Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 04, April-2019

# Analysis & Design of Permanent Way of Cuffe-Parade to Bandra Metro Line-3

Vrushali Gharat [2]Rohan Kondaskar [3]
Kaustubh Mhatre[4],Reetika Sharan [5]
[2,3,.4,5] (UG) STUDENT ,
Dept. of Civil Engineering, DRIEMS Neral.

Naveenkumar Chindam[1]
[1] HEAD oF Dept. of Civil Engineering,
DRIEMS Neral of Maharashtra ,India.

***Abstract*** **- Growing demand for .public transport in cities has serious effect on urban ecosystem and ecologically sustainable urban transport system could be obtained by an appropriate mix of alternative modes of transport resulting in use of environmental friendly fuels and land used patterns. The Mumbai Metro line 3 brings no of benefits and opportunities. Which gives safe of art modern Metro Rail system also gives you connectivity to direct important destinations. TBM (tunnel boring machine) is used to carried out tunneling, Track structure satisfy the technical requirements like dimensions, vertical alignment, horizontal alignment, ride comfort, rail welding, ultrasonic testing of rail and welding etc. The track technologies achieve sustainable development of high speed railway. Metro route maps created as per traffic study and evaluated in accurate manner by GIS and Global Mapper to find out the shortest distance. Ballast less track consists of prefabricated slab just under five meters long. Slip form paving seems to have obvious advantages on sub-grade slab with bending resistance are having big potential and affordable.**

***Key Words: TDM-TUNNEL BORING MACHINE, GIS – GEOGRAPHIC INFORMATION SYSTEM,ULTRSONIC TESTING, URBAN ECOSYSTEM, GLOBAL MAPPER***

## 1. INTRODUCTION

Mumbai Metropolitan Region (MMRC) is one of the fast growing metropolitan in India. In MMRC , public transport system are overcrowded and the road network is congested as there is large gap between the demand and supply. To decongest the existing public transport system and increase mobility across the Region MMRC through MMRC commissioned the service of RITES to prepare a DPR and Environmental and social impact. COLABA – BANDRA - - SEEPZ covering total length of 33.508 km. Mumbai is the financial capital of India, has witnessed phenomenon growth in population and employment. Master plan for Mumbai metro was prepared in 2004 which proposed implementation of metro corridor in three phase. Phase 3 (2016to 2021).MMRDA has carried out DPR studies for all three phase .metro corridor during period (2016-2021) COLABA – BANDRA. In this fast moving technology world urbanization and industrialization has gained serious attractions. Mobilization of resources entirely depend upon transportation, proper channelization and effective planning of transportation. Mass transportation satisfied all the aspects thus providing much important to the movement of traffic in rapid way.

### *1.1 RAIL*

There we used the rail UIC 60 kg/m .The type of rail is harder head ,the weight of rail is 60 kg/m. Railway track showing traditional features of ballast, part of sleeper and fixing mechanisms .

### *1.2 BALLASTLESS TRACK*

In BALLASTLESS TRACK, Rails are rigidly fastened to a special type of concrete . Ballast less track therefore offer:

1. A high consistency in track geometry, the adjusting of which is not possible after the concreting of the superstructure the elasticity of the ballast in the traditional railway superstructure is replaced by flexibility between either the rails and concrete tiles.
2. A disadvantage of traditional track structure is the heavy demand for maintenance, particularly surfacing ( tamping ) and lining to restore the desired track geometry and smoothness of vehicle running .
3. weakness of the sub-grade and drainage deficiencies also lead to heavy maintenance costs. This can be overcome by using ballastless track .
4. In its simplest from this consists of continuous slab of concrete (like Highway structure) with the rail supported directly on its upper surface .

### *1.3 Limit state Method*

The limit state method of design was developed to take account of all conditions that can make the structure unfit for use ,considering actual behaviour of material and structure. IS code 800:2007,the relevant code of practice , applicable to the structural use of hot- rolled Steel is largely based on limit state Method design . However, it still retains the workings stress method which was in use for last several decades .The code recommended the working Street method in situations where limit state Method cannot be adopted conveniently and confidently. There are basically two categories of limit state, strength and serviceability .The acceptable limit for the safety and serviceability requirements before failure occurs is called a limit state. Strength limit state are based on the load capacity of structure and include plastic strength , buckling , fracture, fatigue, In limit state design , basically statistical methods have been used for determining of loads and material properties with a small probability of structure reaching the limit state of strength and serviceability.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 04, April-2019

*1.4 OBJECTIVE*

Objective of the study are following

- To find load or weight of per axial point load.
- To calculate & understand distance between rail (gauge distance) type of gauge use.
- To calculate vibration on vibrating pad use on rai track ( design , specifications)
- To find concrete mix proportion used to built the formation.

*1.5 Statement Of Problems Problems faced during construction of underground metro railway*

1) Water Leakage At Vindhan Bhavan Station.

2) Heritage statues near Hutatma Chowk station.

3) Parsi lake issues in supreme court ( rail alignment problems ).

4) Tilting of piles at Chruchgate station.

5) Repair work of surrounding buildings .

## 2. STUDY AREA & DATA COLLECTION

Mumbai Metropolitan Region (MMR) is one of the Fast growing metropolitan regions in India. In MMRDA public transport systems are overcrowded and the road network is congested as there is a large gap between the demand and supply. To decongest the existing public transport systems and increase mobility across the Region, MMRC through MMRC commissioned the services “01 HITEs”to prepare a DPR and Environmental/Social Impact Assessment study for the corridor of Colaba to Bandra -SEEPZ covering total length of 33.508 km.

*2 Methodolgy*

Plinth system with two elastic levels and indirect fixation has been adopted. The rail rests on
the base plate with an elastic pad separating the two. The second elastic pad is between the
Base plate and the concrete plinth. While the base plate is held in position in the plinth by
Anchor bolts, the rail is held in position by tension clamps. The design of plinth is such that the raised concrete between the two rails acts as a guard rail.

***Design Theory***

**Step 1**

Wheel load = 17Tonnes

DYNAMIC WHEEL LOLAD = $\frac{\sqrt{R^2}}{G}$

R = radius of wheel in m

G = gauge distance of track in m

$= \frac{\sqrt{(0.2)^2}}{1.435}$

$= 0.139$ KN/ $m^2$

$0.139 < 1$ , hence safe.

IMPACT FACTOR = $\frac{V}{1.82\sqrt{\mu}}$

$= \frac{80}{1.82\sqrt{170}}$

$= 0.337$

$0.337 < 1$, hence safe

V= speed of the vehicle in km/hr $\mu =$ modulus of track in $kg/cm^2$

Hammer blow = counter weight = horizontal thrust = 8.8 Tonnes.

***Track modulus:***

Track modulus is the index for the Stiffness of the Track. it is defined as load per unit length of the rail require to produce a unit depression in the track. Track modulus depend upon the gauge, type of rail, type and density of the sleeper track modules beyond 4T load is in a truly elastic range and is called elastic modules

**Step 2**

Material used
steel = HYSD 500
length of desined track = 1m
concrete grade =M40

Moment of inertia = $3921 cm^4$
modulus of elasticity of steel = $2.11 \times 10^6$

**step 3**

for speed above 100kmph

$= \frac{4.5V^2}{10^5} - \frac{1.5V^3}{10^7}$

v = velocity of train

= 0.2112

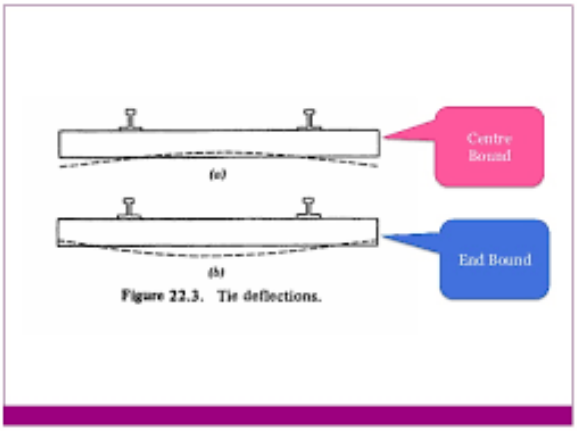


**Fig no. 1 : Track deflection**

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 04, April-2019

Under newly compacted sleeper the deflection on the sleeper takes place as shown in fig with this of deflection, the sleeper is said to be end bound. The repeated application of load causes the depression at the end of the sleeper, resulting in greater depression at the end. The sleeper then said to be centre bound as shown in fig

**step 4**

stress in sleepers

the stresses in sleeper depend on many factors such as

- wheel load - greater the wheel load higher will be stresses
- elasticity of the rail- due to better shock and absorption property load take by sleeper will be less
- strength of the sleeper - the greater the strength of sleeper as a beam better will be the load bearing capacity
- track modulus - degree of compaction of Ballast and formation below governs value of track modulus
- maintenance of track - better maintenance track will be able to bear greater stresses
- Stiffness of the rail - greater the vertical stiffness of the rail , the less will be the load borne by the load3

Step 5

the maximum formation pressure in railway tack is calculated by following formula :

$$P_{f\,max} = \frac{2WS}{\pi DL} \times \sqrt[4]{\frac{\mu}{64\,E.I.}}$$

$$= \frac{2\times170\times25}{3.14\times30\times76} \times \sqrt[4]{\frac{170}{64\times2.11\times10^{6}\times3921}}$$

$$= 5.023 \times 10^{-3}\ kg/cm^3$$

formation pressure or sub grade pressure.

$P_{f\,max}$ = maximum pressure on formation due to live wheel load in kg /cm$^2$

W= live wheel load in tonnes

D = depth of ballast under sleeper in cm

L= effective length of sleeper under one rail seat in cm ( 76 cm for B.G and 63 cm for M.G )

$\mu$ = track modulus in kg/cm

I = moment of inertia in cm$^3$ worn rail in horizontal axis

E = modulus of elasticity of steel rail in kg/$cm^2$

Step 6 :

To counteract the effect of centrifugal force , the level of outer rail is raised above the inner rail by certain amount to introduce the centrifugal force . the raised elevation of outer rail above the inner rail at a horizontal curve is called super elevation . the term cant is frequently used as synonymous for super elevation but truly speaking cant should be used to represent the of a transverse slope

$$e = \frac{GV^2}{1.27R}$$

G = gauge distance of track in m

R = radius of curve in m

$$= \frac{1.435\times80^2}{1.27} \times \frac{5}{1720}$$

e= 21.021 cm

## 3. RESULT & DISCUSSION:

1. Metro rail project creates efficiency in city network, reduction of traffic congestion in city, Metro rail project gives comfort to passengers while traveling .
2. Ballastless track has good damping performance.
3. Ballastless track improved construction efficiency guarantee the quality of concrete structure.
4. Ballastless track reduces the influence of weather and environment.
5. This track gives exact positioning to track and gives less vibrations, noise, etc.

## REFERENCES

1) Aniket Raut (2017), Execution of Metro Rail project-a Case study of Nagpur Metro Rail,1-4
2) Coenraad Esveld (Professor of Railway Engg) Delf University, May 2003 Recent Development of Slab Track. 1-5
3) Ingason H Kumm (Mallarden university) 2012, Final report of metro rail project. 1-40
4) Jijun Wang, senior researcher, May 4th 2011, Ballastless track technology for china high speed Rail. 1-40
5) K Anitha, M Santhia(2018), Analysis and design of underground Metro station,1-12
6) Metro Rail Policy -2017 ,Metro Rail project case study 1-11
7) S M Subhash, K. Chandrabose (2013) , Feasibility study of Metro transport :case study of Madurai, 1-12
8) S M Rupprecht (2015), Underground Track Design, Construction and Maintenance, 1-10
9) Sudin Bag , Dr SOM Sankar Sen (2012), Kolkata Metro Railway and customer satisfaction and Imperical study. 1-11
10) S M Rupperent ( University of Johannesburg) July 2013 , Underground track design construction and maintenance 1-10
11) Virendra Kumar Paul, salman Khursheed (2017), competitive study of construction technology for underground Metro station in India, 1-6