Lecture 04

7.09.2015

Transportation modeling consists 5 steps.

There are 5 steps :

— land use

—

4 steps transportation Modeling

— Trip Generation/ trip attraction (T_i)

— Trip distribution (T_{ij})

— Mode Split (T_{ijm})

— Trip Assignment (T_{ijmr})

Trip generation:

trip making related to three characteristics of land use:

(i) intensity of land

(ii) Characteristic of land use

(iii) location — economic activities

Activities এর কাছে না হচ্ছে ??

many different method → to estimate the trip producing activity,

Trip rates from National / Local Sources:

- Five year plan
- Statistical year book of bangladesh

America → ITE → trip generation hand book

পৃথিবীর — ৭ রকম — in general ৩টা trip → (total) কয়টা trip → mode

Cross Classification Analysis:

Compare করব।

① Table of format (from survey)

Auto Ownership

H.H → number of family

household size	0: H.H	0: Trips	1: H.H	1: Trips	2+: H.H	2+: Trips
1	1200	[illegible]	[illegible]	6194	54	130
2	874	[illegible]	[illegible]	9676	5921	20165
3+	421	[illegible]	[illegible]	8,026	8642	33,704

Number of trips per household size by auto ownership, obtained from regional study

Auto ownership

Trip rate:

household size	0	1	2+
1	2.1	2.4	2.4
2	2.4	2.8	3.4
3+	2.7	3.1	3.9

Trips per household obtained from previous matrix

	0	1	2+
1	25	125	3
2	32	175	254
3+	10	89	512

25 টি family থাকবে 10 yrs on

Forecasted number of households in study zone by auto ownership and size

Auto ownership

Household size	0	1	2+	
1	25 × 2·1	300	7	
2	77	490	864	
3	27	276	2001	4,094

Forecasted number of trips in zone determined by multiplying trip rates by number of household in category

Total কে existing এর সাথে add করে।

(11) From Curve →

Input dwelling Units and Income

↓

Percent of dwelling units. Multiply by number of dwelling units to obtain number of households

↓

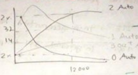
Multiply the rate by number of households to obtain trips produced

↓

% of trips. Multiply by trips produced to obtain trips produced by purpose

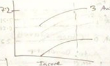
↓

Trip production by purpose (output)



— For American society

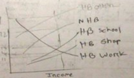
— Income বাড়লে private ownership
↓
for transport freedom



সারা দিনে একটা trip করতো

- তাই private ownership বাড়লে, তত unnecessary trip বাড়ে।
↓
মোটামুটি প্রাইভেট কার নিয়ে ... আবার ... করে।

Auto



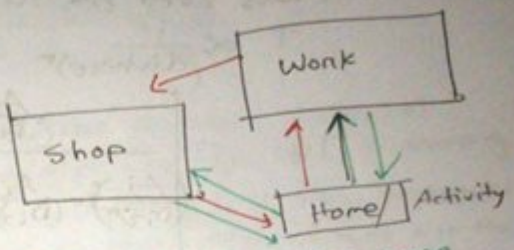
for purpose

- Income বাড়লে Home based হয়ে যায়।
- Unnecessary trip করে যায়

HB work:

Income বাড়লে
↓
work trip ~~কমে গেছে~~ কমে গেছে।

work pattern,
low Income → চাকরিজীবী
High income → Manager →



Either origin/destination home
↳ Home based trip

Home — office — Shop — Home
↓
not home based trip

সাধারণত

Regression Analysis

সাধারণত trip বাড়লে

$$T_i = 0.34 (P_i) + 0.21 (DU_i) + 0.12 (A_i)$$

↳ calibrate করে বের করা হয়।

$$A_j = 57.2 + 0.87 E_j$$ (total employment)

P — population for zone i
E_j — total employment in j
DU — total number of dwelling unit for zone i

A_i → Auto mobile ownership
A_j = total number of trips attracted to zone j

কোন parameter select করব, তাদের মধ্যে correlation থাকে → correlation না থাকলে একটুকে skip করব

Aggregate type of model — group of people নিয়ে

Trip Distribution:

এক zone থেকে আরেক zone

Mass বেশি হলে attraction বেশি হবে।

$$T \propto \frac{1}{(\text{distance})^n}$$

$n = 2$ → depends on factor

$$T_{ij} = \left[\frac{\frac{A_j}{(D_{ij})^n}}{\frac{A_i}{(D_{ij})^n} + \frac{A_2}{(D_{i2})^n} + \cdots + \frac{A_n}{(D_n)^n}} \right] \times P_i$$

$\frac{A_j}{(D_{ij})^n}$ → এখানে zone এর attraction

P_i → total trips produced at zone i for the specific purpose

OD Matrix এর formation

T_{ij} → trips from zone i to zone j for a specified purpose
A_j → a measure of attraction of the jth zone
D_{ij} → distance from zone i to zone j for m zones
n = some exponent that varies with trip purpose

Travel time is more than distance

So - transport এ distance important নয়।

- travel time important

travel time factor $F_t = \frac{C}{t_{ij}^{n_t}}$ → C is a constant

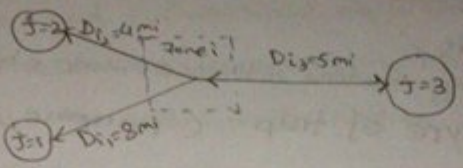
$$T_{ij} = \frac{A_j \; F_{tij} \; K_{ij}}{\sum A_1 \; F_{tij} \; K_{ij}} \times P_i$$

K_{ij} → Social Economic factor between zones i and j → add না করলে perf… হবে না…

$$T_{ij} = \left[\frac{\frac{A_j}{(D_{ij})^n}}{\frac{A_1}{(D_{i1})^n} + \frac{A_2}{(D_{i2})^n} + \cdots \frac{A_m}{(D_{im})^n}} \right] P_i$$

$$T_{ij} = \frac{A_j \; F_{tij} \; K_{ij}}{\sum A_x \; F_{tij} \; K_{ij}} \times P_i$$

Problem:



Given a residential zone that produces a total of 110 shopping trips per day, distribute these trips to shopping centers 1, 2, 3 in accordance with the gravity model. Distances between zones are shown on the sketch. The value of n in the gravity model is 2. Use the amount of commercial floor space within the destination zone as the measure of attractiveness.

Shopping Center	Floor Space (thousand ft²)
1	184
2	215
3	86

$$\text{Trips from zone } i \text{ to zone } 1 = \frac{\frac{184}{8^2}}{\frac{184}{8^2} + \frac{215}{4^2} + \frac{86}{5^2}} \times 110$$

$$= 16$$

$$i \text{ to } 2 = \frac{\frac{215}{4^2}}{\frac{184}{8^2} + \frac{215}{4^2} + \frac{86}{5^2}} \times 110$$

$$= 75$$

$$i \text{ to } 3 = 19$$

$$110$$

Mode Split Models:

Mode ~~depends~~ choice

The following factors influence mode choice

- type of trip (purpose, time of day)
- Cha. of the tripmaker (income, age, auto. ownership)
- " of the transportation system
  (ভিড় নাই, জ্যাম নাই, কষ্ট নাই → আরামে যাবো)
  (relative travel times for the modes available to make the trip)

Individual Choice Model

যার যে mode আছে সেটা নিয়ে যাবে।

logit model:

$$P_{it} = \frac{e^{U_{it}}}{\sum_{j=1} e^{U_{jt}}}$$

U_{it} → utility of mode i to individual t

U_{jt} → utility of mode j to individual t

P_{it} → probability of individual t choosing mode i

Example:

1000 trips

U_{Auto} → parameter → (i) travel time, (ii) travel cost

$P_{auto} = 0.842$

$P_{bus} = 0.114$

An example of this type of mode split model follows. Assume that we know there are 1000 trips being made between zones i and j (which we obtained from trip distributi
There are three modes available to make this trip.
The utility of the individual modes is defined as

$$U_{auto} = 1 - 0.1(TT_{auto}) - 0.05(TC_{auto})$$

$$U_{bus} = -0.1(TT_{auto}) - 0.05(TC_{auto})$$

$$U_{walk} = \underset{-0.5}{\cancel{0}} - 0.1(TT_{walk})$$

TT = travel time by mode in minutes
TC = travel cost by mode in dollars

Assume that we know that the travel time for auto is 5 minutes, for bus 15 min. for walking 20 min. The corresponding costs are $0.60 for auto and $0.50 for bus. Substituting these members into the utility equations results in the following estimates of model utilities,

$$U_{auto} = 0.47 \quad U_{bus} = -1.525, \quad U_{walk} = -2.5$$

Using Eq. 33, we find the following probabilities associated with the use of each mode

$$P_{auto} = \frac{e^{0.47}}{e^{0.47} + e^{-1.525} + e^{-2.5}} = 0.842$$

$P_{bus} = 0.114$
$P_{walk} = 0.043$

Given the 1000 trips between these two zones, one would predict that 842 would use the auto, 114 would use the bus and 43 would walk.

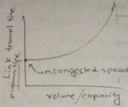
Small urban area → auto is only → this step is not used

Trip Assignment: — travelers will choose a path that minimizes travel time from origin to destination

এর element হচ্ছে link.

যেমন মেইন mirpur road- এর link এ বেশ condition থাকে না.

link → length

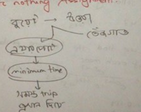


ultimate এর বাঁকানো থাকে.

Fig: Graphical representation of link performance

৩টা: Assumptions

(i) All or nothing Assignment:



(ii) **Capacity restrained:**

Capacity restrained হলে ⓚ এ যাবে না—

(iii) Stochastic Equilibrium Assignment:

travel time কতক্ষণ লাগবে। কত airport দিয়ে যাবে-যাব
information আসে নাই

ITS → Intelligent trasportation System
↓
Advanced Information → microsimulation models

আজকের class এর উপর classtest

Class Test → Monday / Tuesday

শনিবার normal class