Appendix B: Traffic and Safety Analysis Reports

SOUTH LOOP PROJECT

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
2. 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

SOUTH LOOP PROJECT

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

Level of Service	Signalized Intersection Control Delay (sec/veh)	Unsignalized Intersection Control Delay (sec/veh)	Traffic Flow Characteristics
A	≤ 10.0	≤ 10.0	Free flow, insignificant delays.
B	> 10.1-20.0	> 10.1-15.0	Stable operation, minimal delays.
C	> 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.
E	> 55.1-80.0	> 35.1-50.0	Maximum capacity, extended delays. Volumes at or near capacity. Long queues form upstream from intersection.
F	> 80.0	> 50.0	Forced flow, excessive delays. Represents jammed 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.

Table 2: Studied Scenarios Descriptions

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

SOUTH LOOP PROJECT

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	PM	Existing geometry
15	No-Build	2050		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			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

SOUTH LOOP PROJECT

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 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.

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.

SOUTH LOOP PROJECT

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 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 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.

SOUTH LOOP PROJECT

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	AM	Existing geometry
2	No-Build	2050		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			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	PM	Existing geometry
8	No-Build	2050		Existing geometry
9	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
10	Build (Rd Diet) two lanes & Walnut St Open			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 un-signalized 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

SOUTH LOOP PROJECT

- 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.

Intersection Name	Control Type	Existing 2023				2050 - No Build				2050 - Rd Diet (Single Lane)				2050 - Rd Diet (Two Lanes)			
		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay	
AM Peak Hour																	
1. N Truman Rd & Baltimore Ave	Signalized	B	16.0	20.7	NBL	B	17.7	27.9	NBL	B	18.5	29.7	NBL	B	16.4	19.8	NBL
2. S Truman Rd & Baltimore Ave	All-Way-Stop	A	9.8	10.9	EBL	B	13.1	15.5	EBL	E	48.9	63.0	EBT	B	13.1	15.5	EBL
3. N Truman Rd & Main St	Signalized	B	10.4	14.5	WBR	B	11.9	15.6	WBR	B	14.6	17.7	SBT	B	11.9	15.6	WBR
4. S Truman Rd & Main St	Signalized	B	11.9	14.8	EBR	B	13.3	16.1	EBR	C	27.8	31.2	EBT	B	14.9	16.9	EBR
5. N Truman Rd & Walnut St	Signalized	C	23.4	28.8	WBR	C	25.1	31.0	WBR	C	32.8	38.9	WBT	C	28.3	35.3	WBR
6. S Truman Rd & Walnut St	Signalized	B	15.9	16.3	SBL	B	11.1	31.1	SBL	B	15.7	31.1	SBL	B	11.9	31.1	SBL
7. N Truman Rd & Grand Blvd	Signalized	B	18.4	32.8	WBR	C	21.7	38.5	WBR	C	27.4	37.6	WBT	C	21.7	38.5	WBR
8. S Truman Rd & Grand Blvd	Signalized	B	18.1	25.9	EBT	C	20.2	28.6	EBT	D	49.9	76.2	EBT	C	24.6	36.6	EBR
PM Peak Hour																	
1. N Truman Rd & Baltimore Ave	Signalized	B	18.8	24.3	NBL	C	23.0	47.8	NBL	C	23.7	50.9	NBL	B	18.8	30.0	NBL
2. S Truman Rd & Baltimore Ave	All-Way-Stop	A	8.9	10.0	EBL	B	10.5	12.5	EBL	C	15.4	20.9	EBT	B	10.5	12.5	EBL
3. N Truman Rd & Main St	Signalized	B	13.2	17.5	WBR	B	18.5	25.9	WBR	D	36.0	45.9	WBT	B	18.5	25.9	WBR
4. S Truman Rd & Main St	Signalized	B	12.4	16.8	EBR	B	15.8	20.7	EBR	D	37.9	53.5	EBT	B	17.3	22.0	EBR
5. N Truman Rd & Walnut St	Signalized	B	19.9	29.4	WBR	C	21.6	32.0	WBR	C	27.7	36.7	WBT	C	24.9	37.9	WBR
6. S Truman Rd & Walnut St	Signalized	B	16.8	19.7	SBL	B	17.5	28.3	SBL	C	24.5	28.1	SBL	B	18.1	36.1	SBL
7. N Truman Rd & Grand Blvd	Signalized	B	16.3	32.0	WBR	B	19.6	39.2	WBR	C	27.4	41.3	WBT	B	19.6	39.2	WBR
8. S Truman Rd & Grand Blvd	Signalized	C	20.4	29.2	EBT	C	25.6	34.2	NBR	F	125.4	223.1	EBT	C	31.8	43.8	NBR

Intersection Name	2050 - Rd Diet (Mitigated)				2050 - Rd Diet (Single Lane) Reduced Vol.				2050 - Rd Diet (Mitigated) Reduced Vol.				2050 - Rd Diet (Mitigated) Walnut Closure			
	LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay	
AM Peak Hour																
1. N Truman Rd & Baltimore Ave	B	16.4	19.8	NBL	B	17.7	22.2	NBL	B	17.7	22.2	NBL	B	17.4	18.2	NBT
2. S Truman Rd & Baltimore Ave	B	13.1	15.5	EBL	C	18.2	21.1	EBT	C	18.2	21.1	EBT	C	18.6	22.2	EBT
3. N Truman Rd & Main St	B	11.9	15.6	WBR	B	13.8	17.9	WBT	B	13.8	17.9	WBT	B	14.3	17.6	WBT
4. S Truman Rd & Main St	B	14.9	16.9	EBR	B	14.9	17.6	NBT	B	14.9	17.6	NBT	B	15.1	18.2	NBT
5. N Truman Rd & Walnut St	C	28.3	35.3	WBR	C	30.7	38.9	WBT	C	30.7	38.9	WBT	D	37.9	39.2	WBT
6. S Truman Rd & Walnut St	B	11.9	31.1	SBL	B	14.4	30.9	SBL	B	14.1	30.9	SBL	B	12.8	12.8	EBT
7. N Truman Rd & Grand Blvd	C	21.7	38.5	WBR	C	21.8	39.3	WBT	C	21.8	39.3	WBT	D	44	87.0	WBT
8. S Truman Rd & Grand Blvd	C	20.2	28.6	EBT	D	35.2	41.8	EBT	C	21.8	32.1	EBR	C	24.9	37.0	EBR
PM Peak Hour																
1. N Truman Rd & Baltimore Ave	B	18.8	30.0	NBL	C	23.2	38.7	NBL	C	23.2	38.7	NBL	C	21.1	33.7	NBL
2. S Truman Rd & Baltimore Ave	B	10.5	12.5	EBL	B	10.4	12.8	EBT	B	10.4	12.8	EBT	B	11.4	14.0	EBT
3. N Truman Rd & Main St	B	18.5	25.9	WBR	D	48.5	59.7	SBT	D	48.5	59.7	SBT	E	58.3	27.2	SBT
4. S Truman Rd & Main St	B	17.3	22.0	EBR	B	19.8	28.5	NBT	B	19.8	28.5	NBT	C	34.7	48.6	EBT
5. N Truman Rd & Walnut St	C	24.9	37.9	WBR	C	26.9	36.5	WBT	C	26.9	36.5	WBT	C	33.9	35.6	WBT
6. S Truman Rd & Walnut St	B	18.1	36.2	SBL	C	22.3	21.0	SBL	C	22.3	35.5	SBL	C	20.1	33.0	NBR
7. N Truman Rd & Grand Blvd	B	19.6	39.2	WBR	C	26.7	44.4	WBT	C	26.7	44.4	WBT	C	29.4	45.2	WBT
8. S Truman Rd & Grand Blvd	C	25.6	34.2	NBR	F	132.6	267.2	NBR	D	44.9	107.2	NBR	C	30.7	39.5	EBR

Intersection Name	2050 - Rd Closure (Baltimore)				2050 - Rd Closure (Main)				2050 - Rd Closure (Walnut)				2050 - Rd Closure (Event)				2050 - Rd Closure (Event & Walnut)			
	LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Moveme nt Delay	
AM Peak Hour																				
1. N Truman Rd & Baltimore Ave	B	12.0	28.9	SBR	B	19.9	22.1	NBT	B	17.9	24.2	NBL	B	17.8	24.2	NBL	B	17.9	25.7	NBL
2. S Truman Rd & Baltimore Ave	B	11.3	12.2	EBT	C	16.6	22.4	EBL	B	13.6	16.8	EBL	C	16.5	22.3	EBL	B	14.2	18.6	EBL
3. N Truman Rd & Main St	B	13.1	15.9	WBR	B	13.9	14.6	WBR	B	12.3	15.7	WBR	B	16.4	19.3	SBT	C	21.2	25.0	SBT
4. S Truman Rd & Main St	B	13.8	16.6	EBR	B	13.6	13.8	EBR	B	13.2	16.0	EBR	B	14.4	16.9	EBR	B	14.2	16.7	EBR
5. N Truman Rd & Walnut St	C	25.6	31.7	WBR	C	22.9	31.0	WBR	C	28.8	30.6	WBR	D	36.5	43.6	WBT	D	37.1	40.5	WBT
6. S Truman Rd & Walnut St	B	11.7	32.3	SBL	B	11.6	32.3	SBL	A	9.6	25.5	NBR	B	10.0	29.7	SBL	A	9.1	27.0	NBR
7. N Truman Rd & Grand Blvd	C	21.9	37.9	WBR	C	20.9	39.7	WBR	C	21.2	40.0	WBR	D	37.4	40.2	WBT	D	36.2	39.7	WBT
8. S Truman Rd & Grand Blvd	C	22.0	31.0	EBT	C	24.6	31.0	EBT	C	20.0	28.0	EBT	C	22.5	29.6	EBT	C	20.4	29.3	EBT
PM Peak Hour																				
1. N Truman Rd & Baltimore Ave	B	17.2	33.1	SBR	C	22.4	45.0	NBL	C	21.5	36.4	NBL	C	23.9	41.1	NBL	C	31.6	39.0	NBL
2. S Truman Rd & Baltimore Ave	A	10.0	10.4	EBT	B	11.2	13.5	EBL	B	10.9	12.7	EBL	B	10.6	13.1	EBL	B	12.1	15.7	EBL
3. N Truman Rd & Main St	D	35.3	44.7	SBT	C	23.8	26.7	WBR	C	20.4	27.4	WBR	F	88.1	145.3	SBT	F	86.6	150.4	SBT
4. S Truman Rd & Main St	B	13.5	21.2	EBR	B	15.1	15.4	EBR	B	18.3	24.3	EBR	C	20.2	28.3	EBR	C	20.2	27.6	NBT
5. N Truman Rd & Walnut St	C	21.9	33.0	WBR	B	19.9	34.1	WBR	C	29.6	33.1	WBR	C	31.2	42.4	WBT	C	27.5	45.3	WBT
6. S Truman Rd & Walnut St	B	19.7	29.2	SBL	C	26.4	41.8	SBL	B	11.3	33.0	NBR	C	23.2	26.0	EBR	B	10.8	28.9	NRR
7. N Truman Rd & Grand Blvd	C	21.4	41.1	WBR	B	19.6	39.2	WBR	B	19.0	38.1	WBR	D	36.8	40.9	WBT	D	36.5	41.3	WBT
8. S Truman Rd & Grand Blvd	C	28.3	46.2	NBR	C	27.9	44.0	NBR	C	23.5	30.7	EBT	C	26.8	30.7	EBT	C	23.9	26.2	NBR

Note: Method - HCM 6th from Vistro

Intersection Name	Control Type	Existing 2023				2050 - No Build				2050 - Rd Diet (Single Lane)				2050 - Rd Diet (Two Lanes)			
		NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
AM Peak Hour																	
1. N Truman Rd & Baltimore Ave	Signalized	73	57	0	109	133	102	0	141	139	106	0	155	106	81	0	105
2. S Truman Rd & Baltimore Ave	All-Way-Stop	5	7	46	0	8	11	102	0	8	11	493	0	8	11	102	0
3. N Truman Rd & Main St	Signalized	28	37	0	42	60	72	0	73	99	102	0	168	60	72	0	73
4. S Truman Rd & Main St	Signalized	35	20	58	0	67	41	102	0	155	126	481	0	81	55	158	0
5. N Truman Rd & Walnut St	Signalized	6	15	0	90	8	23	0	141	11	31	0	394	8	23	0	218
6. S Truman Rd & Walnut St	Signalized	22	23	99	0	48	51	86	0	48	51	322	0	48	51	140	0
7. N Truman Rd & Grand Blvd	Signalized	80	58	0	199	140	99	0	298	223	149	0	522	140	99	0	298
8. S Truman Rd & Grand Blvd	Signalized	45	165	155	0	71	263	238	0	104	393	913	0	74	273	361	0
PM Peak Hour																	
1. N Truman Rd & Baltimore Ave	Signalized	85	111	0	263	175	229	0	308	179	234	0	309	136	182	0	205
2. S Truman Rd & Baltimore Ave	All-Way-Stop	9	10	28	0	15	16	55	0	15	16	175	0	15	16	55	0
3. N Truman Rd & Main St	Signalized	30	139	0	66	78	312	0	170	182	568	0	496	78	312	0	170
4. S Truman Rd & Main St	Signalized	85	23	68	0	190	53	140	0	378	169	668	0	207	63	182	0
5. N Truman Rd & Walnut St	Signalized	10	52	0	104	15	82	0	165	23	123	0	431	15	82	0	251
6. S Truman Rd & Walnut St	Signalized	61	69	124	0	106	131	175	0	143	190	456	0	122	152	230	0
7. N Truman Rd & Grand Blvd	Signalized	150	79	0	183	249	129	0	281	374	185	0	504	249	129	0	281
8. S Truman Rd & Grand Blvd	Signalized	161	116	254	0	312	219	366	0	562	274	2239	0	348	236	479	0

Intersection Name	2050 - Rd Diet (Mitigated)				2050 - Rd Diet (Single Lane) Reduced Vol.				2050 - Rd Diet (Mitigated) Reduced Vol.				2050 - Rd Diet (Mitigated) Walnut Closure			
	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
AM Peak Hour																
1. N Truman Rd & Baltimore Ave	106	81	0	105	147	52	0	148	147	52	0	148	152	45	0	150
2. S Truman Rd & Baltimore Ave	8	11	102	0	7	3	204	0	7	3	204	0	11	1	213	0
3. N Truman Rd & Main St	60	72	0	73	75	146	0	119	75	146	0	119	83	142	0	138
4. S Truman Rd & Main St	81	55	158	0	81	96	196	0	81	96	196	0	92	105	197	0
5. N Truman Rd & Walnut St	8	23	0	218	22	28	0	394	22	28	0	394	0	8	0	390
6. S Truman Rd & Walnut St	48	140	127	0	48	46	238	0	48	46	238	0	49	0	322	0
7. N Truman Rd & Grand Blvd	140	99	0	298	128	126	0	389	128	126	0	389	194	153	0	772
8. S Truman Rd & Grand Blvd	71	263	238	0	310	471	563	0	230	334	282	0	74	340	362	0
PM Peak Hour																
1. N Truman Rd & Baltimore Ave	136	182	0	205	231	198	0	252	231	198	0	252	95	230	0	266
2. S Truman Rd & Baltimore Ave	15	16	55	0	16	11	76	0	16	11	76	0	10	16	96	0
3. N Truman Rd & Main St	78	312	0	170	119	836	0	509	119	836	0	509	206	988	0	603
4. S Truman Rd & Main St	207	63	182	0	170	151	305	0	170	151	305	0	306	257	626	0
5. N Truman Rd & Walnut St	15	82	0	251	25	109	0	430	25	109	0	430	0	23	0	465
6. S Truman Rd & Walnut St	152	230	212	0	89	219	291	0	89	219	291	0	147	0	454	0
7. N Truman Rd & Grand Blvd	249	129	0	281	444	171	0	474	444	171	0	474	367	280	0	525
8. S Truman Rd & Grand Blvd	312	219	366	0	1411	246	1531	0	855	205	390	0	320	385	463	0

Intersection Name	2050 - Rd Closure (Baltimore)				2050 - Rd Closure (Main)				2050 - Rd Closure (Walnut)				2050 - Rd Closure (Event)				2050 - Rd Closure (Event & Walnut)			
	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
AM Peak Hour																				
1. N Truman Rd & Baltimore Ave	67	0	0	148	253	55	0	251	147	101	0	147	114	138	0	156	80	145	0	187
2. S Truman Rd & Baltimore Ave	9	0	73	0	22	18	157	0	15	11	110	0	24	15	156	0	22	15	122	0
3. N Truman Rd & Main St	68	101	0	92	83	0	0	63	63	75	0	81	130	164	0	186	164	190	0	321
4. S Truman Rd & Main St	58	72	130	0	16	0	127	0	60	41	101	0	89	78	148	0	69	64	145	0
5. N Truman Rd & Walnut St	9	26	0	158	24	23	0	141	0	3	0	130	0	18	0	307	0	9	0	370
6. S Truman Rd & Walnut St	64	62	107	0	64	62	131	0	46	0	91	0	53	5	183	0	28	0	177	0
7. N Truman Rd & Grand Blvd	191	131	0	321	211	123	0	302	131	98	0	285	11	0	0	343	20	0	0	383
8. S Truman Rd & Grand Blvd	82	334	289	0	151	547	289	0	71	263	222	0	30	64	262	0	93	67	282	0
PM Peak Hour																				
1. N Truman Rd & Baltimore Ave	183	0	0	247	199	185	0	343	99	239	0	286	283	265	0	262	302	225	0	589
2. S Truman Rd & Baltimore Ave	4	0	49	0	12	24	66	0	8	18	62	0	32	21	52	0	29	17	84	0
3. N Truman Rd & Main St	125	739	0	310	355	0	0	168	94	343	0	217	114	1716	0	283	146	1691	0	372
4. S Truman Rd & Main St	152	90	97	0	57	0	163	0	232	103	206	0	270	194	240	0	246	184	251	0
5. N Truman Rd & Walnut St	15	102	0	185	105	82	0	202	0	7	0	177	0	298	0	540	0	153	0	457
6. S Truman Rd & Walnut St	122	175	229	0	104	313	409	0	147	0	102	0	66	126	295	0	71	0	237	0
7. N Truman Rd & Grand Blvd	329	117	0	311	283	129	0	281	249	137	0	270	15	0	0	330	18	0	0	331
8. S Truman Rd & Grand Blvd	357	218	426	0	408	217	370	0	282	200	319	0	142	21	507	0	179	21	437	0

Note: Method - HCM 6th from Vistro

1. Existing
AM

Int. no	NB		SB		EB			WB		
1	10	73		57				13	109	
2	5	5	2	7	46	43				
3	3	28	37					42	38	
4	35	11	5	20	37	58	57			
5	4	6	15	4				90	83	83
6	22		15	23	99	90	90			
7	6	80	58	30				199	182	
8	42	45	30	165	84	155	24			

2. Existing
PM

Int. no	NB		SB		EB			WB		
1	40	85	111					6	263	
2	9	8	10	4	28	27				
3	8	30	139					66	60	
4	85	30	23	22	16	68	67			
5	7	10	52	9				104	96	94
6	61		69	30	124	114	112			
7	16	150	79	29				183	161	
8	115	161	54	116	51	254	25			

3. FNB
AM

Int. no	NB		SB		EB			WB		
1	17	133	102					17	141	
2	8	7	4	11	102	95				
3	5	60	72					73	65	
4	67	21	10	41	62	102	100			
5	6	8	23	6				141	130	129
6	48		35	51	86	79	78			
7	9	140	99	50				298	275	
8	66	71	46	263	131	238	37			

4. FNB
PM

Int. no	NB		SB		EB			WB		
1	92	175	229					6	308	
2	15	13	16	6	55	52				
3	20	78	312					170	153	
4	190	61	53	51	31	140	137			
5	11	15	82	14				165	152	149
6	106		131	52	175	161	158			
7	25	249	129	46				281	254	
8	218	312	102	219	70	366	34			

5. Rd Diet - Two Lanes
AM

Int. no	NB		SB		EB			WB		
1	14	106	81					105	95	
2	8	7	4	11	102	95				
3	5	60	72					73	65	
4	81	26	13	55	158	145				
5	6	8	23	6				218	204	
6	48		35	51	140	127				
7	9	140	99	50				298	275	
8	68	74	48	273	361	336				

6. Rd Diet - Two Lanes
PM

Int. no	NB		SB		EB			WB		
1	68	136	182					205	189	
2	15	13	16	6	55	52				
3	20	78	312					170	153	
4	207	68	63	60	182	165				
5	11	15	82	14				251	232	
6	122		152	59	230	212				
7	25	249	129	46				281	254	
8	233	348	112	236	479	445				

7. Rd Diet - Mitigated
AM

Int. no	NB		SB		EB			WB		
1	14	106	81					105	95	
2	8	7	4	11	102	95				
3	5	60	72					73	65	
4	81	26	13	55	158	145				
5	6	8	23	6				218	204	
6	48	35	51	140	127					
7	9	140	99	50				298	275	
8	66	71	46	263	131	238	37			

8. Rd Diet - Mitigated
PM

Int. no	NB		SB		EB			WB		
1	68	136	182					205	189	
2	15	13	16	6	55	52				
3	20	78	312					170	153	
4	207	68	63	60	182	165				
5	11	15	82	14				251	232	
6	122	152	59	230	212					
7	25	249	129	46				281	254	
8	218	312	102	219	70	366	34			

9. Rd Diet - Reduced Vol.
AM

Int. no	NB		SB		EB			WB		
1	18	147	52					148		
2	7	6	1	3	204					
3	7	75	146					119		
4	81	26	22	96	196					
5	16	22	28	8				394		
6	48		31	46	238					
7	9	128	126	63				389		
8	267	310	82	471	563					

10. Rd Diet - Reduced Vol.
PM

Int. no	NB		SB		EB			WB		
1	122	231	198					252		
2	16	15	11	4	76					
3	32	119	836					509		
4	170	59	151	145	305					
5	17	25	109	19				430		
6	89		219	86	291					
7	43	444	171	60				474		
8	588	1411	127	246	1531					

11. Rd Diet - Mitigated - Reduced Vol.
AM

Int. no	NB		SB		EB			WB		
1	18	147	52					148		
2	7	6	1	3	204					
3	7	75	146					119		
4	81	26	22	96	196					
5	16	22	28	8				394		
6	48		31	46	238					
7	9	128	126	63				389		
8	209	230	59	334	282	262				

12. Rd Diet - Mitigated - Reduced Vol.
PM

Int. no	NB		SB		EB			WB		
1	122	231	198					252		
2	16	15	11	4	76					
3	32	119	836					509		
4	170	59	151	145	305					
5	17	25	109	19				430		
6	89		219	86	291					
7	43	444	171	60				474		
8	378	855	102	205	390	362				

13. Rd Diet - Mitigated - Walnut
AM

Int. no	NB		SB		EB			WB		
1	18	152	45					150		
2	11	9	0	1	213					
3	8	83	142					138		
4	92	29	24	105	197					
5			8					390		
6	49				322					
7	29	194	153	67				772		
8	68	74	48	340	362	338				

14. Rd Diet - Mitigated - Walnut
PM

Int. no	NB		SB		EB			WB		
1	52	95	230					266		
2	10	9	16	6	96					
3	62	206	988					603		
4	306	115	257	243	626					
5			23					465		
6	147				454					
7	82	367	280	69				525		
8	222	320	105	385	463	432				

15. Rd Closure - Baltimore
AM

Int. no	NB		SB		EB			WB		
1	67							148		
2	9	9			73	71				
3	6	68	101					92	82	
4	58	19	17	72	78	130	128			
5	7	9	26	7				158	146	144
6	64		43	62	107	99	97			
7	12	191	131	65				321	296	
8	75	82	56	334	162	289	44			

16. Rd Closure - Baltimore
PM

Int. no	NB		SB		EB			WB		
1	183							247		
2	4	4			49	48				
3	36	125	739					310	283	
4	152	50	90	85	22	97	95			
5	12	15	102	17				185	170	166
6	122		175	64	229	214	210			
7	31	329	117	42				311	280	
8	235	357	103	218	77	426	37			

17. Rd Closure - Main
AM

Int. no	NB		SB		EB			WB		
1	30	253	55					29	251	
2	22	19	6	18	157	145				
3	83							62	63	
4	16				125	127				
5	18	24	23	6				141	130	129
6	64		43	62	131	120	118			
7	13	211	123	61				302	279	
8	136	151	79	547	162	289	44			

18. Rd Closure - Main
PM

Int. no	NB		SB		EB			WB		
1	98	199	185					6	343	
2	12	10	24	8	66	62				
3	355							166	168	
4	57				160	163				
5	73	105	82	14				202	190	185
6	104		313	114	409	382	375			
7	28	283	129	46				281	254	
8	261	408	103	217	71	370	34			

19. Rd Closure - Walnut
AM

Int. no	NB		SB		EB			WB		
1	19	147	101					17	147	
2	15	13	4	11	110	103				
3	6	63	75					81	73	
4	60	19	10	41	62	101	99			
5			3					125	130	
6	46				88	91				
7	19	131	98	49				285	263	
8	66	71	46	263	166	222	37			

20. Rd Closure - Walnut
PM

Int. no	NB		SB		EB			WB		
1	55	99	239					6	286	
2	8	7	18	6	62	58				
3	24	94	343					217	199	
4	232	78	103	98	46	206	203			
5			7					166	177	
6	147				98	102				
7	51	249	137	48				270	243	
8	202	282	92	200	142	319	36			

21. Rd Closure - Event
AM

Int. no	NB		SB		EB			WB		
1	16	114	138					18	156	
2	24	21	5	15	156	145				
3	11	130	164					186	164	
4	89	28	18	78	87	148	145			
5	0	0	18	5				307		
6	53		3	5	183	168	165			
7	11							343		
8	28	30	15	64	146	262	41			

22. Rd Closure - Event
PM

Int. no	NB		SB		EB			WB		
1	186	283	265					6	262	
2	32	28	21	7	52	50				
3	36	114	1716					283	259	
4	270	94	194	177	56	240	236			
5	0	0	298	48				540		
6	66		126	50	295	276	271			
7	15							330		
8	102	142	11	21	84	507	40			

23. Rd Closure - Event & Walnut
AM

Int. no	NB		SB		EB			WB		
1	11	80	145					21	187	
2	22	19	5	15	122	114				
3	15	164	190					321	293	
4	69	22	15	64	85	145	142			
5			9					370		
6	28				172	177				
7	20							383		
8	84	93	18	67	157	282	43			

24. Rd Closure - Event & Walnut
PM

Int. no	NB		SB		EB			WB		
1	180	302	225					10	589	
2	29	25	17	6	84	79				
3	45	146	1691					372	339	
4	246	86	184	173	58	251	247			
5			153					457		
6	71				230	237				
7	18							331		
8	127	179	11	21	76	437	37			

	Control Type	Existing 2023				2050 - No Build				2050 - Rd Closure (Walnut) + Rd Diet				2050 - Rd Open (Walnut) + Rd Diet				2050 - Rd Closure (Walnut & Baltimore)				2050 - Rd Closure (Baltimore) + Rd Diet			
Intersection Name	Future Build	LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay		LOS	Delay (sec/veh)	Worst Movement Delay	
AM Peak Hour																									
1. N Truman Rd & Baltimore Ave	All-Way-Stop	B	14.0	30.3	NBT	B	17.5	32.6	NBT	B	10.5	10.9	NBT	A	9.9	10.2	WB	A	8.3	8.4	WB	A	8.3	8.7	WB
2. S Truman Rd & Baltimore Ave	All-Way-Stop	B	11.4	12.4	EB	C	19.8	24.1	EB	C	17.6	20.2	EB	C	19.8	24.1	EB	B	13.6	16.4	EB	C	18.0	23.4	EB
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	B	19.7	24.4	WBT	D	45.3	77.5	NBT
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	81.9	EBT
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	B	11.5	13.0	WB	C	18.4	22.1	WB
6. S Truman Rd & Walnut St	All-Way-Stop	A	8.0	20.5	NBT	B	10.7	28.8	SBL	B	11.6	13.7	EB	B	14.8	17.8	EB	B	11.9	14.2	EB	B	14.8	17.8	EB
7. N Truman Rd & Grand Blvd	Signalized	C	21.2	35.8	WBT	C	21.0	30.4	WBT	B	17.5	34.0	WBT	C	20.3	30.4	WBT	B	19.2	31.4	WBT	C	20.3	30.4	WBT
8. S Truman Rd & Grand Blvd	Signalized	B	12.8	16.9	EBT	B	14.4	18.9	NBT	B	18.7	25.1	EBT	B	18.8	24.6	EBT	B	20.0	27.3	EBT	B	18.8	24.6	EBT
PM Peak Hour																									
1. N Truman Rd & Baltimore Ave	All-Way-Stop	B	14.0	31.2	NBT	A	17.7	36.5	NBT	C	18.3	21.0	WB	C	15.4	17.1	WB	B	10.9	12.0	WB	B	11.2	12.8	WB
2. S Truman Rd & Baltimore Ave	All-Way-Stop	A	9.9	10.7	EB	B	12.9	15.0	EB	B	13.3	15.7	EB	B	12.9	15.0	EB	B	10.1	11.1	EB	B	11.1	12.9	EB
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	42.1	WBT
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	F	90.2	82.9	EBT	C	31.3	46.6	EBT
5. N Truman Rd & Walnut St	All-Way-Stop	B	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	12.7	SB
6. S Truman Rd & Walnut St	All-Way-Stop	A	8.3	20.9	SBL	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	21.2	EB
7. N Truman Rd & Grand Blvd	Signalized	B	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	34.3	WBT
8. S Truman Rd & Grand Blvd	Signalized	B	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	28.5	EBT

Note: Method - HCM 6th - AWSC
Synchro Results - Signalized

	Control Type	Existing 2023				2050 - No Build				2050 - Rd Closure (Walnut) + Rd Diet				2050 - Rd Open (Walnut) + Rd Diet				2050 - Rd Closure (Walnut & Baltimore)				2050 - Rd Closure (Baltimore) + Rd Diet			
Intersection Name	Future Build	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
AM Peak Hour																									
1. N Truman Rd & Baltimore Ave	All-Way-Stop	97	80		31	122	106		49	53	53		88	45	50		74		18		70		41		68
2. S Truman Rd & Baltimore Ave	All-Way-Stop	48	63	61		60	69	339		71	50	244		59	53	383		80		230		82		419	
3. N Truman Rd & Main St	Signalized	193	118		225	226	204		279	159	161		179	224	200		259	227	207		262	223	237		262
4. S Truman Rd & Main St	Signalized	79	122	220		146	158	297		122	191	275		156	160	285		153	198	295		170	201	326	
5. N Truman Rd & Walnut St	All-Way-Stop	131	92		167	167	101		209		44		73	99	64		159		42		129	104	60		152
6. S Truman Rd & Walnut St	All-Way-Stop	93	106	55		115	134	69		58		117		56	53	137		53		102		61	53	124	
7. N Truman Rd & Grand Blvd	Signalized	127	118		236	197	238		321	166	185		265	195	223		296	150	242		285	196	229		280
8. S Truman Rd & Grand Blvd	Signalized	82	148	101		118	197	138		149	200	209		144	203	195		165	205	177		143	199	206	
PM Peak Hour																									
1. N Truman Rd & Baltimore Ave	All-Way-Stop	106	119		64	134	159		121	58	90		152	53	74		136		65		101		51		112
2. S Truman Rd & Baltimore Ave	All-Way-Stop	62	64	72		91	75	63		85	52	138		100	52	103		289		225		105		156	
3. N Truman Rd & Main St	Signalized	84	155		172	146	267		217	226	312		220	133	272		206	223	296		251	218	322		220
4. S Truman Rd & Main St	Signalized	173	90	181		351	175	250		395	237	271		307	190	263		445	214	307		416	233	292	
5. N Truman Rd & Walnut St	All-Way-Stop	54	118		128	76	145		139		66		97	45	67		98		61		88	46	68		110
6. S Truman Rd & Walnut St	All-Way-Stop	71	121	82		93	159	97		35		149		61	50	157		36		113		56	52	132	
7. N Truman Rd & Grand Blvd	Signalized	122	87		183	148	165		236	157	160		213	154	147		224	143	116		215	149	162		223
8. S Truman Rd & Grand Blvd	Signalized	203	137	189		436	162	222		413	164	254		410	167	244		483	145	232		450	170	261	

Note: Method - SimTraffic - AWSC
SimTraffic Results - Signalized

South Loop Project

Traffic Safety Analysis

Kansas City, Missouri

September 2024

Content

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.

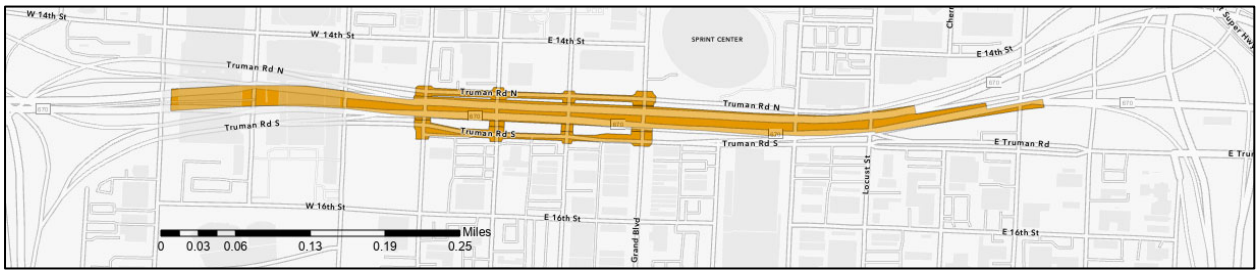
1.1 Project Background

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

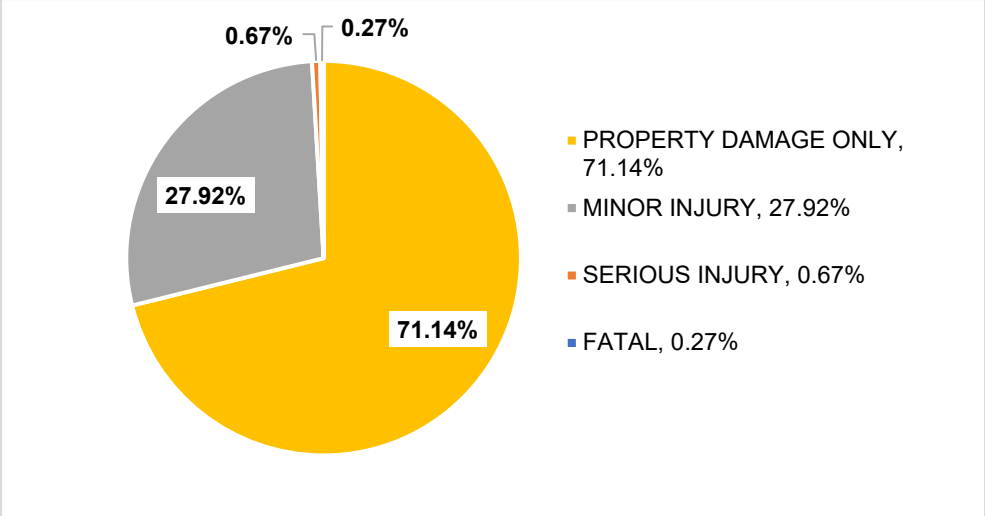
An approximate 2/3rd of a mile segment of I-670 and total 1/2 mile of arterials were evaluated. Each direction of Truman Road measured about 1000’ in length, and each crossing road measured about 200’. **Table 1** identifies and classifies each corridor segment.

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

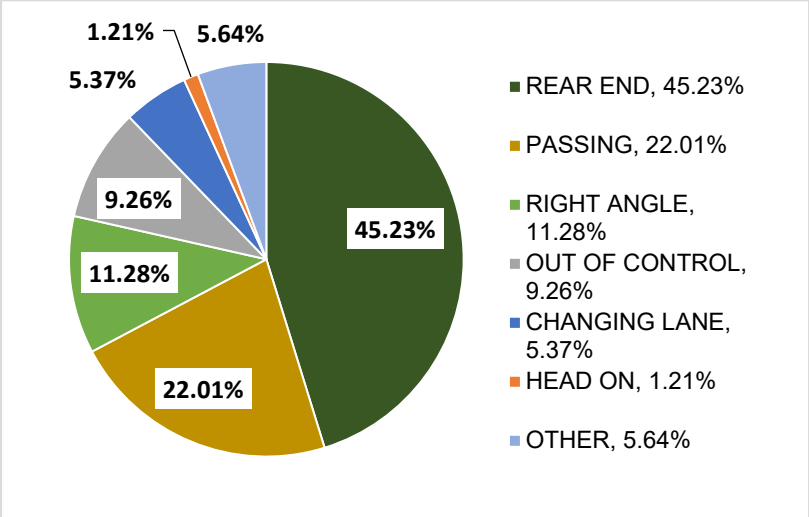
Between the years of 2017-2021, 745 crashes were reported across all the corridors within the safety study limits. A majority of these crashes, 561 (~75%), occurred along the I-670 corridor which largely influenced the severity and type of crashes. Of the 745 crashes reported, 530 (~71%) resulted in 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

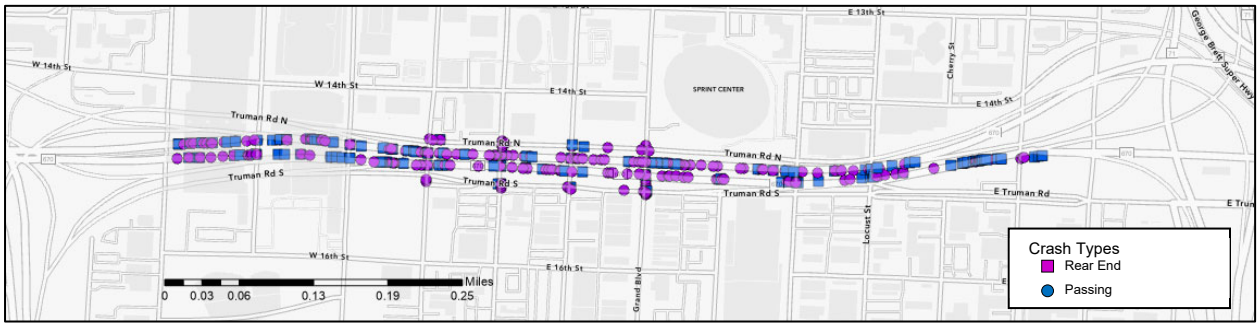
Figure 3: Total Crash Type – All Corridors



Source: MODOT Crash Data 2017-2021

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

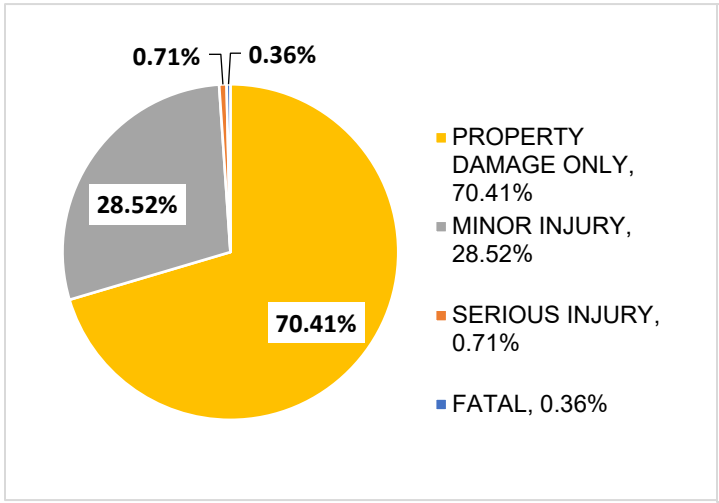
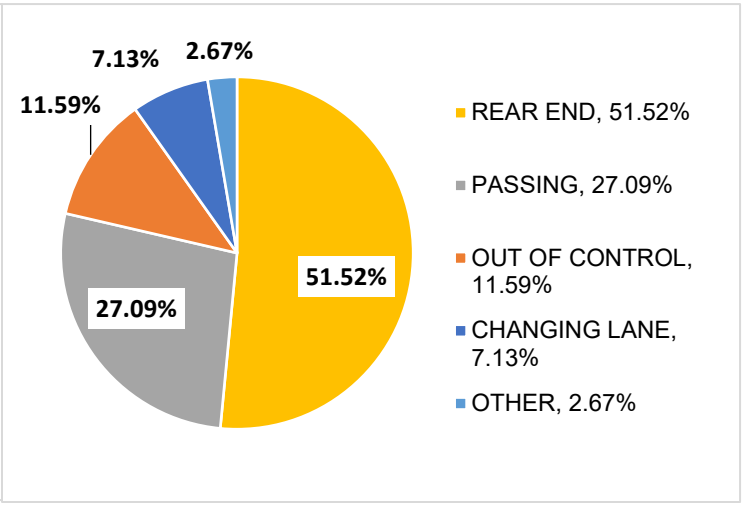


Figure 6: I-670 Crash Type



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 Crash 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

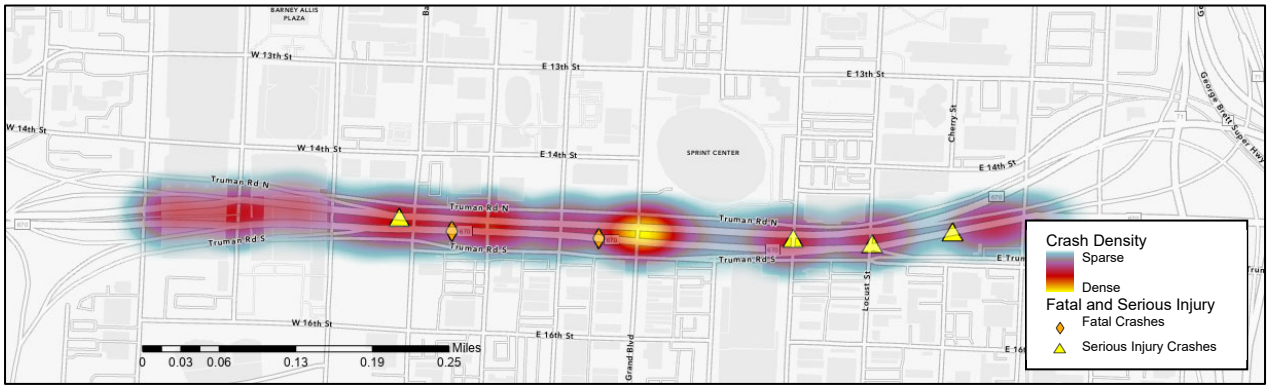
Source: MoDOT statewide averages for similar facilities
Crash rates are calculated with estimated 2019 ADT (120,066) extrapolated from 2023 traffic counts
Crash rates per Hundred Million Vehicle Miles Traveled (HMVMT)

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**.

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.

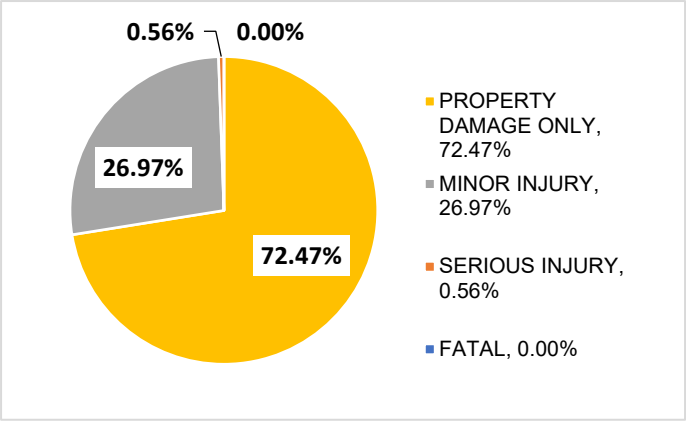
2.2 Truman Road Corridor Analysis

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.

2.2.1 Crash Severity and Crash Types

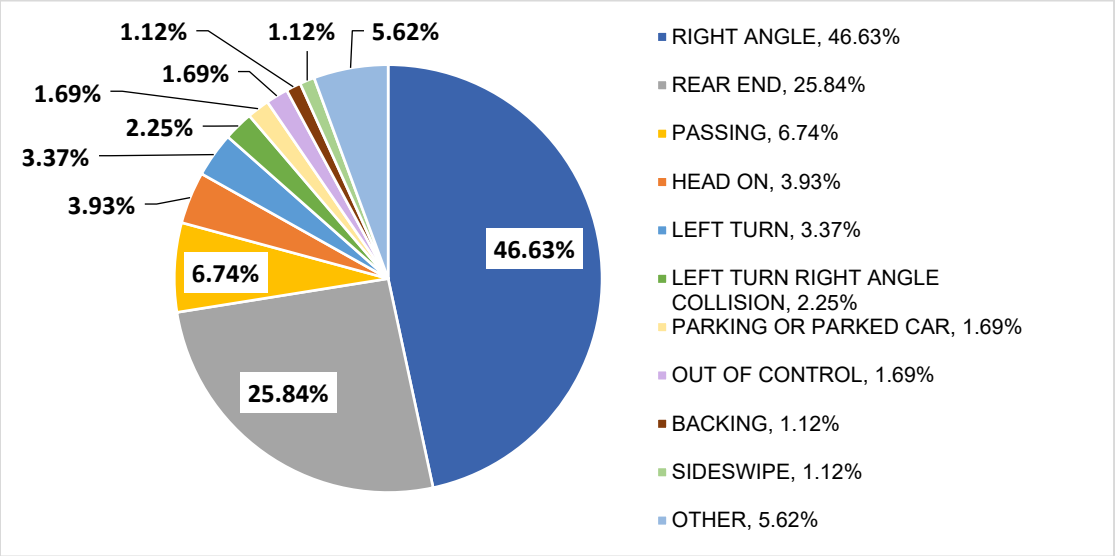
Between the years 2017-2021, 178 crashes were reported on both eastbound and westbound Truman Road. 95 crashes (~53%) were along eastbound Truman Road, and 83 crashes (~47%) were along westbound Truman Road. Of the combined 178 crashes, approximately 72% resulted in property damage only, 28% resulted 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

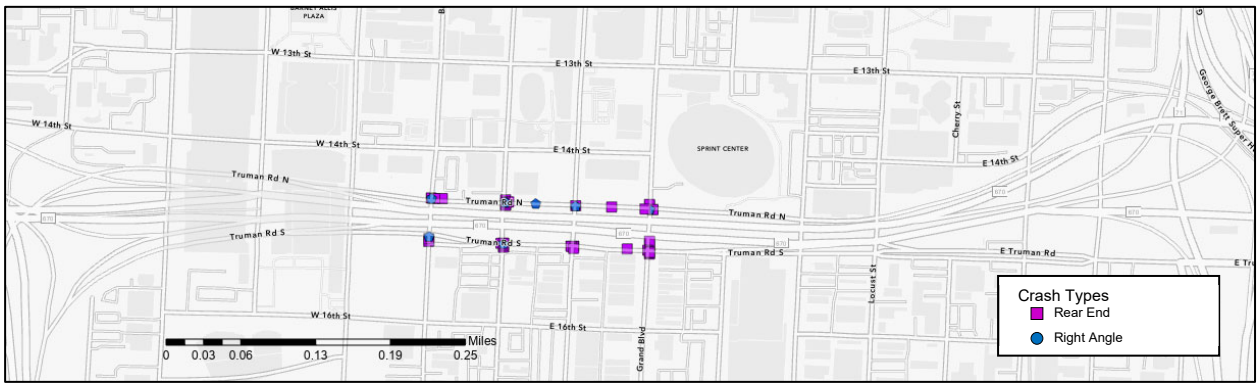
Figure 10: Crash Type – Truman Road



Source: MODOT Crash Data 2017-2021

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.

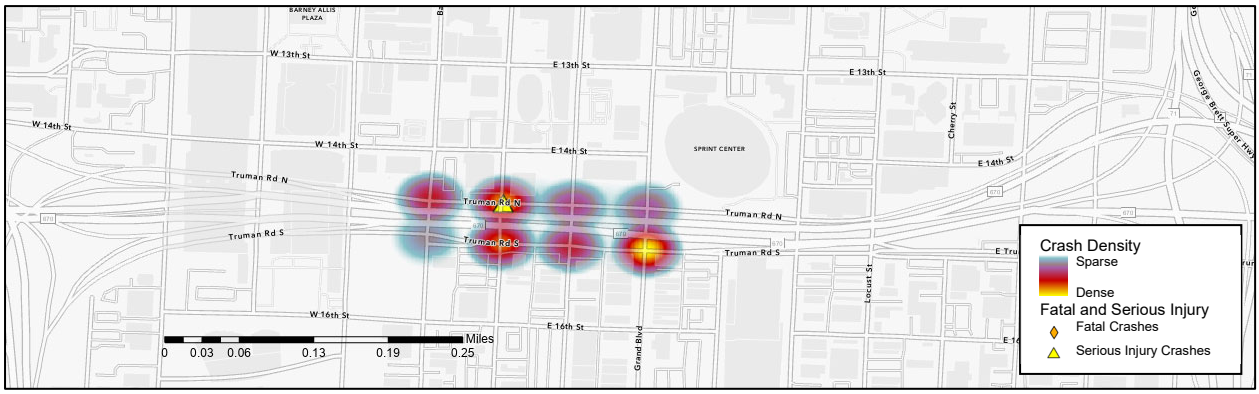
2.2.2 Crash Rate

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.

Table 3: IHSDM Study Limits-Arterials

Road Names	Limits
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
Grand Boulevard	Truman WB to Truman EB

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	A	B	C	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	A	B	C	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)	K	A	B	C	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)	**K**	**A**	**B**	**C**	**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,2016[3]; Ma et al.,2009[4]; 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, 2013[6]; 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

Alternative	Number of Crashes			Delta (FNB to Build)			Percent Change		
	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.

Alternative	Number of Crashes			Delta (FNB to Build)			Percent Change		
	Total Crashes	F+I Crashes	PDO Crashes	Total Crashes	F+I Crashes	PDO Crashes	Total Crashes	F+I Crashes	PDO 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.