## Conceptual model

Assumption:

Grid size: 10\*10, or 1010\*1010

Number of cell: 100

Number of zone: 100

Each cell has a code

Grid: 1cm:1km

Area: 100 km2

Population of residents: 2000 million=2,000,000 exclude people who come from out of the city?

Residential density in average: 20,000/km2

Residential density in region: see graph

Capture area: see graph

Peak period: 7:00-9:00, 17:00-19:00

Off peak period: other time

Alternative vehicles: bus, private car, bicycle, public taxis

Properties of bus

Properties of private car

Properties of bicycle

Properties of public taxis

Properties of walking

Walking speed

Part One: Where to put metro stations?

Method: Trip generation →trip distribution → Choice of mode→ determine where to put metro station

1.Trip generation:

Assumption

1. Income level: high 20%, middle 50%, low 30% need spatial data?
2. Car ownership: zero-auto household60%, one-auto household 40%. Need spatial data? include bicycle?
3. Household structure:
4. Family size:
5. Value of land:
6. (accessibility)

Determine: how to get numbers in this table?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| zone | 1 | 2 | 3 | … | Total |
| Trip production |  |  |  |  |  |
| Trip attraction |  |  |  |  |  |

2.Trip distribution: gravity model

Assumption:

Trip production and attraction (table above)

Travel time between zone (travel by metro or by all different vehicles on average?)

|  |  |  |  |
| --- | --- | --- | --- |
| Zone | 1 | 2 | j |
| 1 | …minutes |  |  |
| 2 |  |  |  |
| i |  |  |  |

Travel time vs. friction factor

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Travel time (min) | 1 | 2 | 3 | 4 | … |
| Friction factor | 82 | 52 | 50 | 41 | … |

Determine: Tij =AiOiBjDjf(cij)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | J | sum(j)T­ij |
| 1 | T11 |  |  | T1j | O1 |
| 2 | T12 |  |  | T2j | O2 |
| 3 | T13 |  |  | T3j | O3 |
| i | Ti1 | Ti2 | Ti3 | Tij | Oj |
| sum(I)T­ij | D1 | D2 | D3 | Dj | Sum(I,j)Tij |

3.Mode Choice: mode split model

Assumption:

* 1. Characteristics of trip maker
  2. Characteristics of journey:
     1. trip purpose (spatial data? With %)
     2. time of a day when journey is undertaken
  3. Characteristics of transport facility
     1. Relative travel time
     2. Relative money cost
     3. Cost of parking
     4. (comfort & convenience, reliability& regularity, protection& security)

1. Method:

Impedance=…

P(metro)=…

100%=MSauto+MStransit= MSbicycle+MSmetro+MScar+MSbus+MStaxis

Determine: Percentage of trip from j to j will be generated by metro

4. Where to put metro stations?

Tij \* P(metro) =Nij=the number of trips generated by metro

If resident density≥…, and 500≥Nij≥100, build a small station

If resident density≥…, and 1000≥Nij≥500, build a middle station

If resident density≥…, and Nij≥1000, build a large station

Part Two: How to design the route of metro lines? Traffic assignment

Determine which routes will be used and how much traffic can be expected on each route

Route choice decision →determine traffic flow→ determine travel time→

Assumption:

available routes between zones

Determine:

1. Travel time on each route
2. Traffic volumes on each route
3. Total system travel time

Based on travel time, make adjustment on:

1. Direction of each line
2. Origin and destination of each line
3. Stations that this line pass through
4. Length of each line
5. Max speed of each line

Part Three: What is the frequency of each metro? Schedule

1.Vehicle Schedule:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| TU | time | station | Max velocity | Stopping time | Break time in the garage |

2.cost computation

1. Vehicle income: ticket price
2. Vehicle maintenance cost:
   1. frequency of maintenance
   2. costs/year
   3. (maintenance the vehicle, the station, the road and other infrastructure)
3. Marketing Strategy? is there any discount for different time period in a day/in a week/ in a year or for different types of passengers for example the elderly and children?

Part four: evaluation

Analysis of the efficiency of the metro system