10: Crash Type – Truman Road

Figure 11 shows the location of right-angle and rear end collisions along the corridor. These crashes primarily occurred at intersections with the majority occurring at the intersection of Truman Road eastbound and Grand Boulevard.

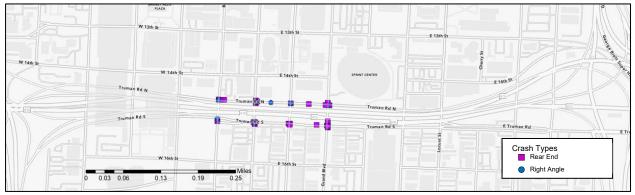


Figure 11: Rear End and Right-Angle Vehicle Crash Locations – Truman Road

Source: MODOT Crash Data 2017-2021

Approximately 86% of all crashes occurred during no adverse weather conditions (Clear or Cloudy). A total of 12% of crashes were noted to have occurred on either wet, snowy, slushy, or icy roads. The weather or roadway conditions do not appear to have a significant impact on crashes along the corridor.

2.2.2 Crash Rate

Crash rates were not evaluated for Truman Road. Evaluation for one-way roads is not standard, and there is no state-wide average to compare to. In addition to this, the segments of Truman Road are far shorter than a standard length of one mile, which would potentially skew further.

2.2.3 Crash Density

The crash density along both the eastbound and westbound Truman Road is shown in **Figure 12** below. The fatal and serious injury crash locations along Truman Road are presented as well.

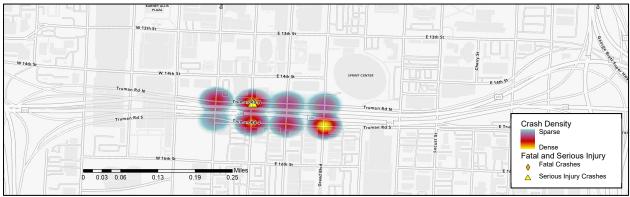


Figure 12: Crash Density – Truman Road

Source: MODOT Crash Data 2017-2021

Crashes along both Truman Road westbound and eastbound occurred nearly exclusively in the intersections with the arterial corridors. Few, but some crashes did occur between Main Street and Grand Boulevard. The only serious injury crash occurred at the intersection of Truman Road westbound and Main Street.

2.2.4 Fatal and Serious Injury Crashes

There were no fatal crashes and one serious crash along the Truman Road corridor between 2017-2021. A brief description of this crash is provided below.

• A disabling injury crash occurred at the intersection of westbound Truman Road and Main Street due to a right-angle collision.

2.2.5 Truman Road Corridor Analysis Summary

A total of 178 crashes occurred along the Truman Road corridor during the study period 2017-2021. The crashes were close to evenly split between the eastbound and westbound directions, 53% and 47% respectively. Among all the crashes, 129 resulted in no injury and 49 crashes resulted in some form of injury. No crashes resulted in a fatality. Right-angle collisions were most common, followed by rear end collisions. The highest density of crashes was located within the intersections between Truman Road and the arterial corridors. The intersection with the most crashes was Truman Road eastbound and Grand Boulevard.

2.3 Other Arterial Corridor Analysis

The other arterial corridors include Baltimore Avenue, Main Street, Walnut Street, and Grand Boulevard. The extent of the project limits of each street include only the bridge over I-670, between the stop bars at the intersections with westbound Truman Road and eastbound Truman Road. Each segment measures approximately 195 feet in length. Each segment is classified as a major collector roadway. Because of the short segment length, the crash data set is too small to complete a full data analysis.

2.3.1 Other Arterial Corridor Analysis Summary

A total of six crashes occurred among the other arterial streets corridor during the study period 2017-2022. All six crashes resulted in no injury. Four crashes occurred along Grand Boulevard, one along Walnut Street, one along Main Street, and none along Baltimore Avenue. Two crashes were rear end collisions, one was a right-angle collision, one was with a parking or parked car, one was due to an out-of-control vehicle, and one was cause by other factors. Only one crash was recorded under hazardous road or weather conditions, which indicates that weather and road conditions did not have a significant impact on crashes along the corridor. Because of the low volume of data, a full analysis including crash rates could not be completed.

2.4 Existing Summary

There is some concern that location information within the crash data might not be absolutely accurate as many crashes along I-670 are located at identical GPS coordinates. This is likely due to the nature of the roadway and a lack of safe locations for emergency officials to take crash reports. Because of this, determining exact locations of crash concerns is difficult and overall trends along the entire I-670 corridor should be considered instead of specific locations.

Overall, the results of the existing crash analysis are what would be expected from an urban interstate corridor that experiences high levels of congestion. High rates of rear end and passing crashes with high crash rates. Rear end and passing crashes accounted for 78% of all crashes along I-670 and crash for all crashes was 4.5 times the statewide average, with fatal and serious injury crashes at almost 2 times the statewide average. However, overall crashes are of low severity with almost all being either Property Damage Only (70%) or Minor Injury (29%).

On the arterial network, crashes are concentrated at intersections with right angle (47%) and rear end (25%) accounting for over 70% of all crashes. As with I-670, almost all crashes are of low severity with almost all being either Property Damage Only (72%) or Minor Injury (27%).

The existing analysis does not specifically point to a safety concern along I-670 or the arterial network. Crash type and severity stratification are as expected for a congested urban area. The current I-670 facility does experience a higher per mile frequency of crashes in the enclosed vs open portions of the corridor, however these segments are far too short to calculate a crash rate to normalize based on volume.

3 Future Analysis

A future predictive crash analysis was conducted using the Interactive Highway Safety Design Model (IHSDM) version 17.0.0 software, developed by the Federal Highway Administration (FHWA), to evaluate the 2050 No-Build and the two Preferred Build Alternatives, the Eastern Superblock (closure of the Walnut Street Bridge over I-670) and the Western Superblock (closure of the Baltimore Avenue Bridge over I-670). IHSDM utilizes methodology from the Highway Safety Model (HSM) to predict crashes based on roadway geometry, roadway characteristics, and traffic volumes. A summary of results from the predictive analysis can be seen in later sections of this report.

3.1 Methodology

The predictive crash analysis includes the mainline from I-670, spanning from the east-facing ramps of the I-35 interchange to the west-facing ramps of the U.S.-71 interchange. Truman Road, running in both eastbound and westbound directions along I-670, between Broadway Boulevard and Oak Street as well as the sections of the arterials crossing over I-670 in that length were included in the studied area.

The Arterial predictive crash analysis includes Truman Road, which runs in both eastbound (EB) and westbound (WB) directions along I-670, spanning from Baltimore Avenue to Grand Boulevard. Additionally, the evaluation extends to the sections of these arterials that cross over I-670. **Table 3** presents a comprehensive breakdown of the predictive crash analysis for various roadway segments within the FNB and Build Alternatives for the Arterials.

Truman Road EB
From Baltimore Avenue to Grand Boulevard
Truman Road WB
From Baltimore Avenue to Grand Boulevard
Baltimore Avenue
Truman WB to Truman EB
Main Street
Truman WB to Truman EB
Walnut Street
Truman WB to Truman EB
Truman WB to Truman EB
Truman WB to Truman EB

Table 3: IHSDM Study Limits-Arterials

3.2 Future No Build (FNB) Alternatives

FNB Alternative was developed for all existing roadway facilities including I-670 mainline, ramps, and all arterials. Also, to evaluate the anticipated impacts of the proposed improvements, FNB was developed for the Arterials that are targeted for the improvements. The following sections provide a summary of results of the FNB Alternatives.

3.2.1 Future No Build (FNB) Alternative - Mainline and Arterials

The current configuration of I-670 corridor consists of both enclosed and open road segments. While it resembles a tunnel without a roof, IHSDM classifies it as an open road. **Table 4** presents the 2050 FNB

predictive crash results for mainline I-670 and Arterials. As shown in **Table 4**, the total number of predicted crashes along all analyzed mainline and arterial roadways is 169 in 2050. The Arterial intersections will experience a substantial number of crashes at over 57% of the analyzed roadways.

Table 4: FNB Predicted Crashes (Mainline and Arterials)

	K	Α	В	С	PDO	Total
Freeway: I-670	0.3	0.8	4.9	9.1	41.0	56.1
Ramps	0.1	0.2	1.2	1.8	4.1	7.4
Arterial Segments	0.0	0.2	0.8	1.5	6.0	8.6
Intersections	0.1	1.1	6.0	14.9	75.0	97.2
Total	0.5	2.4	13.0	27.4	126.1	169.3

Source: IHSDM V 17.0.0 Results

3.2.2 Future No Build (FNB) Alternative - Arterials

Table 5 presents the results from the predictive analysis under 2050 Future No Build Alternative for the Arterials. According to the IHSDM FNB model results, the total number of predicted crashes is 52 in 2050. As shown in **Table 5**, the intersections will experience a substantial number of crashes. The IHSDM results revealed that intersection crashes will comprise mostly angle collisions. With roadway geometry and other basic roadway characteristics being consistent between the existing condition and 2050 FNB IHSDM, this predicted increase in crashes could be attributed to projected increases in traffic volumes, as this is the only non-consistent variable.

Table 5: FNB Predicted Crashes (Arterials)

	K	Α	В	С	PDO	Total
Arterial Segments	0.0	0.1	0.4	0.6	2.7	3.8
Intersections	0.0	0.6	3.1	7.6	37.2	48.4
Total	0.0	0.7	3.5	8.2	39.9	52.3

Source: IHSDM V 17.0.0 Results

3.3 Build Alternatives-Arterials

With the improvements proposed under the two Preferred Build Alternatives, the Eastern Superblock and the Western Superblock, Truman Road will be transformed from a three-lane into a two-lane road in each direction. Additionally, Walnut Street or Baltimore Avenue will be closed over the I-670 mainline (not both), and the traffic control at the Baltimore and Walnut intersections will change from signal-controlled to all-way stop-control in either alternative.

The proposed alternatives are listed below-

- Road diet of Truman Road with two lanes in each direction; no turn lanes except for a single dedicated EB left turn lane at S Truman Road and Grand Boulevard.
- All-way stop-controlled intersections at the Baltimore and Walnut Street intersections.

Closure of the Walnut Street Bridge or Baltimore Avenue Bridge over I-670.

In addition to the proposed improvements above, a bicycle lane is proposed to be added to both directions of Truman Road. To account for this, a Crash Modification Factor (CMF) of 0.734^1 was added to those segments in the IHSDM model. The research used to develop this CMF value shows it to be statistically significant for two-lane undivided urban collectors and local streets. IHSDM is unable to model all-way-stop-control intersections involving one-way approaches, to account for this limitation, the Baltimore and Walnut intersections were modeled as stop-controlled intersections on the minor legs only. A CMF value of 0.78^2 was then applied to account for the conversion of the minor leg stop-controlled intersections into all-way-stop control intersections in the model.

With these proposed improvements accounted for in the 2050 Future Build Alternatives, **Table 6** shows the predictive crash results of the two Build Alternatives. Under the Build Alternatives, crashes are predicted to decrease along all analyzed arterial roadways and intersections. The two Build Alternatives (the Eastern Superblock and the Western Superblock), have similar total predicted crashes and both have decreased predicted crashes in comparison to the FNB predicted crashes.

Table 6: Build Alternatives Predicted Crashes

Eastern Superblock (Walnut Closure)	К	А	В	С	PDO	Total
Arterial Segments	0.0	0.1	0.3	0.5	2.4	3.4
Intersections	0.0	0.4	2.0	4.7	23.6	30.7
Total	0.0	0.5	2.3	5.3	26.0	34.2
Western Superblock (Baltimore Closure)	К	А	В	С	PDO	Total
Arterial Segments	0.0	0.3	0.7	0.8	4.2	5.9
Intersections	0.0	0.4	1.9	4.7	23.2	30.2
Total	0.1	0.7	2.6	5.5	27.4	36.1

Source: IHSDM V 17.0.0 Results

3.4 Literature Review- Tunnel

The I-670 facility through the project area currently sits below grade of the arterial street network and at the western limits travel under the Convention Center. These characteristics are very similar to a tunnel in terms of traffic safety. The project may lead to a reduction of crash rates. To illustrate this, a brief literature review follows about the impact of tunnels on traffic crashes.

The risk of traffic crashes in a tunnel may be reduced by approximately half compared with the open road. However, those crashes that do occur carry the likelihood of higher crash injury severities and fatalities. Especially in the event of fire due to the enclosed environment and expansion of heat and smoke

¹ Avelar, R., K. Dixon, S. Ashraf, A, Jhamb, and B. Dadashova. "Development of Crash Modification Factors for Bicycle Lane Additions While Reducing Lane and Shoulder Widths" Report No. FHWA-HRT-21-013. Federal Highway Administration, Office of Safety Research and Development. McLean, Virginia. (2021).

² Deng, Z., S. Kyrychenko, T. Lee, and R. Retting. "Estimate of the Safety Effect of All-Way Stop Control Conversion in Washington, DC". Transportation Research Record No. 2674, Transportation Research Board of the National Academies of Science, Washington, D.C., (2020).

(Bassan,2016³; Ma et al.,2009⁴; Amundsen et al.⁵). The risk of being severely injured is higher at the tunnel entrance compared to accidents inside the tunnel (Yeung and Wong, 2013⁶; Amundsen et al.).

Due to limitations in predictive safety modeling in relation to tunnels a predictive analysis was not completed. In some aspects tunnels are safer than open roadways due to changes in driver behavior, in other aspects they have additional challenges due to restricted clear zones and barriers. I-670 currently has many of the same constraints and challenges that are inherent in tunnels, such as the lack of clear zones due to the walls and a center median barrier. Minor modifications to the cross section and lane configuration may be proposed during final design; overall, these are expected to be small in scale and therefore have little impact on the overall safety of the facility. Additionally, the impacts from safety features such as fire suppression and incident management will likely reduce the severity level of crashes. Safety will be considered during final design to determine the potential impact due to cross sectional and lane configuration changes.

3.5 Predictive Analysis Results

Compared to the FNB Alternative, the results of the predictive analysis show a net reduction in predicted crashes for both of the Build Alternatives on the arterial network. As shown in **Table 7**, when total crashes along the arterial facilities are compared to the No-Build, the Eastern Superblock is predicted to experience a 36% net reduction in total crashes (19 crashes per year) and the Western Superblock is predicted experience a 32% net reduction in total crashes (17 crashes per year). Compared to the Eastern Superblock, the Western Superblock results in an additional Fatal + Injury (F+I) crash and an additional Property Damage Only (PDO) crash. Despite that, the reduction in crashes for both alternatives compared to the FNB is still significant and the difference in results among the two alternatives is not overly concerning. The number of Fatal and Injury (F+I) crashes are also predicted to decrease significantly. The intersections experience the most substantial decrease in crashes, particularly in terms of angle collisions. The changes under the Build Alternatives, including the reduction of the roadway cross-section of the Truman Roads and the removal of turn lanes, resulting in a decrease in the number of conflict points at the intersections and, consequently, a reduction in the likelihood of crashes occurring at those intersections.

Table 7: Predictive Analysis Results

	Number of Crashes			Delt	ta (FNB to B	uild)	Percent Change		
Alternative	Total Crashes	F+I Crashes	PDO Crashes	Total Crashes	F+I Crashes	PDO Crashes	Total Crashes	F+I Crashes	PDO Crashes
FNB-Arterial	53	12.69	40.57	-	-	-	-	-	-

³ Bassan, S. (2016). Overview of traffic safety aspects and design in road tunnels. *IATSS research*, 40(1), 35-46.

⁴ Ma, Z. L., Shao, C. F., & Zhang, S. R. (2009). Characteristics of traffic accidents in Chinese freeway tunnels. *Tunnelling and underground space technology*, 24(3), 350-355.

⁵ Amundsen, F. H., & Engebretsen, A. (2009). Studies on Norwegian road tunnels II: An analysis on traffic accidents in road tunnels 2001-2006.

⁶ Yeung, J. S., & Wong, Y. D. (2013). Road traffic accidents in Singapore expressway tunnels. *Tunnelling and Underground Space Technology*, 38, 534-541.

	Nu	ımber of Cra	ashes	Delt	ta (FNB to E	Build)	Percent Change			
Alternative	Total	F+I	PDO	Total	F+I	PDO	Total	F+I	PDO	
	Crashes	Crashes	Crashes	Crashes	Crashes	Crashes	Crashes	Crashes	Crashes	
Eastern Superblock (closing Walnut)	34.1	8.1	26	-19	-5	-15	-35.8%	-36.1%	-35.9%	
Western Superblock (Closing Baltimore)	36.1	8.8	27.4	-17	-4	-13	-31.9%	-30.6%	-32.5%	

Source: IHSDM V 17.0.0 Results

The predicted number of crashes along westbound Truman Road and eastbound Truman Road is expected to decrease by 35% (5 crashes per year) and 38% (6 crashes per year) respectively, under the Eastern Superblock, compared to the FNB scenario. This reduction in crashes is attributed to the reduction in the number of lanes. The predicted number of crashes along Walnut Street is expected to decrease by 89% (4 crashes per year) under the Eastern Superblock, compared to the FNB scenario. Baltimore Avenue will also experience a significant reduction in crashes by 69% (4 crashes per year) under the Eastern Superblock, compared to the FNB scenario. Under the Western Superblock, the predicted number of crashes along westbound Truman Road and eastbound Truman Road is expected to decrease by 28% (4 crashes per year) and 28% (4 crashes per year) respectively, in comparison to the FNB scenario. The predicted number of crashes along Baltimore Avenue is anticipated to decrease by 90% (5 crashers per year). Walnut Street will also experience a significant reduction in crashes by 72% (3 crashes per year) under the Western Superblock, compared to the future scenario. The closure of the Walnut Street Bridge or the Baltimore Avenue Bridge over I-670 will lead to a substantial decrease in intersection crashes.

4 Conclusion

Overall, the results of the existing crash analysis are what would be expected from an urban interstate corridor that experiences high levels of congestion. High rates of rear end and passing crashes with high crash rates. The crash rate for all crashes was 4.5 times the statewide average, with fatal and serious injury crash rates at almost two times the statewide average. However, overall crashes are of low severity with nearly all being either Property Damage Only or Minor Injury. On the arterial network, crashes are concentrated at the intersections with the right angle and rear end accounting for over 70% of all crashes. As with I-670, almost all crashes are of low severity with almost all being either Property Damage Only or Minor Injury.

The existing analysis does not specifically point to a safety concern along I-670 or the arterial network. Crash type and severity types are as expected for a congested urban area. The current I-670 facility does experience a higher per mile frequency of crashes in the enclosed vs open portions of the corridor, however these segments are far too short of calculating a crash rate to normalize based on volume.

Future predictive crash analysis for the arterials was conducted to evaluate the 2050 No-Build and Build Alternatives. The results of the predictive crash analysis show a decrease in intersection-related crashes within the project study limit. These reductions are primarily related to the reduction of the roadway cross-section of the Truman Roads and the removal of turn lanes. This leads to a decrease in the number

of conflict points at the intersections and, consequently, a reduction in the likelihood of crashes occurring at those intersections. A brief literature review was also conducted to assess the impact of tunnels on traffic crashes as the HSM does not allow for an analysis of the tunnel condition. The literature points to a reduction in crashes in a tunnel compared to open roads. The research points to an increase of crashes at the entrance of a tunnel, though most of I-670 is uncovered, a portion is covered. As a result, an increase in crashes at the tunnel entrance is not expected as rather the transition zone will shift.