**Problem 1:** Consider a traffic analysis zone (TAZ) that is located in a suburban area of a city. The population and income data for the zone are as follows:

 Number of dwelling units: 60 (20% have 1 car, rest have 2+)

 Average income per dwelling unit: $44,000

$Trips per HH=0.5+0.35\*\frac{HHIncome}{1000}$ for 1 car

$Trips per HH=0.9+0.8\*\frac{HHIncome}{1000}$ for 2+ cars

Determine the number of trips per day generated in this zone.

Answer:

Trips generated from dwelling unit with 1 car per HH = $\left(0.5+0.35\*\frac{44,000}{1000}\right)\*\left(0.2\*60\right)=191$

Trips generated from dwelling unit with 2+ car per HH = $\left(0.9+0.8\*\frac{44,000}{1000}\right)\*\left(0.8\*60\right)=1733$

**Total trips = 191+1733 = 1924**

**Problem 2:** A multiple regression analysis shows the following relationship for the number of trips per household:

$T=0.82+1.3P+2.1A$;

Where $P and A$ are the persons per household and autos per household respectively?

 If a particular TAZ contains 250 households with an average of 4 persons and 2 autos for each household, determine the average number of trips per day in that zone.

Answer:

Trips per household $= 0.82+1.3\*4+2.1\*2$ = 10.22 trips per household.

Total trips generated in that zone = 250\*10.22 **=2,555.**

**Problem 3:** Consider a roadway segment highlighted in red box in the following figure. Traffic counts (AADT) can be seen as 41,500 in 2018. Estimate AADT of the segment in 2040 considering traffic growth 2%.



Answer:

Traffic in 2040 = $41500\*\left(1+0.02\right)^{22} $= 43177

**Problem 4:** In TAZ 235, you have following socioeconomic data;

 Households (HH): 23,000

 Average Annual Income per HH: $30,000

 Average cars per HH: 1.4

 Size (Average number of people per HH): 2.1

 Average number of workers per HH: 1.4

 Total Office Space: 2,000,000 ft^2

 Total Retail Space: 5,000,000 ft^2

Estimate zone productions?

$$TripProductions= 0.3 + 0.82\*Workers+0.0024\*size+0.041Cars+0.0000047\*Income$$

Answer:

Zone productions $= 0.3+0.82\*1.4+0.0024\*2.1+0.041\*1.4+0.0000047\*30000 = 1.651 trips per HH.$

Total trips $= 23000\*1.651 =37,984$

**Problem 5:**

Number of trips per household size by auto ownership obtained from regional study can be seen below:

|  |  |  |
| --- | --- | --- |
|  |  | **Auto ownership** |
|  |  | **0** | **1** | **2+** |
|  |  | **HH** | **Trips** | **HH** | **Trips** | **HH** | **Trips** |
| **Household size** | 1 | 1200 | 2520 | 2560 | 6144 | 54 | 130 |
| 2 | 874 | 2098 | 3456 | 9676 | 5921 | 20165 |
| 3+ | 421 | 1137 | 2589 | 8026 | 8642 | 33704 |

Forecasted number of households in the same study zone by auto ownership and size can also be seen below.

|  |  |  |
| --- | --- | --- |
|  |  | **Auto ownership** |
|  |  | 0 | 1 | 2+ |
| **Household size** | 1 | 25 | 125 | 3 |
| 2 | 32 | 175 | 254 |
| 3+ | 10 | 89 | 512 |

Estimate total trip generated from that zone?

**Answer:**

**Trip Rates**

|  |  |  |
| --- | --- | --- |
|  |  | **Auto ownership** |
|  |  | 0 | 1 | 2+ |
| **Household size** | 1 | $$2520/1200 =2.1$$ | 2.4 | 2.4 |
| 2 | 2.4 | 2.8 | 3.4 |
| 3+ | 2.7 | 3.1 | 3.9 |

|  |  |  |
| --- | --- | --- |
|  |  | **Auto ownership** |
|  |  | 0 | 1 | 2+ |
| **Household size** | 1 | $$2.1\*25=52$$ | 300 | 7 |
| 2 | 77 | 490 | 864 |
| 3+ | 27 | 276 | 2001 |

Total Trips $= 52+300+7+77+490+864+27+276+2001$ = 4094

**Problem 6:** Balance trip production and attractions for the following scenario.

|  |  |
| --- | --- |
|  | **Unbalanced NHB Trips** |
|  | **NHB Productions** | **NHB Attractions** |
| 1 | 100 | 240 |
| 2 | 200 | 400 |
| 3 | 300 | 160 |
| **Total** | **600** | **800** |

**Answer:**

**Trip scaling factor**$= 600/800 = 0.75$

|  |  |
| --- | --- |
|  | **Unbalanced NHB Trips** |
|  | **NHB Productions** | **NHB Attractions** |
| 1 | 100 | 240\* 0.75 =180 |
| 2 | 200 | 300 |
| 3 | 300 | 120 |
| **Total** | **600** | **600** |

**Problem 7:** Travel characteristics between two zones can be seen in following table.

|  |  |  |
| --- | --- | --- |
| **Variable** | **Auto** | **Transit** |
| $$A\_{k}$$ | -0.46 | -0.07 |
| $$t\_{1}$$ | 20 | 30 |
| $$t\_{2}$$ | 8 | 6 |
| C | 320 | 100 |

$$U = a\_{k}– 0.35\*t\_{1} – 0.08\*t\_{2} – 0.005c$$

Trip distribution: total of 12,450 trips going from A to B

**Answer:**

$$U\_{auto}=-0.46-0.35\*20-0.08\*8-0.005\*320= -9.7$$

$$U\_{Transit}=-0.07-0.35\*30-0.08\*6-0.005\*100= -11.55$$

$$p\_{auto}=\frac{e^{-9.7}}{e^{-9.7}+e^{-11.55}}=\frac{0.0000613}{0.00007092}=0.86=86\%$$

$$P\_{transit}=1-0.86=14\%$$

$$Trips\_{auto}=0.86\*12450=10707$$

$$Trips\_{transit}=1743$$