

Dr. Shamsul Hoque

Traffic Engg.

1. Kadiyali
2. Wright & Paquette
3. O'Flaherty

Traffic engg

Operational aspect of Transportation Engg.
Solve any kind of problem in road.

{ Pollution
 { Undue conflict
 { Accident

Efficient Transportation Services mean —

3 attributes: Space efficient, fuel free (FF), fuel efficient (FE)

2. People friendly & Environmental friendly (EF)
Transport System

which can —

— provide economical, faster, reliable and safer transport facilities.

- conserve land, fuel & environment

To ensure these, there is a need for

- Efficient ~~mode~~ mode of transportation &

- Efficient infrastructure of "

Supply driven management

{ with the increase of demand,
supply is also increased

traditional approach

• Solution approach -

- Traditional approach → Supply management

- Sustainable " → Demand

① bus is a space & fuel efficient mode.

almost 90 private cars can be displaced by

one bus

* Public transport is called "Transit"

⊙ Transit oriented thinking is more preferable.

↓

⊙ for Transit — every type of possible priorities & scopes are given

for other vehicles — "do nothing" policy

⊙ Then the other/private vehicle user will shift to transit.

↓

(Moral Shifting)

↓

Demand Management System

⊙ Demand Responsive

⊙ Condition Responsive

⊙ Special type of buses.

Capacity/Hrs of (In terms of passenger capacity.)

$$\boxed{1 \text{ BRT Lane} = 10 \text{ Auto Lane}}$$

↓
Bus Rapid Transit

MRT — Mass Rapid Transit (Rail based)

$$\boxed{1 \text{ MRT} = 15 \text{ Auto Lane}}$$

These BRT & MRT are —

- efficient
 - reliable
 - faster
- System loss in 3 places —
1. signal - U
 2. congestion / time waste
 3. passenger boarding.

⊛ Policy discourage

⊛ Fiscal "

⊛ Highest speed of train — 650 km/hour.

* Transit Oriented Development —

(At first train line बनावे)

Then train station बनावे

Then land use शब्द।)

05.03.2016

Traffic engg :

Traffic engineering deals with the operational aspect . . .

• It is the science of

1. measuring traffic and travel - - - -

2. application of this knowledge to the professional - -

• History

□

□

□

Q What is the eventual learning at present?
~~Sup~~ □ Eventually it became ~~se~~ evident that the planning and design of efficient road network largely depends upon the integrated land use & transport policies and effective demand management (road pricing to control and distribute peak hours demand)

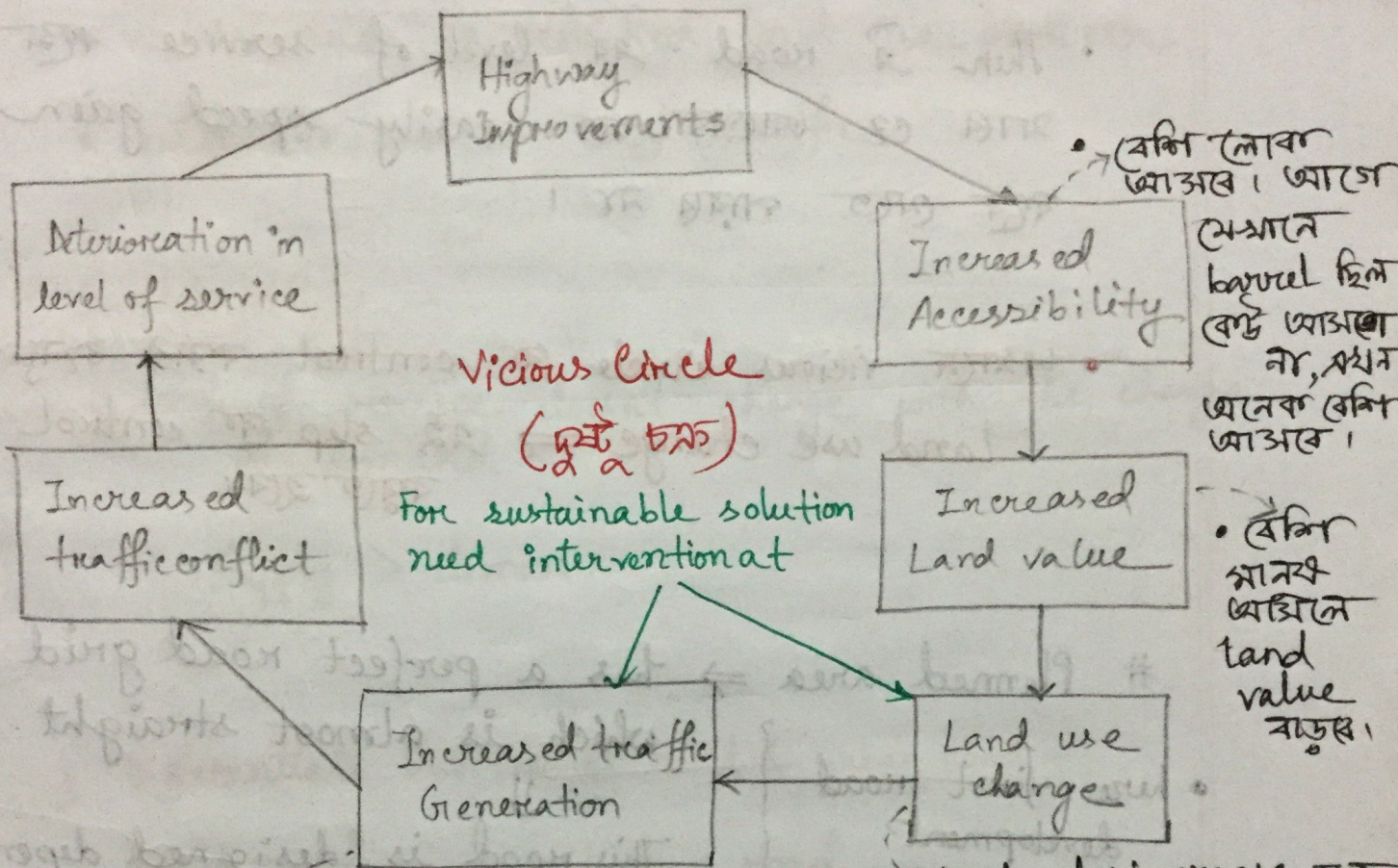


Fig: Transportation-Land use cycle

- এ establishment হলে => traffic generator i.e. entertainment by shopping mall/park etc.
- Then বিনি মানুষ & traffic আসবে। Speed gain করা যায় না। Density of traffic ↑, speed ↓. So this creates confliction.

• Then the road - এর level of service বৃদ্ধি
থাকলে সে জায়গার গতি easily speed gain
করবে যেতে পারবে না।

• যেখানে vicious circle কে control করার জন্য
Land use change \Rightarrow এই step কে control
করতে হবে।

Planned area \Rightarrow has a perfect road grid
which is almost straight.

• here first road
development

↓
Then human
inhabitation

↓
i.e. Preplanning

↓
This road is designed depending
on the land use.

↓
This is known as

LAND USE CONTROL

Unplanned area \Rightarrow Postplanning

- urban area \rightarrow densified land use pattern
- rural area \Rightarrow no local traffic

Sustainability -

level of service doesn't change with the change of demand.

Supply > demand.

2. Differentiate betⁿ rural road & urban road -

Rural road

No peak

No time bound traffic

Urban road

has peak

don't have time bound traffic

- Planned road should be of different steps -
collector road \rightarrow tertiary road \rightarrow secondary road \rightarrow primary road

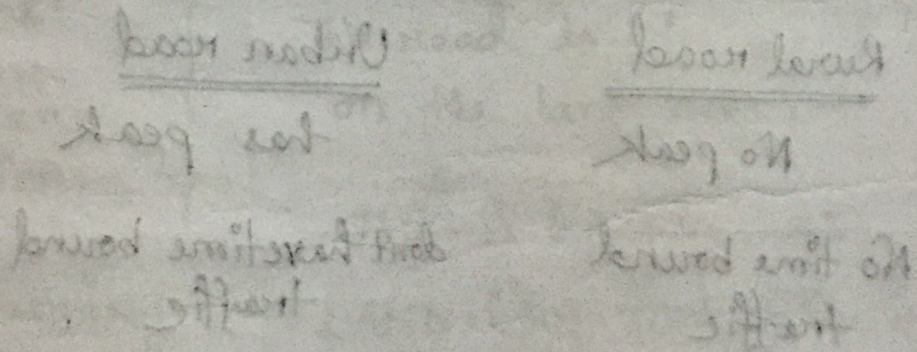
- Arterial road \Rightarrow min^m one fine & broad road.

\downarrow
This uninterrupted free flow condition
No lateral traffic will come.

Modern traffic engg measures → key stone →

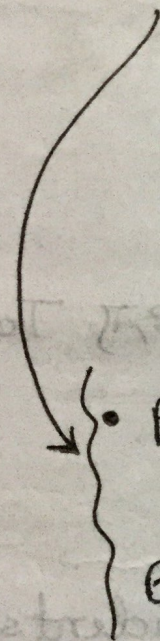
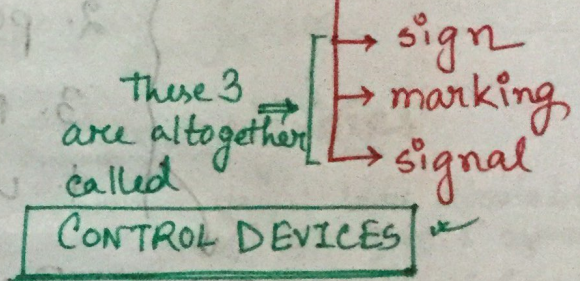
- Public transport facilities &
- Information Technology (IT)

• Side by side adhere TOD (Transit Oriented Development) approach,



Traffic Engineering includes:-

- Studies & analysis of traffic characteristics & flow parameters
- Geometric design (mainly improvement)
- Planning of regulatory measures
 - physical tools
 - regulatory
- Design and application of control devices
- Functional planning of road network



- Peak - 4 2473 ⇒ Arterial Road
- Bottom " " ⇒ 2473 Type 2473

Q. Why

Why Traffic engg. is so essential nowadays??

Because of -

- Increased urbanization process
- Increased traffic demand phenomenon - growth
- Congestion becomes chronic in everywhere
- Difficulties is expanding roadway facilities within built up areas.

Therefore there is a need to maximize the utilization of existing facilities by better traffic management and control measures. Moreover

there is a need to tackle —

- Increased air pollution
- Increased accident numbers
- Increased road network.

So 3rd phase (3rd) rural fabric and urban fabric — 1st phase. Global trend is

1. economy
2. population
3. road network
4. urbanization trend

अब बाढ़ है। So एकर operate करार अन्य Traffic engineer दरकार

↓
C2 एर फल free land बहूत थार

Common causes of congestion & accidents —

1. **Bottlenecks** — sources of flow interruption, which causes sudden decrease of vehicles' speed and roadway capacity. Bottlenecks are the main causes of congestion.

• Common causes for bottlenecks -

1. Geometric factors \Rightarrow permanent fault

- Road intersections
- Railway crossings
- Narrow road/bridge/culverts
- inconsistent roadway width
- poor turning radius/sharp bend

2. Road side frictions \Rightarrow Temporary faults.

- scattered parking / non-motor activities along road

↓
এর জন্য যে কুমড়ি lane available
প্রদেই শন নাশার capacity

- frequent side road entries

↓
আসবে ও পরে wide
road শনও bottle

- bus stops/parking near junctions

neck- এর জন্য
কেবল lane lose

- road side cut/unfinished repair of roadside pavement

↓
এই প্রস্তুত
capacity-ও

- poor drainage facility

আসবে না

* In urban areas -

1. Road mode
2. rail mode
3. water mode

should not be constraint for each other.

• for non-motor activities —

suppose 2 lanes are occupied among 4 lanes.

So, if in upstream & downstream 4 lanes are available, though big road; for middle bottleneck, 2 lanes are available.

⇓

So here may be 50% capacity লাতে পারি।
but 50% of পাওয়া থাকে না \therefore SPEED কম।

* Speed is a very important factor for traffic engineering.

⇓

So speed/capacity should be restrained.

* Speed is a self-enforcing device in traffic engineering.

* One stop service \Rightarrow this means daily needs
আলমপাশের জায়গা মেলেই
হবে। So main road
only used হবে for office.

* Tidal Flow Operation \Rightarrow Peak time - 4 & lane - ৪৩
total road one directional হবে
according to the flow of
traffic.

- So, for this predictable in nature, the existing roads can be managed. This is known as "Tidal Flow Operation".

3. Poor roadway environment -

- poor road discipline
- uncontrolled pedestrian crossing
- poor road surface condition

↑ (for speed breakers ⇒ this is physical restraint)

- speed breakers
- poor lighting

It is known as
HETEROGENEITY

↑
In Bd.
↑

4. Traffic internal frictions

- due to mixed or **heterogeneous traffic stream**
- if traffic demand (volume) > roadway capacity
- due to undue conflicts with the turning movements.

↑
যেহেতু different NMV Lane বিস্তৃত।

↓
Non-Motor Vehicle

☑ Safety problems arise mainly-

- At intersections
- where pedestrian activities are high
- along on street parking
- at blind spots \Rightarrow viz. bends, spots with poor sight distance/lighting facilities etc.

• due to -

- poor road surface condition
- faulty road geometry
- poor traffic operating condition

Road-Traffic System

Driving Convention : \Rightarrow भारत में जहाँ traffic stream बहिर्मुख है

1. Left hand driving (LHD)
2. Right hand driving (RH)

British \rightarrow LHD \Rightarrow our country also
American \rightarrow RHD

- If for vehicle, LHD; then pedestrian should be RHD.

Lane based homogenous traffic Operation

Non-lane based " " " "

\Downarrow
our highway \Rightarrow here no non-motorized vehicle.

Homogeneous \rightarrow only motorized vehicle

Non-homogeneous \rightarrow both " & non-motorized vehicle".

- For Bangladesh \Rightarrow alluvial land - সমতল
 So embankment তৈরি করা
 But এর maintenance - a high
 cost.
 water নিম্ন slope এর soil পানি wash out
 না হয়, so green herbs লাগানো হয়।
 But it is not sustainable.

Typical cross-section of Highway embankment.

- Culvert \Rightarrow road & এর same elevation - এ থাকবে
 এর নিচে কোন water - এ vehicle - এর জন্য
 স্থান রাখা যায় না।
- Bridge \Rightarrow higher elevation - এ থাকবে than roadway so that
 নিচে নিম্নে ship/boat পারে।
 2 parts
 ↓
 1. In water
 2. In land \Rightarrow Viaduct
- Flyover \Rightarrow || to the road by grade separated road
- Interchange \Rightarrow Intersection - এ upgrade/downgrade করা থাকে।
 in junctions.

• Tunnel - when hill comes in the obstruction of road

• Causeway - at grade road on water

↓
H₂O - ଶୁଣ ତଳେ ଥାଏ

Road furniture:

• Divider ⇒ only vehicle separate କରାଏ

• Median ⇒ huge portion kept as divider for future use

↓
much wider than divider.

• Channel

• Island

• Signal.

Roadway Classification -

09.04.2016

- Reverse

↓

Middle road or HOV Road or HO L Road

↓
High Occupancy Lane

- Rigid Pavement / Flexible (Bituminous) Pavement

Diff. - ~~शब्द~~

Bituminous cheaper but needs maintenance

Rigid Pav. (concrete) costly but needs no maintenance.

Can carry a huge load.

can not carry stationary road for long duration. This is known as creep behaviour.

• So ~~अगर~~ toll or for other purpose stationary vehicle ~~अगर~~ we will use Rigid ~~boundary~~ Pavement Road.

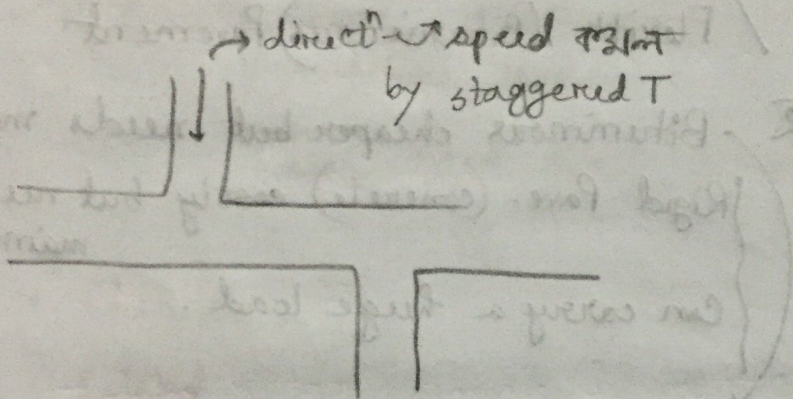
- BOOT - Build, Own, Operate and Transfer Road

BOT - Build, Operate & Transfer Road.

Roadway Intersection -

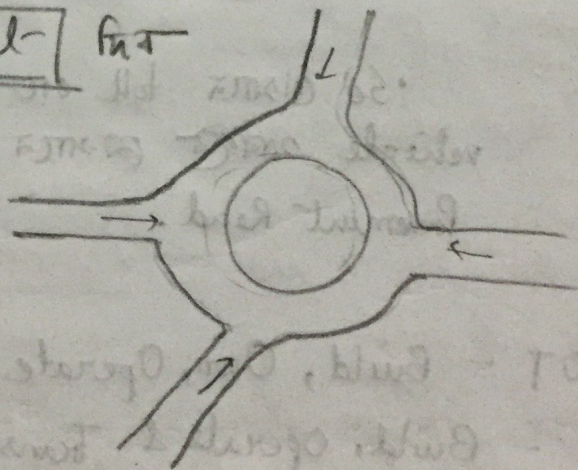
• Intersection Classification -

- Closely spaced to T-junctions \Rightarrow is called Staggered junction



But for 4 direct speed

round about



- but commercial area \Rightarrow staggered / round about
- solⁿ प्रभात काज करत ना।

• Diamond \rightarrow is divided by Major & Minor
 \downarrow \downarrow
no intersection \downarrow intersection
i.e. elevated \downarrow 2
राव

• Diamond \rightarrow दोहे Major रावण
 \downarrow
Full Cloverleaf Interchange

Cloverleaf \Rightarrow No second chance of decision

23.04.2016

Road - Traffic System :

- Vehicles
- Different types of vehicular Maneuvers.

— Crossing

— Merging

— Diverging

— Weaving

• Road users

- Rider \Rightarrow साइकल bicycle & motorcycle सवार
- Pillion \Rightarrow " rider-संग साइकल bicycle / motorcycle सवार

• Road environment

Traffic characteristics :

* Vehicle " — • Introduction

— Design vehicle \Rightarrow 85% vehicle को संदर्भ

• Static / Physical Characteristics

— दो single axle-संग combined

* Minimum head room = 5.5 m for bd.

• Dynamic characteristic

- Speed \Rightarrow influenced geometric design & traffic control system of road.

* Road user characteristics —

Perception reaction time = 2 second
(PIEV time)

(2s value को 1s में 2s से कम करें)

* Pedestrian characteristics —

— Forgiving type

Class Test — Only today's class
(Next Saturday)

Traffic Studies

Need for traffic studies

Traffic studies include

Methods of data Collection and Analysis:

- Data acquisition technique.

- Directly using

- ⇒ Manual Method

- ⇒ Automatic recording devices

- ⇒ Interviews / Questionnaire survey

- Indirectly using - Video recording technique.

- Local situation

-

-

-

-

- Difficulties in getting data information.

Traffic Volume Study

- Introduction

- Definitions

- Volume flow

- Flow rate

- ADT (Average Daily Traffic)

- AADT (Annual Average Daily Traffic)

- H. Sup. - DhV (Design hourly Volume)

- Scope of Traffic Volume Studies

- When to carry out?

Flow map

Vol^m (or) thickness

map - \rightarrow transfer map

map - \rightarrow transfer map

will be a Flow Map.

Traffic Vol^m Study

• Flow derivatives :

1. Interrupted flow

2. Uninterrupted flow

3. Saturation flow

4. Service flow rate

5. Free flow

6. Forced flow

7. Stable / Steady flow

8. Unstable flow

9. Peak flow

10. Off-Peak flow

11. Contra-flow

12. Tidal flow

13. Induced flow.

* Factors affecting traffic volumes:

Traffic Composition - Passenger Car Equivalent / Unit
(PCE/PCE)

• Periodic Variation -

- Hourly flow rates fluctuate throughout the day & night

-

-

• Counting Periods -

- Short duration count \Rightarrow conducted for operational study

- Long duration count \Rightarrow " " transport planning & design.

• Estimate of AADT/ADT from Short Counts -

- Factor Approach

- Equation Approach

* Factor Method:

Graph-1: Hourly traffic flow fluctuation by days of the week on the bridge.

Graph-2: Monthly fluctuation.

Table-1: Hourly Expansion factors for a rural primary Road.

Table - 2: Daily Expansion factors for a rural primary road

Table - 3: Monthly Expansion factors for a rural primary road.

Problem

<u>Hour:</u>	<u>Vol^m</u>	<u>Given, 3 tables</u>
7:00-8:00 am	500	
8:00-9:00 am	400	

Origin & Destination Survey (O-D Survey)

Fig: same as Hasib Sir. (Cordon).

Cordon survey ৩ মাং key point -> সাক্ষর তারা filter সাক্ষর only External-External trip.

- How to carry out?
- Presentation of results - *desire line Graphs*

Speed Study :

- Introduction
- When to carry out
- Factors affecting Speed

Types of speed —

1. Time-Mean Speed
2. Space-Mean Speed

Example

$$\frac{\text{total travel distance}}{\text{total travel time}}$$

Time Mean speed is always $>$ space mean speed.
& The diff. of these two speeds is the
STANDARD DEVIATION of the observation.

- Derivatives of speed.

Problem-1

Pace = Popular range of speed.

Median speed = 50th percentile.

V_{avg} = Weighted Avg.

Speed Study

28.05.2016

Comparison of Mean Speed

Problem-2 :

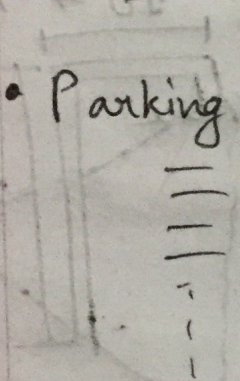
Delay Study

- Delay / Congestion
- When to conduct?
- Causes of delay :
 1. Fixed / Geometric delay
 2. Operational delay.
 3. Non-recurrent delay
 4. Recurrent delay
 - shock wave (after any hard break)

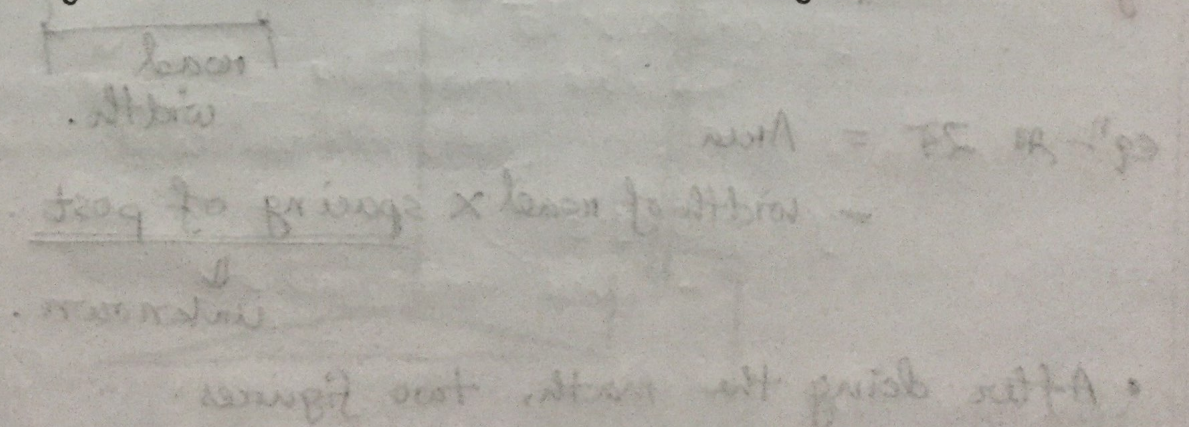
Parking Study

- Introduction-
- Why we need to study?
- Parking studies include
 - supply surveyers.

• Parking should be prohibited at -



• For systematic development of parking facilities -



Street Lighting

- Key locations
- Arrangement / Layout of Street lighting
- Types of light sources / lamps

Design of Street Lighting :

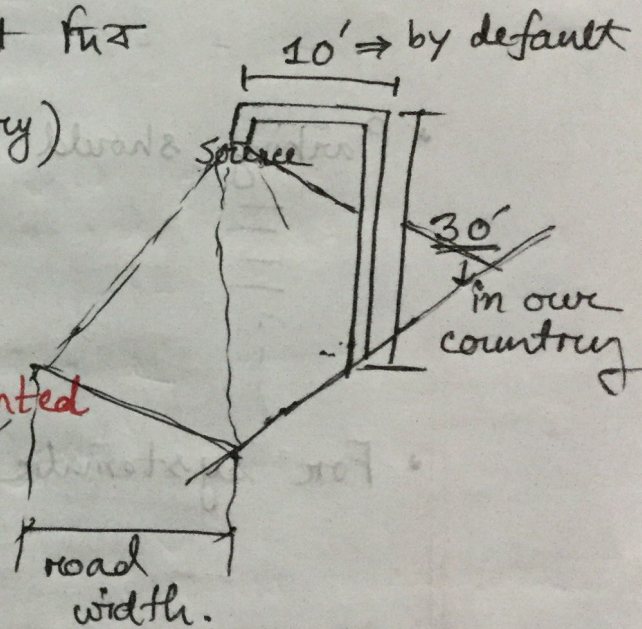
Mounting height — ସଞ୍ଜ ଡିଲୁକ୍ସ୍ light fixture
 = 30' (in our country)

- Coefficient of utilization

All street light must be supplemented by a transparent cover.

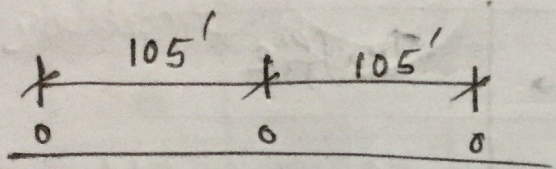
$$\begin{aligned} \text{eq}^n - \text{ଅଞ୍ଜ 23} &= \text{Area} \\ &= \text{width of road} \times \text{spacing of post.} \\ &\quad \downarrow \\ &\quad \text{unknown.} \end{aligned}$$

- After doing the math, two figures.

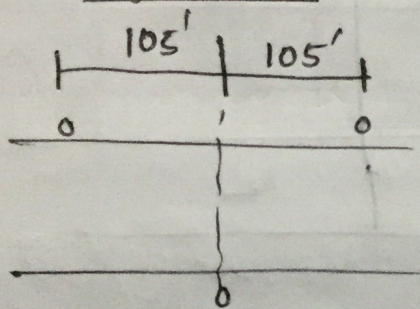


$S = 105'$
 $MH = 30'$
 $Overhang = 10'$

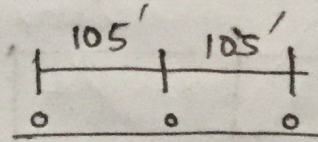
$W < 30 \Rightarrow$ single side
 $W = 30' - 60' \Rightarrow$ Staggering
 $W > 60' \Rightarrow$ both side



Single Side



Staggering



Double Side

Fig : Plan.

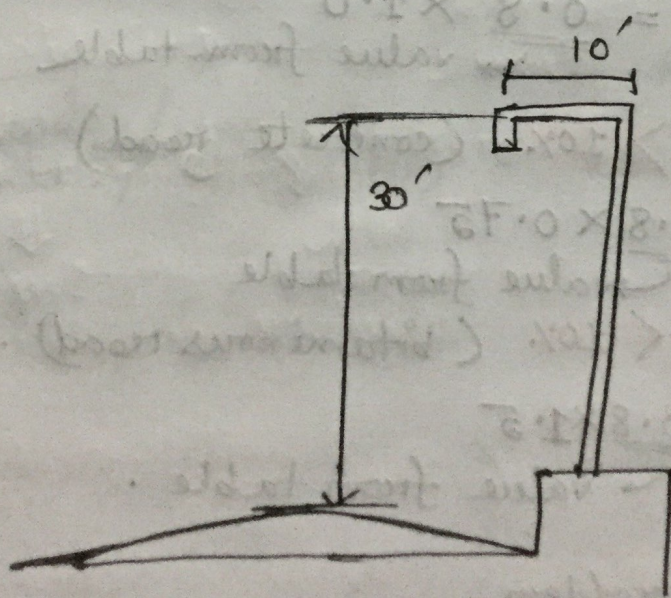


Fig : Elevation

1 lumen = 1 candle
(L)

Recommended Illumination = L/ft^2

		1200	Traffic
Pedestrian			
M		<u>0.8</u>	

Q. Light design for a road having reflectance = 10% (for black surface)

Then $I = \underline{0.8} \times 1.0$
 value from table

Q. Reflectance > 10% (concrete road)

$I = \underline{0.8} \times 0.75$
 value from table.

Q. Reflectance < 10% (bituminous road).

$I = \underline{0.8} \times 1.5$
 value from table.

Now, for this problem

$0.8 \times 0.75 = \frac{\text{Source brightness (5000)} \times C_u \times 0.8}{\text{road width (50)} \times \text{spacing}}$

for poor maintenance of transparent cover.

table

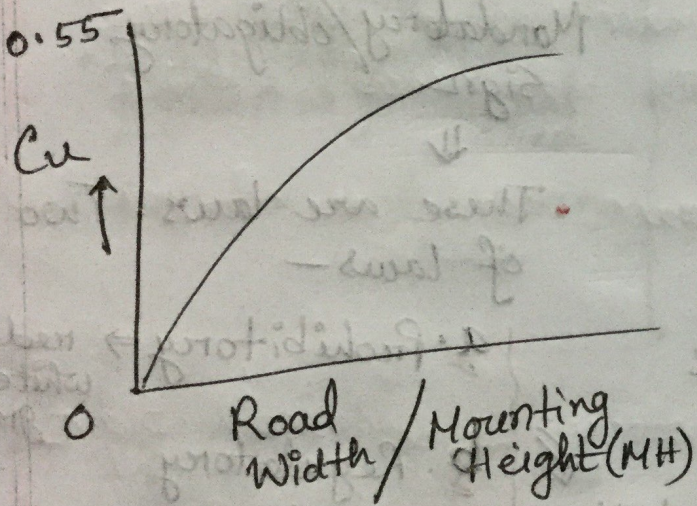
	Efficiency	Wattage
OB		
SB		
MB	30-60	90-160

• Efficiency = $\frac{I}{Wattage}$

If 100 wattage
for bulb
if efficiency = 50

source

brightness = 100×50
= 5000 L



• C_u = Coefficient of utilization

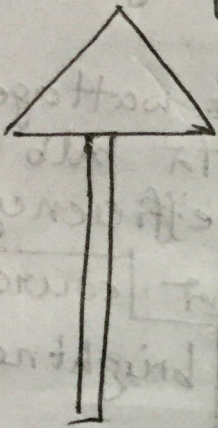
If MH ↑, C_u ↓

c.z Road width (w) = const.

Suppose, $C_u = 0.35$

Vienna Convention of Road Signs and Signals :-

1.



Equilateral triangle pointing upward.

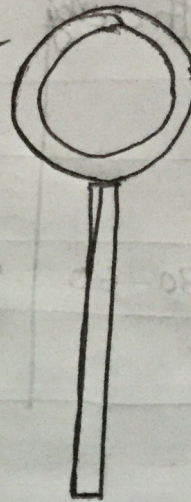
Cautionary/Safety Sign



सूचना

- 1. Speed breaker
 - 2. Other danger
- } ⇒ So speed decrease

2.



Circular

Mandatory/obligatory Sign



• These are laws. Two types of laws -

a. Prohibitory ⇒ red border, white background.

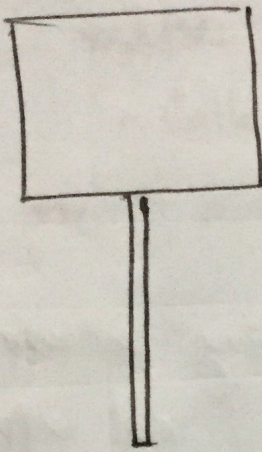
b. Regulatory



Deep blue background, white border

both are obligatory

3.



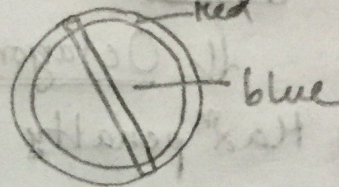
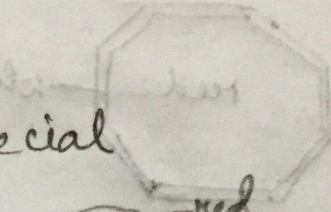
Informatory

Sign

• background color ⇒
1. green ⇒ for rural area

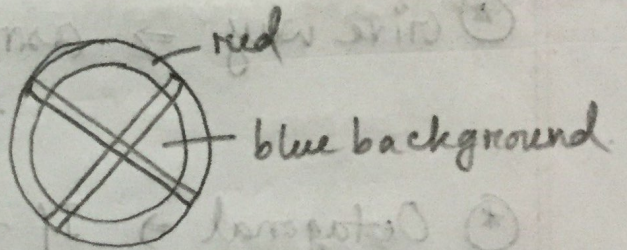
2. deep blue ⇒ for urban area

• Special



No parking

2.



No stopping

4. Equilateral Triangle heading downward

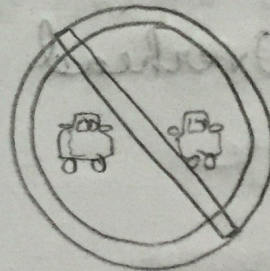
Priority ~~sign~~ Sign/Give Way Sign



↪ assist no police & no signal.

* penalty - 2 points for disobeying

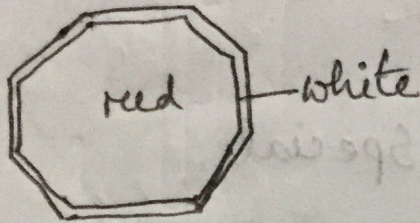
3.



No overtaking

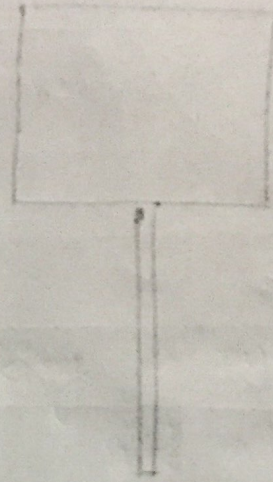
↓
बिमान चक्रीय breaking
white line solid (double)
रुके जाए। चक्रीय चक्रीय
white solid break न
रुके, No overtaking.

S:



⇓ Octagonal Sign

⊛ Max^m penalty (3 points)



⊛ Give way ⇒ असात main road - एसात सातक
& तिजे side road - १ सातक

⊛ Octagonal ⇒ If the main road is obstructed.

For High

Speed Road ⇒ Overhead Gantry Lane based Sign

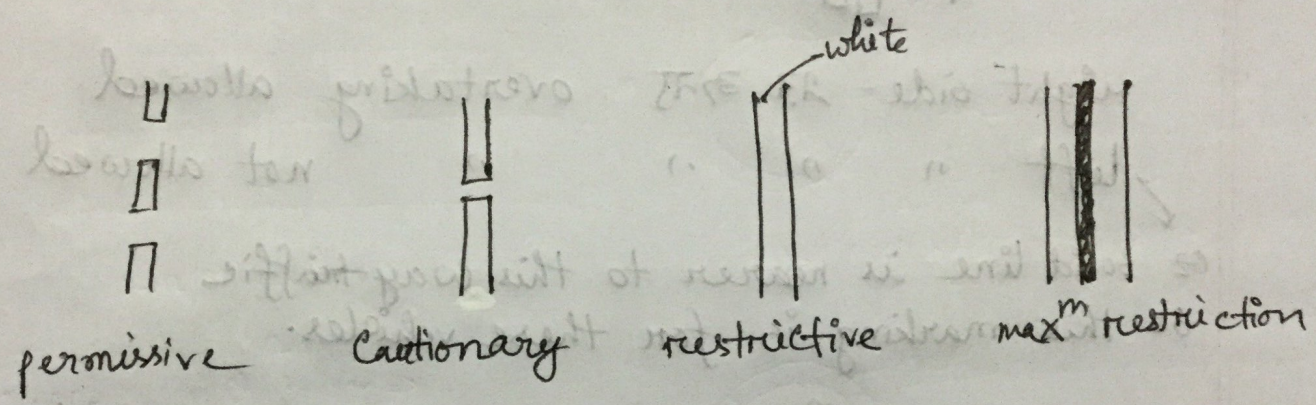
⇓
Sign road - १३ सातक elevation

Sign should be with Retro Reflecting Attribute

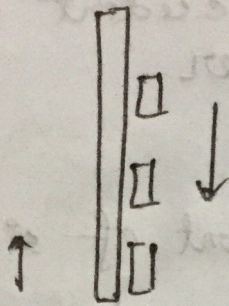
⇓
Retro Reflecting Nature of
Cats Eye

Imp

- New Trend \Rightarrow to overcome accident with posts, make the post either
 1. Collapsible
 - or 2. Give defense in front of sign post



- yellow \Rightarrow prohibition.
- No stopping \Rightarrow खर yellow line
- No parking \Rightarrow खर " "
- Marking 2 types —
 1. Pavement Marking
 2. Object Marking



right side - overtaking allowed

left " " " " not allowed

∵ solid line is nearer to this way traffic
 so this marking is for these vehicles.

Q. Compare betⁿ Marking & Sign:

Marking

Sign

1. is on the line of sight
2. is safe
3. is continuous
4. can not be seen in case of snowfall / congestion

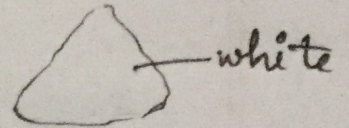
- on one side of the road
- is unsafe

— discrete
 always visible.

• Types of Marking :

1. tactile Marking

2. Thermo Plastic cement Paint
(Structural Marking)



• Stut