

**JINDAL
DURASAFE**

**BRIDGING
SAFETY
FOREVER**

A LEGACY BUILT ON SAFETY & TRUST

Founded by Shri O.P. Jindal in 1970, Jindal Stainless is one of the largest stainless steel conglomerates in India and ranks amongst the top 10 stainless steel conglomerates in the world. Jindal Stainless Group has an annual crude steel capacity of 1.9 MTPA and an annual turnover of \$2.7 billion (as on March 31, 2021).

Our growth has been backed by the excellence of our people, value driven business operations, customer centricity, adoption of one of the best safety practices in the stainless steel industry and a commitment for social responsibility.





ABOUT STAINLESS STEEL

Stainless steel is the common name for all steel grades containing at least 10.5% Chromium. Chromium improves the corrosion resistance of stainless steels. In addition to iron and Chromium, stainless steels contain other alloying metals, of which the most important are nickel and molybdenum. The combination of Chromium and oxygen leads to the formation of a Chromium-rich passive layer on the surface of the steel. This layer protects the steel, and re-forms over time if damaged.

On the basis of their microstructure, stainless steels are divided into austenitic, ferritic and martensitic basic types. More than 100 different stainless steel grades have been developed for various applications.

The contents of the alloying metals influence the corrosion resistance, durability, strength and formability of the steel.



WHY STAINLESS STEEL FOR BRIDGES?

Usage of any alternate material can lead to corrosion which can impact the lifecycle of a bridge. Other materials also have the constraint of being limited as renewable resources or can have high cost of maintenance. To add to that, bridges are exposed to high pollution (vehicular & industrial), leading to accelerated damage of material surface. The conventional carbon steels in those areas are not effective as the steel has a high corrosion rate. In these conditions, Stainless Steel provides sufficient corrosion protection with lower maintenance during its design life. Not only does it provide higher resistance to corrosive wear and tear, but also is more economical on Life Cycle cost basis.





DESIGN FLEXIBILITY

CARBON STEEL

The section type and structural configuration are influenced by the corrosion mitigation, thereby limiting the choices available to the designer while optimising the design.

STAINLESS STEEL

In view of superior corrosion resistance, the structural engineer is free to select the most aesthetic and economical structural configuration with closed sections and any other combination, purely based on strength and serviceability parameters.

APPROVED BY MUNICIPAL CORPORATION & INDIAN RAILWAYS

Indian Railways & Municipal bodies has approved use of stainless steel in structural applications of bridges in line with global success stories of using modern technologies in construction.

STRENGTH TO PROTECT LIFE



PROMISE

Advantages of Stainless Steel Bridges are:

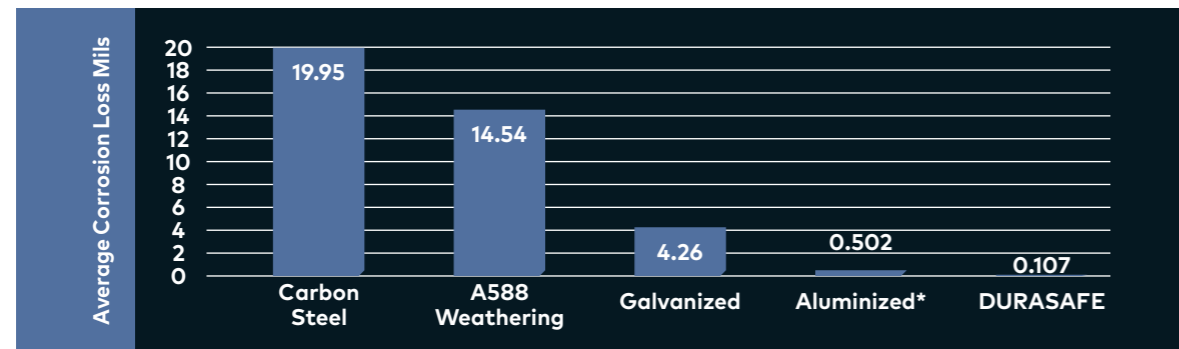


EDGE AHEAD WITH THE JSL EDGE



Durasafe Properties

Upto 186x better corrosion resistance



Corrosion performance in SAE J2334 test consisting of alternating wet/dry cycles with salt for 8 weeks low maintenance

Mechanical Properties

| Grade | Yield Strength | Tensile Strength | % Elongation |
|------------|----------------|------------------|--------------|
| IRS 350 CR | 350 MPA min | 485 MPA min | 18 min |
| IRS 450 CR | 450 MPA min | 585 MPA min | 18 min |

Light weight/cost effective

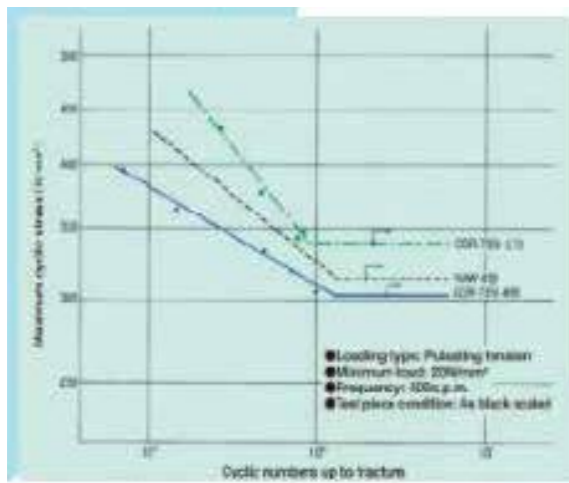
Chemical Composition

JSL Durasafe confirms to ASTM A1010 and RDSO specification BS-S-7.5.3.1-9

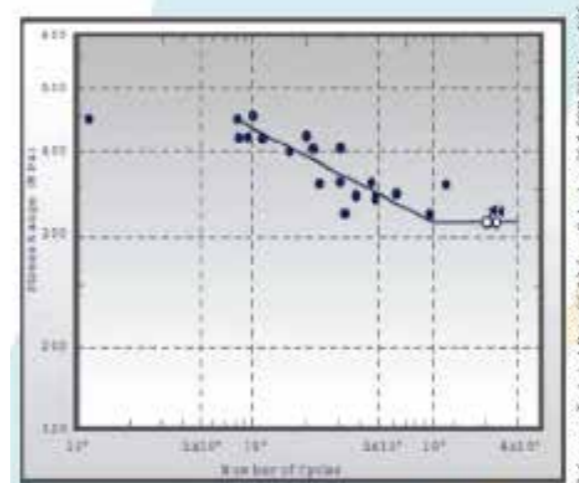
| Element (%)* | C | Mn | Si | S | P | Ni | Mo | Cr | N | Others |
|--------------|------|-----|----|------|------|-----|-----------|-----------|------|--------|
| | 0.03 | 1.5 | 1 | 0.01 | 0.04 | 1.5 | 0.10-0.75 | 10.5-12.5 | 0.03 | - |

*Maximum, unless range or minimum is indicated

Fatigue Strength



S-N Diagram for COR-TEN 490



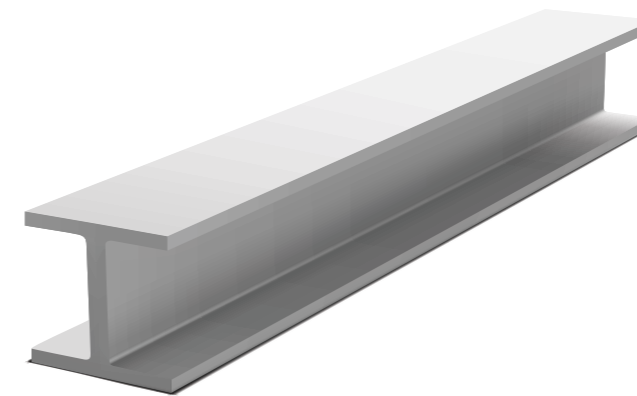
S-N Diagram for 3Cr12 (Equivalent to Durasafe)

The fatigue strength of the COR-TEN 490 is also around 310Mpa similar to grade 3CR12 (Equivalent to Durasafe) under pulsating tension (Stress Ratio R=0, i.e. zero to tensile loading) as shown in figure.

JSL Products for Structural Applications

A. Plates

- Thickness - 3mm-80mm
- Width - 1500mm max
- Length - 13000mm max



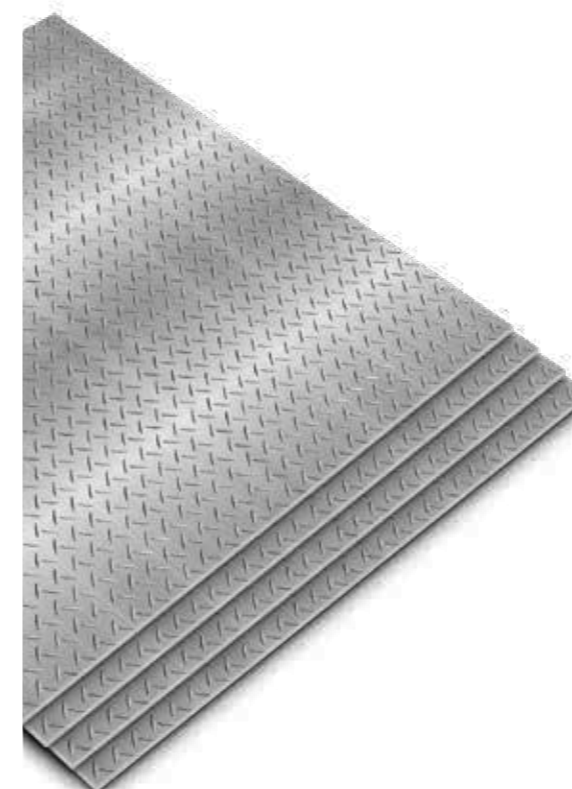
B. Fabricated Girders

- JSL offer welded stainless-steel I-beams, H-beams, hollow-section tubes and bent profiles for load-bearing structures.
- These products are available in lengths of up to 13 m without length splicing.



C. Angles Channels

Cold Rolled Formed / press sections



D. Stainless steel Chequered plates

Hot Rolled Annealed & pickled Stainless Steel Chequered plate having flat bottom of Grade 409M confirming to IS 6911:2017 Amendment 2, with minimum 2.8mm thickness, Pattern as per IS 3502 1A, bead height minimum 0.80mm.

THE PROMISE OF QUALITY IN ONE INTEGRATED SOLUTION



Standards and Codes

| Standard | Corresponding Design Code | Corresponding Construction / Fabrication Code |
|---|---|--|
| EN 10088 (Part 1 – List of Stainless steel) (Part 2 – TDC for sheets/plates and strips of corrosion resisting steels for general purposes) (Part3- TDC for semi-finished products, bars, rods, wire, sections & bright products of corrosion resisting steels for general purposes) (Part4-TDC for sheet/plate and strip of corrosion resisting steels for construction purposes) | 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 (Standard Specification for Higher-Strength Martensitic Stainless Steel Plate, Sheet, and Strip) ASTM A709/A709M(Standard Specification for Structural Steel for Bridges) ASTM 240(Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications | AASTHO LRFD Bridge Design Specifications | AASTHO LRFD Bridge Construction Specifications |
| BS-S-7.5.3.1-9 (Specification for higher-strength martensitic stainless steel for bridge and associated structural applications IRS 350 CR) | AASTHO LRFD Bridge Design Specifications | AASTHO LRFD Bridge Construction Specifications |

JSL Durasafe confirms to ASTM A1010 and RDSO specification BS-S-7.5.3.1-9



Recognised by RDSO & Indian Railways.

Stainless steel specification for structural applications in line with RDSO Specification

1. Material Specification : BS-S-7.5.3.1-9
2. Grade Name: IRS 350 CR
3. RDSO Approved Stainless steel Drawings
 - 3A. Foot Over Bridge (FOB)
 - i. 25-30 mtr lengthX6mtr wide Span – Drawing No-RDSO/B-10424
 - ii. 20-25 mtr lengthX6mtr wide Span -Drawing No-RDSO/B-10426
 - 3B. Road Over Bridge (ROB)
 - i. 36X11 Span – Drawing No-CBS 0048
 - ii. 30 x 11 Span-Drawing No-CBS 0050

Recommended Fasteners details for fabrication of Jindal Durasafe

| Item | Code | Grade |
|--------|----------|---------------|
| Bolt | ASTMA193 | GR B8 Class 2 |
| Nut | ASTMA194 | GR 8 |
| Washer | | Type 303 |

All types of nuts & bolts domestically available

Visit www.makestainless.com for suppliers of consumables, fasteners and fabricated components.

Weldability of Jindal Durasafe

It is recommended to use ER308L, ER309L, ER316L, and their higher silicon content counterparts, however ER309L has by far been the most widely used filler wire for welding of the plate girders fabricated with Jindal Durasafe. Suitable flux should be used with filler wires. For FCAW, ER 309L and for GMAW – ER 309L/ER 309LMO with Gas mixture Ar-98% are recommended. However, any other suitable welding consumable permissible by AWS D1.6 may also be used

LCC Analysis:

- Initial cost increase is 20-25% over existing carbon steel
- Low maintenance over carbon steel. For aesthetics purpose, Paint is recommended for utility Ferritic stainless steel. Addresses the current challenges of maintaining bridges like safety, accessibility, shutdowns, additional cost for upkeeping and channelizing dedicated resources for the repeat jobs.
- Weight Reduction of more than 25-30% achieved due to higher Yield Strength and light weight design
- Payback period is less than 20 years
- Stainless steel is green material and increase in reducing Carbon Foot Print
- Service life of stainless steel is more than 100 years

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 2nd 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)
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To,

Secretaries of All Central Government Ministries/ Departments



Notes

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Notes

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