

## **SHORT QUESTIONS:**

### **1. What are the road equipment's?**

The most important tools for road construction are as follows:

**(from below write any 4 of your choice as it is for 2M)**

#### **Motor Grader:**

Motor grader, also known as a road grader is used to surplus or flatten the surface. The equipment is so powerful that it can flat even rockery or earthen surface in no time. The motor grader generally consists of three axles. This machine is very important as it fastens the work and helps to complete the construction project quickly.

#### **Road Roller Machine:**

Road roller machine is used soon after asphalt is laid down on road. The equipment is rolled to compact the asphalt. Mostly, three wheels are there in the machines. Some road roller machines are built in two wheels only -both in hard metals. The wheels play a significant role in compacting the asphalt. It needs water on the wheel when it rolls on the asphalt. The type of roller machines used in road construction project depends on the specific projects.

#### **Asphalt Mixing Plant:**

Asphalt Mixing Plant is another important road construction equipment. If the project is a large one, then the asphalt mixing plant is set on the road construction site. In this process, the concrete asphalt including other materials including macadam and coated roadstone are mixed together in correct proportion. Once the product is ready, it is used for building the road.

#### **Forklift Truck:**

The forklift truck (also known as fork truck or lift truck) was initially designed to lift or move objects in large manufacturing companies or factoriesThe truck

equipped with an attached prolonged platform helps to pick an object laying on or below the ground and move it to the destination. It can lift heavy materials and take it to anywhere within the construction site and therefore can fasten the road construction project.

### **Crawler Excavator:**

It's a heavy construction equipment used to excavate paved rocks & clay and load onto a dump truck. In fact, it serves many purposes like digging earth, excavating rocks and clay or move rocks or soil from the construction sites.

### **Truck Crane:**

Truck crane helps to do number of things including loading/unloading heavy industry material to lifting heavy products and much more. Generally, cranes comes-attached back to the trucks lorry and it works to lift construction equipment to the construction site.

### **Wheel Loader:**

Wheel loader is one of the must-have equipment for most of the construction sites. This is much like a tractor and it can live and move a pile of materials including clay, soil, stones, rocks, etc. from the ground and load it on to a dump truck. It is popular for removing, lifting and loading things without spreading it out.

## **2. Explain Post Accidental Care?**

**(select some points from each side-heading given below)**

A few guidelines and steps are outlined below to help guide you on what to do, in case you ever find yourself in such a situation, where you may need to move an injured person for safety reasons:

### **First Step of Action:**

- Anytime you are in a situation where you have either witnessed an accident or happen on an injured person, the first step is to call for professional help - dialling the police (dial 100) and the ambulance (dial 108), so as to get professional help to the spot as soon as possible.
- Before you go towards the injured person / accident spot, you need to take a few precautionary steps to ensure your own safety. Scan the area and make sure it is safe for you to enter and provide assistance.
- You need to remain calm so as to be able to take informed and rational decisions, in order to help the accident victim(s).
- Talk to the injured person and explain to them what has happened.
- Tell them that they need to stay calm and not move, to prevent any further injury to themselves.
- Inform them that you will stay with them till help arrives.
- While talking and reassuring an injured person, you should stay alert to the safety of the environment and in case the situation changes, then it may be necessary for you to move yourself and the injured person (s) to a more safe area to wait until help arrives.

### **Possible Situations When an Injured Person Needs to be moved:**

- It is possible that a person may have minor injuries or may not be hurt, in which case the person may be able to move themselves.
- However, if there is immediate danger of any kind, like an unsafe accident spot, risk of explosion, fire, a collapsing structure, traffic hazard or lack of oxygen, then an injured person(s) will need to be moved.
- When a more seriously injured person is underneath another injured person with not so serious injuries, then you may have to move the less injured person to reach the seriously injured person to provide immediate care.

- In case somebody may need CPR, then it is important that they are lying on a flat surface, so in that event, an injured person has to be moved.

### **Moving an injured person:**

- When moving an injured person, avoid as far as possible, from either twisting or bending them.
- If they are lying on the ground, place your hand on the neck of their shirt or upper garment and use your forearms to cradle their head. Then pull the shirt or garment to drag them in a straight line to a spot or place where they will be safe.
- They can also be dragged by their feet, but do ensure to keep their head, neck and spine straight while dragging them. It is very important to keep the person straight and flat, in the event the injured person has neck pain or back pain. Drag the person in a straight line to a safe spot.
- If a hard long board or plank of wood is handy, then the injured person can be log rolled onto the plank or hard board and carried to a safe spot. For this type of action, a minimum of 4 to 5 people are needed to move the person. Place the board or plank on the ground. Then one person will need to hold the neck and head straight, while the other 3 people roll the injured person on to the plank of wood or hard board, on to the injured person's side. The person at the head will count to three and all the others should roll the injured person towards them at the same time, while the person at the head, turns the head to align it with the position of the rest of the body. Step two, once again the person at the head will count to three while all the others roll the body onto the person's back, and the person at the head simultaneously aligns the head to the body's position.

### 3. Explain Traffic Signals?

**Traffic lights** (or **traffic signals**) are [lights](#) used to control the movement of [traffic](#). They are placed at [road intersections](#) and [crossings](#). The different [colors](#) of lights tell [drivers](#) what to do.

In some cases, traffic signals also indicate to drivers when they may make a turn.

These signals may be operated manually or by a simple timer which allows traffic to flow on one roadway for a fixed period of time, and then on the other road-way for another fixed period of time before repeating the cycle.

#### **TYPES OF THE TRAFFIC LIGHTS/SIGNALS:**

[Red](#) light on: This tells drivers to stop.

[Yellow](#) light on: This tells drivers to slow down & be ready to stop.

[Green](#) light on: This means the driver can start driving or keep driving.

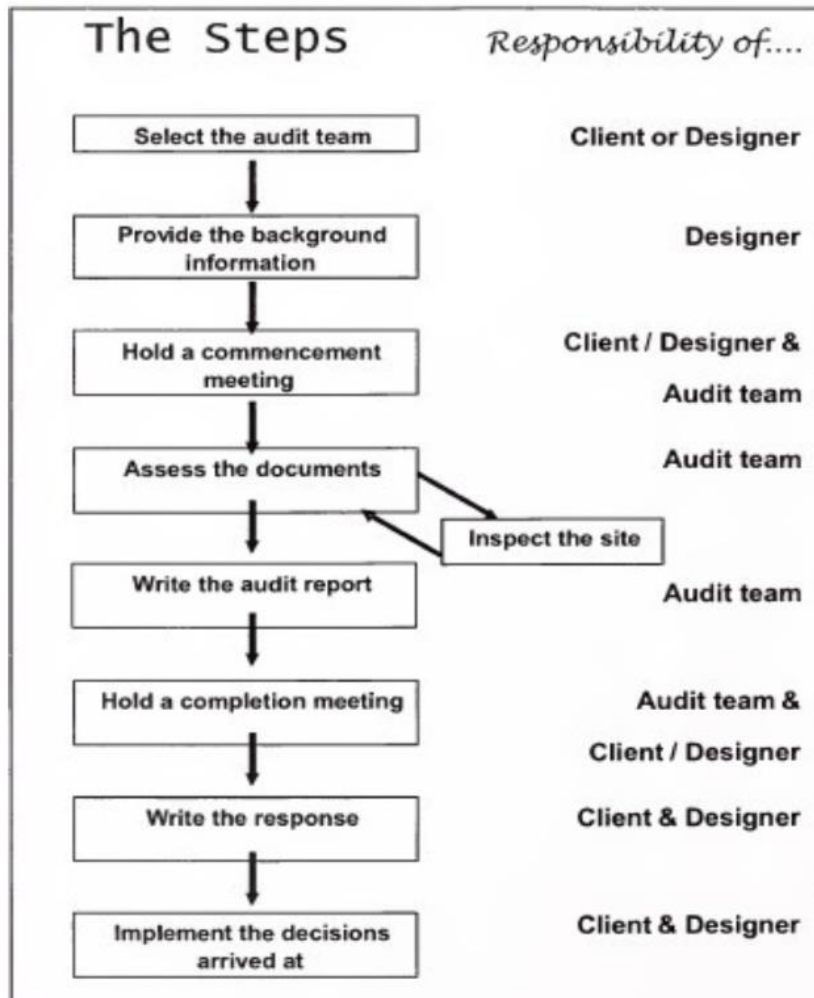
### 4. What Is Road Safety Audit Process?

A Road Safety Audit (RSA) is the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team.

A key feature of a road safety audit is the use of a team of professionals with varied expertise.

The team should include highway safety engineers, highway design engineers, maintenance personnel, and law enforcement. Additional specialties should be added to the team as needed.

Ans. : Steps involved in Road Safety Audits Process are:



## 5. Explain Pavement Marking?

Pavement Markings are defined as the markings used on paved roadways to provide guidance and information to pedestrians and drivers.

The majority of the pavement markings are white or yellow in colour.

All pavement markings should be accurately maintained to provide good daytime and night-time visibility.

Once a municipality has been deciding to install a marking, it is their liability to maintain it. If the municipality has decided that the marking is no longer needed, documentation of the selection process should be recorded.

Following are different types of pavements marking used:

1. Longitudinal Markings.
2. Yellow Center Line Pavement Markings & Warrants.
3. White Lane Line Pavement Markings.
4. Edge Line Pavement Markings.
5. Raised Pavement Markers (Rpm).
6. Roundabout pavement markings

## **LONG QUESTIONS:**

### **1. Write About Redesigning Junction & Cross Section Improvement?**

#### **I. Redesigning Junction:**

Many factors affect accident occurrence at intersections, including traffic volume, traffic control, and frequency of access points, the number of legs, the speed limit, the median type and width, the number of traffic lanes, the existence of turn lanes, and the lighting level, as well as human factors. As such it is very critical that the intersections be properly designed.

#### **Various factors affecting intersection Design:**

##### **(i) Human Factors:**

The driver: Driver performance on the road and highway is important for the design and its operation. The success of design depends on how efficiently and safely drivers use the highway. Driver should be able to interpret the crossing and movements of the other vehicles. The designer of

these intersection points should always keep in mind the limitation of the user and the intersection design should meet the standards and codes based on which it is designed.

The Bicyclist: Experience, capabilities and skills of the Bicyclist affects the design of intersection .Design should be helpful for the Bicyclist in understanding the traverse of the intersection

The Pedestrian: Pedestrian usage of the intersection effect the design .The time in which they will cross the intersection , their physical ability , age all factors affect the design

**ii) Traffic Considerations:** Factors like size and type of the vehicle affects the road design standards too .The operating difference of the vehicle should be included in the design.

**iii) The Physical Environment:** Special focus should be given at the designing time while considering the physical environment features like rural , urban and industrial areas.

**iv) Other Factors:** At intersection point there are varieties of conflicts on regular basis like truck, pedestrians, transit, bicycles. These conflicts plays a vital role in preparing the design of the intersection .Conflicts should be resolved in design for a very small area. Design should focus on Convenience, Comfort and Ease of the various human factors and vehicles. Safety and mobility of the vehicles should be kept in mind at planning phase too.

- For poorly maintained vehicles, with lower braking and acceleration capability a 'dilemma' zone may occur at traffic signals at the end of green stage, as the driver is unable to stop in time or accelerate clear of the junction. Here a longer inter-green should be considered.
- The roundabouts have usually been found the safer form of control, as they are better able to cope with large right turning volumes.



- Potential conflicts between vehicle paths at junctions underlie accidents. Reduction in number of conflict points can potentially reduce the accidents to a great extent.
- On junction involving a major road and minor road, it is customary to control traffic on the minor road by STOP or GIVE-WAY sign or/and road markings. Such junctions are known as 'Priority Junctions'.

### **Speed change lanes (acceleration/deceleration lanes)**

- They are warranted on high speed, high volume roads from accident and delay considerations. They should be of sufficient width and length to enable a driver to manoeuvre vehicle onto it and then reduce or raise speed to that of the turning roadway or through traffic stream.

### **Median shelters**

- On dual carriageway roads at the design stage it is beneficial to consider widening the medians, not only to incorporate any offside diverging lane on the major road, but also to provide shelter for right turning vehicles from the minor roads, so that the gap acceptance decision is split into two easier stages.

### **Corner islands**

- These gives turning guidance to drivers and are often used in conjunction with speed change lanes. If corner island area  $> 4.5 \text{ sq.m}$ , then the island should be raised. Avoid large islands delineated only by pavement markings. Corner islands assist pedestrians in crossing wide areas of pavement at busy junctions.

### **Corner radii**

- On curves, the rear wheels of vehicles track inside the front ones. On open highway curves the effect is pronounced and for a 3.65m lane width, in UK pavement widening is only required on curves of radius  $< 150\text{m}$ . On intersection curves, where generally radii are smaller, the effect is more pronounced.

- An appropriate design vehicle should be chosen (e.g. a 15.5m articulated vehicle on collector or arterial roads in the UK) and its track width on different turning radii and lock (steering angle) determined. Templates have been used in the past based on these track widths to determine suitable corner radii. Computer programmes, such as Auto Track etc. are available simulate turning vehicles at junction.
- Not only should adequate corner radii be provided, but the design vehicle track width should be used to ensure that turning paths from the major road do not conflict with waiting vehicles on the minor road.

## **II. Cross Section Improvement:**

Road Cross-Section elements are those features of a roadway which forms its effective width.

### **1. Lane Width or Highway Travel Way:**

The width of the surfaced road and the no of lanes should be adequate to accommodate the type and volume of traffic anticipated, the assumed design speed of vehicles and in meeting oncoming vehicle or passing slower ones. As traffic density, vehicle speed and truck widths have increased, two lane highway have also increased in width from 16' to the current recommended value of 24' width.

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### **2. Median Strip for Divided Highway:**

A median is the element of a divided roadway that separates the lanes in opposing directions. In order to provide positive protection against a conflict with opposing traffic, median strip are provided on divided highways.

Median is an important component of cross section of roads.

Advantages of Median of a road

Are given as:

1. The chance of accidents producing head on collision over a narrow median is reduced. So road medians provide separation between the two directional traffic.
2. Headlights glare from opposing traffic is less troublesome.
3. At intersection, a wide median provides refuge from crossing traffic and a safe waiting place for traffic taking turns.
4. Space for road furniture
5. Storage lanes

### **3. Shoulders in Highway Cross Section:**

In the cross section of roads it is that portion of the roadway between the outer edge of the outer traffic lane and the inside edge of the ditch, gutter, curb or slope. Shoulders are provided for the safe operation and to allow the development of full traffic capacity. Shoulder also provides a place for vehicle to park in emergency e.g. for changing tires. Shoulders also function to laterally support the pavement structure.

Turfed shoulders are provided in areas with sufficient rainfall.

Slope of the shoulder should be greater than that of pavement shoulder with high type surface.

### **4. Road Camber or Cross-Slopes:**

The slope provided to road surface in the traverse direction to drain off rainwater from road surface is called cross-slopes.

The different shapes of cross-slopes are given below:

- i. Parabolic
- ii. Straight line
- iii. Combination of straight and parabolic line

### **5. Side Slopes in Roadway Cross Section:**

Side slopes are provided on embankments and fills to provide stability for earthworks. They also serve as a safety feature by providing a recovery area for out-of-control vehicles.

FLAT SLOPES are preferred because it provide:

1. Safe operation.
2. Decreased road maintenance.

STEEP SLOPES in cross section of roads erode badly, require high maintenance cost and slopes will be unsightly.

## **2. Explain Safety Provisions For Pedestrians, Cyclists & For Workers At Construction Site?**

### **I. SAFETY PROVISIONS FOR PEDESTRAINS:**

Pedestrians are the most vulnerable road-users. They account for over 25% of road accident deaths and injuries in India.

Some of the safety provisions for pedestrians are:

1. Footways or footpaths (including any path along the side of a road) should be used if provided. Where possible, avoid being next to the kerb with your back to the traffic. If you have to step into the road, look both ways first. Always show due care and consideration for others.
2. If there is no footway or footpath, walk on the right-hand side of the road so you can see oncoming traffic.
3. Help other road users to see you. Wear or carry something light-coloured, bright or fluorescent in poor daylight conditions. When it is dark, use reflective materials (for example; armbands, sashes, waistcoats, jackets, footwear), which can be seen by drivers using headlights up to three times as far away as non-reflective materials.

4. Young children should not be out alone on the footway, footpath or road. When taking children out, keep them in between and hold their hands firmly.
5. When crossing the road, look out for traffic turning into the road, especially from behind you.
6. Where there are barriers, cross the road only at the gaps provided for pedestrians. Do not climb over the barriers or walk between them and the road.
7. Take care when crossing bus & cycle lanes as traffic may be moving faster than in other lanes.
8. You must not get on to or hold on to a moving vehicle.
9. There may be special signals for pedestrians. You should only start to cross the road when the green figure shows.
10. If an ambulance, fire engine, police or any other emergency vehicle approaches using flashing blue lights, headlights and/or sirens, keep off the road.
11. A footway or footpath may be closed temporarily because it is not safe to use. Take extra care if you are directed to walk on or to cross the road.

## **II. SAFETY PROVISIONS FOR CYCLISTS:**

- Keep cycle in working condition. Check brakes, tyre, air pressure, bell light and chain before you ride it.

- Obey traffic signals. While taking turns watch out for traffic and give signal by hand.
- Do not overload. Cycle is for one and maximum for two.
- Move on the left side of the road.
- Avoid overtaking. Be in single file if the road is narrow.
- No acrobatics on road, keep both hands on the handle bar.
- If available use only cycle tracks.
- Remain constantly alert on the roads.
- Wear bright clothes and have bright light at night.
- Wear a helmet.
- Know the weather forecast.
- Carry a cell phone and ID.
- Bring drinking water for longer rides.
- Be vigilant at intersections.

### **III. SAFETY PROVISIONS FOR WORKERS AT CONSTRUCTION SITE:**

#### **Occupational Safety and Health Administration (OSHA)**

From a regulation perspective, OSHA imposes regulations for employers to provide a safe workplace. This includes:

- Ensure that construction sites are free of recognized hazards as much as possible.
- Examine working conditions to ensure they comply with OSHA standards.

- Provide safe tools and equipment and maintain them to the best possible standard.
- Ensure accurate warnings are in place to highlight potential hazards to workers, including colour codes, posters, or labels.
- Have in place clear operating procedures which are updated as required and communicated clearly to employees.
- Ensure that training is given before any work is done on site, and that training is provided in a language and vocabulary that workers understand, which is especially important given the high percentage of immigrant workers in the construction industry.
- Have a hazard communication program if employees work with hazardous chemicals.
- Provide medical exams and training.
- Wear your PPE all the times.

### **3. What Are Road Safety Improvement Strategies & ITS?**

#### **I. ROAD SAFETY IMPROVEMENT STRATEGIES:**

- Seatbelts are the basic safety measure that can save lives by just using them correctly.
- Take some time out to check your vehicles for leaks and regular maintenance. Do check tyres which are the basic contact patch to the road.
- We are not saying that you should buy a very expensive helmet but do research which one offers safety.

- Child seats are designed so as to provide added protection to kids. These are effective only if used properly.
- Phone usage should be strictly avoided while driving the car.
- Drinking is very dangerous while driving. Avoid it.
- Lane discipline should be enforced heavily as the traffic department can now monitor a lot of things through CCTV cameras.
- **Do not cross the speed limits:** The goal of setting a speed limit is to ensure the safety of passengers in the vehicle as well as pedestrians. Besides, driving at high speed, even on roads with less traffic, may result in the driver losing control or a sudden brake fail, thereby causing an accident.
- It is necessary to take utmost care while driving during bad weather.
- As a driver, it becomes your responsibility to make way for emergency vehicles

## **II. INTELLIGENT TRANSPORT SYSTEMS (ITS):**

Intelligent Transport System (ITS) aims to achieve traffic efficiency by minimizing traffic problems. It enriches users with prior information about traffic, local convenience real-time running information, seat availability etc. which reduces travel time of passengers as well as enhances their safety and comfort.

The use is not just limited to traffic congestion control and information, but also for road safety and efficient infrastructure usage.

One such example is the city of Glasgow. In the city, Intelligent Transport System gives regular information to the daily passengers about public buses, timings, seat availability, the current location of the bus, time taken to reach a



particular destination, next location of the bus and the density of passengers inside the bus.

### **Application areas of Intelligent Transport System:**

The entire application of ITS is based on data collection, analysis and using the results of the analysis in the operations, control and research concepts for traffic management where location plays an important role.

Some of the applications are:

1. Real-time parking management
2. Electronic toll collection
3. Emergency vehicle notification systems
4. Automated road speed enforcement
5. Speed alerts
6. RFID in freight transportation
7. Variable speed limits
8. Dynamic traffic light sequence
9. Collision avoidance systems

### **How Intelligent Transport System works?**

Traffic Management Centre (TMC) is the vital unit of ITS. It is mainly a technical system administered by the transportation authority. Here all data is collected and analyzed for further operations and control management of the traffic in real time or information about local transportation vehicle.

#### **1. Data collection**

Hardware: sensors, cameras, GPS

Data type: traffic count, surveillance, speed and time, location, vehicle

weight, delays etc



## **2. Data Transmission**

Rapid and real-time data transmission between the road and Traffic Management Center(TMC)



## **3. Data Analysis**

Error rectification, data cleaning, data synthesis and adaptive logical analysis



## **4. Traveler Information**

Rapid and real-time data transmission between the Traffic Management Center (TMC) and the traveller



## **5. Intelligent Information**

Real-time information like travel time, travel speed, delay, accidents on roads, change in route, diversions, work zone conditions etc.

delivered by a wide range of electronic devices like variable message signs, highway advisory radio, internet, SMS, automated cell.