

Design Consideration of Underpass type of Bridge Structure As per Indian Standard

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Abstract - Bridge is most useful structure for highway Structures and under pass structures in without any obstruction of Crossing Road Traffic, and easily flow out the traffic on main road. In Bridge structures, many type of vehicles like small vehicles, light vehicles and heavy vehicles are flowing in every time, so main concept of bridge is how to become a safe under various types of loading condition of vehicles in one direction. In this paper shows the Design consideration for Design and construction of Underpass Bridge Structure. Generally, the load of vehicles is Both side disperse in 45 degrees from edge of tire of vehicle in both longitudinal and lateral directions. The dispersion of vehicle is effect on the underpass Structure and other factor like geometry, windload, Earthquakeload, friction forces, materials, construction method, and aesthetics this are all the factor is considered and design the underpass Structure. The underpass structure in VUP and PUP Structure are used with Box Type Structure and Directly Supported on Soil. If Available SBC is low then Span width is prefer to increase and Flyover Type Structure in Superstructure is supported on Substructure and Substructure is Supported on the foundation. The load is Transfer from the Deck Slab to the Pier and Abutment via longitudinal Girder and then Directly load Transfer to soil from Foundation of Structure/ The design of underpass is generally used with RCC, and Construction cost is low as compare to other type of Large Structure. This type of Structure Through get much more advantage without disturbing the traffic and provide proper safety in this type of structure. Here in this paper shows the which type of consideration is considered for design of underpass as per the Indian standard.

Keywords: Underpass Structure, vehicular underpass structure, Pedestrian Underpass, Geometry on underpass, Drainage, Material, Retaining wall.

I. INTRODUCTION

Bridges have a different type of Structure. Underpass Structure is one type of Bridge Structure. In which the Traffic is Heavy on the crossing or at the junction, Underpass Structure is Provided. Underpass structure is a called one type of Grade Separator. In Highway which is above 4 lane or 6 lane Highway underpass is frequently provided at the junction and crossing due to heavy traffic. Generally, Village or town Area is near to Highway then this village or town traffic is not disturbed to Main Highway traffic that provide underpass. In underpass Bridge Structure is many types Vehicular underpass, Pedestrian Underpass or Cattle Underpass and Flyover etc., this all are the called Grade Separator required width of Span is necessary more than provide the flyover but span width is providing less so go through the Vehicular underpass and Pedestrian/cattle Underpass. In pedestrian Underpass is designed for normal vehicle like cycle or Cow car etc. and used for pedestrian. Here show some photos of VUP, PUP and Flyover.



Fig 1.1 VUP & PUP type Underpass



Fig 1.2 Flyover type Underpass Structure

II. DESIGN CONSIDERATION STEPS

Construction of Underpass in different type of consideration is effect on them. here show the different steps which is effect on the Underpass. Geometry, Foundation and Earth Pressure, Vehicle Loads, Friction Forces, Earthquake Loads and Secondary Effects, Materials, Construction methods, Environmental constraints, Requirements of affected Authorities, Aesthetics of the structure and surrounds.

III. DESIGN STANDARD

Underpass is Designed as per Indian standard such as a IRC:6, IRC 78 and IRC 112 and others IRC standards in India.

IV. DESIGN INFORMATION

The designer shall check all stages of design for accuracy, completeness and compliance with the Brief and relevant Standards. Underpass structure is designed under the Dead load, Super imposed Dead load and Live load. As per the IRC 6 prepared the Live load combination through analyze the Underpass structure in computer added software and Extract the results of Analysis in Design sheets of underpass and after all this design the Underpass. The main items to include on the Design Summary Sheet are:

- i. Details of the span configuration.
- ii. The design cross-sections used in the analysis at critical positions, e.g. support and mid-span.
- iii. Details of the reinforcement and/or prestress and the section capacities at the critical sections.
- iv. The serviceability design moments and resulting stresses at the critical sections.
- v. Live Load Distribution Factors for different loadings.
- vi. Design Live Load.
- vii. The available live load capacity at the critical sections, for use in checking heavy load movements.
- viii. Foundation information, ie design bearing pressures for spread footings and design pile loads for piled foundations.
- ix. Design scour allowance.

V. MAINTENANCE

In Underpass type of Bridge Structure in different type of maintenance should be carried out, here below show the which type of maintenance is considered by Engineer.

- i. Bearings
- ii. Joints
- iii. Subsoil drains.
- iv. Maintenance requirements of any unusual structural elements eg. suspension cables.
- v. Technical details and recommended procedures for the preventative maintenance of paint systems.
- vi. Barrier repair procedures.

VI. BRIDGE ROADWAY GEOMETRY

Underpass Structure is pass out on Highway alignment so its major impact on them. In highway Alignment two type of Alignment is considered one is the Horizontal and another is Vertical Alignment. Underpass is Prefer under the straight horizontal Alignment and If Curvature is unavoidable then the underpass is preferring on curvature horizontal alignment. The Underpass Location is avoiding on sag type curves because Dynamic Effect of vehicle are increased and effect on the Appurtenance. sometime different condition of Location through prefer the combination of Horizontal and Vertical alignment. The effects of the this considered in design of underpass and should be changes in super elevation on the appear of Bridge Barriers. The Design of Underpass Structure in considered the structure depths of Girder and Deck Slab. If Box girder type underpass in $L/24+0.3$ (m) Depth and Beam and Slab Type Underpass in $L/18+0.3$ (m) types of Structural Depths is used. Structural Economy is major impact on the Project cost, in which type of Structure is Designed and the Underpass is on curvature or not is much effect on them.

VII. MATERIAL

Materials used in the Construction of Underpass is the most effect on the structure. Materials shall be selected on a basis of maximizing durability and minimizing maintenance requirements but may be modified at different condition, with minimize maintenance requirements, in some cases steel components are necessary, then used hot-dip galvanized

after fabrication and painting avoided if this is aesthetically acceptable. Timber is generally used as a construction material for use in pedestrian recreation areas such as boardwalks, jetties and similar structures. steel structures are preferred because of economic, aesthetic, practical considerations and component size precludes galvanizing. Designers shall maintain knowledge of all amendments and upgrades to standards and work shall conform to the standard current at the time of commission. Generally Retaining wall is constructed of reinforced concrete. Stone pitching of embankment slopes should be grouted to avoid the possible dislodgment of stone. The extent of stone pitching should be minimized.

VIII. PROPERTIES CONSIDERATION

In Design of Underpass Structure different type of Materials is used which is Described in topic VII. The different type of Material has Different properties. Material Properties is much effect on the Underpass Types of Structure. Concrete Properties is characteristic Strength, Design Shrinkage Strain, Modules of Elasticity, Creep Factor and Used Admixtures. Steel material Properties is Grade of Steel, Corrosion Protection System and Manufacturing of Steel and other Prestressing tendons, timber, Masonry, Soil foundation this type of material properties is considered in Design of Underpass Bridge Structure.

IX. DRAINAGE

Longitudinal drainage of structures shall be provided for run-off from a 1 in 10-year frequency storm. For structures carrying freeway traffic, there shall be no flooding of traffic lanes. Provision shall be made for longitudinal drainage on long bridges. The longitudinal slope of a bridge carriageway shall be a minimum of 1% except over water where a horizontal structure is acceptable. The decks of bridges over streams shall be drained by the provision of scuppers at the kerb face. The cross falls on the bridge are to match those on the abutting pavements. Consideration shall be given to the effect of drainage outlets. Scuppers on overpasses should be arranged so as not to discharge onto traffic or pedestrian areas below. Where possible, outlets shall be connected to the drainage system.

X. RETAINING WALLS

Retaining walls used for forward and Backward of underpass of structure, to retain the soil on retaining walls. Retaining walls to support roads, bridges and similar structures are important civil engineering structures. They shall be designed by a qualified geotechnical condition. Design assumptions including soil parameters slope and quality of backfill, drainage provisions etc. shall be clearly specified on the drawings.

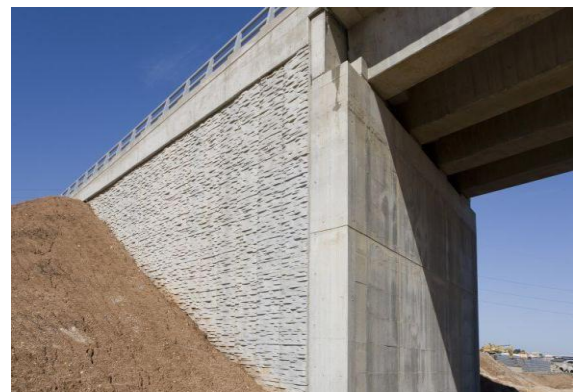


Fig 1.3 Retaining wall

XI. SAFETY

In Underpass type of Bridge Structure in safety is most important for consideration. Provide Safety Requirement during Construction and After Construction when open For Traffic. Underpass is Higher level of Structure from ground so provide safety guide rail, W-Beam Crass barrier or parapet on edge of underpass both side and provide proper sign board for safety. Here below show the photos of W-beam Crash barrier and Parapet.



Fig 1.4 W-Beam Crash Barrier

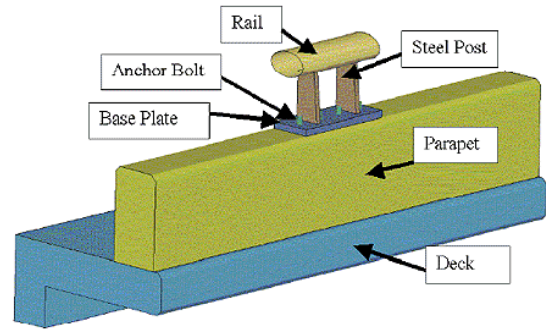


Fig 1.5 Diagram of Parapet with rail

XII. CONCLUSION

In this paper shows the different type of Consideration is taken in the Design of underpass type Bridge Structure. As per Indian Standard with proper material using with underpass is constructed at Site. Generally, highway in small span Width in Box type of VUP and PUP is provided and for large span girder bridge is provided. Box type Structure is easily constructed and safe for heavy load for Small span bridge but for Large Span this is not safe. generally maximum 12 m single span used, if SBC is low at site then Prefer the girder bridge for Safety of Bridge. Proper material characteristic through Design this type of Structure. In this of Structure the Provide the proper drainage System so in heavy rain the water is not stored in them and regularly some interval cleans out this drainage system. For Safety Purpose W Beam Crash barrier or parapet is provided on Edge of the underpass on both side. As per Indian Standard this type consideration is considered and Design the underpass type of bridge Structure and become the Safe Structure under heavy loading.

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