23.05.24

Types of speeds:

(i) Type Time mean speed → arithmetic mean

সব গুলোকে নিয়ে mean করে

$$V_t = \frac{1}{m} \sum_{i=1}^{m} V_i$$

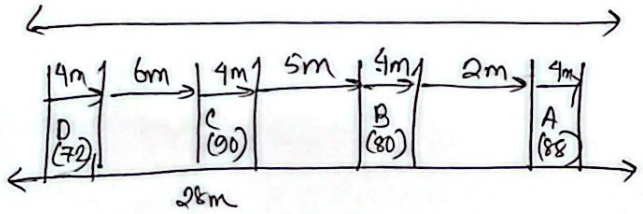
(ii) Space-mean speed → Harmonic mean

unsual data গুলো নিয়ে mean করে

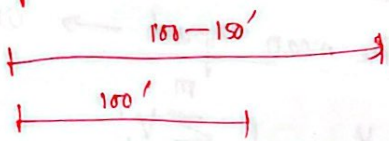
$$V_s = \left(n / \sum_{i=1}^{n} (1/V_i) \right)$$

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Problem: four vehicles are travelling at constant speeds between sections X and Y with their positions and speeds observed at an instant in time. An observer at point X



- highspeed-এ গাড়িগুলো যেখানে move করবে সেখানে বড় লাইন আঁকব
- কম speed-এ ছোট লাইন আঁকব



Solution:

① flow: $q = N\left(\frac{3600}{t_{measured}}\right)$

$= 4\left(\frac{3600}{15}\right)$

$= 960$ veh/hr

② Density: $k = \frac{N}{L} = \frac{4}{28\times10^{3}} = 142$ veh/km

↳ m হলে km-এ নিবে / ft হলে mile-এ নিবে

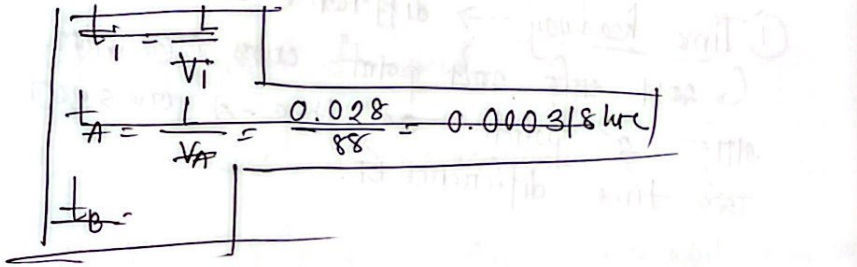
③ Time-mean speed:

$$\bar{V}_t = \frac{1}{N}\left(\sum_{n=1}^{N} V_n\right) = \frac{1}{4}(72+90+80+88)$$

$= 82.5$ km/hr

④ Space-mean ~~time~~ speed:

$$\bar{V}_s = \frac{N}{\sum_{i=1}^{N}\frac{1}{V_t}} = \frac{4}{\frac{1}{72}+\frac{1}{90}+\frac{1}{80}+\frac{1}{88}} = 81.86$$



Problem: The following travel times were observed for 4 vehicles traversing a 1 mile segment of highway:

Vehicle	Time (min)
1	1.6
2	1.2
3	1.5
4	1.7

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Calculate the space and time mean speeds of the vehicles.

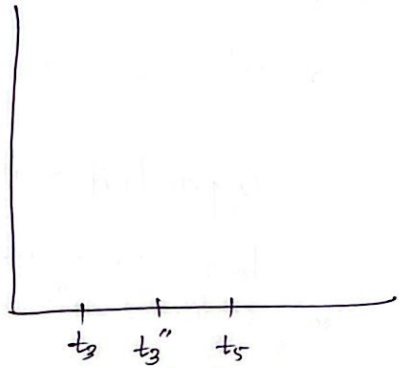
Soln:

1 mile / 1.6 min = speed কে add করতে হবে।

(i) Time mean speed = $\frac{1}{4}\left(\frac{1}{1.6} + \frac{1}{1.2} + \frac{1}{1.5} + \frac{1}{1.7}\right)$

(iii) Spacing or distance headway → distance between successive vehicles in a traffic stream

Time space dia



Headway: → roadway capacity এবং প্রয়োজনীয় লাগবে। level of service এর জন্যও লাগবে।

(i) Time headway → difference between the time
↳ একটা গাড়ি একটা point cross করলো পরের গাড়ি ঐ point এ কত time এ cross করবে তাই time difference ই.

(ii) Space headway → distance between the front of a vehicle and the front of the following vehicle.

Different form of speed:

(i) Spot speed → instantaneous speed

(ii) Running speed → Avg. speed while in motion
↳ বলিয়া হবে journey speed থেকে

(iii) Journey speed → Overall speed including stops.

(iv) free flow speed → when drivers face no restriction in driving and can maintain their desired speed.

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Normal graph - 1 plot হবে

⑨ Operating speed → the speed at which drivers are observed operating their vehicles during

1. Safe speed → 85th percentile speed.
   → যেটা মোট ড্রাইভিংয়ের ৪৫% এর speed.
2. Design " → 98th " "
3. Median " → 50th " "
4. Speed limit → Upper limit → 85th percentile
   lower " → 15th "

- speed data free-flow condition-এ collect করতে হয়।

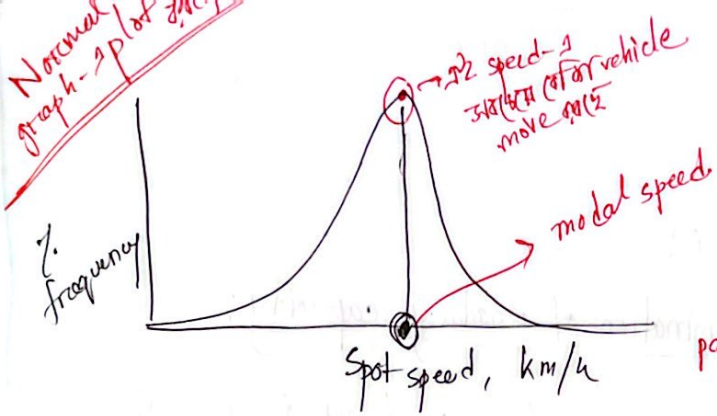
Pace: একটা range এর মধ্যে সবগুলো vehicle data পাওয়া যায়।
10km

Math: following data was coll

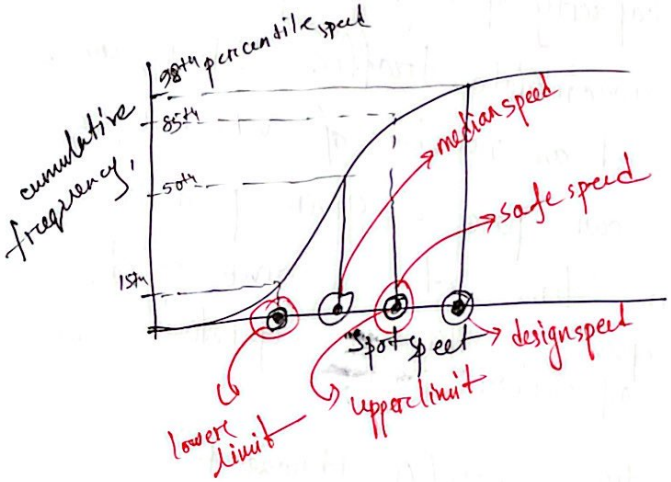
$$\text{frequency} = \frac{\text{no of vehicle observed}}{\text{total vehicle}}$$

$$\text{Mild speed} = \frac{\text{sum of Speed range}}{2}$$

$$V_{avg} = \frac{\text{sum}(f \times v)}{\text{sum}(f)}$$



pace → যেমন 10km এর মধ্যে data কেমন হবে!



EWCE- 352

04.07.24

Nishat Miss.

Exp-07:

Determination of roadway capacity:

The capacity of a roadway is its ability to accomodate traffic. It is usually expressed as number of vehicles (pcu) that can pass a given point in a certain time at a given speed.

→ easily pass করতে পারে কিনা — operating condition

Level of Service (LOS):

- Six type (Level A through F)

(I) A represent free flow

(II) B " stable flow with restrictions (কমলাপ)

(III) C denotes stable flow with more restricting — কিছুটা stable আছে, drivers যখন তখন pass করতে পারেনা। lab report - এ নিবে।

(IV) D → little freedom

(V) E

(VI) F → সবচেয়ে খারাপ

Capacity of roadway:

→ adjustment factors use করে হয় modify করার জন্য

- modifying the capacity of the roadway under Ideal conditions
  - কোনো interference হলেনা side traffic থাকে
  - uninterrupted flow
  - 12 ft. wide traffic lane
  - providing operation at 70 mph
  - no restriction of passing sight distance

Roadway type	Capacity (passengercar/hr
Multilane free flow	2000 per lane
Two lane, two way (lab report)	2000 total both direction
Three lane, two way	4000 " " "

preveiling → existing condition

1. Roadway factors
2. Traffic factors

} adjustment factors.

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Table-7.2

PSD → 80/60/40/এভাবে থাকবে

AHS → Average highway speed

- PSD যত কমবে basic limiting value ও কমবে ফলে velocity কমবে

- basic limiting value (multiplying factor)

- Capacity কে multiplying factor দ্বারা গুণ করতে হবে।

Table-7.3

Lane width	Capacity	
	two lane	multi lane

Table-7.4

Shoulder width

↳ lane width (11) one lane total (22 ft) two lane এর

Shoulder width 4 ft and multiplying factor হবে 92

Example: সব multiplying factor কে শেষে capacity এর সাথে multiply করতে।

1. Roadway pattern: 2 lane 2way
2. Lane width : 11 ft
3. Shoulder width : (2-4 ft) এর মাঝে হলে Interpolate করতে হবে।
4. Operating speed → কে করতে হবে।

⇒ Capacity of two lane two way road

= 2000 veh/hr

Actual roadway capacity = 2000 × 0.68 × 0.88 × 0.92 veh/hour

= 1101 passenger veh/hour in both direction

Table-7.5 → pcu unit

- 15 min পরপর গাড়ি count করতে হবে।
- মানে 15 min-এ side থেকে কত গাড়ি pass

In 15 min

20 busses × 3 = 60 pcu/15 min

= 240 pcu/hour in one direction

= 480 pcu/hr in both direction

Speed বের করতে হবে।

$V = \frac{S}{t}$ → S ধরে নিবে

t → একটা গাড়ি কতক্ষণ ধরে ঐ distance pass হচ্ছে তা count করবো।

$$\text{Operating speed} = \frac{\text{PCU in 1 hour} \times \text{Speed}}{\text{Total number of pcu in 1 hour}}$$

- যতগুলো Rickshaw থাকে সবগুলোর speed avg করতে হবে।
- 15 min পর পর section-এ যেতে 1 hour data নিবে।
- just data calculation ~~& Discussion~~

Munir Sir

10.09.24

Lecture-12:

Example: The standard axle weights for a standing-room-only loaded Metro articulated bus (60-ft. Flyer) are →

Axle	Empty	Full
Steering	13000 lb	17000 lb
Middle	15000 lb	20000 lb
Rear	9000 lb	14000 lb

Using the 4th power approximation, determine the total equivalent damage caused by this bus in terms of ESAL's when it is empty. How about when it is full?

Soln: When empty:

$$\text{Total ESAL's} = \left(\frac{13}{18}\right)^4 + \left(\frac{15}{18}\right)^4 + \left(\frac{9}{18}\right)^4 = 0.817$$

When full:

$$\text{Total ESAL's} = \left(\frac{17}{18}\right)^4 + \left(\frac{20}{18}\right)^4 + \left(\frac{14}{18}\right)^4 = 2.686$$

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Vehicle speed :

- গাড়ি slow অবস্থায় move করলে damage বেশি হয়।

- 2km/hr এ veh চললে যে damage হবে তা 24km/hr এর damage এর 40 গুণ।

Environment :

① Temp → imp for rigid pavement

② Precipitations → imp for flexible pavement

- no of repetation → কতবার move হচ্ছে গাড়ি

Car: 2000 repetations (সারাদিনে 2000 টা গাড়ি move করছে) < Bus/Truck: 1 repetation (সারাদিনে 1টা truck move করছে)

Lecture-13 : 17.09.24

Traffic analysis :

$$ESAL = (ADT)_0 (T)(T_f)(G)(D)(L)(365)(Y)$$

ESAL → for a single/design lane এর traffic

$(ADT)_0$ → 1st design period এর ADT

T → % of truck → কত % truck যাবে

$(ADT)_0$ → ১ম design period এর traffic কত সেটা বোঝাচ্ছে

T_f → Truck factor

G → Growth factor

D → Directional Distribution → কোন দিকে কয়টা গাড়ি যাচ্ছে → কত % গাড়ি যাবে।

L → lane distribution factor → একদিকে একটা lane থাকলে 100% গাড়ি move করবে

365 → ADT এর

Y → design period

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Truck factor (T_f) → পরপর আসতে পারে ques-এ

Growth factor (G_f) → 3 methods

কোনোটির ques-এ বলা না থাকলে এটি use করবে

(i) Avg traffic at the start and end of the design period —

$$G_f = \frac{1}{2}\left[1 + (1+r)^Y\right]$$

→ always max Value দিবে

r → increasing traffic per year (in decimal) → 5% হলে $r = 0.05$

Y = design period

(ii)

Ex-6.11: For an annual growth rate 3.5% and a design period of 30 years, compute the growth factors by eqn 6.31, 6.32, 6.33

Soln:

$r = 0.035 = 3.5\%$

$Y = 30$ years

eqn, 6.31 → $G_f = 0.5\left[1 + (1+0.035)^{30}\right] = 1.90$

eqn, 6.32 → $G_f = (1+0.035)^{0.5\times30} = 1.68$

eqn, 6.33 → $G_f = \left[(1+0.035)^{30} - 1\right] / (0.035\times30)$
$= 1.72$

To determine the annual growth rate, following factors are considered:

1. Attracted or diverted traffic due to the improvement of existing pavement.
2. Normal traffic growth rate due to the increased number

3. Generated traffic due to motor vehicles trips that would not have been made if the new facility had not been constructed

4. Development traffic due to changes in land use as a result of the new facility

Ex 6.12 : A two-lane major rural highway has an AADT of 4000 during the 1st year of traffic, 25% trucks, 4% annual growth rate and 50% on the design lane. If the distribution

- two lane highway → each direction has only one lane.
- 4 lane highway → each direction has two lane → D = 0.5 হবে, L = 80% – 100% এর মধ্যে হবে
- 16 lane highway → each direction has 8 lane → each direction-এ 4 এর থেকে বেশি হলে L → 4 এর জন্য যেটা দেওয়া আছে সেটা use করবো।

- One way traffic → D = 1

Lecture-14: pdf পড়ে আসবে 24.09.24

2 set → 1 compulsory

10, 11, 12, 13 → Lecture → 1 set

- last 4টি lesson → pavement এর → আবার Lec-9-13

Lec-12-13 → pavement design factors

for compulsory

L-12-13:

EALF
ESAL → v.v.I° → defn, eqn, Math

v.v.I° → temp, precipitation, failure criteria জানতে হবে

- Traffic analysis → Math (ESAL, Growth factor)

6.11

L-10:

- Types of pavement,
- Conventional, flexible, rigid pavement এর ছবি drawing করতে হবে।

intercourse কোথায় হয়?

- full depth asphalt কী?

Lec-11:

- subbase course, base course কেন লাগবে।
- Rigid pavement কখন কোথায় লাগাবে + ৫টি ছবি, philosophy টা কী?
- Difference → design principal, temp, economy, openness to traffic

- বাকি Lecture মিলে 1টি কোশ্চেন → math আসবে 30% →
- theory quer → যেগুলো Mid, CT তে আসছে না বাদ

Lec-12:

- Traffic engg. কেন essential? → 5/6টা কারণ
- Causes of congestion → শুধু নাম
- Traffic engg tools → physical, regulatory v.v.I° ছবি লাগবে
- Internal factors

L-3 :

V.V.I

Volume, flow rate → difference

- 15 min-এ flow rate কেন নেয়া হয় ?
  - peak 15 min
  - highest 15 min কে hour -এ convert করতে

- Capacity, LOS → নামগুলো

V.V.I — ADT, AADT, PHV → কোথায় কোথায় এগুলো লাগে।

- Types of flow → service, contra, tidal, induced

V.V.I — Why 30th highest hour? — ছবি দিয়ে explain করবে

~~AADT~~

Lec → 4, 5 :

V.V.I — ~~Headway~~ — ২টি

- types of speed

V.V.I — ~~Graphical~~ problem — ২টি graph আঁকতে হবে → Normal graph

V.V.I

- Minimum data required → Math

L-6 :

- What is design veh ; static, dynamic, kinematic characteristics
- ~~AASHTO~~ guidline for design veh.
- Veh characteristics → affects গুলো → Length, height, Gantry
- Kinematic ও → Importance গুলো কত
  - motion নিয়ে criteria, highspeed -এ behaviour

L-7 :

- ~~General~~ requirement of traffic control device → 6-7টি
- types of traffic sign → গুলো নাম
- Special mendatory sign কী ?
  - (i) Yield (ii) Stop
- placement criteria → sign dimension
- VMS
- shown arrow

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Lec → 8,9 !

- Intergreen period, effective green time, odd

- Why all red period is given ?

- main ans লিখতে হবে শুধু, extra লেখা যাবেনা।

Name → শুধু নাম লিখবে
State
indicate

এগুলো মানলে explain করতে হবেনা

The factors are given below → X
না লেখাই ভালো

factors → এগুলো লিখবে
:
:

Discuss
explain
Enumare

ছবি দিয়ে explain করা better

- mark অনুযায়ী ans করবে