

Course Name – Pavement Construction Technology
Professor Name – Dr. Rajan Choudhary
Department Name – Civil Engineering
Institute Name – Indian Institute of Technology Guwahati
Week – 09
Lecture – 32

A very warm welcome to all of you. I am Rajan Choudhary, a Professor in the Department of Civil Engineering at the Indian Institute of Technology, Guwahati. Course instructor for the NPTEL MOOC course, Pavement Construction and Technology, funded by the Ministry of Education, Government of India. Today's lecture will be under module 9, where we will discuss some of the salient aspects related to pavement markings, their composition, and construction. So, at the very beginning, I would like to acknowledge the use of text, information, graphs, and images sourced from various textbooks, codal standards, journal articles, reports, newsletters, and public domain searches. Now, coming to road markings, what are road markings? These are lines; specifically, I can say these are lines; these are patterns.

This may include words except road signs, which are placed adjacent to any carriageway and are not included in it. So, it includes lines, patterns, and words that are applied or attached to the carriageway, curves, or to objects within or adjacent to the carriageway. So, near or adjacent to the carriageway, the purpose is to control, warn, guide, and inform the road users. So, these are some important features for which road markings are used.

So, they need to have good control. They should warn, guide, and inform the road users, so we have these IRC-coded specifications, IRC 35 Code of Practice for Road Markings. We have sections under these MORTH specifications and road bridge works, which deal with the road pavement markings. So, if I put together what the key roles of roads or pavement markings are, many times they may be called pavement markings or road markings. So, one of the first key aspects can be put up as a guide to control traffic on the highway.

So, it should be able to guide the traffic moving on the road. Act as a psychological barrier because it should give a psychological impression of whether you need to cross it or cannot cross it if some marking is present. So, it should be able to give you a psychological barrier that delineates traffic paths. These are very useful specifically at night when visibility is low, providing lateral clearance, which helps us to stay clear of any hazards for safe movement. Channelize pedestrians and cyclists into safe zones; this is also important because these are the vulnerable users.

So, we try to channelize it because there is a good amount of pedestrians and bicyclists present in the traffic composition. Ensure smooth, orderly traffic flow and promote road safety. So, these are some of the key roles of road markings, or we can say pavement

markings. Now, what does the MoRTH specification say for it that road markings may be executed using ordinary road marking paint, which can be used, or a hot-applied thermoplastic compound, which is very commonly used, or reflectorized paint or cold-applied reflective paint? So, these are certain categories that are used specifically for road markings, and all of them should comply with the specific requirements stated under the MoRTH specifications, the IRC 35, or in the contract document. The two commonly preferred materials for road markings include hot-applied thermoplastic compound, which is very commonly used.

The second one is solvent bond and water bond road marking pavements; specifically, these are done when some temporary works are there, and they are preferred. And other specific materials for specific purposes we can use under road markings, such as cold-applied plastics or preformed adhesive tapes. These are also used for some specific applications; we will discuss them. So the first one, which is the most widely used thermoplastic compound, is a widely used pavement marking material on roadways. The material is a homogeneous mixture of aggregate, pigment, resin, and glass reflectorizing beads.

Its color is white or yellow; these are the two most common colors, as specified in the drawings and definitely in your contract document as well. Applied in its molten state on the carriageway surface, it adheres to the pavement and solidifies rapidly at ambient temperature, allowing the surface to be available for the movement of traffic. So, one requirement in terms of the composition or the proportion of different constituents of this particular one, as per the MRTN guidelines, is shown here, where you can see how much different percentages by weight of binder there are, glass beads there are, titanium dioxide, calcium carbonate, and inert fillers, along with the yellow pigments where they are used. Key advantages of this thermoplastic compound are that it dries quickly and is highly durable. This is one key advantage that it has.

Better nighttime visibility; as I mentioned, during nighttime when visibility is significantly reduced, these road markings are highly helpful. So, we need to have a longer service life because they are continuously exposed to abrasion from the tires, and the presence of water may also be there. So, they should have a higher service life along with higher durability. Now the reflecting glass beads that are specifically used in these thermoplastic compounds shall be transparent; the beads used here have been shown in this picture. So, it shall be transparent, colorless, and free from milkiness, dark particles, and excessive air intrusions.

So, the inclusions are there. So, these are some specific requirements. So, you can see that the gradation requirements of these glass beads are also mentioned as per the MoRTH requirements, which specify what the gradation should be. So, this material requirement is also clearly stated by our MoRTH specifications. And under these beads, the glass beads, which are used in two types, are the most common ones.

The type one under this one is the one that is incorporated into the thermoplastic compound. So, it is incorporated, and then the material is laid over the surface. The second is the one that is applied by spraying on the pavement surface. So, this is the second one that is applied to the pavement surface. So, these are the two most common applications of glass beads.

The glass beads shall conform to the gradation requirements as specified in the table for the respective types, specifically type 1 and type 2, mentioned here. In specific requirements, at least 70% of these glass beads must be true spheres. Minimum refractive index, as we know, gives an idea that it is a ratio of the speed of light when it travels in a vacuum and when it travels through a medium in that particular way. So, it says the minimum refractive index of 1.5 must be free-flowing without lumps or clusters when you are applying it.

As in the case of type II, when you apply it to the surface, it should be free-flowing without any lumps or clusters. So, this is another important requirement with respect to the reflectorizing glass beads. Now, the other two types of marking materials, road marking materials, which are used, are the solvent bond and the water bond marking paints. Now these are quite old; they have been used since very old times and are mainly used specifically for the purpose of marking longitudinal lines in temporary work zones. So, as I mentioned, nowadays, because we have very durable materials with a long service life, these thermoplastic compounds are more preferred.

But compared to that particular one, if we require it for some temporary work zones or for marking required for shorter durations, we use these waterborne or solvent-borne road marking pavements. Now, in these two categories, waterborne and solvent-borne, we prefer to go for the waterborne option because it is eco-friendly, safer for workers, and easy to handle and clean up; this is another requirement. And dries faster, so the road can be opened up for traffic sooner in that particular case, compared to some of the challenges that are present in the solvent bond because we consider them to be relatively more hazardous to the environment, and they take a relatively longer time to dry, which delays opening them up for traffic. Now, the two specific categories are: one is the cold-applied plastics cap, and the other is preformed adhesive tapes, which are there. So, these are two specific categories that are mainly used for specific purposes.

So, when this cap is there, cold-applied plastics are often preferred for colored pavement markings over paints and thermoplastics if you want to have some colored pavement markings. You can see this is a cycling track that is there. So, in this particular case, a dedicated preferred colored pavement marking is there; we can go for these code-applied plastics. They are highly durable; definitely, they retain the color for a longer period of time, and their luminance is also good enough. In addition to this particular one, they are ideal for audible raised edge line markings.

So, edge line markings can be made with these cold-applied plastics. So, as soon as it moves over it, an audible sound is created because of the slight bump that is there. And so, it warns you that you are on the edges of the carriageway. So, cold applied plastics can be applied in various ways with a superior finish; definitely, it has a much superior finish, requires no large equipment, and is easily transported in a medium-sized van trailer. So, you can see that these are some applications of cold-applied plastics.

Now, the other category is preformed adhesive tapes; these are again some specific applications, and we have the ASTM codal guidelines also existing for them. So, they come in continuous rows of various sizes, and they typically last for around 3 to 6 months. So, they do not require any specific equipment, nor do they require any curing and drying period as you have in the case of thermoplastic paints or in the case of waterborne or solventborne pavement marking materials. They have a higher initial cost compared to the other categories of pavement marking materials, but offer a longer service life in high service areas. So, they know when the traffic is very high, specifically when there are some intersections.

So, in that particular case where it is difficult to have the other paints regularly put up. So, in that particular case, we can go for these preformed adhesive tapes. So, it offers a longer service life in high traffic areas, making it more suitable for locations needing frequent replacements of markings, as well as for object markings. So, when there is high traffic and it is difficult for the frequent waterborne or thermoplastic compounds to lay markings, we can opt for preformed adhesive tapes, which are a bit costlier, but under these conditions, they perform well. Now in these markings which are to be provided on a pavement surface, there are certain aspects that need to be taken care of.

One can say the features that need to be taken care of are the colour pattern of the markings; what should be the colour of these markings? It may be white or yellow. So, the color pattern of the markings is related to visibility at different speeds because it will be provided in rural sections, urban sections, and sections with varying speeds. So, they should be clearly visible in advance to drivers. So, it is the aspect that is related to the visibility of the road markings. Retro-reflectivity is very important at night.

With the light from the headlamp, the driver is able to perceive these markings. So, the retro-reflective part of these markings is very important, and the external factors that affect traffic, the presence of water, and other external factors also play an important role in the overall performance of these road markings. So, these are some of the important features related to road marking performance. Now, let us look at the color pattern of the road markings. So, the most common one you might have seen is the white color.

Basically, the reason for the white color is that it is used for high visibility and contrast with the road surface, as most bituminous pavements have a blackened surface. So, these

white markings give good visibility and a strong contrast with respect to the surface. When it comes to yellow color, many a time road marking with yellow colors are also provided. So, there is a specific purpose; it is used for longitudinal markings along the length of the carriageway where crossing is prohibited. It is prohibited for you to give a direction or indication to the user that the crossing is prohibited, so that I can indicate through this particular one in terms of overtaking, parking, or other traffic control purposes.

So, these are some indications that I provide by using yellow markings. Then, we have the blue color pattern, which is there for specific purposes—non-conventional applications, I can call it—because they are for special purposes. One can also be for public transportation facilities there. So, if there is a bus lane, in many cities you might have now seen that the bus rapid transit corridors are there; BRT corridors are dedicated corridors for the movement of buses or for public transportation facilities. So, which may also include three-wheelers and rickshaws.

So, if a dedicated corridor is provided for that particular one, then it can also be through blue color patterns. And in the bus lanes usually marked across the intersections, blue markings highlight that the lane is specifically meant for buses, and other vehicles should not stop or drive in this particular one. So, this gives special applications and for special uses mainly concentrated on public transportation facilities. Then we have the green color patterns. This is another one; this is specifically to distinguish between the non-motorized traffic.

So, in the non-motorized area, we mainly have our bicycles and pedestrians. So, green markings are used to distinguish bicycle and other non-motorized traffic facilities at intersections. Green background prioritized cyclists and pedestrians in crossing the road. So, as you can see, some pictures are shown where these green markings are. So, they give priority to cyclists and pedestrians.

When motorized and non-motorized vehicles share the same carriageway, this is a very common phenomenon. The grain background lanes are preferred in that case for a dedicated lane because that will be a lane dedicated where you have a good amount of share with the bicyclist. So, green cycle boxes are also provided in dedicated non-motorized lanes because these boxes are specifically meant for bicyclists. Then the other one is your red-colored pattern. So, red markings are used specifically in hazardous locations.

The red color itself indicates a similar feature to alert road users to potential danger. So, if that is there, we can get an idea that there is some potential danger. So, some precautions may have to be taken. So, they are recommended at hazardous intersections and areas of pedestrian-vehicle conflict where there is a greater chance that some conflict may arise between your motorized vehicle and specifically the pedestrian movement; we can provide

the red color patterns there. So, the color of these markings, which are typically white, yellow, green, and red, are again used for specific purposes.

Then the second criterion, which is important in this respect, is visibility. It should have good visibility during the day and night. So, this is again not only daytime; nighttime also should have good visibility. This serves as an important aid to drivers, specifically on unlit roads. So, at night, the roads are unlit where road visual cues are absent.

So, you do not have those side queues available to you, so that is the most challenging part. So, in this particular case, the road markings are the ones that give you good guidance specifically. So, as a general requirement, a driver should be able to detect guidance markings from a distance corresponding to at least 2 seconds of travel time. So, at least 2 seconds before that particular one, it should be whatever driving speed you are going. So, considering that driving speed, it should give a distance when you are able to visualize it.

So, it says to have at least 2 seconds of travel time. So, from that particular one using my speed of travel or the design speed of the road, I can work out what the minimum preview distance should be for a driver to react. So, only because if I give a particular color or if I give a particular road marking, that should be at least visible at a distance of, here it says that if this design speed is, say, typically 100 kilometers per hour. So, the per-view distance considering 2 seconds of travel time is around 56 meters. So this far ahead, it should be visible to the driver.

So, the visibility of road markings improves with greater line thickness; whatever width you are providing, if that is greater, it increases. A higher mark-to-gap ratio you can see; this is the length that is marked, and this is the gap that is there. So, if I go for a higher mark to gap, then I increase the visibility again. The third is higher retroreflective luminance, which is there. So, this plays a role, and this should be durable enough, meaning it should be able to provide us with the required luminance during its service life; retro-reflective luminance should be available.

Hence, wider pavement markings combined with higher retroreflectivity, which can be achieved through the use of glass beads, are adopted to ensure better line detection by drivers consistent with the roadway design speed. So, this is what is very important. Now, as mentioned, retro reflection in pavement markings is mainly achieved through incorporating glass beads that are partially embedded in the marking material and also applied externally during placement, which we discussed regarding the two types of glass beads: one that can be incorporated and one that can be applied externally during placement. The quality we have seen, the gradation, and the specifications of these glass beads are important. So, it says the quality and size of beads significantly affect the retroreflective properties as they return headlights back to the driver.

So, this is an important feature that needs to be looked for in the glass beads, which play an important role in the retroreflectivity of the markings. Under wet conditions, standard glass beads are less effective. Why? Because a thin film of water is present between the bead and the light. So, it scatters. So, that is why it says that a thin water film scatters light before it enters the bead, making markings nearly invisible.

It becomes more challenging when you are driving at night and it is raining. So that is why it is always preferred that you go for bits typically of a higher size. So, it says that a minimum of 1 mm sizes of bits should be used. So, why is there a higher profile that allows them to break the water film to a certain extent so they can perform better on slightly wet surfaces? So, a higher profile allows them to protrude through the water films and maintain some amount of retro lift activity. So, these are again important key requirements, which are in terms of the visibility.

Now, as I mentioned, there may be other factors that also influence the performance of these road parking payment materials. What are those? The roadway surface over which it is applied, the amount of traffic present, and the environmental conditions, such as how regularly it rains, all play an important role. So, prior to application, whenever an application has to be made, first of all, the surface has to be cleaned and dried to ensure it is ready for the application of these road marking materials, and what is to be checked is specifically. What needs to be checked are the material composition as per the stated guidelines, the application process, and the right process for application machines. As mentioned, there are certain specific machines required when you are putting up these thermoplastic compounds.

In order to have a uniform application. The roadway surface is there; what is the current state of the surface of the road and the presence of immediate traffic? You need some curing time; if immediate traffic starts flying over it, you do not get good performance from those pavement markings. Now, as it is always mentioned what is desired from the road payment markings, the MoRTH states that the finished road marking shall be free from irregularities along the sides and the edges; they should not have any streaks and should be aligned parallel to the carriageway; they should be straight and aligned parallel to the carriageway. There are transverse markings also, but when laminated markings are present, they should be properly aligned and have a level uniform surface free from streaks, because it may lead to some kind of retention of water as well. So, we will prefer one that is level, uniform, and free from streaks. So, some of the key requirements of these road markings after laying are that the markings shall remain firmly bonded to the pavement surface and not lift up, specifically under freezing conditions.

When the temperature goes down, it should not happen that it loses its bond with the surface. The strip shall not be slippery when wet. This is again a concern because it is wide enough. So, specifically for two-wheelers, when they move over it, the surface should not

become slippery. After application and curing, stripes shall resist deformation and discoloration under traffic loads because they will be there for surface temperatures up to 60 degrees centigrade.

So, because these are the average maximum temperatures that can be experienced on a road surface, that is why 60 degrees is referred to here. The marking shall withstand contact with sodium chloride, calcium chloride, and oil drippings from vehicles without deterioration. So, these chemical agents may be present, which means they should not deteriorate. The stripes shall retain their original dimensions and positions.

They should not be distorted. The material shall possess sufficient cold ductility, specifically challenged when temperatures are low, to accommodate normal pavement movements because there may also be pavement movements, specifically some shrinkage. So, in that particular case, there is no chipping or cracking. So, these are some specific requirements from the markings after the construction. Now, what are the different types of markings specifically classified into seven categories? The seven broad categories under which the road markings are classified are based on the placement of markings with regard to vehicular movement and also on the functions of these markings.

So, there are two criteria. If one considers the placement with regard to the vehicular movement, in which direction it is along the vehicular movement, you can refer to it as a longitudinal marking. If it is across that particular one, there may be another one, and the second is what function it is serving. So, on the basis of these, the classifications are made, and there are seven main categories: longitudinal marking, transverse marking, hazard marking, block marking, arrow marking, directional marking, and facility marking. So, let us first look at the longitudinal marking. Here, they are generally provided along the traffic movement, as the term itself says "longitudinal marking," and the basic main purpose of them is to guide drivers in forward movement and to restrict overtaking at hazardous locations.

So, they allow you to move within this particular one, and they guide you to move in a specific direction. On multi-lane roads, lane boundaries marked longitudinally help prevent sideswipe and head-on collisions. So, specifically, if there is a two-lane road in this particular area moving in opposite directions, these lane markings indicate that you have to move within this specific width and preferably avoid side sweeps in that case. Longitudinal markings again include broken lines, single and double continuous lines, and continuity lines like we have on the edges; continuous lines are there to mark the pavement edges, so continuity lines are there. Broken lines may be crossed during forward movements because if there is some overtaking, you can see in this particular case that the broken lines will be crossed.

Now, in this particular case, there may be continuous lines, and the continuous lines may be single or double. So, there may be continuous longitudinal markings that consist of single and double lines, which means they should not be crossed under normal conditions. So, if I have double continuous lines that definitely emphasize compliance and reinforce that they should never be crossed. So, I can have, if I do not want any overtaking to happen, double these longitudinal lines, which indicate that they should never be crossed, specifically when there is a single line, as it prohibits crossing that particular line. A continuous yellow longitudinal marking indicates a strict prohibition, and as I mentioned when you put up the yellow ones, it further emphasizes that this is a prohibitory marking and shall not be straddled by the vehicle; the vehicle should not go out of it, so they should not take one wheel on one end and keep one wheel on the other end; that should not happen with this particular marking.

Then you have the transverse marking; this is one type of marking. Markings provided across the carriageway are specifically for traffic control, and they are in the form of broken lines, single and double continuous lines; they also come with stop markings and give way markings. So, along with it, we have the markings which are for the stop and give way in this case, and they all come under the category of transverse markings. When these are present, they are also accompanied by the traffic signs; in our lecture, we will also be discussing the traffic signs. So here you can see there is a double transverse line, and this is a single transverse line. Now these are stop markings, so specifically, these are meant to indicate that one vehicle needs to stop; these are transverse markings.

So, a stop line marks the point beyond which vehicles should not go. It is typically provided at traffic signals, pedestrian crossings, and at minor road approaches. You can see this is a minor road approach; there, this line is a transverse line provided, and so minor road approaches merge with major roads. And in conjunction with stop signs, a stop sign also needs to be provided as per the features where these need to be located, and all these are to be followed as per our IRC-35 guidelines. Two specific patterns about these stop lines or stop markings are: one is a single stop line. A single stop line shall be provided at traffic signals and before pedestrian crossings if some pedestrian crossings are present before it is needed.

It shall be a solid wide transverse line, usually 200 mm wide on urban roads and 3 mm wide on rural roads, because you have higher speeds specifically. So, this is when it is a single one, and then the double stop line is used at junctions controlled by stop signs. So, it means that the traffic has to be controlled, has to stop there, and is not used merely as a warning. It should not be used just as a warning, as in the case of your single stop line. So, where the give way marking is more appropriate, if that is the case, it is better to give the give way marking, which we will discuss in the upcoming slide.

So, it consists of two continuous lines; you can see these are two continuous lines, 200 mm wide, each line 200 mm wide is spaced 300 mm apart and shall be supplemented by a stop sign. It should be a stop sign and the word message "STOP"; you can see this is again on the carriageway. So the stop sign marked with a double line implies, and what it implies here is that a stop message is present along with the double stop line. What it implies is that every vehicle shall stop at the transverse line before entering a major road from a minor road.

So, every vehicle, that means compulsory, should stop. And they should not proceed past the line if doing so would require any traffic on the major road to alter its speed. So that should not happen; they can only enter into it when it does not lead to any disruption to the major road traffic in that case. So, this is when we have these double stop lines, which are provided as transverse lines. Then the other transverse one can be a give-way one.

So, this particular marking consists of two broken lines laid side by side. Again, each is made up of 600 mm line segments with 300 mm of gaps. These are the standard requirements according to the coder requirements of the IRC. So, the lines 200 mm wide, spaced 300 mm apart, are placed across minor roads at intersections where they are not controlled by any stop signs, traffic signals, or police when that control is not present. So, we have a symbol; this is a marking for our sign, and we also have a signboard. So, these lines are supplemented by a hollow triangle, which is shown here, and these have standard dimensions.

It is not that they all have the standard dimensions which should comply with the IRC 35 requirements. Approach marking and a roadway give signs, and there is also a roadway sign. So, this is giving a marking can be provided. Then come the hazardous markings. So, hazard markings are specifically there to guide the traffic at specific locations, especially at merging and diverging points, because when the traffic is merging or diverging.

So, at that particular point, we will try to provide and always emphasize hazardous marking, prohibit crossovers, and deflect vehicles away from hazardous locations. So, these are why they are called hazard markings, and what they normally include are the chevron markings, diagonal markings, hatching, and prohibitory markings. So, these are the special categories that are included. So being provided ahead of diverging and merging areas and hazardous locations requires strict compliance. So, they should be in strict compliance because they indicate that some hazard is present and should always be accompanied by appropriate signs because that hazard should be known to you.

So, they give you an idea that you are approaching a hazard, and this signboard will provide you with information about what kind of hazard is there. So, the preferred ones commonly used are diagonal and chevron markings that are used to demarcate the neutral area; this

can be seen in this particular case. So, in this case, you can see there is two pieces of traffic that are getting merged.

So, two lanes are merging here. So, this is the one where you have the chevron markings. You can see in this particular case they are diverging. These two are diverging in this particular case; when they are traveling in this direction, they are merging. So, these are the chevron markings which help you, and they specifically provide us with the neutral area at the rows of the channelizing island. So, you can see this is a channelizing island to the north of it, which gives a neutral island and helps you avoid vehicle collisions, specifically with the curve notch.

So, this is a wonderful advantage with these chevron markings. Now, specifically when do the diagonal markings come, you can see here are the diagonal markings. Now, in these diagonal markings, the traffic is moving in opposite directions. So, this diagonal marking shall be provided where traffic flows on either side, moving in opposite directions. So, you can see here it is moving in this direction. So, then we are going to provide, and as mentioned, there are specific requirements with respect to the width of this, with respect to the length of the diagonal marking, and with respect to the gap between these.

So, we all need to go as per the caudal requirements; just basic information is there. This is provided specifically when the traffic is moving in opposite directions. Now, we have block markings; these are specifically like zebra crossings for pedestrians, and triangular and checkered markings are there for speed breakers. So, even the given symbol, which is there, is one we have seen; this kind of symbol was present. Painted in blocks on the carriageway are classified; they come under the block markings, and depending upon the size and different uses as per IRC 35, they are abbreviated in different manners. I can give you some examples that have been mentioned here in the table, such as the abbreviation BM01.

So, this is block marking 01; this is a rectangular block. The length of it, the width of it, the gap in between, the color white, and this is what it shows. So, this is a rectangular block marking pattern that has been mentioned. So, similarly, another one where you can see this is the gap; this particular one here, the length is more.

So, this is another pattern. So, BM 071, this is for a giveaway symbol that is there. So, again, what is the length, what is the width, the gap in between is not mentioned, and what color is to be there? So, these standard dimensions and patterns are already prescribed, and the details have been made available. So, they need to go according to the specifications. So, you can see that a block marking may also be in terms of a cycle symbol. Then we have the arrow markings specifically, which are painted on the carriageways and give us the mandatory direction of traverse for the users specifically, and are classified as arrow markings.

Again, some examples here, like shown, include a straight arrow that can be there. Another one is the left arrow; this is the other one, and again the dimensions are shown: the right arrow indicates what the length should be and what the width should be. It can be a straight left arrow, which is shown here. So, these are specifically provided on the carriageway and they give us the mandatory directions of travel for the road users or for the drivers and they come under the category of arrow marking. Now, in the directional markings specifically, they are able to convey the direction-related instructions to drivers. So, I can say that if I want to convey that you need to stop, you need to slow down, and you need to have a speed limit.

They can be grouped under the directional markings you can, and these are some of the peaks that show, and again they are abbreviated as per their different requirements in terms of their width, size, and color, which they are trying to indicate. So, like DM, the directional marking DM01 represents information about the stop, including its width, height, and color, which is to be provided. So, here you need to stop because the information is given directionally. We can have information related to slow down.

We need to have a keep clear, specifically when there are school zones or if there is a no entry sign. So, these are directionals which give you information that directional instructions are there that you need to stop or you need to slow down; you have to have control over your speed limits. And the last one is your facility markings, which are there. So, which specifically gives information related to word messages where the information is provided through word messages for buses, cyclists, and persons with disabilities. So, there may be one if a dedicated bus lane is there; it can be written as a bus lane.

So, it is a facility; it is a bus lane. So, it can be mentioned in this manner. And when disabled, there may be a particular lane that can be there for disabled people. So that can also be marked, and a dedicated lane for taxis; you might have seen it many times at airports. So, these are all different abbreviations that are marked under the facility-related markings. So, these are some of the basic information related to the different types of pavement markings and their construction that we do for road construction. Thank you so much.