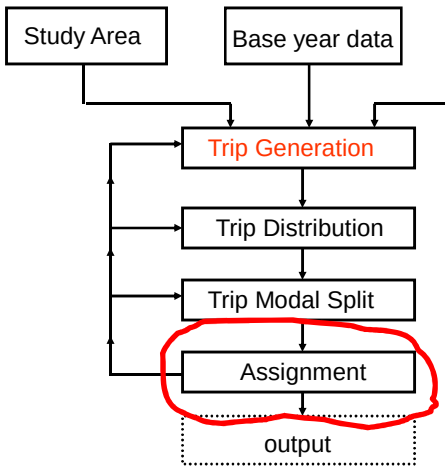
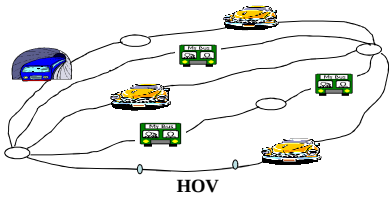



**Route Assignment**




# Given

## (1) OD Matrix

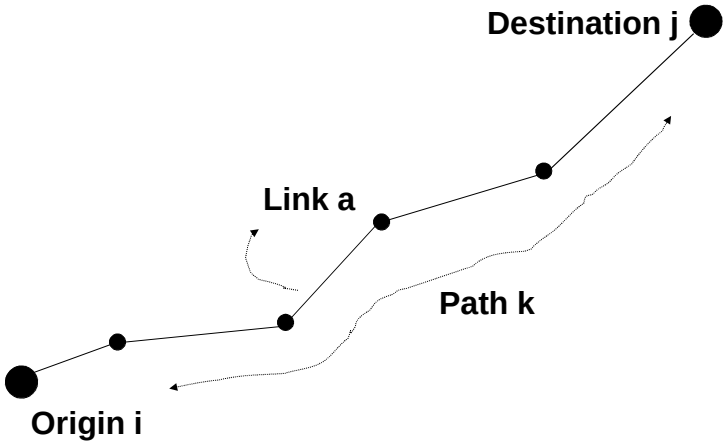
| | i | j | k | l | |
|---|---|---|---|---|---|
| i | 300 | 700 | 700 | 500 | 2200 |
| j | 700 | 400 | 500 | 300 | 1900 |
| k | 300 | 700 | 600 | 400 | 2000 |
| l | 300 | 600 | 500 | 700 | 2100 |
| | 1600 | 2400 | 2300 | 1900 | |

## (2) Transportation Network


## (3) Route Choice Behavior

## (4) Link Performance Function

## Required




Link flows and path flows in Vehicles/Hour

## Why?

- To obtain good aggregate network measures e.g., total motorway flows, total revenue by bus service
- To perform level of service studies
- To estimate zone-to-zone travel costs (times) for a given level of demand.
- To obtain reasonable link flow to identify heavily congested links (bottlenecks).

- **To obtain turning movements for the design of future junctions**
- **To design HOV/HOT lanes, Rapid Transit Services, signal timing etc.**

## Link Path Relationship

$\delta_{ijk}^{a} = 1$ if arc is on path k from i to j

$\delta_{ijk}^{a} = 0$ otherwise

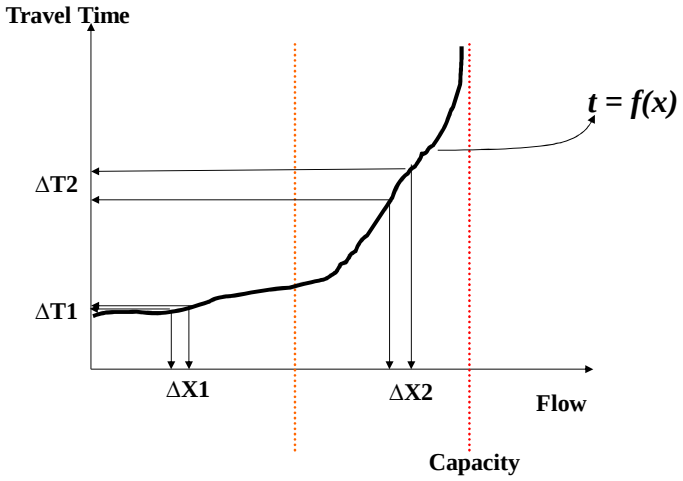
## Factors affects Route Choice

- **Journey time**
- **Distance**
- **Cost**
- **Congestion and queue**
- **Type of maneuvers required**
- **Type of road (freeway, arterial, local)**
- **Scenery**
- **Work zones**
- **Reliability of travel time**
- **Safety and rate of accidents**

**In general, it is very hard to include all these factors in one generalized cost function.**

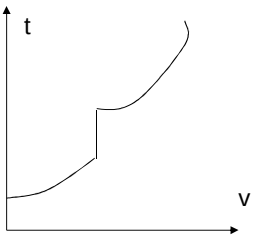
$$GC_{ij}^{k} = C_{ij}^{k} + a * T_{ij}^{k}$$

# Cost-Flow curves




# Desirable properties

- Realism (realistic travel times)
- Non-decreasing and monotone increasing flow should not reduce travel times
- Continuous and differentiable



## One form of the cost-flow relationship

Current traffic volume

Travel time

$$t = t_0\left[1+\alpha\left(\frac{V}{C}\right)^{\beta}\right]$$

Maximum flow (capacity)

Free Flow Travel time

## Marginal Travel time

$$Total\ Travel\ Time = v.t(v)$$

$$Marginal\ Travel\ Time$$

$$\frac{\partial[v.t]}{\partial v} = t + v.\frac{\partial t}{\partial v}$$

Contribution to delay to other traffic made by the marginal vehicle

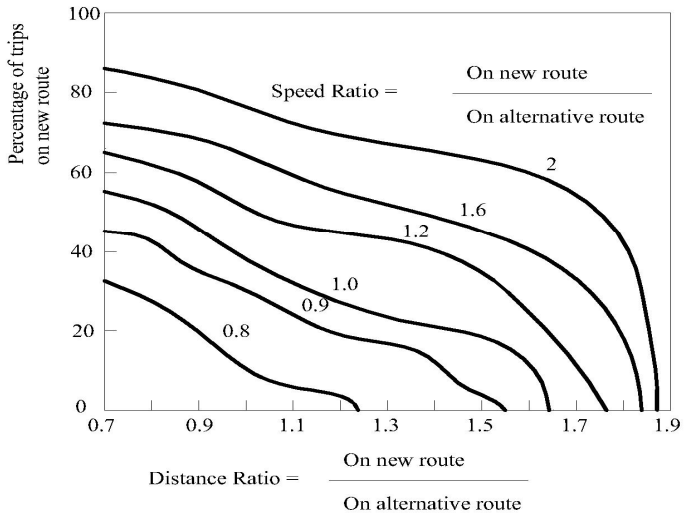
The marginal vehicle travel time

## Assignment models

- Diversion curve
- All or nothing without capacity constraint
- All or nothing with capacity constraint
- Equilibrium assignment

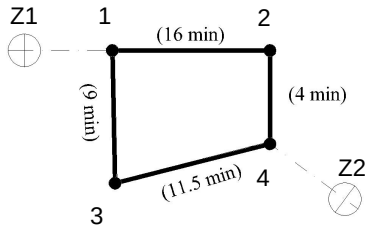
## Diversion curve

- It presents a simple method to estimate the traffic volume on a road.
- It assumes a new road will be constructed that has the same origin and destination to an existing one.
- This method estimates the percentage of diverted traffic to the new road based on the expected difference of resistance function between both (existing and new) road.




# All or nothing without capacity constraint

- Assign <u>ALL</u> traffic volume to the least resistant pat



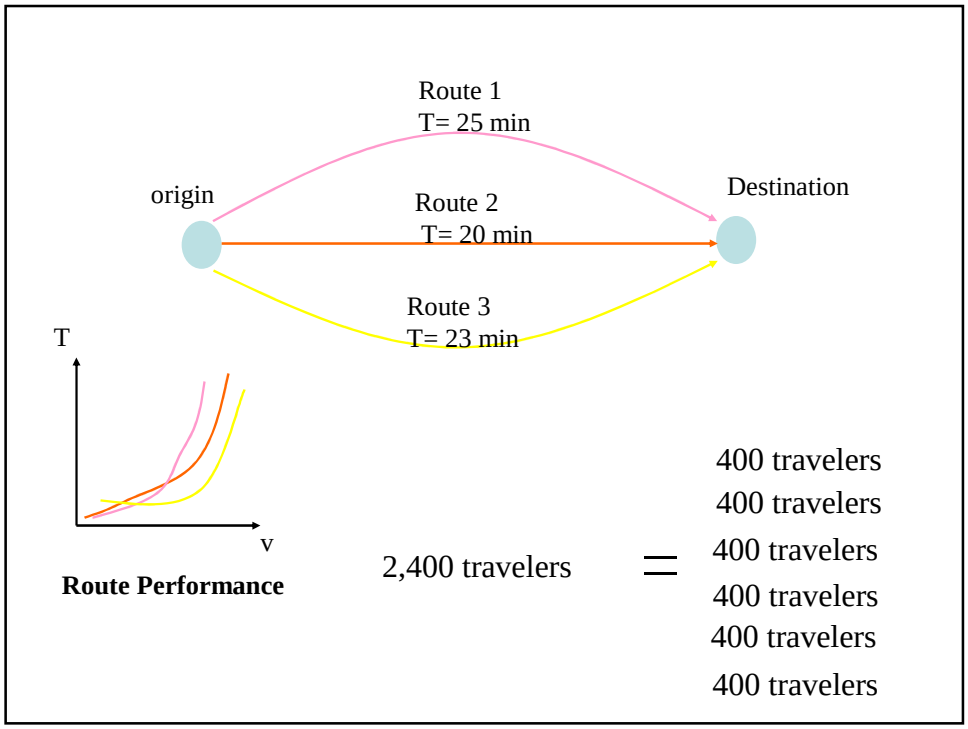
Traffic Assignment Table

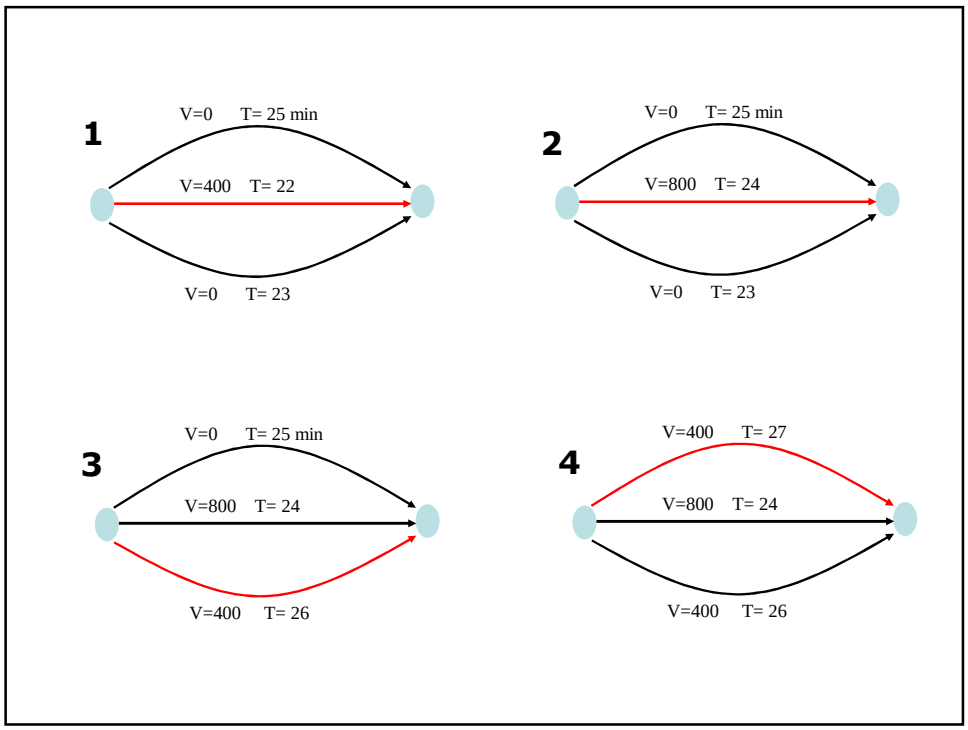
| From | To | Volume | Links | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1-2 | 2-1 | 1-3 | 3-1 | 2-4 | 4-2 | 3-4 | 4-3 |
| 1 | 2 | 10 | 10 | | | | 10 | | | |
| 2 | 1 | 15 | | 15 | | | | 15 | | |
| Direction Total | | | 10 | 15 | | | 10 | 15 | | |

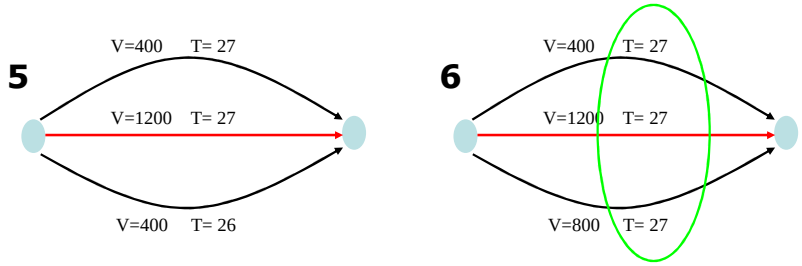
Number of lanes/ direction = Volume / Lane Capacity

Number of Link lanes = 2 * (maximum number of directional lanes)

# All or nothing with capacity constraint


Route 1
T= 25 min
origin
Destination
Route 2
T= 20 min
Route 3
T= 23 min
T
v
Route Performance
2,400 travelers
400 travelers
400 travelers
400 travelers
400 travelers
400 travelers
400 travelers


1
V=0 T= 25 min
V=400 T= 22
V=0 T= 23
2
V=0 T= 25 min
V=800 T= 24
V=0 T= 23
3
V=0 T= 25 min
V=800 T= 24
V=400 T= 26
4
V=400 T= 27
V=800 T= 24
V=400 T= 26




At equilibrium, no traveler can improve his/her travel time by unilaterally changing her/his route.