© INTERNATIONAL JOURNAL FOR RESEARCH PUBLICATION & SEMINAR
ISSN: 2278-6848 | Volume: 08 Issue: 07 | July - September 2017
Paper is available at www.jrps.in | Email : info@jrps.in

Study of Ministry of Road Transport & Highways (MORTH) Specifications for proposed beach corridor project

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ISSN : 2278-6848 03
9 772278 684800
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Abstract : MORTH is an apex organization under the Central Government, is entrusted with the task of formulating and administering, in consultation with other Central Ministries/Departments, State Governments/UT Administrations, organizations and individuals, policies for Road Transport, National Highways and Transport Research with a view to increasing the mobility and efficiency of the Road Transport system in the country.

The formulation of the design standards is required in order to avoid any inconsistency in design from one section to the other and provide desired level of service and safety. For this project it is proposed to follow Design Standards given in IRC codes, guidelines and special publications, and MORTH circulars as applicable to National Highways. Where the said standards are silent the following standards has been referenced and the one considered the best and most relevant adopted:

- American Association of State Highway and Transport Officials (AASHTO) standards
- British Standards
- Any other National or International Standard as considered suitable

The standards have been framed based on Two-Laning Manual i.e. IRC: SP-73-2007

In this paper we have discussed the specifications for Road and Bridge Works of Ministry of Road Transport & Highways published by Indian Road Congress will be used for materials to be used for construction of bridges.

Loads and Load Combinations

Dead Loads

Following unit weights has been assumed in the design as per IRC Codes.

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Pre-stressed Concrete	-	2.5 t/cu.m
Reinforced Concrete	-	2.4 t/cu.m
Plain Cement Concrete	-	2.4 t/cu.m
Structural steel	-	7.85 t/cu.m
Dry Density of Soil	-	2.07 t/cu.m
Saturated Density of Soil	-	2.2 t/cu.m

Superimposed Dead Loads

Wearing Coat : 65mm thick asphaltic concrete with total weight of 0.2 t/sq.m (including allowance for overlay)

Crash barriers : From design (i.e. 1.0 t/m per side)

Carriageway Live Load

Preliminary design of all the new cross drainage structures shall be done for the following loading;

Live Loads : One/Two lanes/Three lanes of IRC Class A (Whichever produces worst effect) or one lane of IRC Class 70R (wheeled/ tracked) + one lane of Class A.

The impact factor shall be as per IRC: 6-2010 for the relevant load combinations.

Footpath Live Load: The loading shall be taken 400kg/m^2 according to IRC: 6-2010.

Longitudinal Forces

The following effects shall be considered for calculating the longitudinal forces in the design

- Braking forces as per the provision of Cl. 211 of IRC: 6-2010
- Frictional resistance offered to the movement of free bearings due to change of temperature.
- Distribution of longitudinal forces due to horizontal deformation of bearings/frictional resistance shall be carried out as per Cl. 211.5 of IRC: 6-2010 by assuming stiff supports.

Centrifugal Forces

Bridges on a horizontal curve shall be designed for centrifugal forces based on the following equation;

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C = W*V^2/127R,

Where, C = Centrifugal force acting normal to the traffic

W = Carriageway live load

V = Design speed of the vehicles using the bridge in Km per hour

R = Radius of curvature in meters

The centrifugal force shall be considered to act at 1.2m above the formation level of the bridge in the transverse direction. No impact value on carriageway live load shall be considered for calculating the centrifugal force.

Water Current Forces

The effect of water current forces shall be calculated in accordance with clause number 210 of IRC: 6-2010 on sub-structure and foundations.

Earth Pressure

Horizontal forces due to earth pressure shall be calculated as per the provision of Cl. 214 of IRC: 6-2010 assuming the following soil properties;

Type of soil assumed for backfilling	:	Gamma = 2.0 t/cu. m
Angle of Internal Friction	:	$\phi = 30°$
Angle of Wall Friction	:	$\delta = 20°$

Coefficient of Friction `μ' at base: tan (2/3ϕ), where ϕ is the angle of internal friction of substrata immediately under the foundation.

Live load surcharge shall be considered as equivalent to 1.2m height of earth fill in case of abutments and equivalent to 0.6m height of earth fill in case of return/wing walls.

Wind Forces

Structures shall be checked for wind effects as stipulated in the Cl. 209 of the IRC: 6-2010.

Seismic Effect

The project road falls under seismic zone III. Horizontal seismic force shall be calculated using the following formula;

Feq = Ah x (Dead Load + Appropriate Live Load)

Where,

Ah = horizontal seismic coefficient = (Z/2) x (Sa/g)/(R/I)

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Z = Zone factor and is equal to 0.10 for seismic zone II

I = Important factor and is taken as 1.2 for important bridges

R = Response reduction factor

Sa/g = Average response acceleration coefficient depending upon fundamental period of vibration T

T = Fundamental period of the bridge in seconds in horizontal vibrations.

Combination shall be taken according to clause 219.4 of IRC: 6-2010

Temperature Range

The bridge structure/components i.e. bearings and expansion joints, shall be designed for a temperature variation of + 25°C considering extreme climate. The super-structures shall be designed for effects of distribution of temperature across the deck depth as per stipulations of BD 37/88; suitably modified for the surfacing thickness.

Differential Shrinkage Effects

A minimum reinforcement of 0.2% of cross sectional area in the longitudinal direction of the cast-in-situ slab shall be provided to cater for differential shrinkage stresses in superstructures with in-situ slab over pre-cast girders as per Cl. 605.2 of IRC: 22-2008.

Construction Stage Loadings

A uniformly distributed load of 3.6 KN/m² of the form area shall be taken into account of construction stage loadings in the design of superstructure elements, wherever applicable, as per Cl. 4.2.2.2.2 of IRC: 87-1984.

Buoyancy

100% buoyancy shall be considered while checking stability of foundations. Pore pressure uplift limited to 15% shall be considered while checking stresses of the substructure elements.

In the design of abutments of river bridges, the effects of buoyancy shall be considered assuming the fill behind abutments has been removed by scour.

Load Combination

All members shall be designed to safely sustain the most critical combination of various loads and forces that can coexist. Various load combinations as relevant with increase in permissible stresses considered in the design shall be as IRC: 6-2010 and Cl. 706 of IRC: 78-2000

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