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USP 587 Homework 5: Putting it All Together

# 1. Trip Generation

Future year productions and attractions for the 4-zone region could be determined (Table 1) by using the following formulas:

Pi = 37.6 + 1.7 HHi + 2.4 Ci + 1.9 Wi

Aj = 115.0 + 3.0 Ej + 2.5 HHj,

As suggested in class, I have renamed the base year to be 2015 and the future year to be 2025, for a more realistic approach to this homework assignment.

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| --- | --- | --- | --- | --- |
| **Table 1: Projected 2025 Productions and Attractions** | | | | |
| Zone | Productions | Attractions | Balance Factor | Balanced Attractions |
| 1 | 846.7 | 695.5 | 0.987466 | 686.7824 |
| 2 | 942.8 | 955 | 0.987466 | 943.0297 |
| 3 | 870.3 | 1060.5 | 0.987466 | 1047.207 |
| 4 | 932.6 | 927 | 0.987466 | 915.3806 |

# 2. Trip Distribution

Task 2a

The included calculation worksheet documents the Iterative Proportional Fitting (IPF) process for the trip generation process. Table 2 depicts the baseline and future projected trip table that resulted from the IPF process.

**Table 2: 2015 and 2025 Trip Tables**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Future 2025 Condition | | | | |
| ***Zone*** | ***1*** | ***2*** | ***3*** | ***4*** |
| ***1*** | 245 | 115 | 282 | 59 |
| ***2*** | 133 | 500 | 51 | 242 |
| ***3*** | 276 | 76 | 233 | 457 |
| ***4*** | 192 | 250 | 304 | 175 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Base 2015 Condition | | | | |  |
| ***Zone*** | ***1*** | ***2*** | ***3*** | ***4*** |  |
| ***1*** | 250 | 125 | 375 | 75 |  |
| ***2*** | 100 | 400 | 50 | 225 |  |
| ***3*** | 205 | 60 | 225 | 420 |  |
| ***4*** | 155 | 215 | 320 | 175 |  |

Task 2b

Table 2 depicts overall flow patterns for the 4-zone region studied, and Table 3 depicts summary figures based upon 2015 and 2025 projects. There is a 6.4% increase in overall trips and 6.7% increase in total travel time, but average travel time across the network is essentially unchanged at 10.2 minutes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 3: Summary Comparison of Base and Future Year** | | | |
| Year | Total Trips | Total Travel Time (Min) | Average Travel Time (Min) |
| 2015 | 3375 | 34,445.0 | 10.21 |
| 2025 | 3592 | 36,781.8 | 10.24 |

# 3. Convert Production-Attraction trips to OD Trips

Using the data provided in Table 4 and the formula: TijOD = P-A Factor\*TijPA + A-P Factor\*TjiPA, OD trips were calculated (Table 5).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 4: Temporal Distribution of Trips by Purpose** | | | | | | | | | |
|  |  | HBW | | HBO | | NHB | | Total | |
| Analysis Period | | P-A | A-P | P-A | A-P | P-A | A-P | P-A | A-P |
| 1. AM-peak (7-9:00am) | | 0.3 | 0 | 0.06 | 0.02 | 0.04 | 0.04 | 0.2 | 0.1 |
| 2. PM-peak (4-7:00pm) | | 0.03 | 0.3 | 0.09 | 0.15 | 0.12 | 0.12 | 0.1 | 0.2 |
| 3. Off-peak (other) | | 0.17 | 0.2 | 0.33 | 0.33 | 0.34 | 0.34 | 0.2 | 0.2 |

**Table 5: AM Peak OD Trips**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015 AM Peak** | |  |  |  |  | **2025 AM Peak** | |  |  |  |
| ***Zone*** | ***1*** | ***2*** | ***3*** | ***4*** |  | ***Zone*** | ***1*** | ***2*** | ***3*** | ***4*** |
| ***1*** | 75.0 | 37.5 | 112.5 | 22.5 |  | ***1*** | 73.6 | 34.6 | 84.7 | 17.8 |
| ***2*** | 30.0 | 120.0 | 15.0 | 67.5 |  | ***2*** | 40.0 | 150.3 | 15.3 | 72.5 |
| ***3*** | 61.5 | 18.0 | 67.5 | 126.0 |  | ***3*** | 82.9 | 22.8 | 69.8 | 137.0 |
| ***4*** | 46.5 | 64.5 | 96.0 | 52.5 |  | ***4*** | 57.6 | 75.2 | 91.3 | 52.5 |

# 4. Mode Choice

Task 4a

Utilizing a logit mode choice model where: Vcar = -0.333 \* time\_car and Vbus = -7 –0.5 \* bus\_fare, auto and bus person trips, rounded to the nearest trip, could be calculated for the AM peak hours (Table 6, 7).

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 6: Automobile Person Trips for AM Peak** | | | | | | | | | | |
| Pcar 2015 (Person Trips) | | | | |  | Pcar 2025 (Person Trips) | | | | |
| ***Zone*** | ***1*** | ***2*** | ***3*** | ***4*** |  | ***Zone*** | ***1*** | ***2*** | ***3*** | ***4*** |
| ***1*** | 75 | 34 | 108 | 18 |  | ***1*** | 73 | 31 | 81 | 15 |
| ***2*** | 27 | 119 | 10 | 66 |  | ***2*** | 36 | 149 | 11 | 70 |
| ***3*** | 59 | 13 | 67 | 125 |  | ***3*** | 80 | 16 | 70 | 135 |
| ***4*** | 38 | 63 | 95 | 52 |  | ***4*** | 47 | 73 | 90 | 52 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 7: Bus Person Trips for AM Peak** | | | | | | | | | | |
| Pbus 2015 (Person Trips) | | | | |  | Pbus 2025 (Person Trips) | | | | |
| *Zone* | *1* | *2* | *3* | *4* |  | *Zone* | ***1*** | ***2*** | ***3*** | ***4*** |
| ***1*** | 0 | 4 | 5 | 4 |  | *1* | 0 | 4 | 3 | 3 |
| ***2*** | 3 | 1 | 5 | 2 |  | *2* | 4 | 1 | 5 | 2 |
| ***3*** | 2 | 5 | 0 | 1 |  | *3* | 3 | 7 | 0 | 2 |
| ***4*** | 8 | 2 | 1 | 0 |  | *4* | 10 | 2 | 1 | 0 |

Task 4b

Vehicle trips were calculated using automobile person trips and AM peak occupancy of 1.1 persons per vehicle and rounded to the nearest trip (Table 8).

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 8: Vehicle Trips** | | | | | | | | | | |
| **2015** | | | | |  | 2025 | | | | |
| ***Zone*** | ***1*** | ***2*** | ***3*** | ***4*** |  | ***Zone*** | ***1*** | ***2*** | ***3*** | ***4*** |
| ***1*** | 68 | 34 | 102 | 20 |  | ***1*** | 67 | 28 | 74 | 13 |
| ***2*** | 24 | 108 | 10 | 60 |  | ***2*** | 33 | 136 | 10 | 64 |
| ***3*** | 54 | 11 | 61 | 113 |  | ***3*** | 72 | 14 | 63 | 123 |
| ***4*** | 35 | 57 | 86 | 48 |  | ***4*** | 43 | 66 | 82 | 48 |
| Total Trips | | | | 892 |  | Total Trips | | | | 936 |

# 5. Traffic Assignment

The TrafAsmtUE.exe program produced the following assignment results for 2015 and 2025:

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 9: Baseline and Future Condition Assignments** | | | |
| Year | Total VMT | Total Vehicle Minutes | Average Speed |
| 2015 | 8465.514 | 18475 | 27.49273 |
| 2025 | 8639.768 | 23394 | 22.15893 |

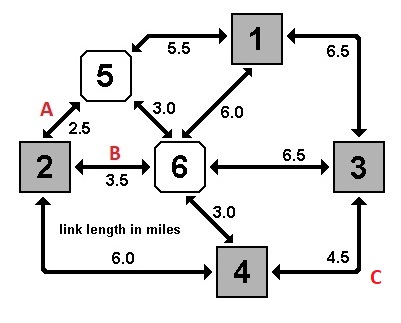
Based on this analysis, future year 2025 sees a 5 mph decrease in average network speed.

# 6. Congestion Alleviation

To regain the 5 mph speed increase in the overall network in order to maintain the original 2015 network speed, I examined two projects (Fig 1):

* Project A, widening link 2-5 into a 3-lane configuration (1.5 lanes in either direction)
* Project B, widening link 2-6 into a 3-lane configuration (1.5 lanes in either direction)
* Project C, widening link 4-3 into a 3-lane configuration (1.5 lanes in either direction)
* Combination Project A+B
* Combination Project A+C

**Fig 1: Proposed Network Improvement Projects**



Projects A, B, and C were chosen because of their short segment length in relation to their importance to the vehicular network. Project A (Link 2-5) is the most over-capacity link on the 2025 network with a V/C ratio greater than 1.7. Similarly, Projects B and C (Link 2-6 and 4-3) have V/C ratios greater than 1.3.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 10: Assignment Results, Proposed Projects** | | | |  |
| Project | Total VMT | Total Vehicle Minutes | Avg Speed | Total project length |
| A | 8020.6 | 18004.7 | 26.7 | 2.5 |
| B | 8048.8 | 17867.6 | 27.0 | 3.5 |
| C | 79423.0 | 17577.1 | 27.1 | 4.5 |
| A+B | 8648.85 | 17637.7 | 29.4 | 6 |
| A+C | 7966.77 | 17070.5 | 28.0 | 7 |

Full calculation results can be found in the attached Appendix spreadsheets.

Projects A, B, and C alone bring the average network speed to within 1.8% - 2.8% of the original 27.49 mph speed. Project B alone, while not the shortest segment at 3.5 miles in length, brings the Network speed within .5 mph of 2015 speeds. If this .5 mph speed difference is acceptable, then it is the sole recommended project. However, if the project requirements are such that 27.49 mph is the minimum required speed, then project A+B is the recommended project, despite its likely higher construction cost.