

November 19, 2021

Maria PazFernandez, P.E. Project Manager Regional Transportation Commission of Washoe County 1105 Terminal Way, Suite 300 Reno, NV 89502

# **DRAFT Traffic Operations Analysis for Virginia Street Cycle Track**

Dear Ms. PazFernandez,

This letter report presents the findings of a traffic operations analysis completed to assess traffic flow on Virginia Street if directional cycle tracks were implemented. Directional cycle tracks have been suggested as a potential option for a north-south cycling facility, connecting previous multi-modal improvements on Virginia Street both adjacent to UNR and in mid-town. The purpose of this evaluation is to provide objective information regarding the suggested concept and potentially serve to inform the Downtown Placemaking Study in process by the City of Reno. Headway Transportation has prepared this analysis to quantify probable delays, estimate vehicle queuing, and to identify potential operational strategies for the contemplated lane configurations and cycle track concept if it were to move forward.

## CYCLE TRACK CONCEPT

The analysis area is Virginia Street between 1<sup>st</sup> Street and 9<sup>th</sup> Street in Reno, NV. The evaluated concept is directional cycle tracks on both sides of Virginia Street between Liberty Street and 8<sup>th</sup> Street. The contemplated cycle tracks would connect the multimodal improvements completed adjacent to the UNR Campus with prior improvements on Virginia Street through Midtown. **Figure 1** shows the cycle track concept overview between Liberty Street and 8<sup>th</sup> Street. In segments with limited roadway pavement width, generally 1<sup>st</sup> Street to 4<sup>th</sup> Street, a minimum width concept may be used. **Figure 2** shows the "minimum width concept" which includes six foot cycle tracks, two foot buffers, and one ten foot travel lane in each direction. The following lane reductions would be implemented to retrofit Virginia Street for directional cycle tracks:

- 9<sup>th</sup> Street to 8<sup>th</sup> Street No modifications.
- 8<sup>th</sup> Street to 5<sup>th</sup> Street Remove one northbound and one southbound through lane. Signal timing adjustments are recommended at the I-80 Interchange. Maintain existing turn lanes.
- **5**<sup>th</sup> Street to 4<sup>th</sup> Street Remove one northbound and one southbound through lane.
- 1<sup>st</sup> Street to 4<sup>th</sup> Street Remove all turn lanes on Virginia Street.

The lane configurations for the contemplated cycle track concept are shown in **Figure 3** and conceptual layouts for the corridor are provided in **Attachment A**.

#### ANALYSIS METHODOLOGY

#### Level of Service

Level of service (LOS) is a term commonly used by transportation practitioners to measure and describe the operational characteristics of intersections, roadway segments, and other facilities. This term equates seconds of delay per vehicle at intersections to letter grades "A" through "F" with "A" representing optimum conditions and "F" representing breakdown or over capacity flows.

#### Intersections

The complete methodology for intersection level of service analysis is established in the *Highway Capacity Manual (HCM)* 6<sup>th</sup> *Edition,* published by the Transportation Research Board (TRB). **Table 1** presents the delay thresholds for each level of service grade at signalized and unsignalized intersections.

| Level         |  | Average Delay |                               |  |  |  |  |
|---------------|--|---------------|-------------------------------|--|--|--|--|
| of<br>Service | Brief Description  | Signalized    | Unsignalized<br>Intersections |  |  |  |  |
| A             | Free flow conditions.  | < 10          | < 10                          |  |  |  |  |
| В             | Stable conditions with some affect from other vehicles.        | 10 to 20      | 10 to 15                      |  |  |  |  |
| С             | Stable conditions with significant affect from other vehicles. | 20 to 35      | 15 to 25                      |  |  |  |  |
| D             | High density traffic conditions still with stable flow.        | 35 to 55      | 25 to 35                      |  |  |  |  |
| E             | At or near capacity flows.                                     | 55 to 80      | 35 to 50                      |  |  |  |  |
| F             | Over capacity conditions.                                      | > 80          | > 50                          |  |  |  |  |

Source: Highway Capacity Manual (6<sup>th</sup> Edition)

Level of service calculations were performed using the Synchro/Sim Traffic 11 software package with analysis and results reported in accordance with the *HCM 6<sup>th</sup> Edition* methodology.

#### Level of Service Policy

The 2050 Regional Transportation Plan (RTP) establishes level of service criteria for regional roadway facilities in the City of Reno, City of Sparks, and Washoe County. The current level of service policy is:

- "All regional roadway facilities projected to carry less than 27,000 ADT at the latest RTP horizon LOS D or better."
- "All regional roadway facilities projected to carry 27,000 or more ADT at the latest RTP horizon LOS E or better."



• Except where noted in the 2050 RTP, "All intersections shall be designed to provide a level of service consistent with maintaining the policy level of service of the intersecting corridors".

All roadways within the study area are projected to carry less than 27,000 ADT except for 8<sup>th</sup> Street east of Virginia Street. Therefore, the policy level of service on Virginia Street is generally LOS "D". However, the 2050 RTP provides exceptions specifically setting the policy at LOS "F" on the following segments of Virginia Street:

- Virginia Street Kietzke Lane to S. McCarran Boulevard
- Virginia Street Plumb Lane to Liberty Street
- Virginia Street 8<sup>th</sup> Street to 17<sup>th</sup> Street
- Virginia Street / I-80 Ramps Maple Street and 8<sup>th</sup> Street

Since the LOS policy is set at "F" on Virginia Street both north and south of the study area, consideration could be given to revising the LOS policy between Liberty Street and 8<sup>th</sup> Street as a corridor management decision.

### DATA COLLECTION

Intersection counts were initially conducted at the study intersections in September 2019 and July 2021. Turning movement volumes were recollected for key intersections (9<sup>th</sup> Street, 8<sup>th</sup> Street, Maple Street, and 4<sup>th</sup> Street) on Thursday, September 23, 2021 with UNR and Washoe County Schools in regular session. The peak hours were generally 7:45-8:45 AM and 4:00-5:00 PM. During data collection, it was observed that 9<sup>th</sup> Street was impacted by construction closures of 9<sup>th</sup> Street to the east. Therefore, traffic volumes specifically on 9<sup>th</sup> Street were obtained from the prior counts. Traffic volumes at all intersections were then adjusted and balanced up with the recollected counts to establish existing condition traffic volumes. The existing intersection turning movement volumes are shown in **Figure 4.** 

#### **GENERAL PHASING ASSUMPTIONS**

#### Typical Cycle Track Signal Phasing

Each of the studied intersections are controlled by traffic signals and existing signal timing was obtained from the Washoe County RTC. The existing phase splits, pedestrian timings, signal offsets and coordination were used unless otherwise noted. Signal timing at many of the study intersections (9<sup>th</sup>, 6<sup>th</sup>, 5<sup>th</sup>, 4<sup>th</sup>) will only need minor adjustments to the yellow and red clearance intervals to accommodate directional cycle tracks (slightly longer times for bicycle clearance). The cycle track movements will run concurrently with the existing northbound and southbound phases. **Exhibit 1** shows the typical signal phasing (permissive lefts in the north-south and east-west directions) on Virginia Street.





Exhibit 1. Typical Cycle Track Signal Phasing on Virginia Street

#### Virginia Street / 1st Street & 2nd Street Modifications

With the proposed directional cycle tracks, it would be necessary to remove the left turn lanes on Virginia Street at the 1<sup>st</sup> Street and 2<sup>nd</sup> Street intersections. Therefore, it would be necessary to also remove the yield on flashing yellow arrows in the north and south directions at both intersections. Additionally, it is recommended that the pedestrian scramble (diagonal crosswalks) at the Virginia Street / 2<sup>nd</sup> Street intersections would operate with permissive left-turn phasing as shown in **Exhibit 1**.

#### Virginia Street / 8th Street & Maple Street Modifications

The removal of one northbound lane and one southbound lane would be required on Virginia Street over I-80. It is important to note that any modifications within this area will require NDOT permitting. With this reduction in capacity, signal timing adjustments will be needed at both the Virginia Street / 8<sup>th</sup> Street and Virginia Street / Maple Street intersections. **Exhibit 2** and **Exhibit 3** show existing and suggested phasing/timing modifications. Note that the cycle length has been held constant to maintain overall interchange area signal coordination. Fine tuning of the timings would be necessary.



Exhibit 2. Existing Signal Timing at 8<sup>th</sup> & Maple





#### TRAFFIC OPERATIONS WITH PROPOSED CYCLE TRACK

#### Intersection Level of Service

AM and PM peak hour level of service calculations were performed using the existing traffic volumes and the proposed cycle track lane configurations and signal timing adjustments. **Table 2** presents the level of service analysis results and calculation sheets are provided in **Appendix B**, attached.

| ID | Interestion            | AM Peak               | w/ Cyc | le Track    | PM Pea                | k w/ Cy | cle Track   |
|----|------------------------|-----------------------|--------|-------------|-----------------------|---------|-------------|
| U  | Intersection           | Movement <sup>1</sup> | LOS    | Delay (sec) | Movement <sup>1</sup> | LOS     | Delay (sec) |
| 1  | Virginia St / Oth St   | Overall               | В      | 14.2        | Overall               | В       | 16.2        |
| T  | virginia St / 9th St   | WB L/T                | D      | 42.6        | WB L/T                | D       | 46.6        |
| 2  | Virginia St / Oth St   | Overall               | С      | 21.9        | Overall               | С       | 21.9        |
| 2  | virginia St / 8th St   | SBT                   | Ε      | 58.9        | SBT                   | D       | 41.4        |
| 2  | Virginia St / Manla St | Overall               | С      | 26.3        | Overall               | D       | 38.7        |
| 5  | virginia st / Maple st | NB T/R                | D      | 38.0        | NB T/R                | Ε       | 68.1        |
| 1  | Virginia St / 6th St   | Overall               | В      | 14.2        | Overall               | С       | 34.7        |
| 4  |                        | WBL                   | C      | 25.1        | EBL                   | Ε       | 69.5        |
| F  | Virginia St / Eth St   | Overall               | В      | 15.0        | Overall               | С       | 34.8        |
| 5  | virginia St / Stn St   | NB L                  | C      | 22.8        | SB T/R                | D       | 49.9        |
| 6  | Vincinia Ct. / Ath Ct. | Overall               | В      | 12.2        | Overall               | D       | 51.9        |
| 6  | virginia St / 4th St   | EBL                   | В      | 16.8        | NB L/T/R              | F       | 143.3       |
| 7  | Virginia St / and St   | Overall               | В      | 14.8        | Overall               | С       | 24.9        |
|    | virginia St / Zhu St   | EB L/T                | C      | 21.6        | WB L/T                | С       | 31.7        |
| 0  | Virginia St / 1st St   | Overall               | Α      | 8.9         | Overall               | С       | 31.3        |
| ð  | virginia St / 1St St   | EB L/T                | C      | 20.1        | NB L/T/R              | D       | 52.1        |

| Table 2. Cycle Track Configuration Leve | l of Service |
|---|--------------|
|---|--------------|

Notes: <sup>1</sup> Level of Service is reported as overall and worst movement. Policy Level of Service is based on overall intersection delay for signalized intersections.

Source: Headway Transportation, 2021



As shown in **Table 2**, all the study intersections are anticipated to operate within policy levels of service for <u>overall conditions (average of all movements)</u> during both the AM and PM peak hours. However, many movements are anticipated to operate at poor levels of service during the PM peak hour due to the removal of lanes and numerous movements will experience significant queuing. Level of service analysis of individual intersections does not fully describe the overall Virginia Street corridor operation, which will be worse than LOS D in this case.

#### Queuing

A SimTraffic micro-simulation model was created to further illustrate the operations and queuing at the study intersections. It is anticipated that the removal of travel lanes from N. Virginia Street will cause significant queuing during the PM peak hour in particular. **Figure 5**, attached, shows the anticipated queuing throughout the corridor with implementation of the cycle track. In particular, the following intersections are anticipated to experience significant queues:

- Virginia St. / Maple St. Northbound queuing from Maple Street extending south beyond 5<sup>th</sup> Street
- Virginia St. / 8<sup>th</sup> St. Southbound queuing from 8<sup>th</sup> Street extending north beyond 10<sup>th</sup> Street
- Virginia St. / 4<sup>th</sup> St. Southbound queuing from 4<sup>th</sup> Street extending north to 6<sup>th</sup> Street
- Virginia St. / 4<sup>th</sup> St. Northbound queuing from 4<sup>th</sup> Street extending south to 2<sup>nd</sup> Street
- Virginia St. / 6<sup>th</sup> St. Eastbound left queuing from 6<sup>th</sup> Street extending beyond Sierra Street
- Virginia St. / 1<sup>st</sup> St. Southbound queuing from 1st Street extending south to Mill Street

#### CONCLUSIONS

The contemplated directional cycle tracks on Virginia Street would provide a high quality cycling facility connecting to the previously constructed multi-modal improvements adjacent to UNR and in Mid-town.

A minimum width concept with only one lane of travel in each direction and no northbound or southbound turn pockets would be necessary between 1<sup>st</sup> Street and 4<sup>th</sup> Street.

Under existing traffic volumes, vehicle delay and queuing would significantly increase in the Virginia Street corridor. SimTraffic micro-simulation analysis indicates that, during peak travel times, northbound queuing from Maple Street would likely extend south beyond 5<sup>th</sup> Street.

It is important to note that this analysis does not include special event traffic or future year condition traffic volumes when vehicular and pedestrian traffic may be higher and operations may be worse than discussed in this report. However, it should also be recognized that some traffic may shift to other parallel roadways if travel lanes are removed from Virginia Street. Diversion of traffic to other routes was not quantified or evaluated in this preliminary level analysis.



Reconfiguring arterial corridors through constrained urban environments often requires decisions which balance desires for vehicular capacity, walkability, improved bicycle travel, transit efficiencies, and frontage improvements for business vitality. In this perspective, consideration could be given to modifying the level of service policy and/or accepting vehicular congestion during peak hour conditions.

This letter report serves to answer the question of how traffic would operate if vehicle travel lanes were removed from Virginia Street in order to potentially implement directional cycle tracks. This report is not intended to recommend whether directional cycle tracks should be constructed. Decisions regarding long-term plans for the Virginia Street corridor should be made through, and in the context of, the Downtown Placemaking Study process and recommendations.

Sincerely, Headway Transportation, LLC

DRAFT

Loren E. Chilson, PE

Principal

Attachments:

Figure 1. Cycle Track Overview
Figure 2. Minimum Width Concept
Figure 3. Contemplated Cycle Track Lane Configurations
Figure 4. Existing Weekday Peak Hour Traffic Volumes
Figure 5. Sim Traffic Queuing Results
Attachment A. Contemplated Cycle Track Cross Sections/Layout
Attachment B. Cycle Track Level of Service Calculations (Existing Traffic Volumes)





NO SCALE









**Cycle Track Concept - A** 





Virginia Street Cycle Track Concept

Sheet 1A



**Buffered Bike Lane Concept - B** 





Virginia Street Cycle Track Concept



Sheet 1B



**Cycle Track Concept - A** 





Virginia Street Cycle Track Concept



Sheet 2A



**Buffered Bike Lane Concept - B** 





Virginia Street Cycle Track Concept

Sheet 2B

























Virginia Street Cycle Track Concept







# NB\_&\_SB\_Thru Lanes Removed







Virginia Street Cycle Track Concept

Attachment A. Contemplated Cycle Track Cross Sections/Layout

NB\_&\_SB\_Thru\_Lanes\_Removed\_







Virginia Street Cycle Track Concept

NB\_&\_SB\_Thru,Lanes\_Removed\_



| 11 <sup>7</sup><br>Drive Lane        |  |
|--------------------------------------|--|
| 12 <sup>7</sup><br>Left Turn<br>Lane |  |
| 12'<br>Left Turn<br>Lane             |  |
| 11'<br>Drive Lane                    |  |
| 6' 3'<br>Cycle Buffer<br>Track       |  |
|                                      |  |



Virginia Street Cycle Track Concept



### SimTraffic Performance Report Virginia St Plus Cycle Track

# 2: 8th St & Virginia St Performance by lane

| Lane               | WB   | WB   | WB  | NB   | NB   | SB   | SB   | All  |
|--------------------|------|------|-----|------|------|------|------|------|
| Movements Served   | LT   | Т    | TR  | L    | Т    | Т    | TR   |      |
| Denied Delay (hr)  |      |      |     |      |      |      |      | 0.1  |
| Denied Del/Veh (s) |      |      |     |      |      |      |      | 0.2  |
| Total Delay (hr)   | 3.5  | 1.1  | 1.1 | 0.4  | 1.7  | 3.1  | 1.7  | 12.6 |
| Total Del/Veh (s)  | 20.9 | 13.1 | 9.1 | 23.1 | 22.5 | 58.9 | 29.3 | 21.9 |

# 3: Virginia St & Maple St Performance by lane

| ane                | FB   | FB    | FB  | NB   | SB   | SB   | All  |
|--------------------|------|-------|-----|------|------|------|------|
| Movements Served   | LT   | <br>T | TR  | TR   | L    | T    | 7 41 |
| Denied Delay (hr)  |      |       |     |      |      |      | 0.0  |
| Denied Del/Veh (s) |      |       |     |      |      |      | 0.1  |
| Total Delay (hr)   | 3.0  | 0.5   | 0.1 | 2.7  | 1.3  | 1.1  | 8.8  |
| Total Del/Veh (s)  | 34.7 | 22.1  | 7.3 | 38.0 | 18.5 | 15.9 | 26.3 |

### 6: 4th St & Virginia St Performance by lane

| Lane               | EB   | EB   | EB  | WB   | WB   | WB  | NB   | SB   | All  |  |
|--------------------|------|------|-----|------|------|-----|------|------|------|--|
| Movements Served   | L    | Т    | TR  | L    | Т    | TR  | LTR  | LTR  |      |  |
| Denied Delay (hr)  |      |      |     |      |      |     |      |      | 0.1  |  |
| Denied Del/Veh (s) |      |      |     |      |      |     |      |      | 0.4  |  |
| Total Delay (hr)   | 0.2  | 0.6  | 0.1 | 0.2  | 0.6  | 0.1 | 0.5  | 0.7  | 2.9  |  |
| Total Del/Veh (s)  | 16.8 | 12.2 | 7.6 | 15.6 | 11.8 | 7.6 | 15.2 | 12.2 | 12.2 |  |

## 7: Virginia St & 2nd St Performance by lane

| ane                | EB   | EB  | WB   | WB  | NB  | SB   | All  |
|--------------------|------|-----|------|-----|-----|------|------|
| Movements Served   | LT   | TR  | LT   | TR  | LTR | LTR  |      |
| Denied Delay (hr)  |      |     |      |     |     |      | 0.0  |
| Denied Del/Veh (s) |      |     |      |     |     |      | 0.0  |
| Total Delay (hr)   | 0.5  | 0.1 | 0.5  | 0.0 | 0.1 | 1.0  | 2.2  |
| Total Del/Veh (s)  | 21.6 | 7.0 | 20.7 | 4.6 | 4.0 | 17.4 | 14.8 |

### 8: 1st St & Virginia St Performance by lane

| Lane               | EB   | EB  | NB  | SB  | All |
|--------------------|------|-----|-----|-----|-----|
| Movements Served   | LT   | R   | LTR | LTR |     |
| Denied Delay (hr)  |      |     |     |     | 0.0 |
| Denied Del/Veh (s) |      |     |     |     | 0.1 |
| Total Delay (hr)   | 0.3  | 0.1 | 0.3 | 0.4 | 1.1 |
| Total Del/Veh (s)  | 20.1 | 4.2 | 9.6 | 6.8 | 8.9 |

### SimTraffic Performance Report Virginia St Plus Cycle Track

10/13/2021

# 1: Virginia St & 9th St Performance by lane

| Lane               | EB   | EB  | WB   | WB  | NB   | NB  | NB  | NB  | SB   | SB   | SB  | All  |
|--------------------|------|-----|------|-----|------|-----|-----|-----|------|------|-----|------|
| Movements Served   | LT   | R   | LT   | TR  | L    | Т   | Т   | R   | L    | Т    | R   |      |
| Denied Delay (hr)  |      |     |      |     |      |     |     |     |      |      |     | 0.5  |
| Denied Del/Veh (s) |      |     |      |     |      |     |     |     |      |      |     | 1.0  |
| Total Delay (hr)   | 1.5  | 0.1 | 1.4  | 0.4 | 0.1  | 0.4 | 1.0 | 0.1 | 0.4  | 1.0  | 0.0 | 6.3  |
| Total Del/Veh (s)  | 36.9 | 7.1 | 42.6 | 7.6 | 14.0 | 8.0 | 9.4 | 2.9 | 18.3 | 10.6 | 2.3 | 14.2 |

### 4: 6th St & Virginia St Performance by lane

| Lane               | EB   | EB   | EB  | WB   | WB   | WB  | NB   | NB  | SB   | SB   | All  |  |
|--------------------|------|------|-----|------|------|-----|------|-----|------|------|------|--|
| Movements Served   | L    | Т    | TR  | L    | Т    | TR  | L    | TR  | L    | TR   |      |  |
| Denied Delay (hr)  |      |      |     |      |      |     |      |     |      |      | 0.0  |  |
| Denied Del/Veh (s) |      |      |     |      |      |     |      |     |      |      | 0.1  |  |
| Total Delay (hr)   | 0.4  | 0.4  | 0.0 | 0.1  | 0.4  | 0.1 | 0.1  | 0.3 | 0.1  | 1.2  | 3.1  |  |
| Total Del/Veh (s)  | 22.1 | 17.2 | 6.2 | 25.1 | 16.0 | 5.2 | 11.6 | 7.6 | 16.4 | 16.0 | 14.2 |  |

### 5: Virginia St & 5th St Performance by lane

| Lane               | EB   | EB  | WB   | WB  | NB   | NB   | SB   | SB   | All  |  |
|--------------------|------|-----|------|-----|------|------|------|------|------|--|
| Movements Served   | LT   | TR  | LT   | TR  | L    | TR   | L    | TR   |      |  |
| Denied Delay (hr)  |      |     |      |     |      |      |      |      | 0.0  |  |
| Denied Del/Veh (s) |      |     |      |     |      |      |      |      | 0.0  |  |
| Total Delay (hr)   | 0.5  | 0.0 | 0.0  | 0.0 | 0.1  | 0.7  | 0.1  | 0.9  | 2.3  |  |
| Total Del/Veh (s)  | 11.9 | 6.6 | 10.1 | 4.8 | 22.8 | 18.9 | 21.6 | 15.1 | 15.0 |  |

## Total Network Performance

| Denied Delay (hr)  | 0.7  |
|--------------------|------|
| Denied Del/Veh (s) | 0.6  |
| Total Delay (hr)   | 40.5 |
| Total Del/Veh (s)  | 34.5 |

# Intersection: 2: 8th St & Virginia St

| Movement              | WB  | WB  | WB  | NB  | NB  | SB  | SB  |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|
| Directions Served     | LT  | Т   | TR  | L   | Т   | Т   | TR  |
| Maximum Queue (ft)    | 314 | 264 | 224 | 95  | 228 | 381 | 125 |
| Average Queue (ft)    | 249 | 161 | 106 | 37  | 125 | 175 | 106 |
| 95th Queue (ft)       | 336 | 255 | 191 | 80  | 235 | 350 | 151 |
| Link Distance (ft)    | 295 | 295 | 295 | 221 | 221 | 375 |     |
| Upstream Blk Time (%) | 3   | 0   | 0   |     | 2   | 1   |     |
| Queuing Penalty (veh) | 0   | 0   | 0   |     | 3   | 4   |     |
| Storage Bay Dist (ft) |     |     |     |     |     |     | 100 |
| Storage Blk Time (%)  |     |     |     |     |     | 20  | 23  |
| Queuing Penalty (veh) |     |     |     |     |     | 43  | 42  |

# Intersection: 3: Virginia St & Maple St

| Movement              | EB  | EB  | EB  | NB  | SB  | SB  |
|-----------------------|-----|-----|-----|-----|-----|-----|
| Directions Served     | LT  | Т   | TR  | TR  | L   | Т   |
| Maximum Queue (ft)    | 291 | 227 | 85  | 322 | 229 | 219 |
| Average Queue (ft)    | 177 | 85  | 16  | 158 | 127 | 113 |
| 95th Queue (ft)       | 266 | 203 | 51  | 270 | 223 | 212 |
| Link Distance (ft)    | 304 | 304 | 304 | 594 | 221 | 221 |
| Upstream Blk Time (%) | 0   |     |     |     | 2   | 1   |
| Queuing Penalty (veh) | 0   |     |     |     | 5   | 3   |
| Storage Bay Dist (ft) |     |     |     |     |     |     |
| Storage Blk Time (%)  |     |     |     |     |     |     |
| Queuing Penalty (veh) |     |     |     |     |     |     |

### Intersection: 6: 4th St & Virginia St

| Movement              | EB  | EB  | EB  | WB  | WB  | WB  | NB   | SB  |
|-----------------------|-----|-----|-----|-----|-----|-----|------|-----|
| Directions Served     | L   | Т   | TR  | L   | Т   | TR  | LTR  | LTR |
| Maximum Queue (ft)    | 67  | 118 | 83  | 63  | 141 | 94  | 101  | 108 |
| Average Queue (ft)    | 22  | 56  | 23  | 20  | 65  | 23  | 41   | 44  |
| 95th Queue (ft)       | 56  | 105 | 60  | 52  | 119 | 61  | 85   | 95  |
| Link Distance (ft)    |     | 303 | 303 |     | 295 | 295 | 1044 | 394 |
| Upstream Blk Time (%) |     |     |     |     |     |     |      |     |
| Queuing Penalty (veh) |     |     |     |     |     |     |      |     |
| Storage Bay Dist (ft) | 150 |     |     | 150 |     |     |      |     |
| Storage Blk Time (%)  |     | 0   |     |     | 0   |     |      |     |
| Queuing Penalty (veh) |     | 0   |     |     | 0   |     |      |     |

# Intersection: 7: Virginia St & 2nd St

| Movement              | EB  | EB  | WB  | WB  | NB  | SB   |
|-----------------------|-----|-----|-----|-----|-----|------|
| Directions Served     | LT  | TR  | LT  | TR  | LTR | LTR  |
| Maximum Queue (ft)    | 94  | 52  | 100 | 48  | 63  | 203  |
| Average Queue (ft)    | 42  | 17  | 44  | 16  | 14  | 97   |
| 95th Queue (ft)       | 81  | 45  | 85  | 44  | 46  | 173  |
| Link Distance (ft)    | 303 | 303 | 311 | 311 | 320 | 1044 |
| Upstream Blk Time (%) |     |     |     |     |     |      |
| Queuing Penalty (veh) |     |     |     |     |     |      |
| Storage Bay Dist (ft) |     |     |     |     |     |      |
| Storage Blk Time (%)  |     |     |     |     |     |      |
| Queuing Penalty (veh) |     |     |     |     |     |      |

## Intersection: 8: 1st St & Virginia St

| Movement              | EB  | EB  | NB  | SB  |  |
|-----------------------|-----|-----|-----|-----|--|
| Directions Served     | LT  | R   | LTR | LTR |  |
| Maximum Queue (ft)    | 84  | 53  | 89  | 101 |  |
| Average Queue (ft)    | 28  | 19  | 37  | 43  |  |
| 95th Queue (ft)       | 66  | 44  | 79  | 89  |  |
| Link Distance (ft)    | 302 | 302 | 414 | 320 |  |
| Upstream Blk Time (%) |     |     |     |     |  |
| Queuing Penalty (veh) |     |     |     |     |  |
| Storage Bay Dist (ft) |     |     |     |     |  |
| Storage Blk Time (%)  |     |     |     |     |  |
| Queuing Penalty (veh) |     |     |     |     |  |

#### Intersection: 1: Virginia St & 9th St

| Movement              | EB  | EB  | WB  | WB  | NB  | NB  | NB  | NB  | SB  | SB  | SB  |  |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Directions Served     | LT  | R   | LT  | TR  | L   | Т   | Т   | R   | L   | Т   | R   |  |
| Maximum Queue (ft)    | 172 | 121 | 245 | 125 | 72  | 152 | 181 | 96  | 111 | 222 | 42  |  |
| Average Queue (ft)    | 81  | 21  | 78  | 56  | 12  | 63  | 91  | 17  | 41  | 99  | 9   |  |
| 95th Queue (ft)       | 148 | 66  | 159 | 113 | 43  | 127 | 156 | 64  | 89  | 181 | 33  |  |
| Link Distance (ft)    | 321 |     | 294 |     |     | 375 | 375 |     |     | 682 |     |  |
| Upstream Blk Time (%) |     |     | 0   |     |     |     |     |     |     |     |     |  |
| Queuing Penalty (veh) |     |     | 0   |     |     |     |     |     |     |     |     |  |
| Storage Bay Dist (ft) |     | 100 |     | 100 | 100 |     |     | 100 | 100 |     | 150 |  |
| Storage Blk Time (%)  | 6   | 0   | 5   | 0   |     | 1   | 4   | 0   | 0   | 6   |     |  |
| Queuing Penalty (veh) | 2   | 0   | 12  | 0   |     | 0   | 2   | 0   | 1   | 6   |     |  |

# Intersection: 4: 6th St & Virginia St

| Movement              | EB  | EB  | EB  | WB  | WB  | WB  | NB  | NB  | SB  | SB  |  |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Directions Served     | L   | Т   | TR  | L   | Т   | TR  | L   | TR  | L   | TR  |  |
| Maximum Queue (ft)    | 90  | 99  | 40  | 47  | 94  | 61  | 36  | 92  | 149 | 244 |  |
| Average Queue (ft)    | 37  | 42  | 7   | 10  | 37  | 19  | 9   | 30  | 27  | 97  |  |
| 95th Queue (ft)       | 74  | 85  | 29  | 36  | 79  | 51  | 31  | 69  | 92  | 214 |  |
| Link Distance (ft)    | 300 | 300 | 300 | 306 | 306 | 306 |     | 401 |     | 594 |  |
| Upstream Blk Time (%) |     |     |     |     |     |     |     |     |     |     |  |
| Queuing Penalty (veh) |     |     |     |     |     |     |     |     |     |     |  |
| Storage Bay Dist (ft) |     |     |     |     |     |     | 150 |     | 125 |     |  |
| Storage Blk Time (%)  |     |     |     |     |     |     |     |     | 0   | 6   |  |
| Queuing Penalty (veh) |     |     |     |     |     |     |     |     | 0   | 2   |  |

## Intersection: 5: Virginia St & 5th St

| Movement              | EB  | EB  | WB  | WB  | NB | NB  | SB  | SB  |
|-----------------------|-----|-----|-----|-----|----|-----|-----|-----|
| Directions Served     | LT  | TR  | LT  | TR  | L  | TR  | L   | TR  |
| Maximum Queue (ft)    | 120 | 51  | 39  | 28  | 53 | 132 | 38  | 169 |
| Average Queue (ft)    | 55  | 9   | 8   | 2   | 8  | 56  | 6   | 56  |
| 95th Queue (ft)       | 100 | 35  | 30  | 14  | 34 | 112 | 27  | 128 |
| Link Distance (ft)    | 307 | 307 | 306 | 306 |    | 394 |     | 401 |
| Upstream Blk Time (%) |     |     |     |     |    |     |     |     |
| Queuing Penalty (veh) |     |     |     |     |    |     |     |     |
| Storage Bay Dist (ft) |     |     |     |     | 50 |     | 150 |     |
| Storage Blk Time (%)  |     |     |     |     | 0  | 19  |     | 1   |
| Queuing Penalty (veh) |     |     |     |     | 1  | 2   |     | 0   |

#### Network Summary

Network wide Queuing Penalty: 129

### SimTraffic Performance Report Virginia St Plus Cycle Track

# 2: 8th St & Virginia St Performance by lane

| Lane               | WB   | WB   | WB   | NB   | NB  | SB   | SB   | All  |
|--------------------|------|------|------|------|-----|------|------|------|
| Movements Served   | LT   | Т    | TR   | L    | Т   | Т    | TR   |      |
| Denied Delay (hr)  |      |      |      |      |     |      |      | 0.8  |
| Denied Del/Veh (s) |      |      |      |      |     |      |      | 1.1  |
| Total Delay (hr)   | 6.2  | 2.2  | 1.4  | 0.7  | 1.4 | 1.9  | 1.7  | 15.5 |
| Total Del/Veh (s)  | 37.0 | 20.6 | 14.0 | 16.7 | 9.9 | 41.4 | 16.6 | 21.9 |

# 3: Virginia St & Maple St Performance by lane

| Lane               | EB   | EB   | EB  | NB   | SB   | SB  | All  |
|--------------------|------|------|-----|------|------|-----|------|
| Movements Served   | LT   | Т    | TR  | TR   | L    | Т   |      |
| Denied Delay (hr)  |      |      |     |      |      |     | 0.0  |
| Denied Del/Veh (s) |      |      |     |      |      |     | 0.1  |
| Total Delay (hr)   | 3.4  | 0.3  | 0.2 | 12.7 | 1.7  | 1.1 | 19.4 |
| Total Del/Veh (s)  | 48.1 | 23.9 | 9.2 | 68.1 | 23.0 | 7.8 | 38.7 |

### 6: 4th St & Virginia St Performance by lane

| Lane               | EB   | EB   | EB  | WB   | WB   | WB   | NB    | SB   | All  |  |
|--------------------|------|------|-----|------|------|------|-------|------|------|--|
| Movements Served   | L    | Т    | TR  | L    | Т    | TR   | LTR   | LTR  |      |  |
| Denied Delay (hr)  |      |      |     |      |      |      |       |      | 0.3  |  |
| Denied Del/Veh (s) |      |      |     |      |      |      |       |      | 0.6  |  |
| Total Delay (hr)   | 0.5  | 0.8  | 0.3 | 0.3  | 1.0  | 0.4  | 15.1  | 6.0  | 24.4 |  |
| Total Del/Veh (s)  | 22.5 | 12.5 | 9.1 | 18.9 | 12.9 | 11.5 | 143.3 | 52.9 | 51.9 |  |

#### 7: Virginia St & 2nd St Performance by lane

| Lane               | EB   | EB   | WB   | WB   | NB   | SB   | All  |
|--------------------|------|------|------|------|------|------|------|
| Movements Served   | LT   | TR   | LT   | TR   | LTR  | LTR  |      |
| Denied Delay (hr)  |      |      |      |      |      |      | 0.0  |
| Denied Del/Veh (s) |      |      |      |      |      |      | 0.1  |
| Total Delay (hr)   | 1.0  | 0.2  | 2.4  | 0.5  | 2.2  | 3.0  | 9.3  |
| Total Del/Veh (s)  | 25.7 | 11.3 | 31.7 | 15.8 | 22.5 | 26.5 | 24.9 |

#### 8: 1st St & Virginia St Performance by lane

| Lane               | EB   | EB  | NB   | SB   | All  |
|--------------------|------|-----|------|------|------|
| Movements Served   | LT   | R   | LTR  | LTR  |      |
| Denied Delay (hr)  |      |     |      |      | 1.3  |
| Denied Del/Veh (s) |      |     |      |      | 4.4  |
| Total Delay (hr)   | 1.0  | 0.1 | 6.1  | 2.3  | 9.6  |
| Total Del/Veh (s)  | 25.0 | 6.6 | 52.1 | 18.2 | 31.3 |

## SimTraffic Performance Report Virginia St Plus Cycle Track

10/13/2021

# 1: Virginia St & 9th St Performance by lane

| Lane               | EB   | EB  | WB   | WB  | NB   | NB  | NB  | NB  | SB   | SB   | SB  | All  |
|--------------------|------|-----|------|-----|------|-----|-----|-----|------|------|-----|------|
| Movements Served   | LT   | R   | LT   | TR  | L    | Т   | Т   | R   | L    | Т    | R   |      |
| Denied Delay (hr)  |      |     |      |     |      |     |     |     |      |      |     | 0.6  |
| Denied Del/Veh (s) |      |     |      |     |      |     |     |     |      |      |     | 1.1  |
| Total Delay (hr)   | 1.5  | 0.1 | 3.2  | 0.4 | 0.2  | 0.3 | 0.8 | 0.0 | 0.6  | 2.1  | 0.0 | 9.1  |
| Total Del/Veh (s)  | 36.2 | 6.6 | 46.6 | 7.3 | 13.9 | 4.2 | 7.4 | 1.1 | 24.3 | 15.6 | 2.3 | 16.2 |

### 4: 6th St & Virginia St Performance by lane

| Lane               | EB   | EB   | EB   | WB   | WB   | WB   | NB   | NB   | SB   | SB   | All  |  |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|--|
| Movements Served   | L    | Т    | TR   | L    | Т    | TR   | L    | TR   | L    | TR   |      |  |
| Denied Delay (hr)  |      |      |      |      |      |      |      |      |      |      | 2.1  |  |
| Denied Del/Veh (s) |      |      |      |      |      |      |      |      |      |      | 4.1  |  |
| Total Delay (hr)   | 4.5  | 1.5  | 0.5  | 0.2  | 0.7  | 0.3  | 0.3  | 3.8  | 0.4  | 5.3  | 17.5 |  |
| Total Del/Veh (s)  | 69.5 | 21.4 | 19.0 | 29.7 | 19.2 | 16.9 | 27.7 | 33.8 | 24.6 | 37.5 | 34.7 |  |

#### 5: Virginia St & 5th St Performance by lane

| Lane               | EB   | EB   | WB   | WB  | NB   | NB   | SB   | SB   | All  |  |
|--------------------|------|------|------|-----|------|------|------|------|------|--|
| Movements Served   | LT   | TR   | LT   | TR  | L    | TR   | L    | TR   |      |  |
| Denied Delay (hr)  |      |      |      |     |      |      |      |      | 0.0  |  |
| Denied Del/Veh (s) |      |      |      |     |      |      |      |      | 0.1  |  |
| Total Delay (hr)   | 1.0  | 0.2  | 0.2  | 0.0 | 0.2  | 3.6  | 0.2  | 6.2  | 11.6 |  |
| Total Del/Veh (s)  | 16.4 | 10.9 | 12.0 | 6.5 | 29.4 | 35.2 | 32.6 | 49.9 | 34.8 |  |

### Total Network Performance

| Denied Delay (hr)  | 5.2   |
|--------------------|-------|
| Denied Del/Veh (s) | 3.0   |
| Total Delay (hr)   | 118.2 |
| Total Del/Veh (s)  | 66.8  |

# Intersection: 2: 8th St & Virginia St

| Movement              | WB  | WB  | WB  | NB  | NB  | SB  | SB  |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|
| Directions Served     | LT  | Т   | TR  | L   | Т   | Т   | TR  |
| Maximum Queue (ft)    | 335 | 310 | 268 | 135 | 229 | 382 | 125 |
| Average Queue (ft)    | 302 | 225 | 135 | 59  | 152 | 157 | 108 |
| 95th Queue (ft)       | 347 | 314 | 239 | 110 | 250 | 353 | 148 |
| Link Distance (ft)    | 295 | 295 | 295 | 221 | 221 | 375 |     |
| Upstream Blk Time (%) | 22  | 1   | 0   |     | 1   | 1   |     |
| Queuing Penalty (veh) | 0   | 0   | 0   |     | 4   | 5   |     |
| Storage Bay Dist (ft) |     |     |     |     |     |     | 100 |
| Storage Blk Time (%)  |     |     |     |     |     | 3   | 22  |
| Queuing Penalty (veh) |     |     |     |     |     | 10  | 50  |

# Intersection: 3: Virginia St & Maple St

| Movement              | EB  | EB  | EB  | NB  | SB  | SB  |
|-----------------------|-----|-----|-----|-----|-----|-----|
| Directions Served     | LT  | Т   | TR  | TR  | L   | Т   |
| Maximum Queue (ft)    | 306 | 224 | 69  | 612 | 225 | 222 |
| Average Queue (ft)    | 176 | 85  | 27  | 497 | 123 | 116 |
| 95th Queue (ft)       | 267 | 204 | 58  | 721 | 211 | 216 |
| Link Distance (ft)    | 304 | 304 | 304 | 594 | 221 | 221 |
| Upstream Blk Time (%) | 0   | 0   |     | 12  | 1   | 1   |
| Queuing Penalty (veh) | 0   | 0   |     | 84  | 4   | 4   |
| Storage Bay Dist (ft) |     |     |     |     |     |     |
| Storage Blk Time (%)  |     |     |     |     |     |     |
| Queuing Penalty (veh) |     |     |     |     |     |     |

### Intersection: 6: 4th St & Virginia St

| Movement              | EB  | EB  | EB  | WB  | WB  | WB  | NB   | SB  |
|-----------------------|-----|-----|-----|-----|-----|-----|------|-----|
| Directions Served     | L   | Т   | TR  | L   | Т   | TR  | LTR  | LTR |
| Maximum Queue (ft)    | 93  | 150 | 114 | 79  | 165 | 134 | 872  | 405 |
| Average Queue (ft)    | 40  | 76  | 44  | 29  | 91  | 52  | 481  | 227 |
| 95th Queue (ft)       | 77  | 126 | 90  | 64  | 149 | 106 | 1033 | 426 |
| Link Distance (ft)    |     | 303 | 303 |     | 295 | 295 | 1044 | 394 |
| Upstream Blk Time (%) |     |     |     |     |     |     | 4    | 4   |
| Queuing Penalty (veh) |     |     |     |     |     |     | 15   | 18  |
| Storage Bay Dist (ft) | 150 |     |     | 150 |     |     |      |     |
| Storage Blk Time (%)  |     | 0   |     |     | 1   |     |      |     |
| Queuing Penalty (veh) |     | 0   |     |     | 0   |     |      |     |

# Intersection: 7: Virginia St & 2nd St

| Movement EB EB WB WB NB SB                  |
|---|
| Directions Served LT TR LT TR LTR LTR       |
| Maximum Queue (ft) 148 90 231 183 259 387   |
| Average Queue (ft) 72 29 137 75 113 192     |
| 95th Queue (ft) 126 66 212 159 261 336      |
| Link Distance (ft) 303 303 311 311 320 1044 |
| Upstream Blk Time (%) 2                     |
| Queuing Penalty (veh) 7                     |
| Storage Bay Dist (ft)                       |
| Storage Blk Time (%)                        |
| Queuing Penalty (veh)                       |

# Intersection: 8: 1st St & Virginia St

| Movement              | EB  | EB  | NB  | SB  |
|-----------------------|-----|-----|-----|-----|
| Directions Served     | LT  | R   | LTR | LTR |
| Maximum Queue (ft)    | 169 | 63  | 447 | 308 |
| Average Queue (ft)    | 74  | 26  | 246 | 138 |
| 95th Queue (ft)       | 136 | 53  | 461 | 283 |
| Link Distance (ft)    | 302 | 302 | 414 | 320 |
| Upstream Blk Time (%) |     |     | 14  | 1   |
| Queuing Penalty (veh) |     |     | 0   | 6   |
| Storage Bay Dist (ft) |     |     |     |     |
| Storage Blk Time (%)  |     |     |     |     |
| Queuing Penalty (veh) |     |     |     |     |

#### Intersection: 1: Virginia St & 9th St

| Movement              | EB  | EB  | WB  | WB  | NB  | NB  | NB  | NB  | SB  | SB  | SB  |  |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Directions Served     | LT  | R   | LT  | TR  | L   | Т   | Т   | R   | L   | Т   | R   |  |
| Maximum Queue (ft)    | 198 | 125 | 317 | 125 | 64  | 113 | 145 | 75  | 125 | 405 | 149 |  |
| Average Queue (ft)    | 88  | 18  | 184 | 99  | 21  | 38  | 69  | 11  | 58  | 172 | 24  |  |
| 95th Queue (ft)       | 163 | 68  | 318 | 161 | 52  | 94  | 124 | 42  | 123 | 329 | 86  |  |
| Link Distance (ft)    | 321 |     | 294 |     |     | 375 | 375 |     |     | 682 |     |  |
| Upstream Blk Time (%) |     |     | 3   |     |     |     |     |     |     | 0   |     |  |
| Queuing Penalty (veh) |     |     | 0   |     |     |     |     |     |     | 0   |     |  |
| Storage Bay Dist (ft) |     | 100 |     | 100 | 100 |     |     | 100 | 100 |     | 150 |  |
| Storage Blk Time (%)  | 8   | 0   | 26  | 1   | 0   | 0   | 2   | 0   | 2   | 17  | 0   |  |
| Queuing Penalty (veh) | 3   | 0   | 79  | 2   | 0   | 0   | 1   | 0   | 10  | 25  | 0   |  |

# Intersection: 4: 6th St & Virginia St

| Movement              | EB  | EB  | EB  | WB  | WB  | WB  | NB  | NB  | SB  | SB  |  |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Directions Served     | L   | Т   | TR  | L   | Т   | TR  | L   | TR  | L   | TR  |  |
| Maximum Queue (ft)    | 289 | 256 | 173 | 60  | 129 | 96  | 142 | 363 | 150 | 553 |  |
| Average Queue (ft)    | 173 | 124 | 58  | 16  | 62  | 38  | 42  | 168 | 63  | 275 |  |
| 95th Queue (ft)       | 319 | 245 | 149 | 46  | 113 | 78  | 130 | 388 | 155 | 524 |  |
| Link Distance (ft)    | 300 | 300 | 300 | 306 | 306 | 306 |     | 401 |     | 594 |  |
| Upstream Blk Time (%) | 13  | 4   | 0   |     |     |     |     | 2   |     | 1   |  |
| Queuing Penalty (veh) | 0   | 0   | 0   |     |     |     |     | 11  |     | 5   |  |
| Storage Bay Dist (ft) |     |     |     |     |     |     | 150 |     | 125 |     |  |
| Storage Blk Time (%)  |     |     |     |     |     |     | 0   | 22  | 0   | 32  |  |
| Queuing Penalty (veh) |     |     |     |     |     |     | 0   | 10  | 0   | 18  |  |

# Intersection: 5: Virginia St & 5th St

| Movement              | EB  | EB  | WB  | WB  | NB | NB  | SB  | SB  |
|-----------------------|-----|-----|-----|-----|----|-----|-----|-----|
| Directions Served     | LT  | TR  | LT  | TR  | L  | TR  | L   | TR  |
| Maximum Queue (ft)    | 193 | 144 | 81  | 45  | 74 | 335 | 174 | 411 |
| Average Queue (ft)    | 85  | 32  | 24  | 8   | 25 | 178 | 34  | 236 |
| 95th Queue (ft)       | 157 | 95  | 60  | 31  | 66 | 322 | 123 | 433 |
| Link Distance (ft)    | 307 | 307 | 306 | 306 |    | 394 |     | 401 |
| Upstream Blk Time (%) | 0   | 0   |     |     |    | 1   |     | 5   |
| Queuing Penalty (veh) | 0   | 0   |     |     |    | 3   |     | 22  |
| Storage Bay Dist (ft) |     |     |     |     | 50 |     | 150 |     |
| Storage Blk Time (%)  |     |     |     |     | 3  | 48  |     | 40  |
| Queuing Penalty (veh) |     |     |     |     | 12 | 13  |     | 9   |

#### Network Summary

Network wide Queuing Penalty: 431

Existing PM PP