



Study on Various Types of Structures in Project of Six laning of Vijayawada bypass from China Autupalli (Design Ch. 0.000) to Gollapudi (Design Ch. 30.000) in Vijayawada - Gundugolanu section of NH-16

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ABSTRACT

This is learning based training. This is about Flexible Pavement Highway construction with the process of laying different layer, including lab & site tests for different layers and aggregates and different types of structures like bridges, VUP, ROB present in National Highway. Highway is a main road, especially one connecting major towns and cities. It is any public and private road or other public way on land. It is used for major roads, but also includes other public roads and public tracks. In INDIA highways are made by NHAI (National Highway Authority of India).

Keywords: Highway, NHAI, Wet Mix Macadam, Dense mix Bitumen Macadam, Bitumen Concrete, IRC

1.INTRODUCTION

The Government of India has taken up a massive program of up-gradation and development of National Highways. As a part of this program, the National Highways Authority of India (NHAI) has been entrusted with the **project stretch (Package III) which aims in serving as a bypass for Vijayawada city starts near Chinna Avutapalli village (Km 0.000) on NH-16 and ends near Gollapudi village (Km 30.000), Krishna District in the State of Andhra Pradesh** to 6-lane with paved shoulder configuration.

Krishna district is an administrative district in the Coastal Andhra region of the Indian state of Andhra Pradesh. Machilipatnam is the administrative headquarters and Vijayawada is the most populated city in the district.. It is bounded by West Godavari on the east, Bay of Bengal on the South, Guntur and in the west and a portion of it also borders with the state of Telangana. The project consists of " Independent Engineer Services for supervision of Six laning of Vijayawada bypass from China Autupalli (Design Ch.0.000) to Gollapudi (Design Ch.30.000) in Vijayawada – Gundugolanu section of NH-16 in the State of Andhra Pradesh under Bharatmala Pariyojana on Hybrid Annuity Mode (Package-3) Total length of project is 30.000 km (6 Lane Length) from [Design Ch.0.00] to [Design Ch.30.000].

Project Features

Description of Item	Unit	Scope of the Project
<u>Highway:</u>		
Highway	Kms	30.00
Carriageway	Lane	6
ROW	Mts	60
Service Roads	Kms	11.17
RE Wall	Kms	11.17
Toll Plaza	No's	1
Truck Lay Bays	No's	2
Intersection	No's	1
<u>Structures:</u>		
Major Bridge	No's	3
Minor Bridge	No's	10
ROB	No's	2
VUP	No's	6
Fly Over	No's	2
LVUP	No's	11
Box Culverts	No's	42
Pipe Culverts	No's	44

MAJOR BRIDGES:

A major bridge is a bridge which has a length of more than 60 meters. According to Indian Road Congress which is established in december1934, a bridge which have a length more than 60m is considered as a major bridge. In simple words a bridge having more than two spans can also be considered as a major bridge.

Minor bridges: A minor bridge is a bridge which has a length ranging from 6 meters to 60 meters. This is also choosed by the IRC and it's a rule that only a bridge is called as a minor bridge when it has a length between 6 meters to 60 meters. A bridge which have 2 spans or less than 2 spans is called as a minor bridge.

COMPONENTS OF BRIDGES:

A bridge is a structure which is a combination of different types of elements and if any of the element fails, it leads to the failure of the whole bridge. Every component of the bridge plays a key role for keeping the bridge stable. From the foundation to the girders every component is very important in the bridge construction

1.PILE FOUNDATION: A pile foundation, which is a type of deep foundation, is a thin column or long cylinder composed of materials such as concrete or steel that is used to support the structure and transfer the load at a desired depth using end bearing or skin friction. Pile foundations are a type of foundation that is quite deep. They are composed out of long, slender columnar parts that are usually made of steel or reinforced concrete, but can also be made of wood. When the depth of a foundation exceeds three times its width, it is referred to as stacked.

2.PILE CAP: A pile cap is a thick concrete pad that sits on top of concrete or timber piles placed into soft or unstable ground to give a sufficiently secure foundation. The load of the building is distributed into the piles by the cast concrete pile top.

3.WING WALL: The wing walls of a bridge operate as retaining walls and are near to the abutments. They are usually made of the same material as abutments. The wing walls can either be joined to or separate from the abutment. The earth filling of the approaches is kept in place by wing walls at both ends of the abutments. Their design is determined by the nature of the embankment rather than the type or components of the bridge. The wing walls, which can be at right angles to the abutment or splayed at varying angles, hold the soil and fill that supports the roadway and approach embankment. The wing walls are usually built at the same time as the abutments and using the same materials.

4.ABUTMENTS: An abutment is the substructure that supports the superstructure of a bridge span or dam. Abutments at each end of a single-span bridge offer vertical and lateral support for the span, as well as acting as retaining walls to prevent lateral movement of the bridge approach's earthen fill. Piers are required in multi-span bridges to support the ends of spans that are not supported by abutments. Dam abutments are typically the walls of a valley or canyon, but they can also be man-made to support arch dams like Japan's Kurobe Dam.

5.PIER: A pier is a sort of construction that supports the superstructure of a bridge while also transferring weights to the foundation. Bridge piers can be built to be both visually appealing and structurally sound in order to handle both vertical and horizontal loads. If the bridge spans water, it also does not obstruct water movement or tide. Concrete, stone, or metal piers can be used to construct bridge piers. Because metal rusts in water, concrete is typically specified as a building material if the pier is submerged in water. It is created in a variety of places, including waterways and dry plains where highway systems are established as overpasses.

6.PIER CAP: A bridge's pier cap, also known as a headstock, is a component that distributes loads from the superstructure to the piers. The pier cap provides enough seating for the bridge girders while also dispersing the loads from the bearings that are installed on them to the piers. Pier caps should not be extended up and across the girder's outer face if at all possible. This adds unneeded complexity and raises the level of difficulty. The pier cap appears to be supporting the deck. The pier top should be the same width and shape as the pier column wherever possible.

7.BEARING: A bridge bearing is a component of a bridge that serves as a resting surface between the bridge piers and the bridge deck. A bearing's aim is to allow for regulated movement and hence lessen the stresses involved. Thermal expansion and contraction, creep, shrinkage, and fatigue due to the qualities of the bearing's material are all possible causes of movement. There are a variety of bridge bearings that are utilized depending on a variety of parameters such as the bridge span, loading circumstances, and performance specifications.

8.GIRDER: A girder is a type of support beam used in bridge and building construction. It's the major horizontal structure that holds smaller beams in place. Girders typically feature an I-beam cross section with two loadbearing flanges separated by a stabilizing web, although they can also have a box, Z, or other shape.

FLY OVER BRIDGE

Objective:

A flyover bridge is a type of bridge that is built to allow passage over a barrier while avoiding impeding the path below. A fly-over bridge, often known as a fly-over, aids in streamlining traffic control. To cut down on journey time. We can reduce journey time with the use of fly over. An overpass, sometimes known as a flyover, is a high-level road bridge that spans a highway interchange or intersection. It is a structure that connects two or more sites separated by accessible routes or a constructed structure in order to reduce traffic congestion and allow for faster travel. The distinction between a bridge and a flyover is dependent on the function for which they are used and the place in which they are constructed. Bridges are constructed to connect two sites separated by a natural feature such as a valley, river, sea, or other body of water. Depending on the width of the valley or river, they can be quite long. Construction over a river is time-consuming since the foundation must be laid on the riverbed. Bridges are typically constructed for trains, buses, and automobiles.

Flyovers:

It is a structure that connects two or more points separated by an accessible route/s or a man-made structure in order to reduce traffic congestion and allow for speedier travel. They're frequently built above traffic intersections, roads, and streets, among other things. The name implies that you are flying above a congested area. They're usually made for vehicles on the road.

SPECIFICATIONS: A Fly over is a type of major bridge, which is of 320 m length with 32 spans, 10 m per span. It consists of a deck slab, longitudinal girders, cross girders, deck beam, pier and foundation. For a fly over a vertical clearance of 4.2m is adequate. The height of a fly over should be a minimum of 4.2 meters, so that any heavy vehicle can easily travel in the service roads that are below it, or can pass through the ways that are present below it. The Fly over bridge should be constructed in a very careful manner by taking necessary precautions, because if any of the part of a fly over fails, it leads to a very massive destruction. The arrangement of deck slab, over the bearings of the girder should be in a proper manner and the camber should be provided correctly to the pedestrians that are provided to the girder.

ADVANTAGES: There are many advantages by constructing a fly over. They are We can easily travel from one place to another place. We can skip the traffic jams because of fly overs. We can minimize the travel time and reach the destination before the stipulated time. A fly over is like a shortcut between two places. We can save fuel as fly over is a shortest path compared to the existing road. As a fly over connects to several places of a city, so we can go to our destination very easily with the help of fly overs. The above picture is a flyover which has connections to various places, so we can reach our destination very easily.

RAIL OVER BRIDGE

OBJECTIVE: Rail over Bridge is a type of bridge that allows traffic to pass over a railway. It is built in order to reduce the traveling time of road traffic and as well as trains. This will help in increasing the speed of traffic. As the Rail Over Bridge is constructed above a railway lane, so it helps avoiding the stopping of road traffic during passing of trains. The rail over bridge is designed to allow the road traffic to pass over the railway line. The designing and construction of rail over bridge is one of the major structure in road ways and railways. A Rail Over Bridge is constructed over an existing railway line, which helps by minimizing the travel time, by skipping the railway track that is present in an existing path. A Rail Over Bridge is similar

to a Fly over but the difference between the fly over and Rail Over Bridge is that, for a fly over there will be a existing road which is also called as a service road below it, while coming to Rail Over Bridge, there will be an existing railway track below it.

SPECIFICATIONS: As we know that Rail Over Bridge is a type of Bridge that is constructed over a railway line in order to decrease the time of travelling, and also due to the presence of a Rail Over Bridge, the trains can also move fast, as there will be no obstacle for them in their path. As everything needs dimensions in order to plan or construct at a particular place, while coming to Rail Over Bridge, the height should be a minimum of 4800mm, this is called as FOOT OVER BRIDGE. In case of restricted height of existing overhead structure, the minimum height above rail level shall not be lower than 5070mm in case of Heavy Overhead Structure (such as Road Over & Flyovers) and 5270mm. The construction of a Rail Over Bridge should be done in a careful manner, because as it done over a height above than 4m, it may lead to death of workers, so proper precautions should be taken.

UNDER PASS

OBJECTIVE: A Under pass is one of the bridge, which have only single span. The passage which is created along the cross-section of a bridge or fly over, which helps in crossing of vehicles or pedestrians or any other to move from one side of a bridge to other side is called a Under pass. Under pass is a very useful way, which helps to save the time of travel by helping to simply cross through it rather than going to the starting point and taking U-turn. A under pass in simple words can be explained as the way of passage which is provided below the bridge or fly over is called an Under pass. In the under passes we have different types and based on the requirement we equip and construct the type of under pass that we needed.

SPECIFICATIONS: As everything will have some sort of specifications, there are certain specifications for the Under passes also i.e, it should contain a certain height, in order to match the criteria of the vehicles that are passing through it, from one side to another side. Based on the requirement we need, we construct different types of Under pass by providing certain heights to the underpass.

TYPES: As there are many types of underpasses which are constructed in order to fulfil its requirement, they are
Vehicular Under Pass

- Light Vehicular Under Pass
- Pedestrians Under Pass
- Cattle Underpass

1.Vehicular Under Pass: This a Type of Under Pass through which any type of vehicle i.e, including heavy vehicles can be passed through them. The vertical clearance that is the height of a Vehicular Under Pass should be 5.5 meters.

2.Light Vehicular Under Pass: This is also a type of Vehicular Under Pass but the difference between Vehicular Under Pass and Light Vehicular Under Pass is, In Vehicular Under pass, heavy vehicles passage can be done, but in Light Vehicular Under Pass, the heavy vehicles are restricted. The vertical clearance nothing but height of a Light Vehicular Under Pass should be 4 meters.

3.Pedestrian Under Pass: It is a type of Under Pass through which only Pedestrians can walk from one side to another. The height of a Pedestrian Under Pass should be a least of 3 meters. **4.Cattle Under Pass:** This is also a type of Pedestrian Under Pass, but the difference is through this underpass, cattle movement takes place. **The height of a Cattle Under Pass** should be a minimum of 3 meters.

ADVANTAGES:

The benefits of an underpass include:

- Easy passage from one side to the other
- Reduced accidents
- Reduced travel time
- Fuel savings

CULVERTS

i. OBJECTIVE: A culvert is a sealed conduit or tunnel that transports water from one location to another, usually from one side of a road to the other. Culverts are often box-shaped, circular, or elliptical in cross section. Rainwater runoff can also be channeled along, under, or away from highways using culverts. The difference between a bridge and a culvert is that a bridge is designed to allow water to travel over an obstruction such as a road, whereas a culvert is designed to allow water to pass beneath an impediment such as a road. A culvert is a waterway that has a base over which the water runs for the advantage of the water. A bridge is a structure that allows traffic to travel over and provides a base for that movement. A culvert is a structure that directs water around an obstruction or through a subterranean waterway. A culvert is a pipe, reinforced concrete, or other material that is typically embedded such that it is surrounded by dirt.

ii. SPECIFICATIONS: Culverts can be made of a variety of materials, such as cast-in-place or precast concrete (reinforced or unreinforced), galvanized steel, aluminum, or plastic (typically high-density polyethylene). Composite constructions are made up of two or more materials. Open-bottom corrugated steel buildings, for example, are frequently erected on concrete footings. Construction or installation of a culvert causes disruption of

the site's soil, stream banks, or stream bed, which can lead to unintended consequences like scour holes or bank slumping near to the culvert construction.

Culverts are classed according to their load capacity, water flow capacities, life spans, and bedding and backfill installation needs.[2] When designing, engineering, and specifying culverts, most agencies follow these guidelines. Culverts must be sized and installed correctly, as well as protected against erosion and scour. If the length of a construction is shorter than or equal to 6 meters, it is referred to as a culvert.

TYPES: There are two types of culverts. They really are.

- 1.Culverts in boxes
- 2.Culverts for Pipes

1.Box Culverts: Box culverts are four-sided concrete culverts that are extensively used. A short-spanbridge is known as a box culvert (over highways, waterways, railways, for golf courses, etc.). Stormwater, sewage, and industrial pollutants can all be transported using box culverts (storm drains). Larger box culverts can be built to meet higher flow rates and capacity.

2.Pipe Culverts: A pipe culvert is a pipe that is placed in an excavated trench to transport water away. It's the most popular type of drainage system. This style of culvert is particularly popular due to its low cost and ease of installation. Pipe culverts are found in different shapes such as circular, elliptical, pipe arch etc. Generally, the shape depends on site conditions and constraints. Pipe culvert is generally used in order to provide supply of water to the fields, and are placed below the ground surface in order to provide oath for the vehicles.

CONCLUSION

1. By constructing the nation from chinna autupalli to gollapudi which was in the range of 30kms Will reduce the time and distance for road users
2. Also reduce the traffic and pollution in Vijayawada
3. If we do not constructed the road properly during the construction them maintenance cost will increase for the company so during construction only the engineer should check everything in the site

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