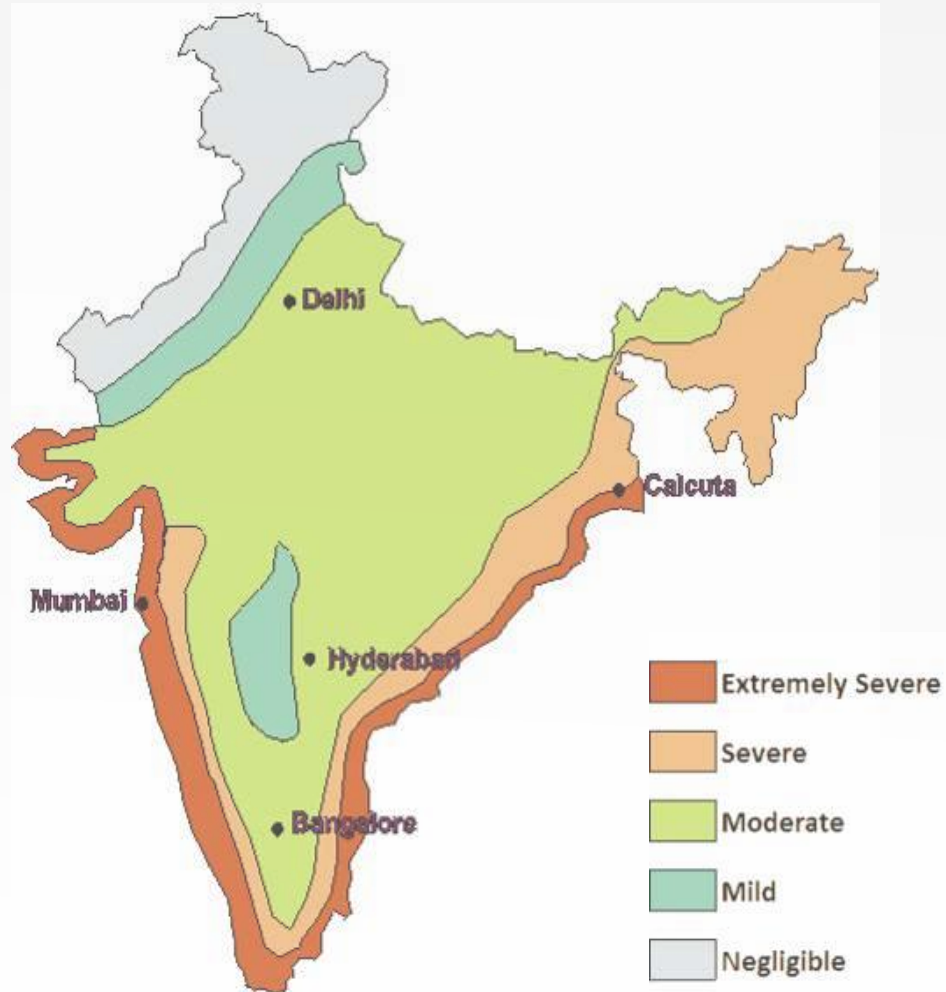


Making  
Bharat  
Atmanirbhar  
Since 1970



# CORROSION MAP OF INDIA



## WHY IS STAINLESS STEEL NECESSARY IN INDIAN INFRASTRUCTURE?



Almost 80% of India falls under moderate to extreme corrosion-prone regions



Highly critical to adopt Stainless Steel in the coastal regions



Economic Impact of Corrosion 5-7% of GDP

# CORROSION - WHAT IT CAN RESULT INTO

## BRIDGE COLLAPSE

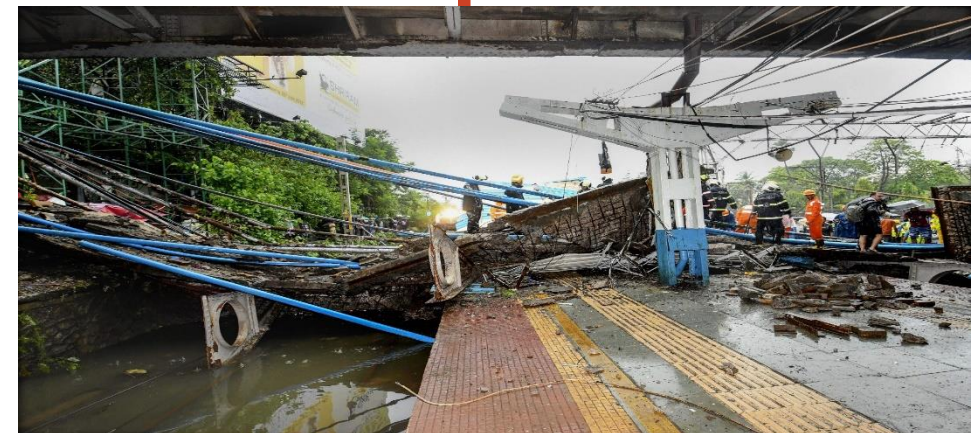
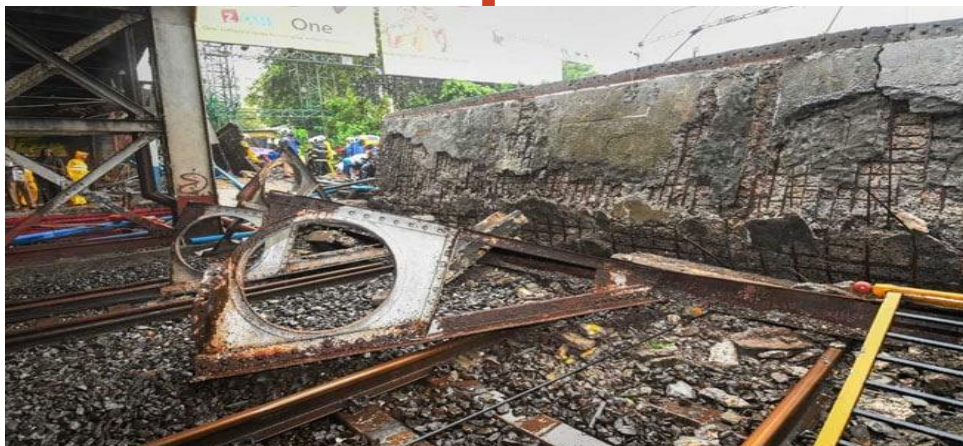
### India

#### Factors

- Environment
- Corrosion
- Maintenance
- Load

#### Outcome

- Loss of Life
- Loss of Revenue
- Loss of Material



*Andheri Foot Over Bridge , Mumbai*

# CORROSION OF STRUCTURE - A WORLDWIDE PROBLEM



*Fatal Taiwan bridge collapse*

**Collapse**

**“Dangerous levels of corrosion”** Not ascertained till it collapsed.  
Just 20 years old



# CORROSION OF STRUCTURE - A WORLDWIDE PROBLEM

*Washington State*



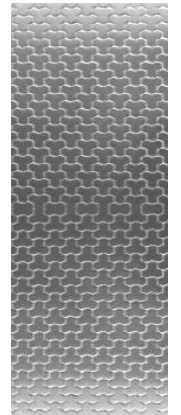
*Miami*

Climate Change May See One In Four US  
Steel Bridges Collapse By 2040\*

•Source :

<https://www.newscientist.com/article/2221040-climate-change-may-see-one-in-four-us-steel-bridges-collapse-by-2040/#ixzz6Ntw22jcn>

# ADVANTAGES OF STAINLSS STEEL





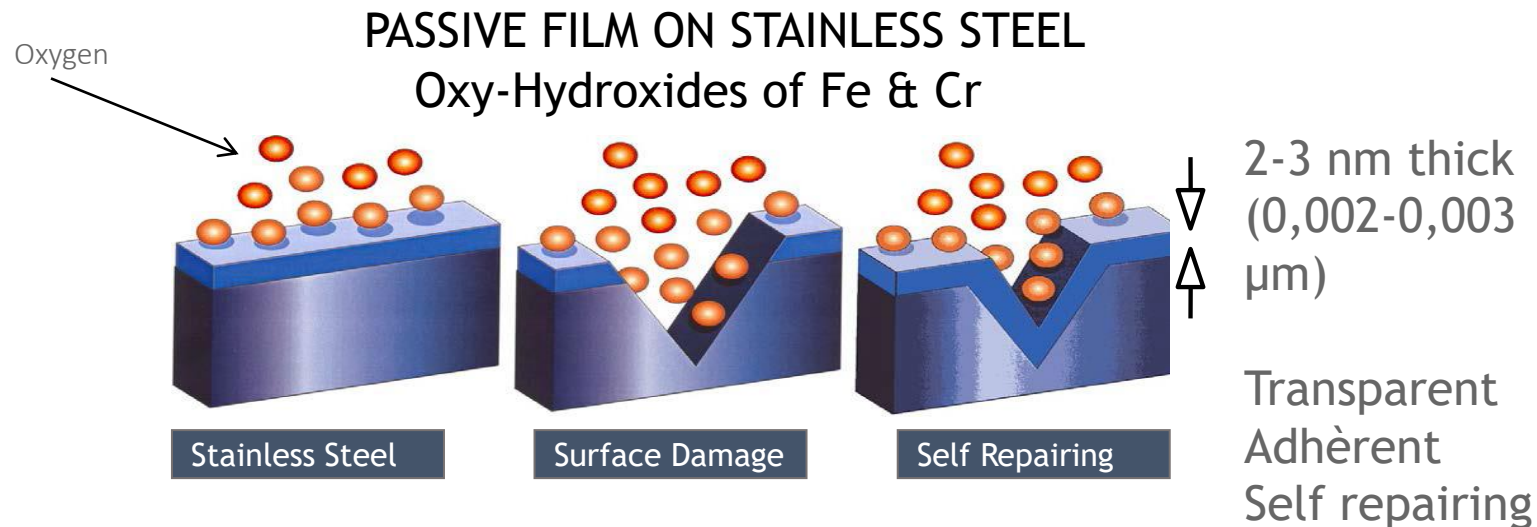
# WHY STAINLESS STEEL DOES NOT RUST

Stainless steel is an alloy of iron (Fe) and chromium (Cr).



Iron

Chromium



**SELF REPAIRING SURFACE**

Ni, Mo and other alloying element to achieve desired properties

## **GREEN MATERIAL**

- **100% RECYCLABLE**
- **EXTENDED LIFESPAN**
- **REDUCED CARBON EMISSION**
- **MORE THAN THRICE LIFESPAN**



### **Video Credits:**

**Mr. Amitabha Ghoshal**

**Ex- Chairman IRC**

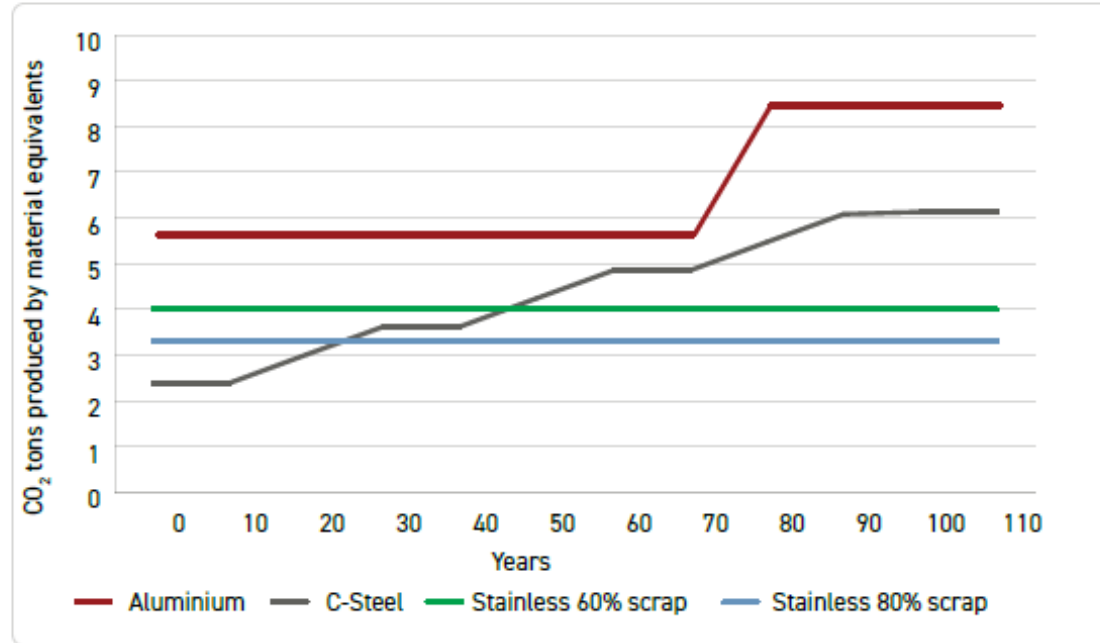
**Chief Advisor to Board – STUP CONSULTANTS**

**Bridge Expert**



# Carbon Emission Advantage with Stainless steel

Figure 3 *CO<sub>2</sub> production emissions for alloys in structures over 110 years of operational life*  
The data was calculated from material and processing emissions data available from the International Stainless Steel Forum, the World Steel Association and the Organisation for Economic Co-operation and Development (OECD).



## CO<sub>2</sub> production emissions for alloys in structures over 110 years of operational life

Figure 3 shows the CO<sub>2</sub> production and maintenance emissions for stainless steels, carbon steel and aluminium. Two different types of produced stainless steel have been included, namely Stainless 1 which is produced with an 80% recycle content and Stainless 2 which is produced with a 60% recycled content.

The data comprises CO<sub>2</sub> tons emitted per ton of material produced (Scope 1 + Scope 2 + Scope 3) plus any CO<sub>2</sub> emissions associated with regular maintenance needs. The carbon steel emissions increase every 10 years due to regular maintenance needed to suppress corrosion. Stainless steel and Aluminium emissions do not increase as their passive films prevent the need for regular maintenance. The lifetime of stainless steels in-service beyond 110 years are not yet known as the industry is currently 108 years old.

The CO<sub>2</sub> emissions data and associated included recycling credits are industry supplied figures.

The Aluminium data has been adjusted downwards to reflect the fact that the density of Aluminium is about one third that of carbon steel and stainless steels.

15  
million  
tonnes

SOURCE: International Stainless Steel Federation

# MAINTENANCE FREE

- CHROMIUM >10.5% , MAKES IT CORROSION FREE
- NO RUST DUE TO OXIDE LAYER
- LEAST DETERIORATION OF AESTHETIC APPEAL



**Video Credits:**  
**Mr. Amitabha Ghoshal**  
**Ex- Chairman IRC**  
**Chief Advisor to Board – STUP CONSULTANTS**  
**Bridge Expert**





## LIGHTER STRUCTURE

- HIGH STRENGTH OF STAINLESS STEEL REDUCES OVERALL WEIGHT OF THE STRUCTURE THAN MILD STEEL.
- GREATER HARDNESS



### Video Credits:

Mr. Amitabha Ghoshal

Ex- Chairman IRC

Chief Advisor to Board – STUP CONSULTANTS

Bridge Expert

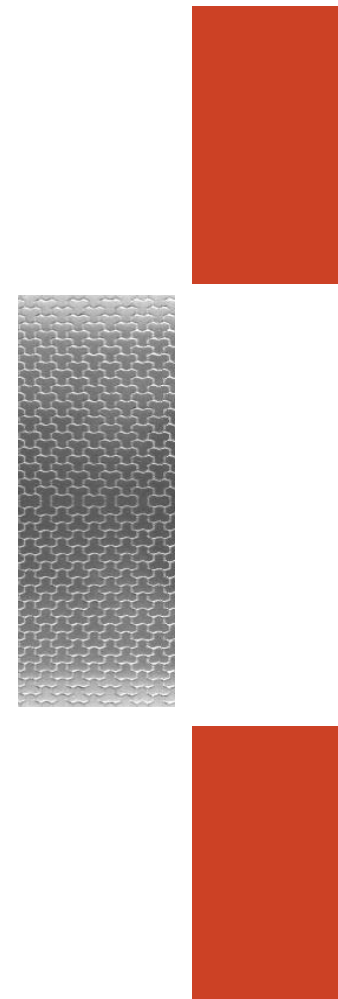
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## LONGER SPAN

- LESSER PIERS AND LEAST OBSTRUCTION
- GREATER VISIBILITY AND LOWER COST



# GLOBAL REFERENCES



# NATIONAL ARCHIVES OF CANADA, OTTAWA



- **GRADE– 304 & 316 STAINLESS STEEL**
- **APPLICATION :- STRUCTURES**
- **Qty – 2,800 MT**



# SAINT PIO OF PIETRELCINA CHURCH



- **GRADE– 316 STAINLESS STEEL**
- **APPLICATION :-**
  - STRUCTURES

# THE GRANDE ARCH LIFTS AT LA DEFENSE, FRANCE



- **GRADE**– DUPLEX STAINLESS STEEL
- **APPLICATION :-**
  - MAIN & SUB STRUCTURE

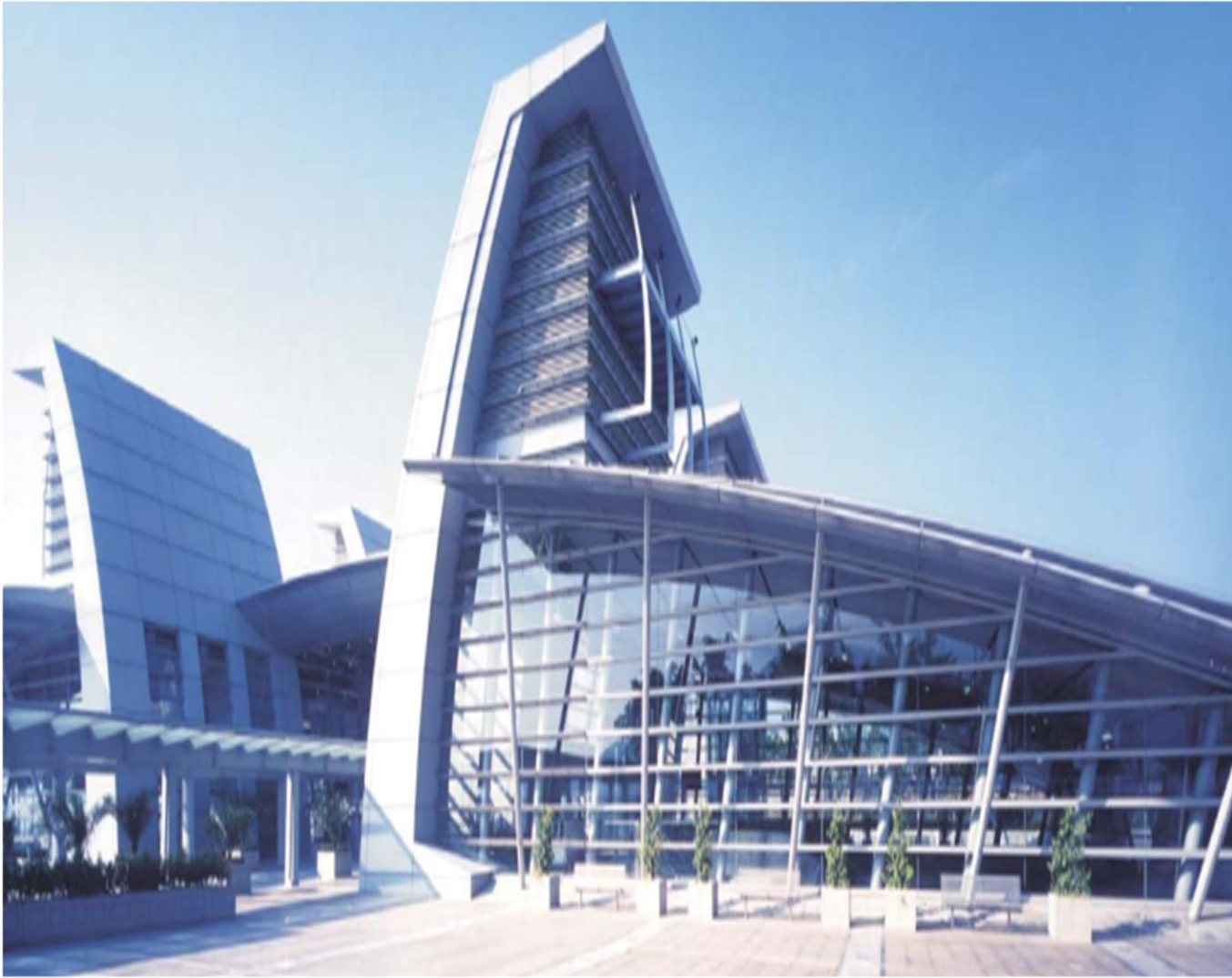


# LONDON WATERLOO TRAIN STATION



- **GRADE– 316 STAINLESS STEEL**
- **APPLICATION :-**
  - ROOF STRUCTURAL SUPPORT & PANNELS
  - SLIP RESISTANT FLOORING
  - TICKET BOOTHS EXTERIOR

# HONG KONG KOWLOON STATION



**GRADE– 316 STAINLESS  
STEEL**

**APPLICATION :-**

**-BUILT UP STAINLESS  
STEEL STANDING SEAM  
ROOF**



# BRITOMART TRAIN STATION, AUCKLAND



**GRADE– 316 STAINLESS  
STEEL**

**APPLICATION :-**

-STAINLESS STEEL  
CEILING AND COLUMN  
COVERS

# Torino Porta Susa railway station.

## Concourse



- Architects: Silvio d'Ascia Architecture
- Area: 30,000 m<sup>2</sup>
- Year: 2015
- Application – Roof Cladding of concourse



# INDIAN PROJECTS



### **Himalaya FOB at CSMT Station**

- Contractor : PINAKEE ENGINEERS & DEVELOPERS  
MUMBAI
- Fabricator : Esskay Engineering, Odisha
- Stainless steel supplier : JSL



## Pedestrian Bridges



### **Naupada junction railway station, waltair division, ECR.**

- Contractor : MD Jahageer, Visakhapatnam
- Fabricator : Pennar Industries Ltd, Hyderabad
- Stainless steel supplier : JSL

## Pedestrian Bridges



### **Bhayandar railway station, Mumbai** **Division, WR.**

- Contractor : Sai Projects Mumbai Pvt Ltd, Mumbai
- Fabricator : Sai Projects Mumbai Pvt Ltd, Mumbai
- Stainless steel supplier : JSL



## Pedestrian Bridges



### **Srikakulam Road Railway station, Walter Division, ECR.**

- Contractor : Sai Projects Mumbai Pvt Ltd, Mumbai
- Fabricator : Sai Projects Mumbai Pvt Ltd, Mumbai
- Stainless steel supplier : JSL



## West Mrinaltai Bridge



Mrinal Tai Bridge – Erection work by Relcon Infra in Duplex – 2205 (SS Supplied - 450 Tons)



# UIC - BUILDING

**Contractor:** PSK Engineering Construction Company.  
**Client :** United India Insurance Company  
Stainless Steel Used in Project.

**Structural Form –** Diagrid Structures.

Grade	Product	Application	Quantity
SS 316	Plates ( 8mm – 25 mm)	Built- Up Box Sections	135 Tonnes





# First Railway ROB to be executed by NHAI

- (d) Repairs/replacements of railing/parapets of the existing bridges shall be undertaken as follows:

Sl. No.	Location at km	Remarks
	NIL	

- (e) Drainage system for bridge decks  
An effective drainage system for bridge decks shall be provided as specified in paragraph 7.20 of the Manual

- (f) Structures in Marine environment:

All the structures shall be design for severe condition as per IRC;112. In addition, use of stainless steel in Bridges on National Highways and other centrally sponsored projects shall be in compliance with requirement of MoRTH circular No RW/NH-34049/03/2020-S&R (B) dated 22 January 2021. In addition to the above, stainless steel shall be used in the bow string girders.

- (iv) Rail Road Bridges (ROB/RUB)

- (a) Design, construction and detailing of ROB/RUB shall be as specified in the provision of the Manual.

- (b) Road Over Bridge

Sl. No.	Chainage (km)	Type of Structure		No of Span with	Total Width	ROB/RUB	TCS
		Foundation	Super				





# KOPERKHAIRANE RAILWAY STATION, NEW BOMBAY



**GRADE – 304 STAINLESS  
STEEL**

**APPLICATION :-  
-STAINLESS STEEL ROOF**

# MAJOR ONGOING PROEJCTS IN STAINLESS STEEL

S. No.	PROJECT NAME	AGENCY	PROJECT	PROJECT STATUS	JSL PRODUCT
1	SITA CAMP - FLYOVER - MCGM	MCGM	20000	PRE-TENDER	PLATES IRS 450CR,
2	J J Nagar - MCGM - FLYOVER	MCGM	5500	PRE-TENDER	PLATES IRS 450CR,
3	NHAI - Sheelanagar - Convent Junction - Vizag	NHAI	6500	TENDER AWARDED	PLATES IRS 350CR,
4	NHAI - Chandikhole - Paradip - Package 4	NHAI	10000	TENDER AWARDED	PLATES IRS 350CR,
5	Marve Manori - Flyover - MCGM	MCGM	15000	PRE-TENDER	PLATES IRS 350CR,
6	Madh Versova - Flyover- MCGM	MCGM	15000	PRE-TENDER	PLATES IRS 350CR,
7	Navi Mumbai-Vashi Mankur -Flyover-PWD-3	PWD	3500	PRE-TENDER	PLATES IRS 350CR,
8	Worli-ROB-MCGM-Nehru Planeterium-07	MCGM	5400	UNDER EXECUTION	PLATES IRS 350CR,
9	Mumbai-Bridge at Lagoon road -MCGM-Plate (Group 1)	MCGM	10000	PRE-TENDER	PLATES IRS 350CR,
10	Mumbai - Dharivali Village - FOB	MCGM	25000	PRE-TENDER	PLATES IRS 350CR,
11	Mumbai - Bridge at Ramchandra Nalla - MCGM	MCGM	10000	PRE-TENDER	PLATES IRS 350CR,
12	Mumbai - Bridge across oshiwara river & malad Creek -MCGM	MCGM	25000	PRE-TENDER	PLATES IRS 350CR,
13	Borivali-Flyover-MCGM-Kora Kendra Kariappa-02	MCGM	1550	UNDER EXECUTION	PLATES IRS 350CR,
14	Bhagat Singh Nagar - MCGM	MCGM	3000	TENDER AWARDED	PLATES IRS 350CR,
15	Eastery Railway - 5 ROB ( Dankuni)	Eastern Railways	1500	PRE-TENDER	PLATES IRS 350CR,
16	Chennai- Adyar Bridge -Highways Department	Highways Department	1500	PRE-TENDER	PLATES IRS 350CR,
17	Visakhapatnam-ROB-Plate-NHAI	NHAI	7000	TENDER AWARDED	PLATES IRS 350CR,
18	Bangalore – Bridge across Vrishabhavati river - Plate - KRDCL	KRDCL	2000	PRE-TENDER	PLATES IRS 350CR,
19	Chennai - PEN Memorial - PWD	PWD	1600	PRE-TENDER	PLATES IRS 350CR,
20	Goa Airport FOB + Flyovers	-	1000	PRE-TENDER	PLATES IRS 350CR,



# GRADES

## Focused Grades of Stainless Steel

---

**Ferritic  
Stainless  
Steel**

400 Series

**Austenitic  
Stainless  
Steel**

300 Series

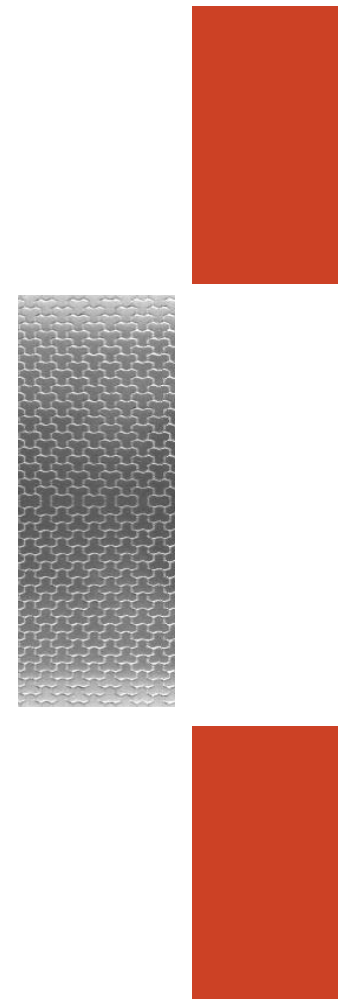
**Duplex  
Stainless  
Steel**

2000 Series



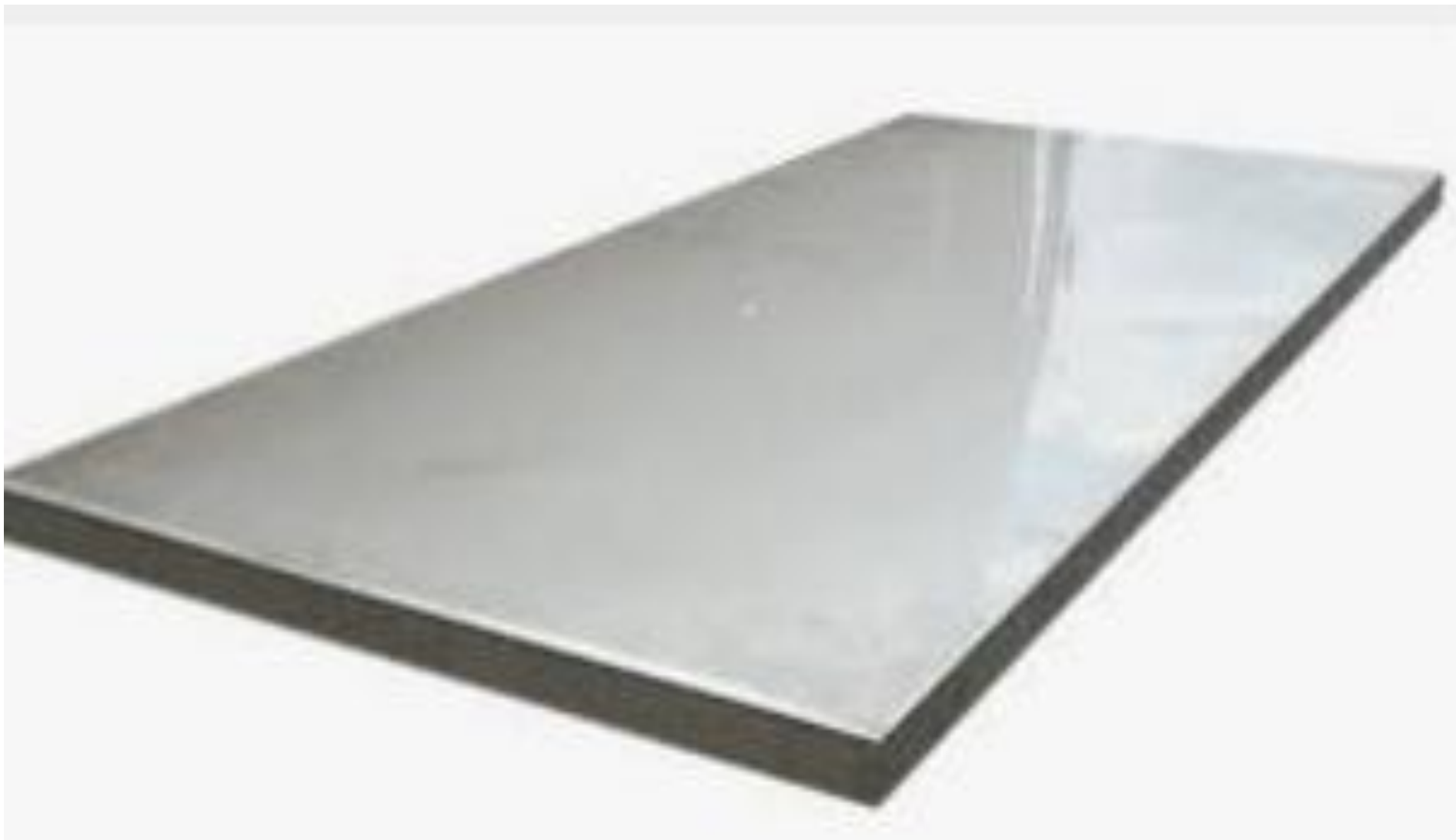
COMPOSITION (%)	GRADE 300	GRADE 400	GRADE 2000
CARBON	0.03-0.15%	0.05-0.7%	0.03%
CHROMIUM	16-20%	10.5- 27%	21-23%
NICKEL	8-14%	0.5-2.5%	4.5-6.5%
MOLYBDENUM	-	0.4-2.5%	2.5-3.5%
SILICON	1%	1%	1%
MANGANESE	2%	0.8-1.5%	2%
SULPHUR	0.03%	0.015-0.03%	0.02%
PHOSPHORUS	0.045%	0.04%	0.03%

# JSL Offerings





## PLATES



## HOLLOW SECTIONS





## FABRICATED SECTIONS



## ROOFS

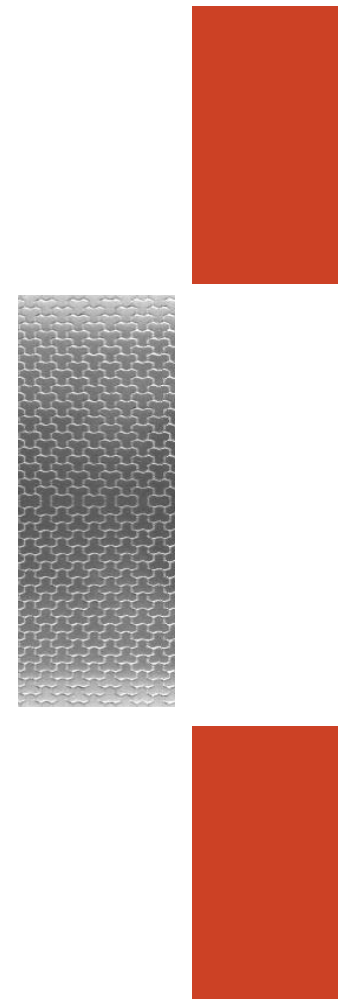




# CHEQUERED SHEETS



# APPLICATIONS





## OTHER APPLICATIONS

CLADDINGS



FACADES



ROOF SHEETS



## OTHER APPLICATIONS

CABLE TRAYS



ART APPLICATIONS

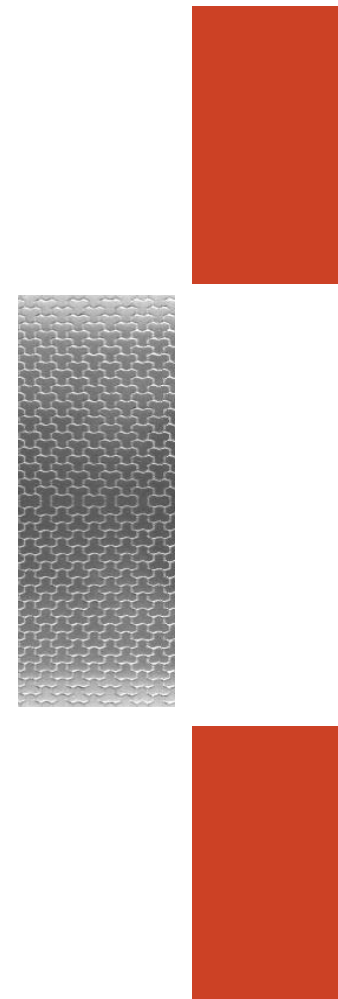


CANOPIES





# SUCCESS STORY



1.	Name of work	:	Construction of New Domestic Building and miscellaneous Belagavi Airport
----	--------------	---	--

**First tender released by Airport Authority of India for Belagavi Airport car park structure shed in stainless Steel IRS 350.**

## 8. Stainless Steel Structure

### A) SCOPE:

Steel products under this specification shall be having minimum yield strength 350 MPa.

### B) REFERENCE CODES & SPECIFICATIONS (LATEST EDITIONS):

Following codes has been referred while preparation of this specification:

BELAGAVI TERMINAL BUILDING

C-NIL I-NIL O-NIL

CS-522

- (I) ASTM A1010/A1010M-13 (Reapproved 2018) –Standard specification for higher StrengthMartensitic Stainless Steel plate, sheet and strip
- (II) ASTM A709/A709M – Standard specification for structural steel for bridges
- (III) ASTM A480/A480M - Standard Specification for General Requirements for Flat-RolledStainless and Heat-Resisting Steel Plate, Sheet and Strip.
- (IV) ASTM A751- Test Methods, Practices, and Terminology for Chemical Analysis of SteelProducts
- (V) ASTM A370- Test Methods and Definitions for Mechanical Testing of Steel Products
- (VI) ASTM A673/673M- Specification for Sampling Procedure for Impact Testing of StructuralSteel

# Project Cable Tray



भारतीय विमानपत्तन प्राधिकरण/ AIRPORTS AUTHORITY OF INDIA  
विशाखपट्टणम हवाईअड्डा / VISAKHAPATNAM AIRPORT



ISO 9001:2015 & ISO 14001:2015 Certified

## SCOPE OF WORK:-

1. Removal of the rusted cable tray from the cable tray supporting Frame without disturbing the live cables.
2. Supply and installation of the new cable tray on the cable tray supporting Frame with out disturbing the live cables by using stainless steel nuts and bolts.
3. Cables need to be tied with the new laid cable tray by using weather proof ties.
4. Replacing of the rusted nuts and bolts of the cable tray supporting frame with stainless steel nuts and bolts & washers.



# POLICIES

# ADOPTION OF LCC PRINCIPLE POLICY BY MINISTRY OF FINANCE

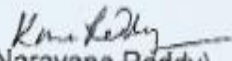
No.F.1/37/2018-PPD  
Government of India  
Ministry of Finance  
Department of Expenditure  
Procurement Policy Division

512, Lok Nayak Bhavan,  
New Delhi. Dated 2<sup>nd</sup> January, 2019

## OFFICE MEMORANDUM

**Subject :- Adoption of principles of Life Cycle Cost (LCC) Analysis.**

Attention is invited to Rule 136(1)(iii) of GFR 2017 wherein it has been provided that no work shall be commenced or liability incurred in connection with it until a properly detailed design has been sanctioned; while designing the projects etc. principles of Life Cycle cost (LCC) may also be considered. It has been brought to the notice of this department by Ministry of Steel that the principles of LCC are not being adopted while preparing Detailed Project Report (DPR) or at the time of finalization of the tender terms. In this regard, it is again advised that provisions of GFR relating to LCC may be considered while designing the projects. Consulting engineers/ structural engineers/ metallurgists may be consulted wherever considered appropriate.

  
(K Narayana Reddy)

Under Secretary to the Govt. of India  
Tel.: 24621305  
Email: kn.reddy@gov.in

To,

Secretaries of All Central Government Ministries/ Departments

## MINISTRY OF FINANCE

**Date : 2<sup>nd</sup> January, 2019**

**Subject : Adoption of principles of Life Cycle Cost (LCC) Analysis.**

### **Key Points:**

- 1- While designing the projects etc. principles of life cycle cost (LCC) may also be considered.
- 2- Consulting engineers/ structural engineers/ metallurgists may be consulted wherever considered appropriate.

# STAINLESS STEEL REBARS POLICY BY MORTH RAILWAY BOARD

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS  
RAILWAY BOARD

No. 2018/06/CE-III/BR/Stainless Steel

New Delhi, dt. 02.05.18

Principal Chief Engineers,  
All Zonal Railways,

Chief Administrative Officers (Construction)  
All Zonal Railways,

207

Sub: Use of Stainless steel reinforcement in various structures.

Ref: i) Board's letter no. 2016/4/CE-III/BR/BSC/84 Seminar dt. 28.07.17  
ii) Board's letter no. 2017/51/CE-III/BR/CRB dt. 03.11.17  
iii) A&C slip – 6 dt. 27.07.17 of IRS Concrete Bridge Code

Vide reference above, instructions have been issued that stainless steel reinforcement conforming to IS 16651:2017 may be used in corrosion prone structures to prevent corrosion and ensure overall durability of structure. In continuation of same, a committee of SAG level officers was constituted by Board for specifying the corrosion prone structures where stainless steel reinforcement can be used and to also deliberate on cost implications. A copy of the committee's report is enclosed herewith.

2.0 Based on the recommendations of the aforesaid committee, Board (ME) has decided that Stainless steel reinforcement bars ( Grade G (410L)- Ferritic conforming to IS 16651:2017 ) to be used for the following structures:

- Bridges in coastal area (up to 30 kms from coast): Railway bridges, FOB, ROB/RUB, Rail Flyover/Metro, Mono Rail crossings.
- Tunnels in coastal areas.
- C & W and Loco inspection pits, catwalks, washing aprons & water tanks at all places.
- Any other structure located in extremely adverse environmental conditions or where frequent inspection is not possible even if it is away from coastal area after due justification & with the personal approval of PCE.

The necessary action may be taken accordingly under intimation to Board.

DA: As Above

(V.K. Jain)  
Director CE/B&S  
Railway Board

Copy for information and necessary action to:

1. Director General/RDSO
2. CMD/RVNL, IRCON, RITES, New Delhi
3. CMD/KRCL, MRVC, Mumbai
4. ED/MTP, Railway Board

## RAILWAY BOARD

Date : 2<sup>nd</sup> May, 2018

Subject : Use of Stainless steel reinforcement in various structures.

### Key Points:

- 1- Instructions have been issued that stainless steel reinforcement may be used in corrosion prone structures to prevent corrosion and ensure overall durability of structure.
- 2- Board (ME) has decided that stainless steel reinforcement bars (Grade G (410L) – Ferritic conforming to IS 16651:2017).



GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS  
(RAILWAY BOARD)

No.2017/50/CE-III/BR/FOB

New Delhi, Date: 30.07.2020

Director General,  
RDSO  
Manak Nagar, Lucknow

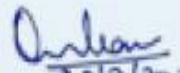
Sub: Stainless Steel for Structural Application.

Ref: (i) Board's letter No. 2017/50/CE-III/BR/FOB dated 09.07.2019  
(ii) Minutes and Recommendations of PCEs Seminar issued by Director  
IRICEN letter No. 151/20307 dated 25.06.2020

In PCEs conference held on 19<sup>th</sup> and 20<sup>th</sup> June-2020 the issue of development of specification and standard drawings for various standard span configuration of stainless steel FOB was decided as under:

*"FOB constructed using stainless steel structural members are aesthetically beautiful and having more resistance of corrosion. Hence, it is proposed to execute all new FOBs, duly adopting stainless steel structural members. Specifications and drawings for various standard span configurations need to be issued for execution of FOB, using stainless steel structural members."*

In view of above, RDSO is requested to issue specifications and standard drawings for various configurations in next 3 months, which will be used by zonal railways in corrosion prone areas. Progress made in this regard should be submitted to Board every month.

  
30/7/2020  
(O. N. Sharma)  
Dir. CE/B&S

**Copy to:**

Principal Chief Engineer/All Zonal Railways - for information.  
ED(B&S)Steel/RDSO - for necessary action.

## RAILWAY BOARD

**Date : 30<sup>th</sup> July, 2020**

**Subject : Stainless steel for structural applications.**

### Key Points:

1- FOB constructed using stainless steel structural members are aesthetically beautiful and having more resistance of corrosion. Hence it is proposed to execute all new FOBs, duly adopting stainless steel structural members, specifications and drawings for various standard span configurations need to be issued for execution of FOB, using stainless steel structural members.

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS  
(RAILWAY BOARD)

Instructions No. 31/2019

No.2017/50/CE-III/BR/FOB

New Delhi Dt: 04.11.2019

Principal Chief Engineers  
Central Railway, Mumbai  
Western Railway, Mumbai

Sub: Stainless Steel for Structural Application.

Ref: (i) This office of even letter no. dated 09.07.2019.

(ii) ED/B&S/RDSO's letter no. CBS/Stainless Steel/FOB dt.  
30.08.2019, 03.09.2019 & 22.10.2019.


Vide this officer letter referred (i) above, use of stainless steel for construction of FOB was permitted in some of the Zonal Railways including CR & WR. Further, RDSO vide letters referred (ii) above, proposed that stainless steel for ROBAs in corrosion prone area is useful and provide sufficient corrosion protection with lower maintenance. With a view to use of Modern Construction Techniques for longer life of structures, following have been decided:

- (a) Use of stainless steel will be carried out in CR & WR for ROBAs.
- (b) Both the Railways will select one ROBA of each design such as plate girder composite type with concrete deck on top, through girder type (truss type) and new design of multi cell box girder (pre-fabricated).
- (c) CBE of the Zonal Railways will decide the ROBAs depending upon the corrosion proneness of the area and will ensure that stainless steel for ROBAs are used at most corrosive part of concerned Zonal Railways.
- (d) Design of Stainless steel ROBAs shall be done by the Zonal Railways through reputed consultants and got proof checked from IITs. RDSO will finally approve the design.
- (e) Fabrication & inspection of these girders (ROBAs) shall be governed as per Railways Board letter no. 2016/54/CE-III/BR/RDSO/Misc, dated 15.07.2019.
- (f) RDSO will be actively associated in the above and will provide all assistance to Zonal Railways concerned with design (as in 'd' above).
- (g) The above may be executed, by the concerned Zonal Railways, out of the available sanctions (of work).

Zonal Railways are advised to take action at the earliest and monthly progress should be submitted to Board regularly.

This issues with the approval of Board(MIE).

30/11/19

  
(O. N. Sharma)  
Director Civil Engineering/B&S  
Railway Board  
Email: dcebarb@gmail.com

Copy, for information and necessary action to:

1. CAO/Ce, CR & WR
2. CBEs, CR & WR
3. ED/B&S, RDSO, Lucknow

9/c

## RAILWAY BOARD

Date : 4<sup>th</sup> November, 2019

Subject : Stainless steel for structural applications.

### Key Points:

1- Use of stainless steel for construction of FOB was permitted in some of the Zonal Railways including CR and WR.

2- Design of stainless steel ROBAs shall be done by the zonal railways through reputed consultants and got proof checked from IITs. RDSO will finally approve the design.

**Divisional Railway Manager  
Eastern Railway,  
HWH, ASN, SDAH and MLDT**

**Subject:** Use of Stainless steel Chequered Plate in place of Mild Steel Chequered Plate over Bridges of Eastern Railway.

1. It have been observed that the existing Chequered plates provided as gangway/ walkway/ trolley refuse on bridges, corrode very fast despite repeated paintings. The corroded chequered plate is also potential safety hazard.
2. In view of above following decision has been taken :
  - i. Stop using chequered plates conforming to IS 3502, with base metal of Grade E250 conforming to IS 2062 in Footpath/ Walkway over Bridges of Eastern Railway. Old Chequered Plates of IS 2062 Base metal, already in service, to continue till it requires replacement.
  - ii. 6mm thick chequered Plate should be used conforming to IS 3502, with specified Base Metal as Stainless steel conforming to IS: 6911-2017, Indian Steel Standard Grade designation 409M in all Bridges/ Footpath/ Walkway. The fasteners for chequered plate should also be of appropriate Stainless Steel grade, recommended by manufacturer.
  - iii. As the thickness of chequered plate is fixed to 6 mm only, measurement and payment for Stainless steel chequered plate to be made in unit of "Square meter".
3. In order to keep uniformity in description of item during tendering, standard description as detailed below should be adopted by the executing units of Open line as well as in Construction organization.

**Description of Item:**

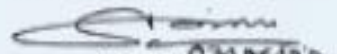
*"Supplying and fixing of 6mm thick (excluding bead height) Chequered plate conforming to IS: 3502 with Specified Stainless Steel base metal conforming to IS: 6911-2017, ISS Symbol Grade designation 409M. The stainless steel base material should be hot rolled, annealed and pickled and Mill test certificates by manufacturer should be submitted in support of above along with the material.*

*The rate is inclusive of Supplying the Chequered plate, testing at third party Laboratory if ordered, all wastages, cutting to size as per drawing, drilling of holes, fixing with matching stainless steel fasteners, all lead and lift, labor and fitting over railway sleepers, pathway or any other locations, etc complete in all respect as directed by Engineer in Charge.*

*Measurement will be done by measuring area of Chequered plate in completed work in Square meter. No deduction for holes as per approved drawings is to be made."*

4. Estimated Rates to be decided by Executing units based on LAR/Analysis of rates of similar item in USSOR.

This is issued with approval of competent authority (PCE).

  
Chief Bridge Engineer  
Eastern Railway, Kolkata

Copy to :

- a) Sr. DEN/ Co-ord/HWH, ASN, SDAH and MLDT for information and necessary action.
- b) Dy CE (Br) for information and necessary action.
- c) Dy CVO (Engg) for information.
- d) CTE, CE(P&D), CE(G), CE(TP), CE(Br- Rehab), CE(TMC), CE(SD) for information.
- e) CPD (SD) for kind information.
- f) CAO/ Con for kind information and necessary action for Construction projects of ER.
- g) Sec to PCE - for kind information of PCE.

## EASTERN RAILWAY

**Date : 3rd June, 2022**

**Subject : Use of stainless steel chequered plate in place of Mild Steel Chequered Plate over Bridge of Eastern Railway..**

### Key Points:

- 1- Stop using chequered plates with base metal of grade E250 in Footpath/ Walkways over Bridge of Eastern Railway.
- 2- 6mm thick chequered plate should be used, with specified Base Metal as Stainless steel.



## Stainless steel in USSOR

  
 भारत सरकार  
 GOVERNMENT OF INDIA  
 रेल मंत्रालय  
 MINISTRY OF RAILWAYS

दक्षिण मध्य रेलवे  
 SOUTH CENTRAL RAILWAY

**भारतीय रेल एकीकृत मानक दर अनुसूची**  
 (फॉर्मेशन कार्य, पुल कार्य एवं पी वे कार्य)  
 Indian Railways  
 Unified Standard Schedule of Rates  
 (Formation Works, Bridge Works and P. Way Works)

**दर अनुसूची**  
 Schedule of Rates

इंजीनियरिंग विभाग  
 Engineering Department

**2021**

Item No.	Description of Item	Unit	Rate (₹)
195040	Supplying & fixing Gang pathway of MS /Stainless Steel chequered plates between guard rails on un-ballasted deck bridge for gang pathway, overlapping at regular intervals of 2m to 2.5m with bolts duly drilling holes in chequered plate, as directed on new bridge or replacement of existing gangway on old bridge including removal of old chequered plates and stacking near approaches of bridge clear from all infringement.. Note: Overlapping of chequered plates shall not fall in between sleepers		
195043	Anti skid Stainless steel chequered plate of 409 M Grade as per Specification ASTM A240 SS and Pattern conforming to BIS 3502 with average thickness of 3.5 mm with bead height of 0.8 mm min thick - on New Bridges.	Kg	211.45
195044	Fixing Anti skid Stainless steel chequered plate of Grade 409 M and average thickness of 3.5 mm with bead height of 0.8 mm min thick including removal of existing chequered plates on Bridges Note: Payment shall be made only as pert weight of new Chequered Plate fixed.	Kg	215.98

**OFFICE OF THE ENGINEER IN CHIEF  
MADHYA PRADESH PUBLIC WORKS DEPARTMENT  
NIRMAN BHAWAN ARERA HILLS BHOPAL (M.P)**

WEBSITE: www. mppwd.gov.in

EMAIL: pddbhop@mp.nic.in

TELEPHONE NO. 07552551485, FAX- 2556527

**SCHEDULE OF RATES FOR ROAD & BRIDGE WORKS (W.e.f 25.3.2022)  
(AMMENDMENT No.2)**

The following Amendments are made in the SOR for Road and Bridge works issued by the

Serial No.	Item No.	Item Name	Description of Item	Unit	Rate
7	13.17	<b>Reinforcement Bars for RCC work</b>	Supplying, Providing & fixing in position Stainless steel rebars of grade G 410-L Ferritic confirming to IS 16651 : 2017 for RCC works of any dia. Up to 32 mm whenever directed including handling, fixing, straightening, wastage, cutting, bending, placing in position, binding, complete in all respect.	<b>MT</b>	
		a	For Dia. 6 mm to 10 mm	<b>MT</b>	<b>158,847.00</b>
		b	For Dia. 12 mm to 20 mm	<b>MT</b>	<b>154,847.00</b>
		c	For Dia. 25 mm to 32 mm	<b>MT</b>	<b>152,847.00</b>
8	13.18	<b>Chequered Plates</b>	Supplying and fixing of Hot Rolled Annealed & pickled stainless steel chequered plate having flat bottom of Grade 409M confirming to IS:6911:2017 Amendment 2 Pattern as per IS: 3502 1A, bead height minimum 0.80mm for pathway, staircase, floor for the bridge including fixing the same over channels by drilling holes in channels etc. including supply and fixing of nuts & bolts, tools & plants, labour , lead including ascend/descend complete in all respect.		
		a	For 3 mm Thickness	<b>Sqm</b>	<b>4,122.00</b>
		b	For 4 mm Thickness	<b>Sqm</b>	<b>5,393.50</b>
		c	For 6 mm Thickness	<b>Sqm</b>	<b>7,905.00</b>
		d	For 8 mm Thickness	<b>Sqm</b>	<b>10,432.80</b>
		e	For 10 mm Thickness	<b>Sqm</b>	<b>12,638.50</b>
		f	For 12 mm Thickness	<b>Sqm</b>	<b>15,488.00</b>
9	13.19	<b>Stainless Steel Plates (IRS 350CR):</b>	Supplying Stainless Steel Hot Rolled Annealed Pickled Plates 350N/mm2 designated IRS 350 CR similar to RDSO Specifications BS-S 7.5.3.1-9 for the Structural application,ASTMA1010/ A1010M-01E1 and Indian Standard (IS) 6911-2017 amendment 2 having chemical properties of C 0.03%Max, Mn1.5%, Si 1% max., S 0.01% max., P 0.04% max., Ni 1.5% max, Mo 0.10-0.75% min., Cr 10.5%– 12.5%, N 0.03% max & mechanical properties 0.2% proof Stress 350MPA min, Ultimate Tensile Strength 485 MPA min% Elongation 18min, inclusive of all necessary testing & certification.	<b>MT</b>	<b>175,851.69</b>

**PWD – MADHYA PRADESH**

**PUBLIC WORKS  
DEPARTMENT, MADHYA  
PRADESH HAS ALREADY  
AMMENDED THEIR SOR  
WITH STAINLESS STEEL ITEMS**

# Stainless steel Rebar – Railway Policy

## ADDENDUM & CORRIGENDUM SLIP No. 7 DATED - 26.06.2018

New Clause **4.5.1 (e)** to be added as under:-

**4.5.1 (e)** High Strength Deformed Stainless Steel Bars and Wires for Concrete Reinforcement satisfying requirements of Indian Standard Code “IS 16651”.

Existing Clause **7.1.5** to be modified as under:-

**7.1.5 Corrosion resistance measures**– In order to ensure adequate resistance against corrosion for reinforcement bars, following measures may be taken depending upon the environmental conditions:

- a) Removal of loose mill scales, loose rust and dust from the surface of the reinforcement bar shall generally be sufficient.
- b) In **Extreme Cases**, say up to 30 Km from Coastal Areas and in unavoidable circumstances, Stainless Steel Reinforcement Bars may be used. Properties of stainless steel reinforcement shall not be inferior to the carbon steel reinforcement of corresponding strength class.

Regarding Stainless Steel Reinforcement, Indian Standard Code “IS 16651: 2017 - High Strength Deformed Stainless Steel Bars and Wires for Concrete Reinforcement – Specification” to be referred.



# Stainless Steel Rebar – NHAI Policy



RW/NH-34049/03/2020-S&R (B)  
GOVERNMENT OF INDIA  
MINISTRY OF ROAD TRANSPORT & HIGHWAYS  
S&R -(Bridges)  
Transport Bhawan, 1, Parliament Street, New Delhi-110001

Dated: 22.01.2021

To,

1. The Chief Secretaries of all the State Governments / UTs.
2. The Principal Secretaries / Secretaries of all States / UTs Public Works Department dealing with National Highways, other Centrally sponsored schemes.
3. The Engineers-in-Chief and Chief Engineers of Public Works Department of States/UTs dealing with National Highways, other Centrally sponsored schemes.
4. The Director General (Border Roads), Seema Sadak Bhavan, Ring Road, Delhi 110010.
5. The Chairman, National Highways Authority of India, Plot G-5 & 6, Sector-10, Dwarka, New Delhi 110075.
6. The Managing Director, NHIDCL, PTI Building, Parliament Street, New Delhi 110001.

Sub: Use of Stainless Steel in Bridges on National Highways and other centrally sponsored Projects to be constructed in marine Environment Susceptible to Severe Corrosion.

Sir,

Ministry vide circular No RW/NH/34041/44/91-S&R dated 14th March, 2000 prescribed use of Fusion Bonded Epoxy Coated Reinforcement in Bridges on National Highways and other centrally sponsored Bridge Projects in Marine Environment as detailed thereto. The various specifications, conditions etc. for use of Fusion Bonded Epoxy Coated Reinforcement have also been stipulated in the above said circular.

2. The instructions given hereby are now in supersession of the above circular in light of the further experience/knowledge gained and modifications/evolution of new materials/specifications.

3. It has been decided that the stainless steel conforming to the requirement stipulated in IS:16651:2017 shall be used for reinforced concrete bridges (superstructure and substructure) on National Highways located in Extreme Environment Exposure as defined in IRC:112:2020. In locations, where it is difficult to ascertain the environment exposure condition, a zone within 15 km from the sea or creek shall be considered as Extreme Environment.

4. The contents of this Circular may please be brought to the notice of all the Concerned in your Organization for strict implementation. This circular will be implemented from the date of its issuance.

5. This issues with the approval of the Competent Authority.

Yours faithfully,

*Mian*

(Jitendra Kumar),  
Superintending Engineer, S&R - (Bridges),  
For Director General (Road Development) & SS.

P.T.O

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# Stainless steel Rebar – NHAI Policy

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Yours faithfully,



(Jitendra Kumar),  
Superintending Engineer, S&R - (Bridges),  
For Director General (Road Development) & SS.

# STANDARDS & CODES



# RDSO SPECIFICATION FOR STRUCTURAL STAINLESS STEEL

1. Material Specification : **BS-S-7.5.3.1-9**
2. Grade Name: **IRS 350 CR**

ISO9001:2015	Doc No BS-S-7.5.3.1-9	Ver No 1.0	Date Effective	17.12.2020
Document title: Specification for Higher-Strength Martensitic Stainless Steel for Bridge and Associated Structural Applications				

RESEARCH DESIGNS AND STANDARD ORGANISATION  
MANAK NAGAR, LUCKNOW-226011

DOCUMENT NO.: BS-S-7.5.3.1-9

DOCUMENT TITLE: SPECIFICATION FOR HIGHER-STRENGTH MARTENSITIC STAINLESS STEEL  
FOR BRIDGE AND ASSOCIATED STRUCTURAL APPLICATIONS

AMENDMENT HISTORY:

S. No.	Amendment Date	Version	Reasons for Amendments
1.	-	1.0	New specification

Table-1: Chemical Composition Requirements	
Element	Percentage (%) <sup>a</sup>
UNS Designation	541003
Carbon (C)	0.030
Manganese (Mn)	1.5
Silicon (Si)	1.00
Sulphur (S)	0.010
Phosphorus (P)	0.040
Nickel (Ni)	1.50
Molybdenum (Mo)	0.10-0.75
Chromium (Cr)	10.5 – 12.5
Nitrogen (N)	0.030
Other Elements	-----

Table 2: Mechanical Test Requirement				
Grade name	Plate Thickness (mm)	Yield Strength min (MPa)	Tensile Strength min (MPa)	% Elongation in 50 mm min
IRS 350 CR	Up to 50	350	485	18

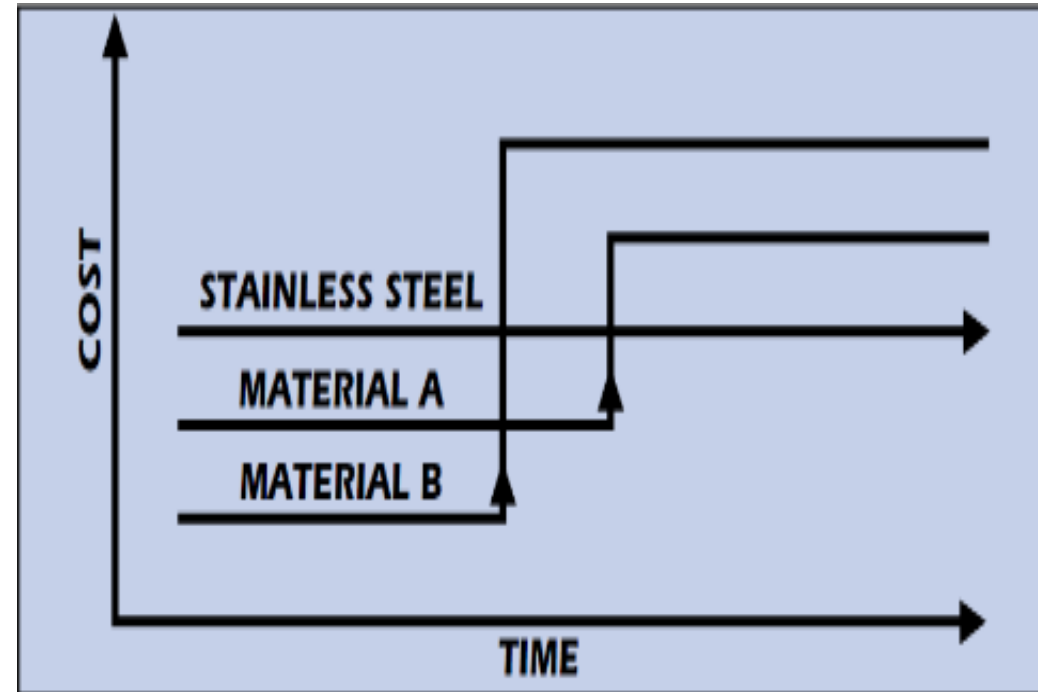
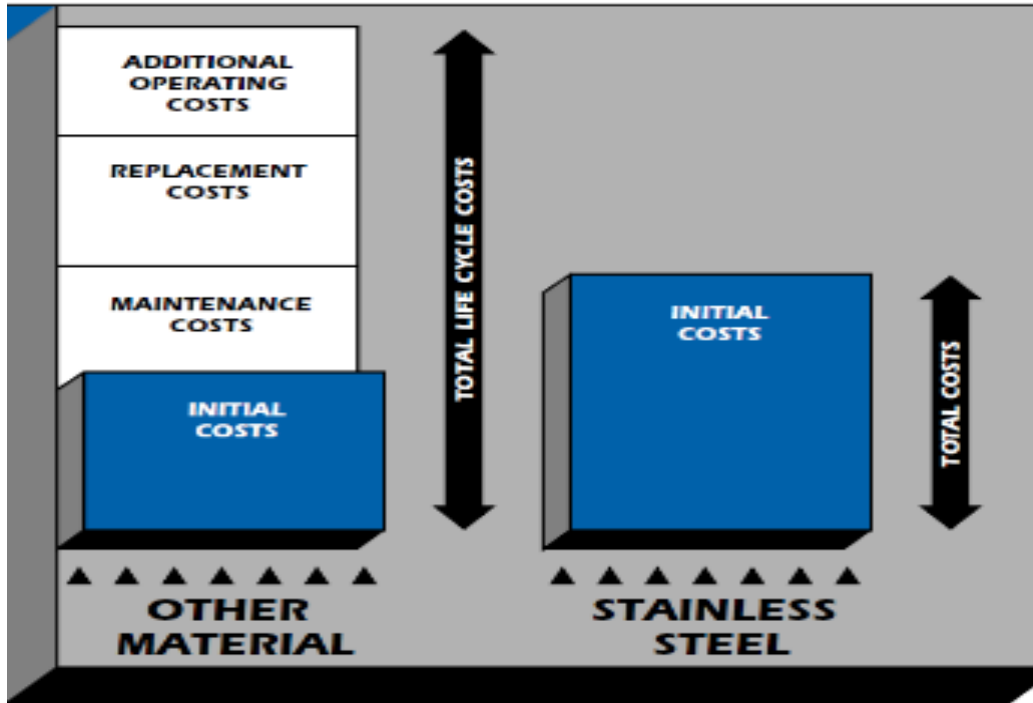
ADE/SB/B&S	DBS II	Printed
Prepared by	Issued by	17.12.2020

# STAINLESS STEEL STANDARDS

Material Codes	Corresponding Design Code	Corresponding Construction / Fabrication Code
EN 10088 (all parts)	EN 1993-1-1(General Design Rules), EN 1993-2 (Steel Bridges) & EN 1993-1-4 (Supplementary rules for Stainless steels)	EN 1090-2: Execution of steel structures (Technical Requirements for Steel Structures)
ASTM A1010/A1010M ASTM A709/A709M ASTM 240	AASHTO LRFD Bridge Design Specifications	AASHTO LRFD Bridge Construction Specifications
BS-S-7.5.3.1-9 (IRS 350 CR)	AASHTO LRFD Bridge Design Specifications	AASHTO LRFD Bridge Construction Specifications

✓ **New Material Standard proposal for Structural stainless steel has been submitted to BIS by ISSDA. Draft preparation is under progress**

# LIFE CYCLE COST ANALYSIS



- ✓ Stainless Steel is not expensive if the Life Cycle Cost is taken into account
- ✓ The Cost of other materials substantially increases over time while the cost of Stainless Steel normally remains constant



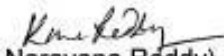
No.F.1/37/2018-PPD  
Government of India  
Ministry of Finance  
Department of Expenditure  
Procurement Policy Division

512, Lok Nayak Bhavan,  
New Delhi. Dated 2<sup>nd</sup> January, 2019

### OFFICE MEMORANDUM

**Subject :- Adoption of principles of Life Cycle Cost (LCC) Analysis.**

Attention is invited to Rule 136(1)(iii) of GFR 2017 wherein it has been provided that no work shall be commenced or liability incurred in connection with it until a properly detailed design has been sanctioned; while designing the projects etc. principles of Life Cycle cost (LCC) may also be considered. It has been brought to the notice of this department by Ministry of Steel that the principles of LCC are not being adopted while preparing Detailed Project Report (DPR) or at the time of finalization of the tender terms. In this regard, it is again advised that provisions of GFR relating to LCC may be considered while designing the projects. Consulting engineers/ structural engineers/ metallurgists may be consulted wherever considered appropriate.

  
(K Narayana Reddy)  
Under Secretary to the Govt. of India  
Tel.: 24621305  
Email: kn.reddy@gov.in

To,

Secretaries of All Central Government Ministries/ Departments

Source: <https://doe.gov.in/divisions/adoption-principles-life-cycle-cost-lcc-analysis>

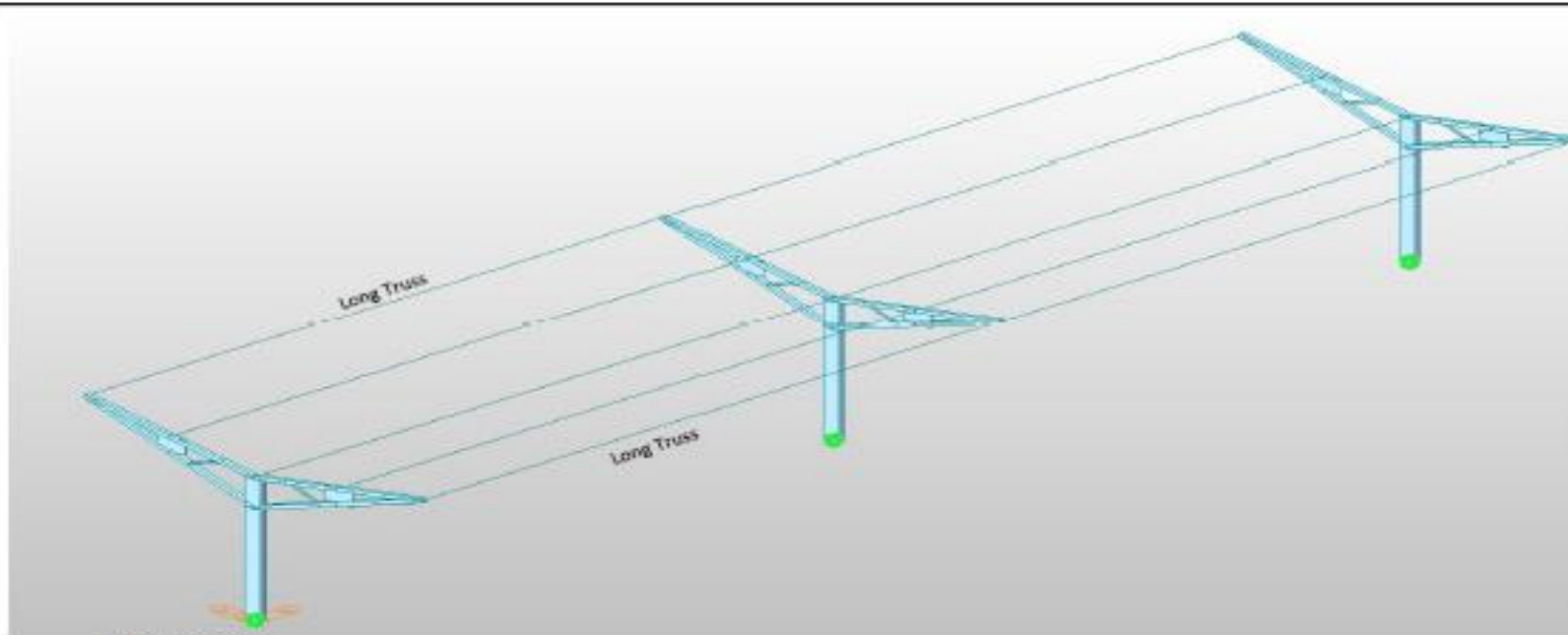
## 2.0 Total Cost of Ownership

While the value of a product covers all components of value over the "Whole-Of-Life" (WOL), the costs incurred on the product should also take into consideration the total of various elements of costs incurred over WOL of the product. For this purpose, future costs are discounted to present value (not to be confused with the value we are discussing – this is a financial discounting concept). For example, it would not be prudent to buy a cheap car, which has a very high cost of operating. This is called variously as WOL or "Life-Time-Cost" (LCC) or "Total Cost of Ownership" (TCO). The last is a preferred nomenclature in procurement and is defined as the total of all costs associated with a product, service, or capital equipment that are incurred over its expected life. Typically, these costs can be broken into four broad categories:

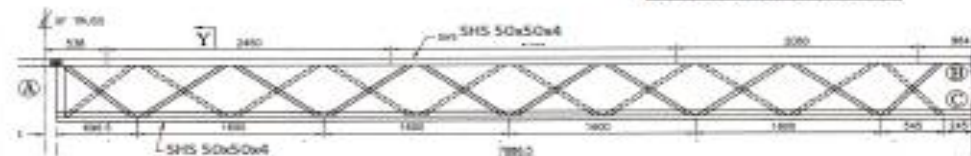
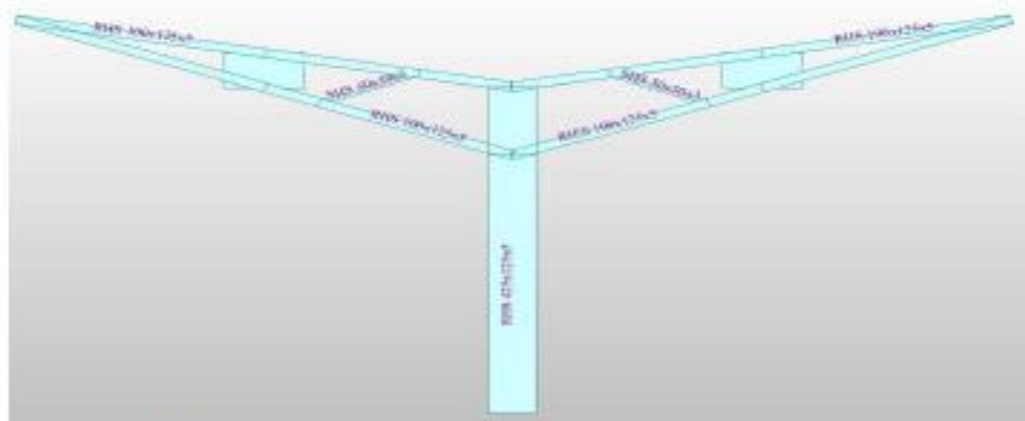
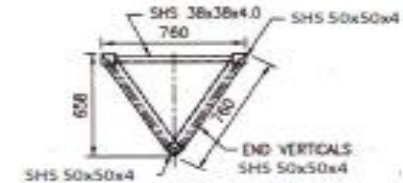
- i) **Procurement price.** The amount paid to the vendor/contractor for the product, service, or capital equipment;
- ii) **Acquisition costs.** All costs associated with bringing the product, service, or capital equipment into operation at the customer's location. Examples of acquisition costs are sourcing, administration, freight, taxes, and so on;
- iii) **Usage costs.** In the case of a product, all costs associated with converting the procured part/material into the finished product and supporting it through its usable life. In the case of a service, all costs associated with the performance of the service that is not included in the procurement price. In the case of capital equipment, all costs associated with operating the equipment through its life. Examples of usage costs are inventory, conversion, wastage, lost productivity, lost sales, warranty, installation, training, downtime, and so on; and

Source: Manual for procurement of Goods 2017

# Platform Structures - Railways



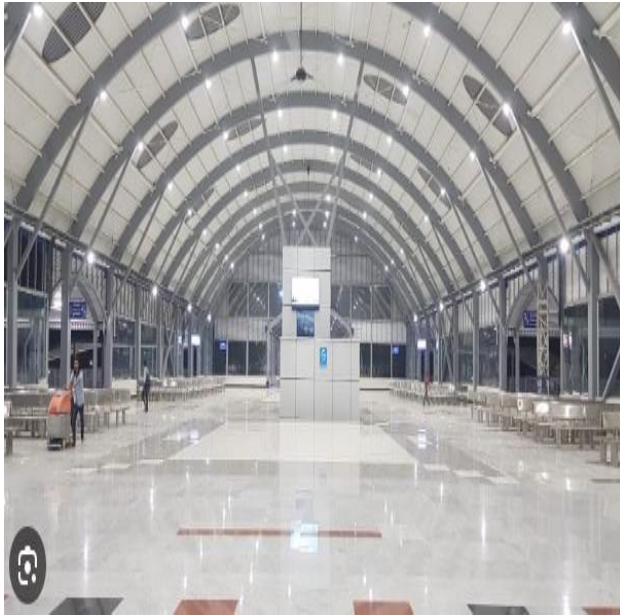
	H 425 B 125 t <sub>fl</sub> 5.000 t <sub>br</sub> 4.000 t <sub>cl</sub> 5 t <sub>cs</sub> 3.000	<b>RHS 425x125x5</b>
	H 425 B 125 t <sub>fl</sub> 5.000 t <sub>br</sub> 4.000 t <sub>cl</sub> 5 t <sub>cs</sub> 3.000	<b>RHS 425x125x5</b>
	H 50 B 50 t <sub>fl</sub> 3.000 t <sub>br</sub> 3.000 t <sub>cl</sub> 3 t <sub>cs</sub> 3.000	<b>RHS 50x50x3</b>



CHK	MEMB U.R.		Section	N	My	Mz	Vy	Vz
CHK	COM AX AND BENDING	SHEAR	Material	Nd	Mdy	Mdz	Vdy	Vdz
OK	13	1	RHS 425x125x5	-175	0	-125	-28	0
OK	0.81	0.04	IRS 350 CR	1255	96	187	804	0
OK	17	2	RHS 100x125x5	34	-19	0	0	-28
OK	0.79	0.17	IRS 350 CR	684	23	30	0	163
OK	22	3	SHS 50x50x3	66	0	0	0	0
OK	0.37	0	IRS 350 CR	179	3	3	0	0

Reaction at base of foundation (app.)	
Self weight	22.72 kN
ULS ENV	177.32 kN
SLS ENV	121.98 kN





## PLATFORM STRUCTURES



## CONCOURSE



## FOOT OVER BRIDGES





## ROOFING



## RAIL OVER BRIDGES



**SS REABARS + SS  
CHEQUERED PLATES &**

**USE OF SS MADEUPS:**

- GRATINGS
- TRENCH COVERS
- CABLE TRAYS

# SHAPING A STAINLESS WORLD

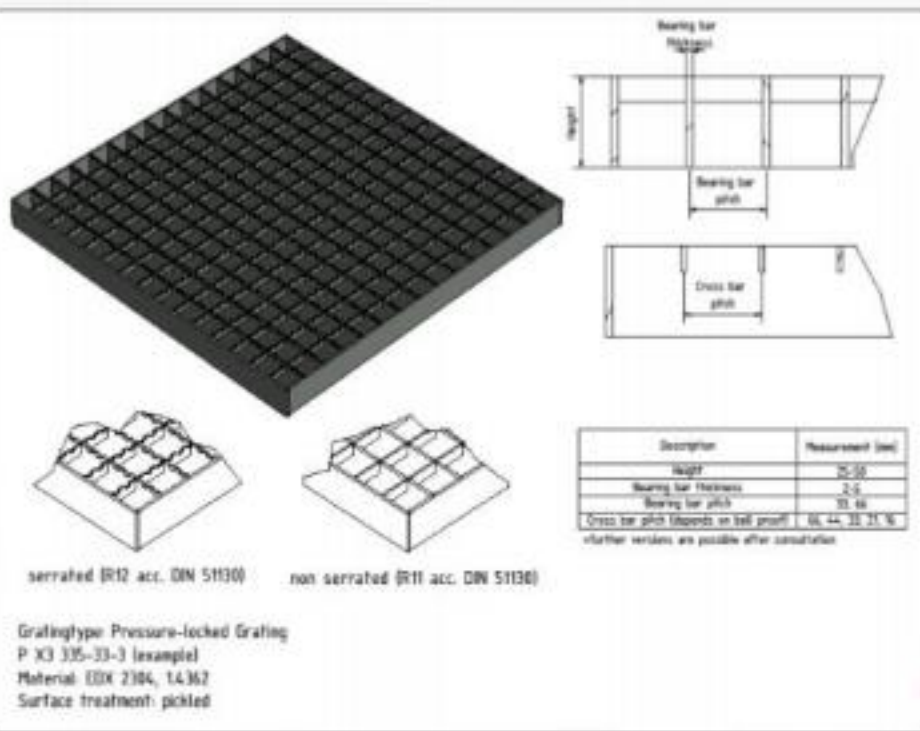
THANK  
YOU

Contact us:

RITIK BHARTI  
(+91) 9163492219







## Main advantages by using grating's in Stainless Steel

Vs hot dip galvanized C –steel gratings

- Significantly lighter.
- Longer lifetime
- High Strength

Vs glass fiber reinforced plastic gratings.

- Longer lifetime
- Uniform strength in all direction
- Withstand fire.

The optimized Stainless steel Grating of 22 Kg/ Sqmtr is capable to span approx. 1500 mm





## SS Cladding project : Mumbai



**Name of the building:** Museum for Indian Cinema, (a NBCC Project done by M/s Shapoorji Pallonji And Company Private Limited)  
**Location :** Peddar Road, Mumbai  
**Stainless Steel Sheets (SS 316L)**



# Stainless Steel Green (Plant) Sun Screens



SUB-  
HEADING  
HERE



## SS Cladding including AC Vent



## SS Cladding including AC Vent





## SS column Cladding with seating arrangements



scription





## SS Facade





## Cladding ( Delhi Airport Terminal 2)





## Wall Guard / Louvers - Defense Airport







Jindal Champagne finish approved for Chennai Airport Project Column

# Chennai Airport Modernisation Project





# Hyderabad Airport Project









Ice Flower



Mystic



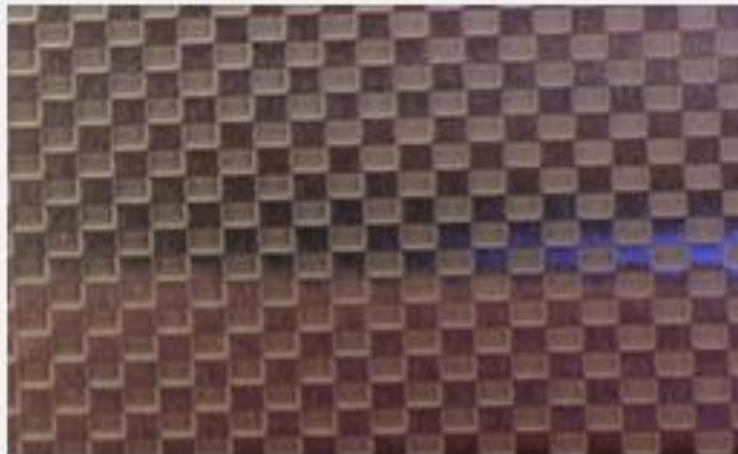
Linen



Honey Comb



Box



Moon Rock





## SS Finishes for Lift Panel ( Scratch Free ) – For transit Buildings





## SS Finishes for Lift Panel ( Scratch Free ) – For transit Buildings

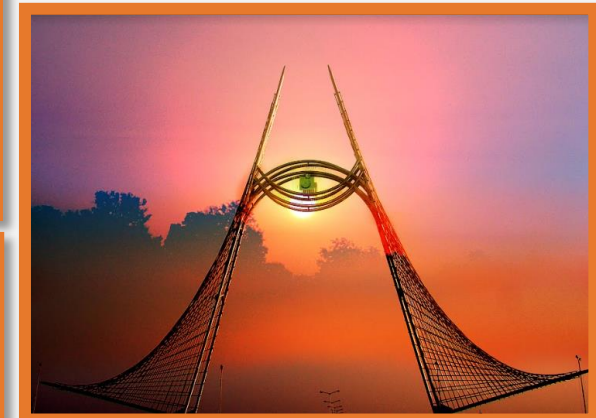








# JSL LIFESTYLE PRODUCT OFFERING

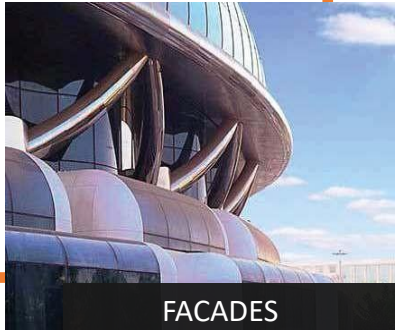


JINDAL ARC  
INFRA SOLUTIONS



# OUR OFFERINGS

JINDAL  
L I F E S T Y L E



FACADES



CANOPIES



CLADDING



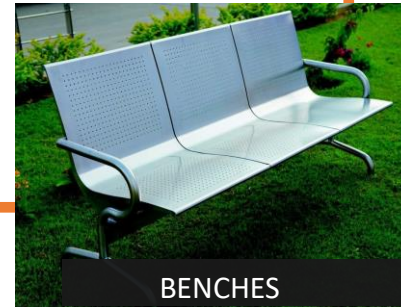
RAILINGS



PANTRY



DUSTBINS



BENCHES



BOLLARDS



SIGNAGES



CHEQUERED PLATES



CONVEYOR CLADDING

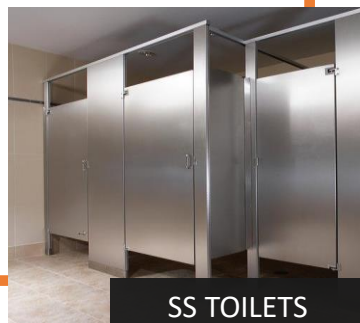


LIGHT POLE

## OUR OFFERINGS



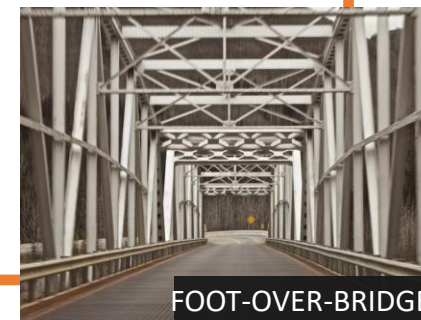
CABLE TRAY



SS TOILETS



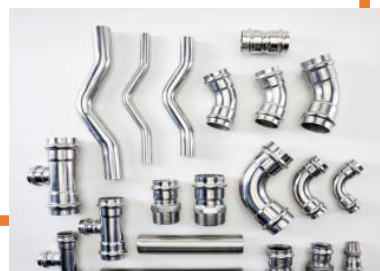
CURTAIN COVER



FOOT-OVER-BRIDGE



PIPES



FITTINGS



WATER TANK



# LOOKING FORWARD

