**Kevin Saavedra**

USP 587 Homework 4: Network Assignment

1. **Task 1: Baseline Scenario**

Utilizing the provided file, TrafAsmtUE.exe, the total network travel time for the Baseline Scenario is 42,841 vehicle minutes. This could be calculated manually by using the sum product of Flow and Congested Time. In this baseline scenario, busiest streets by volume are in the central and northern parts of Simpletown, comprising Chagrin Road, Murphy’s Way, Hypotenuse Street, Central Avenue, Commerce Avenue, and Bella Luna Road (Table 1).

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| ***Table 1: Busiest Links by Volume.*** | | |
| **Link Number** | **Street Name** | **Flow (vph)** |
| 7-19 | Chagrin Rd. | 1846.1 |
| 2-10 | W. Central Ave. | 1688.65 |
| 4-7 | Murphy’s Way | 1521.58 |
| 10-2 | W. Central Ave. | 1483.28 |
| 8-7 | N. Meridian Road | 1339.62 |
| 1-2 | W. Central Ave. | 1337.52 |
| 17-9 | Commerce Ave. | 1308.54 |
| 1-4 | Hypotenuse St. | 1307.19 |
| 9-17 | Commerce Ave. | 1300.5 |
| 18-19 | Bella Luna Rd. | 1296.15 |

Over-capacity links (> 1.0 V/C ratio) occur in the Downtown area, mostly along N. Meridian Road, and on the East Side of Simpletown, on Bella Luna Road (Table 2).

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| ***Table 2: Links Over Capacity*** | | |
| **Link Number** | **Street Name** | **V/C ratio** |
| 8-7 | N. Meridian Rd. | 1.48846 |
| 1-2 | W. Central Ave | 1.48613 |
| 18-19 | Bella Luna Rd. | 1.44017 |
| 7-8 | N. Meridian Rd. | 1.39669 |
| 9-8 | N. Meridian Rd. | 1.35368 |
| 8-9 | N. Meridian Rd. | 1.33233 |
| 2-1 | W. Central Ave. | 1.32143 |
| 19-18 | Bella Luna Rd. | 1.19486 |
| 14-15 | Bella Luna Rd. | 1.16738 |
| 15-18 | Bella Luna Rd. | 1.11849 |
| 17-16 | Market St. | 1.07001 |
| 14-13 | Wooden Palate Ave. | 1.06166 |
| 9-5 | Rush St. | 1.05816 |
| 7-19 | Chagrin Rd. | 1.02561 |
| 9-10 | N. Meridian Rd. | 1.02406 |

1. **Characterize Network Perfomance**

In order to eliminate congestion effects, setting α = 0 within the BPR function produced *t*congested = *t*freeflow. Performing the same calculation using the TrafAsmtUE.exe file. With the Baseline and Freeflow travel times (Table 3), the computed Congestion Index is 1.287. This can be interpreted to mean that under congested conditions, total travel time in vehicle minutes is increased by a factor of 1.287.

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| ***Table 3: Total Travel Time*** | |
| **Scenario** | **Total Vehicle min** |
| Baseline | 42840.9 |
| Freeflow | 33294.7 |

Under freeflow conditions, the most important links to regional vehicular flow could be determined by the number of vehicles which utilized them as a part of shortest-path routing. Table 4 shows the top links in order of importance.

Generally, the most-travelled links are in the denser “downtown area,” with the centrally-located N-S and E-W axial streets (N. Meridian Road, Commerce Ave, Central Ave) seeing the most traffic. Of the ring roads, Bella Luna Road carries the greatest volume of traffic, 2-4 times the amount of Circle Freeway North, Circle Freeway South, and Blast Furnace Road. As the model is configured, the central location of the axial roads makes them more attractive for a shortest-path algorithm, whereas the higher-capacity ring roads are hardly utilized at all.

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| ***Table 4: Critical Regional Links*** | | |
| **Link** | **Street Name** | **Flow (vph)** |
| 7-8 | N. Meridian Rd. | 7 |
| 9-17 | Commerce Ave. | 6 |
| 17-9 | Commerce Ave. | 6 |
| 2-10 | W. Central Ave. | 5 |
| 6-4 | Race St. | 5 |
| 10-11 | S. Meridian Road | 5 |
| 11-10 | S Meridian Rd. | 5 |

1. **Urban Design Proposal**

Three urban design proposals were examined utilizing the TrafAsmtUE.exe program:

* The closure of Skid Row to vehicular traffic.
* Eastbound Race St. and Westbound Rush St. one-way couplet + Skid Row closure.
* Reverse one-way couplet on Race St. and Rush St + Skid Row closure.

Appendix A illustrates the change in volume per link, denoted by direction, for each of the three scenarios compared to the baseline.

All scenarios divert traffic onto Hypotenuse St., Murphy’s Way, and N. Meridian Road. Circle Freeway South also sees a notable increase in volume, ranging from 3% to 18% over baseline. This increase in volume does not extend to Circle Freeway North, which sees 0 volume change over all three scenarios; Hypotenuse St. and Murphy’s Way instead takes any change in volume resulting from the projects.

Fig 1 depicts the change in total vehicle minutes on the Simpletown network resulting from the projects. All proposed projects produce an increase in total vehicle minutes over the baseline condition.

Converting from V/C ratios to Level of Service (LOS) designations allows for classification of the total vehicle minutes on the Simpletown Network (Table 5).

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| ***Table 5: Classifying V/C Ranges into LOS Conditions*** | | |
| **Level of Service** | **Description** | **V/C range** |
| A | Free-flow conditions. | 0.00 to 0.60 |
| B | Reasonably unimpeded operations. | 0.61 to 0.70 |
| C | Stable operations, with restrictions. | 0.71 to 0.80 |
| D | Approaching unstable operations. | 0.81 to 0.90 |
| E | Operations with significant intersection approach delays. | 0.91 to 1.00 |
| F | Operations with extremely low speeds. | Greater than 1.00 |
| Source: Transportation Research Board, *Highway Capacity Manual, Special Report 209*  (Washington, D.C., 1994) | | |

When comparing networks based on LOS classifications, the Race St. / Rush St. Couplet + Skid Road Closure alternative eliminates the greatest percentage of LOS F and LOS D conditions on the network, with significant increases to LOS C.

**Recommendation**

Based on the analysis of proposed urban design changes using the TrafAsmtUE.exe program, the recommended project is the Eastbound Race St. and Westbound Rush St. one-way couplet + Skid Row closure. While this project ultimately increases vehicular minutes on the network, the total change is marginal, at 1.16%. However, the significant decreases in LOS F and LOS D conditions in this recommended scenario arguably outweighs the increase in vehicular minutes.