

**Traffic Components and Characteristics**  
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**Lecture No. 03**  
**Road Users**

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NPTEL Online Certification Course on  
Traffic Engineering

**Module A**  
**Traffic Components and  
Characteristics**

Week 1: Lecture A.3  
Road Users

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Welcome to Module A, lecture 3. In this lecture, we shall discuss about Road User, one of the major components of traffic systems.

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**Recap of Lecture A.2**

- While traffic engineering focuses on providing **safety and efficiency**, basic function of transportation system is to provide **mobility and accessibility**
- **Non-uniform characteristics** of different traffic engineering components (Vehicle, roadways etc.) make the job difficult for the traffic engineer
- **Uniformity of approach** is needed to deal with the complexity of non-uniform characteristics of different components

Road Users   Vehicles   Roadways   Control Devices   Prof. Bhargab Maitra

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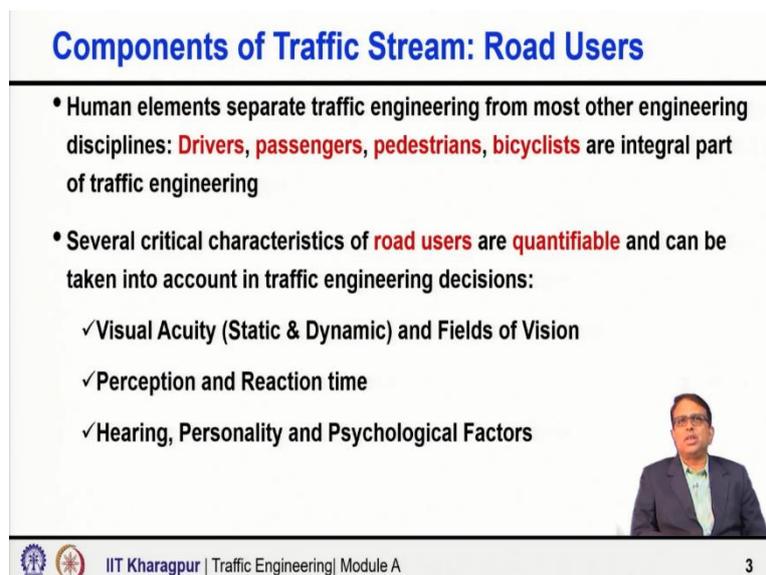
Before that, let us quickly relook at the major points of lecture 2. What we said that traffic engineering, the focus is on safety and efficiency but if we take the roads or the transportation

systems, then the focus is on function wise two major functions are mobility and accessibility.

Then, the major next point was that non-uniform characteristics of different traffic engineering components, road users particularly make the job difficult for traffic engineers. Vehicles are different, road users are different so that make the job difficult for traffic engineer. And we need kind of uniformity of approach to deal with the complexity of non-uniform characteristics of different components.

Although, the uniformity will not ensure or not mean that every user or every vehicle response will be same, still there will be variation, but the variation can be reduced to a large extent. Then, we also mentioned that there are four major components of traffic system and they are road users, vehicles, roadways and control devices. So, today we shall discuss a little bit more only on road users and their characteristics.

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**Components of Traffic Stream: Road Users**

- Human elements separate traffic engineering from most other engineering disciplines: **Drivers, passengers, pedestrians, bicyclists** are integral part of traffic engineering
- Several critical characteristics of **road users** are **quantifiable** and can be taken into account in traffic engineering decisions:
  - ✓ Visual Acuity (Static & Dynamic) and Fields of Vision
  - ✓ Perception and Reaction time
  - ✓ Hearing, Personality and Psychological Factors

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It may be mentioned that human elements separate traffic engineering from most other engineering disciplines because here drivers are there, passengers are there, pedestrians are there, bicycles are there and all are integral part of traffic engineering and their behaviour their response they are very different.

The way the drivers react there is a variation, the way the passengers behave there is a variation and therefore, several characteristics of road users we need to consider in the design of our road and traffic control systems which are directly in the hands of traffic engineers and we can exercise control there.

So, what we need to really quantify several characteristics of road users and take them into consideration in traffic engineering decisions. For example, visual acuity which could be both static and dynamic, fields of vision, perception and reaction time also hearing, personality and psychological factors.

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**Components of Traffic Stream: Road Users**

**Visual Acuity**

- Static visual acuity: Ability to see small stationary details clearly
- Dynamic visual acuity: Ability to see objects that are in motion relative to the eye
- A person with normal vision is said to have 6/6 vision
- Normal vision is defined as the ability of a person to recognize a letter or an object (size about 8.5 mm) from a distance of nearly 6.0 m

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Coming to visual acuity, there are two types of visual acuity which are considered one is called static visual acuity and the other one is dynamic visual acuity. Static visual acuity indicates the ability to see small stationary details clearly because if I am just looking ahead, I should be able to identify objects which are at certain distance in a normal situation and I should be able to see that object clearly.

So, how clearly or at what distance I am able to see that as compared to a normal person, what is expected normally, that all those are considered in the context of static visual acuity. And dynamic visual acuity relates to the ability to see objects that are in motion relative to the eye, carefully observe we are saying that relative to the eye. That means the object may be moving, the vehicle may be moving right and or both may be in motion.

So, a person with normal vision is said to have 6 by 6 vision. What is the meaning of 6 by 6 vision? It is defined as the ability of person to recognize a letter or an object of size about 8.5 mm from a distance of nearly 6 meter. So, a normal person is with proper visual acuity with proper vision, normal vision is expected to see that. So, that is called 6 by 6 vision.

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### Components of Traffic Stream: Road Users

- Visual acuity measurement (static) is necessary while issuing or giving renewal of driving license (by performing a **standard eye test**)
- Static visual acuity test is just a **prerequisite for good** vision characteristics: **Can-not guarantee** that the person who is having **good static** visual acuity will also have a **good dynamic** visual acuity
- Knowledge of visual acuity of drivers is important while **designing road signs**



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Now, visual acuity measurement or particularly the static one is necessary while issuing or giving renewal of driving license by performing the standard eye test. If you are issuing a driving license to a person, you should know whether he is able his vision is correct he is able to see it correctly.

Static visual acuity test is just a prerequisite for good vision characteristics because it is not adequate also, it is required essential but not sufficient, why? Because static visual acuity test does not guarantee that the person who is able to also have the required good dynamic visual acuity.

Two things are different and knowledge of visual acuity of driver is very important while designing road signs. So, if you want you know a person to know that there is a school zone ahead so, where you would actually place it with reference to the school, how much distance and where you want him to see that and start reacting. So, that is very, very important.

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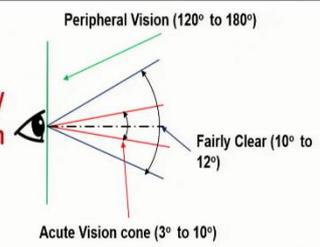
## Components of Traffic Stream: Road Users

### Fields of Vision

- Includes **acute or clear vision cone**, **fairly clear vision cone** and **peripheral vision cone**

**Acute or Clear Vision Cone**

- ✓ **3° to 10°** around the line of sight
- ✓ Legend can be read only within this narrow field of vision



The diagram illustrates the human field of vision from a side profile of an eye. A vertical line represents the line of sight. Three distinct regions are shown as cones originating from the eye: 1. **Acute Vision cone (3° to 10°)**: A narrow red cone centered on the line of sight. 2. **Fairly Clear (10° to 12°)**: A slightly wider red cone extending further from the line of sight. 3. **Peripheral Vision (120° to 180°)**: A very wide green cone covering the rest of the visual field.



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Coming to the next that field of vision, this is another characteristics of drivers which is again very important and it includes three types of vision cone. One is called acute or clear vision cone, the second is called fairly clear vision cone, the third is called peripheral vision cone.

What is an acute or clear vision cone? If you look at the line of sight, then it is 3 to 10 degree around the line of sight, you can see the photograph here. I have shown it the two red lines and you know this each case from the line of sight, it is 3 to 10 degrees around the line of sight.

So, legend can be read only within this narrow field of vision. So, if you want somebody to read and identify the legend clearly, then that should be placed within that degree within that range. So, that is why the field of vision or the acute or clear vision cone is important.

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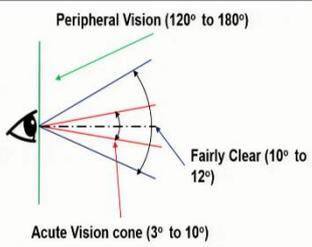
### Components of Traffic Stream: Road Users

**Fairly Clear Vision Cone**

- ✓ **10° to 12°** around the line of sight
- ✓ **Color and shape can be recognized in this field**

**Peripheral Vision**

- ✓ **May extend up to 90° to the right and left of the centerline of the pupil, and up to 60° above and 70° below the line of sight**



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The second is called fairly clear vision cone which is 10 to 12 degrees around the line of sight. You can see the two black lines are shown and you know, you can see now the area which can be covered and we are seeing that is fairly clearly vision zone not acute vision zone cone, but fairly clear vision cone. Colour and shape can be recognized in this field.

So, if I have to identify a colour, that whether it is blue or green or red, I can still identify within that. It need not be within you know acute vision cone of 3 to 10 degree it can be in the range of 10 to 12 degree as well. So, you have wider range available, wider range available for that.

Third is called peripheral vision. What is peripheral vision? Further increasing that angle and may extend up to 90 degree to the right and left of the centreline of the pupil and up to 60 degree above and 70 degree below the line of sight. So, you know the whole area how much it can come. So, peripheral vision much wider.

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### Components of Traffic Stream: Road Users

- ✓ Stationary objects are generally not seen in the peripheral vision field, but the **movement of objects** through this field is **detected**
- Information on field of vision is important while **deciding the placement of road signs**
- **Shape and color** of road signs needs to be **uniform** considering field of vision
- ✓ For example, **signs** should be placed **within 10 degree cone of vision of drivers** so that drivers do not require to change the line of sight while driving



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Now, static objects are generally not seen in the peripheral vision field but the movement of objects through this field can be detected. So, each vision cone has got a different function or I will say the ability is different. So, if an object is within 3 to 10 degree, then one can read the legend clearly, if it is 10 to 12 degree, then the colour and shape can be recognized, but in the peripheral vision which is even at a wider angle and as I have stated in the right and left and up and down, you know up to some degrees, you can still see a moving object you can still identify moving object.

Now, information on vision field or field of vision is important while deciding the placement of road sign, where you want to place the sign because driver will be approaching. So, within you know what vision cone, you want to place the sign that you have to decide, because you want you know the driver to clearly notice the signs.

Shape and colour of road sign need to be uniform considering the field of vision. For example, sign should be placed within 10 degree cone of vision of drivers. So, the drivers do not required to change the line of sight while driving because when the person is driving, the attention will be on the road. That is the line of sight.

So, it has to be if it is within 10 degree because you can see that 3 to 10 degrees is the clear vision cone and 10 to 12 degree is the fair clear vision cone. So, if it is within 10 degree of vision cone so the drivers do not have to move here and there still can concentrate line of sight need not be changed but still the sign can be identified.

And if we want the drivers to really note the sign and it is important of course, so, we have to place the sign with an understanding of this clear vision cone or peripheral vision or even the acute clear vision cone.

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### Components of Traffic Stream: Road Users

- However, these field of visions are defined for **stationary person**
- Peripheral vision **narrows as speed increases** such as from 100 degree to 40 degree while speed changes from 32 km/h to 64 km/h
- Objects placed in the **periphery vision** range can draw **the attention of the drivers** and **appropriate action** can be taken



PERIPHERAL VISION

32 km/h      64 km/h



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However, this vision, field of visions are defined for stationary person, when I am standing the way we have defined the discuss till now, it is all for a stationary person. I am standing and I am trying to look at it but we need to recognize signs. When we are driving that means we are in motion.

Now there this narrows down, the angle will come down effectively and depends on the speed. Higher the speed, narrower will be the angle. So, for example, as I said here, peripheral vision narrows as speed increases, such as from 100 degree it will become only 40 degree if the speed changes from 32 kilometre per hour to 64 kilometre per hour.

So, that means, this is again not same. How this is related? So, you know that different roads have different design speed, different safe speed limit. So, it is also linked with the speed that again the traffic engineer has to consider. So, objects placed in the periphery vision range can draw the attention of the driver and appropriate action can be taken.

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### Components of Traffic Stream: Road Users

✓For example, appropriate action can be taken when **child running onto the street** after a ball or **vehicles approaching to the intersections**, if these incidents happen within the **clear periphery vision** of the driver



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For example, just a small video or animation, you can say rather. The appropriate action can be taken when child running into the street after a ball or vehicle is approaching to the intersection. Here you can see that one vehicle is approaching to the intersection, you know the car is also approaching from the straight portion. So, the driver gets the information, able to see that and therefore, accordingly control the movement or control the manoeuvre.

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### Components of Traffic Stream: Road Users

#### Visual Deficits

- Visual problems like cataracts, glaucoma, peripheral vision deficits, diabetes, color blindness, etc. can have **negative impact** to **driver's performance**, if the problems became **acute**
- Out of these visual problems, even **milder version of color blindness** can have **devastating** effect to the affected driver



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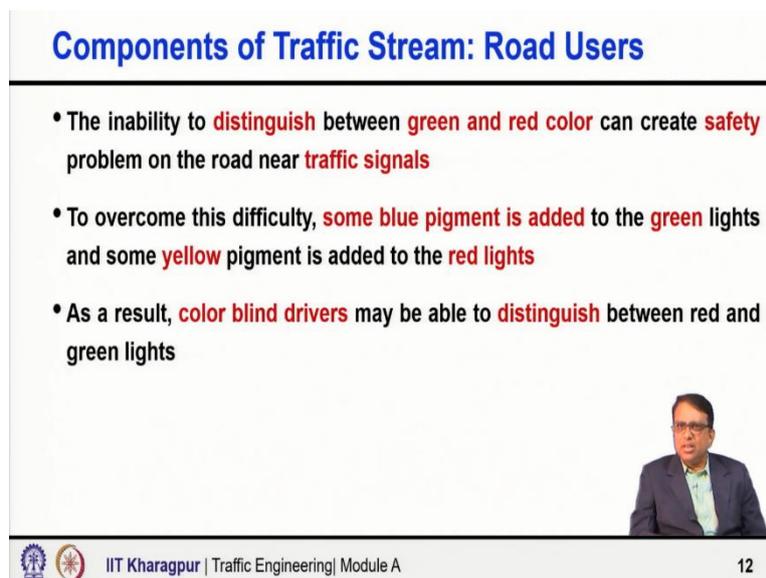
The next is visual deficits. There could be various kinds of visual deficits. For example, somebody may have cataracts, somebody may have glaucoma or peripheral vision deficits, diabetes also will have a detrimental, may have a detrimental impact or effect on the vision, colour blindness, again a very, very important thing and all these may have negative impact

to drivers performance, if the problem became acute. So, this is again all very, very important information.

Now, you can understand every such problem may be quite acute in terms of the impact on driving and the safety, but one of those which is having a major impact is the colour blindness because the signals, traffic signals, if red is not understood and interpreted as red or green is not understood and interpreted as green, then it will be simply disaster or devastating effect and impacting the safety. So, this is very important, why the colour blindness we must know that if a driver has really got a colour blindness.

So, many cases in India maybe so much rigorous test of the characteristics, driver characteristics is not done and maybe some basic things only we do most of the time but as the traffic engineer we must understand and I really hope that the process become more scientific and more rational over a period of time. So, in the future the licensing procedure in India is also should change actually, is expected to change and should change actually.

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**Components of Traffic Stream: Road Users**

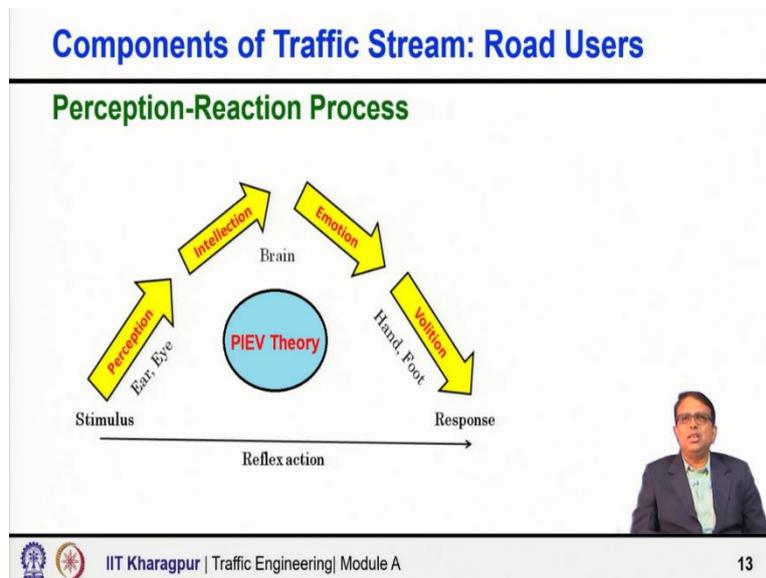
- The inability to **distinguish** between **green and red color** can create **safety** problem on the road near **traffic signals**
- To overcome this difficulty, **some blue pigment is added** to the **green lights** and some **yellow pigment is added** to the **red lights**
- As a result, **color blind drivers** may be able to **distinguish** between red and green lights

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The inability to distinguish between green and red colour can create safety problems on the road near traffic signals I have mentioned that and what is done actually to some extent this is a good attempt I should say that some blue pigment is added to the green light and some yellow pigment is added to the red light. So, to take care of the to some level the colour blindness issue.

So as a result, colour blind drivers still may be able to distinguish between a red and a green light.

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Next characteristics is basically the perception reaction process. You might have studied it in your B.Tech course but still, I will mention it briefly. It is also called a known as PIEV theory. P stands for perception, I stands for intellection, E stands for emotion and V stands for volition.

So, perception is through what? Sense, sense through ear and eye. We can listen or we can see that is where the perception is through that. Intellection and emotion is something which is happening in the brain. Extracting data, analyzing the data and volition is the action taken through hand or foot.

Either you take the leg from the accelerator pedal put it on the brake pedal or put your hand on the gear, put the gear on a lower side right, maybe you're driving on the third gear you change it to second gear and so on. So, these are the four components. So, it covers actually the whole range of activities or components which are executed I should say, starting from stimulus to response.

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## Components of Traffic Stream: Road Users

**Detection or Perception**

✓ In this phase, an object or condition of concern enters the driver's **field of vision**, and the driver becomes **consciously aware** that something requiring a **response** is present

**Identification or Intellection**

✓ In this phase, the driver acquires **sufficient information** concerning the object or condition to allow the consideration of an **appropriate response**



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First is the perception. Perception you can also think is that detection. What is done in this phase? An object or condition of concern enters in driver's field of vision and the drivers become consciously aware that something requiring a response is present. Something is there that is the thing when I am driving, there is no threat, no problem, nothing is there, but then I identify something is there which may require a response. Just that much.

Then, next step comes identification or intellection. What is done in this phase? The driver acquires sufficient information concerning the object or condition to allow the consideration of an appropriate response. So, now the driver starts getting sufficient information because you find something is there. So, I should get more information, I should get more data, so that identification or intellection happen to allow consideration of an appropriate response.

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**Components of Traffic Stream: Road Users**

**Decision or Emotion**

- ✓ Once identification of the object or condition is sufficiently completed, the driver must **analyze the information** and **make a decision** about **how to respond**

**Response or Volition**

- ✓ After a decision has been reached, the **response** is **now physically implemented** by the driver

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Third is the decision. Now, once the identification of the object or condition is sufficiently completed that means the first two perception and then intellection or detection and subsequent identification. Then now, it is the making process of making a decision.

So, once the driver of the object or condition is sufficiently completed, the driver must analyse the information and make a decision about how to respond, the decision could be okay no, I do not need to do anything. Okay, the way the pedestrian is crossing, pedestrian will cross the road safely. I do not need to do anything. It could be that I need to only change the lane. So, lane change is the decision or the decision could be, I should actually apply brake and stop. That is also a possible decision.

Next is the response or volition. After the decision has been reached, the response is now physically implemented by the driver. So, you now and you see okay braking is done. So, you actually do the response. So, after the decision has been reached, the response is now physically implemented by the driver. Till this time the driver was simply waiting for a decision. Now, the decision is there.

So, now, he will take the leg maybe on the brake pedal and then the brake is applied. Now, once the brake is applied, then it comes to the other part right because then it will depend on what brake efficiency will consider or what is the coefficient of friction, longitudinal coefficient of friction of the road surface that you want to consider depending on the speed and then how much distance or how much time it will take. Once the brake is applied to stop the vehicle completely. That is the next part.

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### Components of Traffic Stream: Road Users

- Perception-reaction time (PRT) is helpful in deciding braking distance, overtaking distance etc. and also in amber time determination
- PRT depends on the characteristics of the driver, type and complexity of the event to be responded by the driver
- AASTHO recommends different values of PRTs in different situations



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Perception reaction time is helpful in deciding braking distance, overtaking distance etc. and also in amber time determination. Why the braking distance overtaking distance because till this perception reaction time vehicle is traveling in the original speed because there has been no action. So, if you are traveling at 60 kilometres per hour, you still continue to travel at 60 kilometres per hour. And only after that, things start happening.

PRT time, perception reaction time obviously it depends on the driver. So, the characteristics of the driver is very important. Age old driver, young driver, all may be different, even among young drivers, all of them may not be same that way even the aged driver also aged person and not all of them will have the same perception reaction time. Also, it depends on the type and the complexity of the event to be responded by the driver.

Now, AASTHO: American Association of State Highway and Transport Officials, the AASTHO Green Book is almost like a Bible to all of us and when we talk about the geometric design part.

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### Components of Traffic Stream: Road Users

Situation	Recommended PRT
Normal stop at a signal control	1.0s
Normal stop on a highway	2.5s
Avoidance maneuver: Stop on a highway	3.0s
Avoidance maneuver: Stop on an Urban Road	9.1s
Avoidance maneuver: Speed/path/direction change on rural road	10.2-11.2 s
Avoidance maneuver: Speed/path/direction change on sub-urban road	12.1-12.9s
Avoidance maneuver: Speed/path/direction change on urban road	14.0-14.5s



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So, AASTHO recommends different values appear in different situations. Some of the things I have indicated here say normal stop at a signal control, normal stop on a highway or different kinds of avoidance manoeuvre. Stop on a highway, stop on urban road, path speed or direction change in rural road and so on.

So, I am not going into details but to show that what I say depends on the situation it depends on the characteristics of the event and the type and complexity of the event. So, for different situations, different perception reaction values, that are given that are considered in AASTHO as I have shown it here.

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### Components of Traffic Stream: Road Users

**Factors affecting PRT**

- Expectancy: **Significant impact** on PRT
  - ✓ Reaction of drivers will be **quicker** in situations they **expect to encounter** rather than in situations they **do not expect to encounter**
  - ✓ For example, drivers **do not** expect that the **leading** vehicle will **slow down** without a reason
  - ✓ Drivers react **quickly** to the **alerted** situations than the **surprise**



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Then there are several factors which affect the perception reaction time other than these two. How much will be the really the perception reaction time? One very important thing very, very important thing which we can influence as traffic engineer that is the expectancy. So, it has got significant impact on PRT.

What I mean by expectancy? Say, reaction of drivers will be quicker in situation they expected to encounter rather than in situations they do not expect to encounter. So, say for example, if I am informed that there is a school zone, I know the schoolchildren are not so matured, somebody may come on the road or they might be playing somewhere by the side of the road and suddenly run on the road or on the carriage way suddenly can come on the carriageway. So, I am mentally prepared. I know that there might be something.

The other thing I do not know and then all of a sudden I find a child is right in the middle of the road just running without looking at the traffic, without looking understanding or realizing that the vehicle is too close or so. So, there it gives a lot of opportunity to us that is the reason you want to inform drivers in advance. School zone ahead, market area ahead the moment you said there is a market area drivers know that how or what happens in market area and how people or different road users behave in market area.

They will try to cross if there is a market area a lot of pedestrians will be there some bicycles will be there in Indian situation maybe there will be some encroachment on the road. So, you may not get the full lane width available for the movement of vehicle. So, the shoulder may be completely occupied all such expectancy. The expectancy will be developed.

So, the driver will be more you know informed and that will impact the PRT, perception reaction. As I have said drivers do not expect the leading vehicle will slow down without reason if there is a signal there, I know that the vehicle in front also will stop. But if there is nothing suddenly vehicle apply brake. I do not expect, I do not expect the vehicle to stop suddenly like this. So, drivers react quickly to the alerted situation than the surprise.

So, there is also another reason the vehicles familiarity with the route in our Indian Roads Congress guidelines so far to the best of my understanding this is not considered so adequately in different contexts. But if we look at AASTHO, they consider it the familiarity of the route.

If I am driving every day, every day I am using a particular road, the whole thing is there in my mind even without saying, things will be there in my mind, but if I am a new driver, I

may not be aware of the things but the traffic signs, marking can play a very vital role in this regard.

We do not expect every vehicle, driver to know every meter of the road, it is not necessary wherever you know, it is in necessary to warn the driver we should be able to do it using appropriate signs, appropriate markings and locating or placing the sign properly keeping in mind all other trigger characteristics which I have already discussed.

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### Components of Traffic Stream: Road Users

- ✓ When a red light is added to initiate braking, then the reaction is even quicker (Less PRT time)
- Other factors like age, fatigue, consumption alcohol or drugs by the drivers can influence PRT

The graph plots PRT in Seconds on the y-axis against Percentile on the x-axis. Three data series are shown: Brake (red line with circles), Alerted (green line with squares), and Surprise (blue line with triangles). All three series show an upward trend as the percentile increases, with the Surprise condition consistently having the highest PRT values and the Brake condition having the lowest. A small inset video of a speaker is visible in the bottom right corner of the slide.

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So, when a red light is added to initiate braking, then the reaction is even quicker. So, you can see the vehicle in front you can see that the brake light is on. That is also an indication, preparation. So often factors like age, fatigue, consumption of alcohol or drugs, but the driver can also influence PRT. So, the same person but over age the perception reaction will go down. Fatigue also if you are driving continuously, then the perception reaction may be longer.

So, here I have shown here in the graph, you can see the x axis was percentile and y is the PRT in seconds, the actual value I have not mentioned because as I said that it may depend on the situation. So, but what is important here, surprise situation, that means I am not alerted, I do not expect but suddenly I find that something is there.

As I said that suddenly I find that you know a child is running and has come in the middle of the carriageway. So, that kind of surprise. The second is alerted, you have informed the driver in advance that you are going to enter into market area now or you are going to pass through

an area where there is a school. The third one is the brake that means the drivers of a bus, the driver of a bus. Driver knows that any how he has to stop at the schedule bus stop.

So, he is even prepared to stop, he knows that he has to stop. So, this is for you know this called brake that way we have used the legend. So, you can see percentile wise take any percentile, the lowest value is for what? Lowest value is for brake, then under alerted and the highest perception reaction will be under surprise when the drivers do not expect.

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**Components of Traffic Stream: Road Users**

**Psychological and Physical Factors**

- “Road rage” is the **extreme** expression of a **driver’s psychological and personal displeasure** (aggressiveness) over the traffic situation he or she has **encountered**
- It does, however, **remind traffic engineers** that drivers display a **wide range of behaviors** in accordance with their own **personalities** and **psychological characteristics**
- **Most of these factors cannot be addressed** directly through **design or control decisions**

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Psychological and physical factors for example, road rage, we often see on Indian roads sometimes in urban area, rural area, we suddenly experience this kind of thing, you can see a driver suddenly stopped the vehicle and got very angry or just open the window and put the head outside telling something, many form, many ways. So, road rage is the extreme expression of a driver’s psychological and physical, personal displeasure.

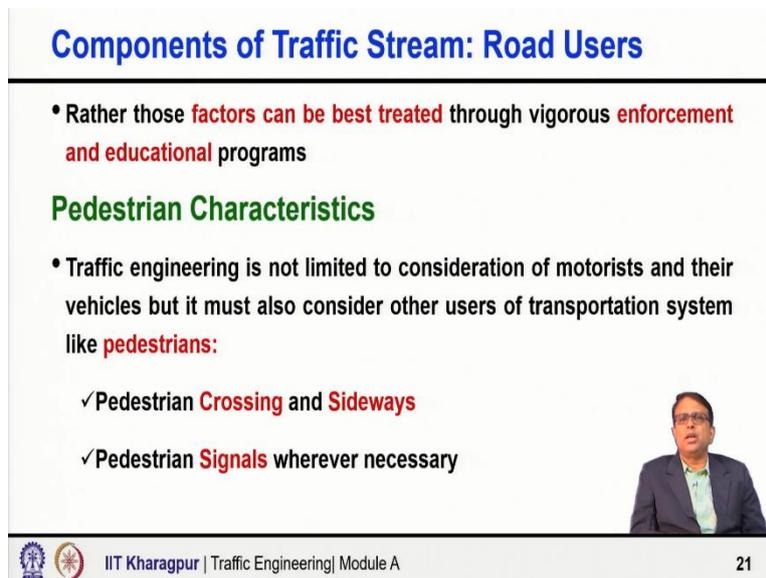
So, road rage is the extreme expression of a driver's psychological and personal displeasure and some kind of aggressiveness over the traffic situation, maybe I mean, it sometimes come because he is totally fatigued, he is totally frustrated waiting in congestion for a long time and has become somewhat desperate. But that is the behaviour that is because of the psychological and physical factors.

It does however, remind the traffic engineers that drivers display a wide range of behaviour, somebody will be very calm and quiet and cool even though things are traffic is not able to move and congestion for a long time and so, still there will be good. Some will be extremely

aggressive. Turned, changed into very aggressive person. So, and may get involved into road rage.

So, there are different personalities different psychological characteristics and you have to remember that not everybody is going to behave in the same manner and many of these things or rather most of these things related to psychological and physical factors cannot be addressed directly through the design or the control decisions, but many of these can be best treated through rigorous enforcement and educational program.

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**Components of Traffic Stream: Road Users**

- Rather those **factors can be best treated** through vigorous **enforcement and educational** programs

**Pedestrian Characteristics**

- Traffic engineering is not limited to consideration of motorists and their vehicles but it must also consider other users of transportation system like **pedestrians**:
  - ✓ Pedestrian **Crossing** and **Sideways**
  - ✓ Pedestrian **Signals** wherever necessary

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Now, the second way the drivers, the other road users are pedestrians, pedestrian's characteristics are also important. So, it is not limited to consideration of motorists and their vehicles, but also must consider other users for example, the pedestrians and pedestrian characteristics are important when pedestrians are crossing or using the sideways or sidewalks or pedestrians using a pedestrian signal wherever it is available and appropriate.

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### Components of Traffic Stream: Road Users

- Pedestrians walking speed at crosswalks is an important factor to be considered in signal timing design
- Gap acceptance behavior of pedestrians is important in crosswalks involving unsignalized intersections



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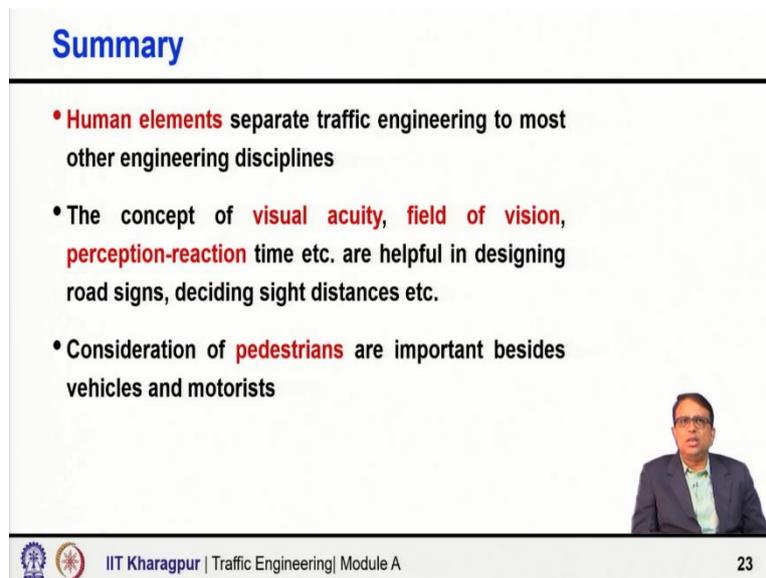
Because if you cannot see that pedestrian walking speed at crosswalk is an important factor to be considered in signal timing design. What walking speed you take so that pedestrians should be able to cross safely within the pedestrian green time.

If there is no signal, then it is basically the gap acceptance behaviour. It is the judgment one vehicle and another vehicle how much is the gap and some users will accept, some users will reject the gap. So, it all depends on the gap acceptance because it is the judgment right there gap acceptance behaviour.

So, the gap acceptance behaviour of pedestrian is important in crosswalk involving unsignalized intersection because you do not have a signal to say that pedestrian now you cross. Depend on the traffic they apply judgment and that whatever I said judgment actually more in traffic engineering term, I would say that this is gap acceptance behaviour.

What gap you are accepting, if the gap is too small, you will not accept. If the gap is too large okay, maybe most of the pedestrians will accept if something in between maybe a few pedestrians will accept. So, these are important.

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**Summary**

- **Human elements** separate traffic engineering to most other engineering disciplines
- The concept of **visual acuity, field of vision, perception-reaction time** etc. are helpful in designing road signs, deciding sight distances etc.
- Consideration of **pedestrians** are important besides vehicles and motorists



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So, to summarize, I would say human elements separate traffic engineering to most other engineering discipline and the concept of visual acuity, static, dynamic also the field of vision, perception reaction time, all these are important and helpful in designing road signs, deciding the road sight distance and also the justify that where I should place the sign, what type of sign what I should concentrate, do I want to why the legend is important, why the colour is important, why the uniformity of sign is important, why the placement is important all this.

Now consideration of pedestrians' characteristics are also important besides vehicles and motorists because particularly to design the pedestrian facilities such as sidewalk such as crossing in an uncontrolled in a signalized intersection, and so on. So, with this I close, thank you so much.