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STAINLESS INDIA

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**BUILDING A
STAINLESS ERA**

30th Foundation
Anniversary
Special



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Stainless-Steel Industry: Development & Growth in India

Evolution of Stainless Steel and its initial growth

From being discovered more than hundred years ago, the green metal called Stainless steel has grown to be an integral part of our lives. Stainless steel is mainly known for its corrosion resistance properties. It also has excellent engineering properties and can be found in multiple applications where strength, innovation and aesthetics are important.

Though stainless steel is just over hundred years old its production volumes started picking up only in 1950s with introduction of hot and cold rolling facilities. After the vast commercial pick up, the various grades were invented suiting to various environment & applications & later classified into austenitic, ferritic, martensitic, duplex and PH grades with its unique properties.

Initial Growth of Stainless-Steel Industry in India

India's tryst with stainless steel started just about four decades ago, with first production primarily getting used for utensils in kitchen with some limited special applications in engineering use. Initially the country was fulfilling its usage through imports only till 1978. It was only in 1978 that two plants ASP & VISL (Both a part of SAIL now) started producing rounds and billets by taking country domestic usage to 18000 MT per annum. The production & usage increased when players like Bihar Alloys Steel & Jindal Strips Ltd. (now Jindal Stainless) started their production facilities in early 1980's to produce flat products. These were further used by re-rollers to produce patta for utensils market. Availability of indigenously produced flats accentuated the emergence of new facilities for re-rolling near Jagadhari, Jodhpur and Delhi. During this time domestic production started to get noticed which reach to 50,000 MT per Annum. But at the time when other developed countries started using more of stainless steels in wide variety of industrial usage Indian end use was still restricted to Utensils and kitchenware products, primary reason being lack in technological advancements and know how.

Only in year 1981 SAIL/Salem Steel Plant started the first cold rolling unit in the country. The production touched more than 100,000 MT per annum finding end use in many architectural as well as industrial application. But this development was slow, however,

growing demand for the use of stainless steel for utensils allowed to bloom and spread the 'patta' industry in other regions of the country specially in the state of Gujarat and Maharashtra.

There was a serious threat to stainless steel growth during 1990 when nickel prices increased sharply, and it touch to 18000 US\$ /MT. Most of the production was happening in grade 304 having higher nickel content and India being fully dependent on imports of Nickel the growth of stainless steel was seriously hampered due to increases in this price.

However, during this time there were lot of changes in technological advancements in the process of stainless-steel making. It enabled the producers worldwide to produce high quality stainless steel in various grades for wide range of applications. Upto mid 60's, the stainless steels were manufactured mostly by Electric Arc Furnace – Ingot Casting - Slabbing and hot rolled to coil/sheets in hot strip/plate-sheet mills. But in 1990s new technology of Argon Oxygen Decarburization (AOD) made it possible to replace Nickel with nitrogen and manganese and produce different variations of non-magnetic stainless steels, which were ideally suited for applications where corrosion resistance requirements were moderate. These new 200 series grades were having very high strength compared to other austenitic stainless steels and had good ductility also. These were less costly and their dependency on Nickel price volatility was lower. Indian producers took advantage of this opportunity and developed many popular grades expediting the end use growth rate specially in utensil sector. Till now, many new producers Mukund, Panchmahal, Facor, Viraj & BRG forayed into production stainless steel catering to need of Flat & Long products started their productions taking over production of India to 320000 MT per month.

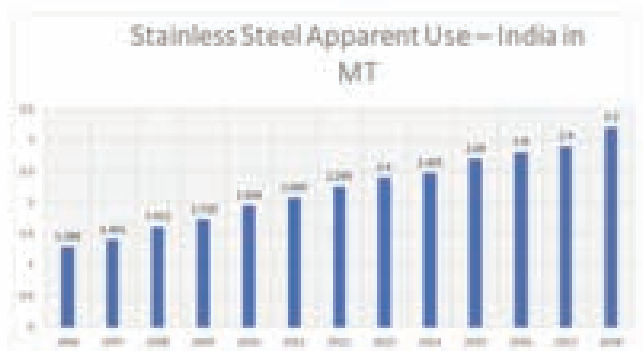
Although stainless steel industry was growing at a very steady rate in the country but till 1989-1990s more than 90 % of use was still in kitchen and related applications. Meanwhile, western and other developing countries started using stainless steel in more and more applications such as rail coaches, tankers for carrying liquids, pipelines for carrying oil, gas, liquids including potable water, various products for architecture, building and construction (Infrastructure Applications).

Activities leading to Market Growth of Stainless Steel

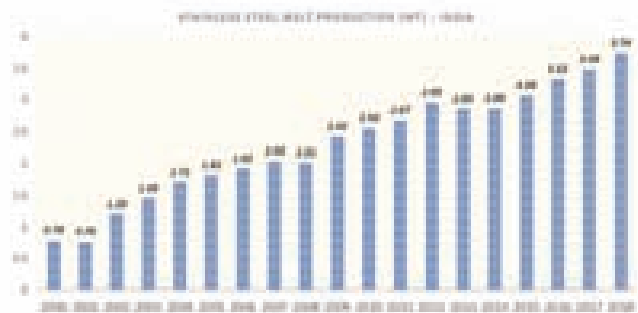
At the time when most of the production in India was concentrated in utensils segment, a need was felt by Indian producers to make a coordinated effort to create an association for development of new end use sector for stainless steels. At that time there were only four Stainless Steel Development Associations were in existence (Japan, Germany, Italy & South Africa) and it was observed that there has been a marked difference in the stainless-steel market development in these countries compared to others. Accordingly, Indian Stainless-Steel Development Association (ISSDA) was formally born in November 1989 as non-profit Organization after extensive deliberations and taking into confidence key manufacturers (seven producers) of stainless steel at that time.

The primary objective of ISSDA is to create awareness for Stainless Steel usage & support in diversifying the use of Stainless Steel in different sectors as per the global applications. ISSDA has joined hands with the domestic producers to initiate training & education programs for different industries along with promotional activities. The one of the important aspects of Stainless-Steel properties is its lifecycle cost & people must be aware about this concept & ISSDA has taken this initiative to make industry stakeholders aware since if wisely used the life cycle cost will result in long term value addition. In the last two decades, stainless steel has undergone a tremendous change in perception and production volumes in India. ISSDA has been successful in creating the awareness and changed the perception on stainless steel being seen as a material good only for kitchenware, it is now seen as a wonderful engineering material that lasts for decades and gives you value for money.

Today we see use of stainless steel not only in kitchen but in India Railways & Metro Rail Coaches, Wagons, tankers, various products for building & construction & process Industry but also in sectors such as nuclear, Power, Oil & gas where high quality & grades that are indigenously produced, supplied & are being used.



Growth of Indian Stainless Steel Melt Production



Current Production and Consumption trend of stainless steel

The world Crude Stainless Steel production in 2019 is estimated over 50.7 million tons. The world production has grown at a CAGR of 5% p.a. over the last 10 years. Asia has been leading the production dominated by China accounting for more than 50% share of world production. India has been a part of this impressive growth with its production reaching 3.74 million tons in 2018-19. For the last two consecutive years, India has been the second largest producer of stainless steel in the world with an impressive growth of more than 7 percent. Not only production, but India is also the second largest user of stainless steel in the world reaching an apparent consumption of 3.2 million tons in 2018-19.

Potential for increase in stainless steel consumption in India

Stainless steel is known for its corrosion resistance, mechanical strength and formability, fine lustre, hygiene, recyclability etc. Many of these characteristics make it suitable for varied applications. The demand for stainless steel is expected to keep growing, driven by consumer durables, Architecture Building & Construction (ABC) segment and infrastructure.

Following segments have been identified as the key areas for development in India:

- Architecture Building & Construction (ABC) segment** - including stainless steel roofing systems, furniture, escalators, elevators, construction (housing, organised retail), etc.
- Urban Infrastructure** – this includes water pipelines, desalination plants, sewage pipelines, waste treatment plants etc.
- Automobile, Railways & Transport (ART sector)** – including the increased use in Automobiles, Railway

wagons and coaches, luxury bus bodies and metro coaches etc.

d. Process industries via use in chemicals, petrochemicals, pharmaceuticals and food processing industry. It also finds extensive use in power sector – in thermal, solar and nuclear power stations, use in critical boilers of power plants, water treatment plants etc.

Based on the above and the general market scenario, the following three areas have been identified as key areas for growth in demand:

- **Urban infrastructure –**
 - a. water pipelines/ desalination plants
 - b. sewage and water treatment plants
 - c. Water storage and transportation
- **Urban transportation -**
 - a. Increased use in Bus bodies (public transportation)
 - b. Wagons / coaches in Railways and in metro rails
- **Food processing -**
 - a. Food processing equipment including tubes and pipes for Oil / milk / beverages.

In the above mentioned areas, the use of stainless steel can be improved either through a replacement of an existing usage or by devising new application areas for the particular usage.

Urban infrastructure

Urban population is large and growing. This is likely to double in the next couple of decades. To cater needs of this urbanization, India needs good cities with modern infrastructure. This challenge has been answered by the GOI through setting up of "SMART CITIES" and "AMRUT CITIES" at identified locations across the country which will merge smart solutions and functional efficiency to create better living communities and thereby improving the future for the country.

The objective of the SMART CITY includes quality water supply, provide proper waste management, promoting a variety of public transportation options and develop well planned open spaces. Keeping in line with these broad outlines, the stainless steel industry has identified the following areas:

a. Drinking water related usages - Safe Drinking water is right of every Citizen. Corroding pipelines with interrupted supply contaminates water posing

serious health hazards. Moreover, it is estimated that in 40-50% water is lost due to leakage.

b. Stainless steel drinking water tankers used in distribution of safe and pure drinking water to the large population is the demand of any growing city. The easy cleaning ability of stainless steel makes it the first choice for strict hygiene conditions. In addition to the hygiene and purity of water, the tankers have Long Life, are lighter & stronger, have Higher fuel efficiency, Minimum Maintenance, Easy Cleaning, fully recyclable and also adds aesthetic value to city and its surrounding. In urban cities Mobile water vending machines / water ATMs is also widely being used.

c. Stainless steel water pipelines including stainless steel service pipe lines for transportation and distribution of drinking water. This has been extensively been used in developed cities like Tokyo, Seoul, Taiwan etc. This has multiple benefits. The following are its advantages:

- a. It reduces water loss to less than 1%
- b. Reduces the incidence of water borne diseases to almost NIL.
- c. They have been proven to be earthquake friendly since elasticity and ductility absorb shocks preventing breaking or cracking. Even under catastrophic conditions, drinking water is not contaminated and remains available.
- d. They are suitable for distribution given the non-corrosive nature and therefore, no leakage
- e. SS material has low maintenance, higher service life makes it a cheaper alternative in terms of a life cycle costing.
- f. There is less scaling of pipes and therefore greater pressure or reduced energy demands, which are all very important for water supply in a water stressed country like India.

b. Use in desalination plants – with limited fresh water sources and increasing contamination of these fresh water sources due to Increasing population and migration of people, we have to turn to desalination of sea water to quench the thirst of the ever increasing population. The use of SS in these desalination plants **Can fight extreme corrosion, can decrease maintenance and can make water affordable by minimizing production cost based on life cycle cost analysis.**

c. Urban construction - through use of overhead water tanks, Stainless steel pipes for plumbing for

leak proof buildings. (Successfully used in Residential complexes of CPWD, IIT Delhi and most recently in the new Supreme Court complex). This can be used in all the redevelopment of urban residential and commercial areas like Kidwai Nagar, Sarojini Nagar, Nouroji Nagar projects in Delhi and Bendi Bazar in Mumbai and other institutional buildings undergoing redevelopment.

d. Stainless steel for public toilets – successfully installed and running well in cities like Chennai and Madurai.

e. Sewage and Waste water treatment plants - 70% of the world's surface is covered with water, but less than 3% of it is fresh water and wastewater is a valuable, sustainable resource and should be treated appropriately. Stainless Steel can be used in Manhole covers, Pipes and fittings Pumps, Screens, Tanks and tank linings, Valves, Wall ducts Components used in settling tanks, grease and oil separation, dewatering and compacting, grit and sludge treatment, and filtration.

Urban Transportation

The use of stainless steel in public transportation especially in long distance buses and other public transport systems is accepted worldwide. It is being used in structural parts as well as side paneling, floor and luggage compartments. The reduction in overall weight offers substantial reduction in fuel consumption. The main areas for improvement include:

- **Wagon and coaches in Railways/ Metro rails:**

Stainless steel use in railways is increasing steadily owing to strength-to-weight ratio which makes wagons lighter by around 40%. As a result, trains travel faster, consume less fuel and increase efficiencies. In 2001-02, Indian Railways inducted German designed Linke Holfmann Bush (LHB) coaches for Rajdhani and Shatabdi trains. LHB coaches are made up of stainless steel, unlike conventional coaches of carbon steel. After successful sprint of Rajdhani and Shatabdi trains, Indian Railways decided to introduce stainless steel coaches for mail and express trains as well. It is heartening to note that Railways have now decided to make only stainless-steel coaches in the three Railway Coach Factories and replace the entire fleet of remaining 50,000 coaches with stainless steel coaches. In addition, stainless steel made bio toilets are being fitted in all railway coaches to improve hygiene, both inside and outside the trains.

- **Stainless steel in Railway wagons:** Increase usage in Railway Wagons especially used in transportation of specialised materials like milk, oil, coal ore, fertilizers,

food grains, cement etc. In 2008-09 Railways decided to induct several thousand stainless steel open wagons for mineral transportation. Stainless steel wagons are not only much lighter and needed less maintenance (or the reduced down time). The higher initial cost was offset with more freight per rake, save on fuel, lesser down time and less maintenance costs.

- **The shift to EURO VI norms** for light vehicles will trigger the average usage of stainless steel in cars by way of newly designed exhaust systems in stainless steel. However, as we become more and more environment friendly and take steps towards improvement there is an urgent need to include all commercial vehicles into this regime of Euro VI. This will increase consumption of stainless steel considerably.

- **Stainless steel Bus bodies in urban transportation**

Apart from weight reduction and subsequent saving in fuel consumption, the excellent impact toughness properties of stainless steel provide safety to passengers in case of accidents and crashes. This is already being used in some parts of the country. India is the 2nd largest market in the world for bus coaches and therefore it is quite imperative to encourage use of safer, fuel saving, sustainable buses on Indian roads as we will see increase use of public transport in newly developed cities. There is a need to shift to stainless steel bus bodies as is prevalent in many advanced countries

Food processing industry

From being a dominant material in household kitchen, stainless steel is now used in commercial kitchens as well. The fact that stainless steel is inert to most food environments makes it an ideal material for the food industry. Therefore, it is also easy to maintain the high levels of hygiene requirements in processing food for the masses. Clean, smooth surfaces free from cracks and crevices are easiest to clean. Unsmooth surfaces allow build-ups that may protect bacteria and other microorganisms from being killed or removed by heat or chemical application.

Currently, it is widely accepted for use in the dairy sector. They must also be used in meat, oil and beverage processing equipment. Worldwide, it is a standard practice for dairy and meat industry equipment and processing plant to be made from stainless steel. In India too considering the health and hygiene, there is a need to mandate the use of stainless steel in these food processing industries including food dairy and meat.

Stainless steel can also play a vital role in eliminating single use plastics in food and drinking water storage and handling.

Process industry

This industry historically has been consistent consumer of Stainless steel. It is used in wide ranging process industries including Refineries, Petrochemical, Chemicals, Dairy, Power, Textile, Sugar, Food processing, Distilleries, Fertilizer, Cement, Drugs, Paper and Pulp and others.

Role of ISSDA:

ISSDA has access to vast technical resources which enable us to guide users of stainless steel in the selection of proper grade of stainless steel for various service environments, as well as matters related to fabrication. This service is provided with no fee

or charge. ISSDA organizes workshops for specific end-use applications of stainless steel targeted at designers, material specifiers, engineers, architects, maintenance personnel; workshops for improving the quality of welding & fabrication; international conferences for increasing the awareness of applications among the stainless-steel industry. The technical strength of ISSDA is derived from its close association with the Nickel Institute, the International Stainless-Steel Forum (ISSF) and close collaboration with more than 20 national stainless-steel development associations (SSDAs) around the world. We are confident that in times to come we will witness good growth in use of stainless steel in all end use applications.

Vision:

To strive for corrosion free world and a sustainable society.

Mission:

To partner with our members, industry, Government and public at large for promoting stainless steel based solutions towards sustainability and growth.



K K Pahuja
President
Indian Stainless-Steel Development Association

Stainless Steel : Indian Success Story

The last century has witnessed several man-made miracles. We have conquered outer space, diminished distances, produced clones, developed artificial intelligence, and owned digital assistants in our pockets. Besides these marvels, the 20th century also saw the birth of a modern unique metal which is now conquering almost every facet of human life. This wonder metal, aka stainless steel, has revolutionised the modern world and out-performed other traditional materials in its demand and growth. The success of this incredible metal lies in its inherent and exceptional trait of being corrosion-resistant along with possessing unrivaled strength among all competing materials.

As an enthusiast for stainless steel since an early age, I have closely experienced the development of the domestic industry over these years. From initially being used in basic applications like washroom sinks for airbuses and baggage trolleys at airports, to revolutionising the country's public transport landscape with projects like the pan-India metro networks and Train 18, stainless steel has come a long way. During this journey, not only has stainless steel widened its application portfolio, but has also been acclaimed as the most preferred metal for modern infrastructure. Consequently, with stable economic growth and an improved business sentiment, the domestic stainless steel industry has witnessed a booming demand across crucial sectors like architecture, construction, transportation, health and hygiene, sanitation, kitchenware, white goods, processing industries, and even art.

Stainless steel has registered a remarkable growth in India. Once a net importer of stainless steel, India today ranks as the second largest producer of stainless steel in the world. What is more worthwhile is that other than meeting the domestic demand, we are also one of the leading stainless steel exporting nations in the world. When stainless steel manufacturing began in India, the nation achieved a per capita consumption of ~2 kgs stainless steel over a period of four decades. It is now time to raise our glasses to celebrate the milestone of recording a per capita consumption of 2.5 kgs stainless steel this year. This has been achieved in a very short span of time, when compared with other nations,

through the collaborative efforts of Indian Stainless Steel Development Association (ISSDA) and the domestic industry. India has also shown the fastest CAGR of 8-9% for stainless steel demand over the last three decades, highest among its global peers. From being nowhere on the global map of stainless steel producing nations 50 years ago, India now stands tall and proud of its achievements.

ISSDA plays the critical role of a philosopher and guide, that partner with and promotes stainless steel in the interest of the domestic stainless steel industry and the society at large. The association continues to educate, empower, and equip the domestic players with essential knowledge and resources in order to develop advanced stainless steel grades for a myriad of applications. Moreover, ISSDA leads the Indian stainless steel fraternity at all global forums promoting India's stand. It assumes the responsibility of voicing key issues and inviting collaborative opportunities with global stainless steel players in the interest of the country. For Jindal Stainless, ISSDA continues to act as an industry expert, bridging the gap between the existing demand and the endless possibilities that stainless steel can offer. Further, ISSDA's technical expertise acts as a reservoir of knowledge for domestic players. Several industrial projects involving specific requirements call for expert advice on choosing best stainless steel grades for the job; that is where ISSDA's prowess comes in handy. ISSDA also proactively engages with policy makers to articulate the concerns of stainless steel industry and acts an interface between government and industry.

Indian stainless steel demand over the years has witnessed a significant change; from a humble beginning in the kitchenware segment to quintessential economic fronts like nuclear, defence, ABC, ART, and energy generation applications. It is noteworthy that the developed nations, in the past, have followed a similar growth trend in expansion of stainless steel applications, which is reassuring for the Indian growth story. The exceptional ability of stainless steel to adapt to numerous applications helps in economic growth due to its lower life cycle costing and curbing of corrosion-related losses. Moreover, the production of high quality stainless steel creates more opportunities for exports, augmenting foreign

exchange for the country. Globally, we have marked our presence as one of the most quality-conscious stainless steel producers. This is testified by the fact that Indian stainless steel products are exported even to some of the most quality-conscious markets in Europe and US.

Being the second largest stainless steel producer and ranked among the top three fastest-growing economies in the world, India remains a bright spot in the global landscape. As a globally trusted stainless steel producer, the Indian stainless steel industry is working with ISSDA to further promote stainless steel as a green metal and a sustainable solution for a variety of applications across the spectrum. The stainless steel industry remains committed to the 'Make in India' vision of the government and will play a critical role in enhancing the high-value product manufacturing capabilities in the country. I am confident of collaborative efforts of the government and industry to take Indian economy to US\$ 5 trillion economy in short span of time.

As we join ISSDA in looking back at and celebrating this 30-year long journey, we also envision a self-reliant India in 2030, basking in her own brilliance. The need of the hour is to address the cause of sustainability when we imagine growth in any field. Stainless steel stands tall in this regard as it is the perfect 'green' alternative to several metals and materials, by being almost completely recyclable. Crafting innovative and sustainable applications in stainless steel is what the future asks of us. There is immense potential in this metal and in the domestic industry to lead the wave of sustainable development. I'm certain that with high spirits and continued support from ISSDA, celebrations will soon be in order.

My heartiest wishes to ISSDA on 30 glorious years of success.



Abhyuday Jindal
Managing Director, Jindal Stainless

Stainless Steel Long Products – Making India A World Leader.

Indian stainless-steel industry has outpaced the global average growth rate in the last decade. Today India is the 2nd largest producer of stainless steel in the world. Though production of stainless steel for both flat and long products grew manifolds over past several years but on domestic front; flat products command a large share in the consumption whereas long products command a bigger share in the export market. It was just two decades ago, when there was high increase in global demand for stainless steel long products. Though initial growth of stainless-steel industry was attributed to only flat products and that too was primarily coming from the increasing consumption in the kitchen segment. While India was still at a nascent stage exploring ways to use this wonder material, the developed countries of the world were already on the path of using stainless steel in various outdoor applications as well. Their preference towards stainless steel was influenced by several factors like low maintenance, aesthetics, lower life time cost etc. Stainless steel not only has good corrosion resistance but also excellent engineering properties and which makes it one of the most preferred materials.

Stainless Steel long products find wide range of usage in Industrial applications but this opportunity to export finished long products was not being utilized in the absence of quality manufacturers in India. Viraj commenced its first melting shop operations in 1992, although production of stainless steel first began in 1995, and in the same year flanges division was established, as was the production of bright bars for exportation. In subsequent years Viraj diversified further, with the addition of profile division, from which 99 per cent of the products were exported to international clients. The addition of wire division and a second melting shop resulted in expansion of stainless-steel product ranges increasing the export activities in many countries. In 2006, Viraj broadened its portfolio of stainless-steel solutions even further, integrating a fastener division and a wire rod division into its facilities.

Today Viraj is the largest producer of finished long products in the world. Viraj also functions as one of the world's largest stainless steel flange manufacturers, which has led to the company's trusted reputation as a leading provider of flanges for marine applications. In stainless steel long products, India is quite competitive compared to other leading countries in

the world. The capability of the long product sector is comparable to the best in the world.

Though long products are primarily exported but with rapid industrialization and urbanization long products market is likely to grow further in the country. Stainless Steels are one of the most sustainable materials amongst metals. It offers great value during its service life and can be fully recycled after its optimum service life. Stainless Steel Long products see application in automobile industries, food processing industries, boilers, pressure vessels, shipbuilding, oil pipelines, petrochemical facilities, construction projects and surgical instruments, building and construction – among many other means of utilisation. Domestically there has been successes in segments like wire baskets in modular kitchen, fastener, building hardware and welding consumables etc. There is a significant scope in of increasing usage volume of long products especially as structural elements.

Indian Stainless Steel Development Association (ISSDA) which is a market development arm of the stainless steel industry in India has been at the forefront in promoting use of stainless steel in the country. It plays a critical role in providing technical knowledge and spread awareness on the use of stainless steel. We believe that in coming days India will not only remain global leader in supplying long products of stainless steels but India will become global hub of manufacturing and long products consumption will grow exponentially.



Mrs Pooja Mehra
Executive Director, Viraj Profiles Ltd.

Stainless Steel Welded Pipes & Tubes – Dawn of a New Era

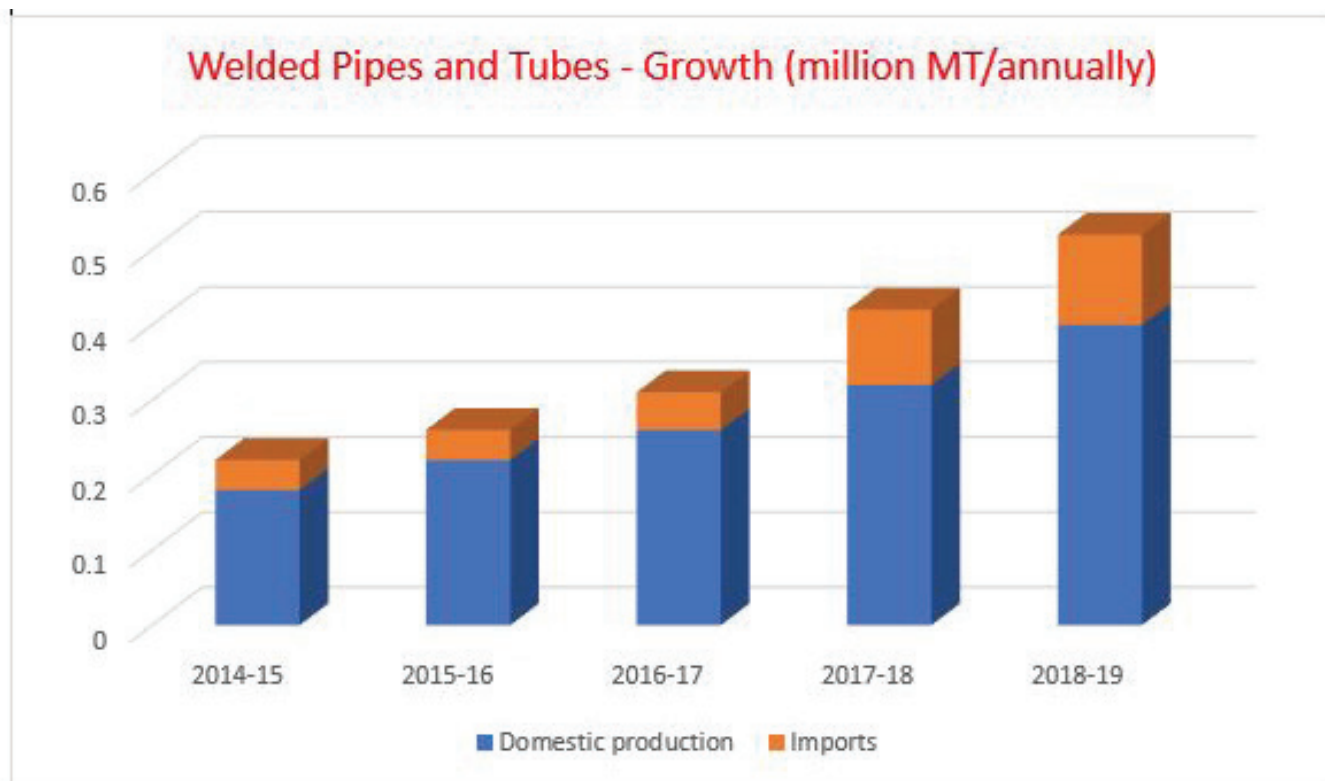
Indian Cities are going through a phase of rapid urbanization and construction activities, both at the level of private and government, has picked up and likely to speed up the stainless steel demand in this sector. Apart from traditional use of building hardware there has been a noticeable shift in the use of stainless steel as a preferred choice of material for gates, handrails and window frames. Today, even a moderate size residential flat in a high rise apartment or an individual houses, big or small, would prefer to have a designer stainless steel gate in the front. The increase in demand of such gates can be gauged from the fact that several pipes and tubes mills has come up in recent past in the country. The growth of stainless steel welded pipes & tubes industry in the last 5 years speaks volumes about the current and future capabilities it holds. Welded pipes & tubes production in India has grown from 0.18 million MT in 2014-15 to almost 0.40 million MT in 2018-19 putting us at almost 18% year-on-year growth rate. These numbers would have been even higher if not for the huge surge in

enjoying almost 20 percent of market share currently. What is noteworthy here is that where Indian pipe & tube domestic production has more than doubled itself in these last 5 years, flat product production has only increased by 25 percent from 2 million MT in 2014-15 to 2.5 million MT in 2018-19. With a market share of 16%, our industry should pride itself as the biggest single sector for flat product consumption in India.

To give more perspective on where we stand currently, a SWOT analysis of our industry projects following facts.

Strengths:

1. Superior Quality: Indian manufactures have proven quality; market gives a premium for 'made in India' pipes & tubes. We have globally proven expertise in varied sectors like ornamental, structural, heat exchangers, hollow sections, automobile,



imports. Indian pipes & tubes domestic consumption was estimated at 0.2 million MT in 2014-15 which increased to 0.50 million MT in 2018-19, with imports

exhausts, water pipeline, food & beverage, sugar industry etc.

2. High Efficiency: Even though manufacturers based out of countries like China are highly subsidized, our conversion cost is at par with them if not less. 90% of our industry are small family driven enterprises who have micromanaged every aspect of production, sales & distribution creating a streamlined assembly line. Most of us invariably follow lean manufacturing which even big global setups are not able to achieve. Technologies like high Frequency welding for Stainless Steel pipes & tubes are only available in India.

3. Young and abundant workforce: Our industry enjoys the abundance of young human capital that our country possesses that too at optimum wages.

4. Low nickel grades: Advent of 200 series has increased affordability of Stainless Steel pipes & tubes. It has transformed stainless steel from a luxury product to a mass market product. India being rich in ferrochrome should always have an edge against its 'fair' competitors globally in 200 series.

Opportunities:

1. Growing market: Just for reference, steel pipe production in India is close to 9-10 million MT annually, whereas we are still shy of 1 million MT annually. I reckon, we will cover almost 30% of steel pipe market in the next 5 years. This alone puts us at 25-30% growth rate. Not only steel, stainless steel pipes & tubes have found new applications which were previously owned by PVC industry. These include drinking water distribution pipeline, plumbing, drinking straws etc. Current call by Indian Government to discourage use of plastic will help in increasing usage of stainless steel pipes & tubes as best alternative. A lot of credit should go to ISSDA for creating awareness regarding this within the Indian government.

2. Surplus Capacities & Ease of Expansion: We have ample surplus capacities, almost 30% by my estimate, to counter any kind of demand surge across all sectors. We are still to achieve optimum economies of scale; this would increase our efficiency even further. In the last 5 years, we have seen more than 100 new individual production units coming up in different parts of India. Our industry does not require huge capital expenditure. This makes it very easy for us to expand further as the market grows.

3. Downstream industry: Our downstream industry is still unorganized and lacking in standard operating procedures providing an opportunity to reach out and expand the business.

4. Lifestyle Product: In recent years stainless steel has become an integral part of Indian lifestyle. Using

stainless steel in buildings, lifts, kitchens, appliances, railways etc. has become a trend, something which is also explicitly advertised. In this world of 'social media', superior aesthetics of our product has given us a distinct advantage.

5. World against China: For years China has taken advantage of the huge Indian marketplace. Now that countries across the globe are taking measures to ban imports from China, it opens more marketplace for us. Just keep in mind, 'fair trade' will always last longer.

Weaknesses:

1. Non-availability of cheaper raw material: A lot has been said on this over the years and without going into specifics I would just acknowledge that this is major challenge especially when our prices are pegged against cheap and subsidized imports.

2. Lack of skilled labor: We do not have training facilities for our workforce. Most of them learn on the job. We need to create specialists, rather than 'jack of all trades.'

3. Lack of cooperation amongst domestic manufacturers: I believe Indian market has enough opportunities for everyone. But tactics like price undercutting, employee poaching and negative marketing harms the industry. We should focus inwards rather than outwards.

4. Logistics and distribution: Although our mills are very efficient, we are faced with high logistics costs. For reference, a typical container from a port within the ASEAN region would cost around 4 Rs/kg door-to-door delivery with an average transit time of 10-15 days. If we combine our input and output logistic costs and transit times, it would sometimes be much more than this. Our accessibility to various smaller cities is limited. Having more than 2 layers of distribution channels between mill and local shops adds on to the sunk cost. I am highly hopeful about the inland water transport being developed by our government currently.

5. Need of standardization: Unlike steel industry which is older and much more evolved we are still to standardize our product. Standardization will help us create opportunities in various sectors, improve upon the quality further, help in educating the customers, and also prevent sub-standard imports.

Threats:

1. Trade agreements: Although our industry has shown tremendous growth, but on a macro level we

are just a fraction of India's GDP. Protecting ourselves from an array of free trade agreements being signed by Indian government will need tremendous effort from Indian manufacturers. By my estimate, countries like Vietnam have increased their domestic production by more than 10 times in the last 3 years alone riding on Indian demand. Many more India centric export hubs will come up in the coming years specially in ASEAN region.

2. Lack of timely support from Government: If governments of various ASEAN units are so supportive providing a plethora of subsidies to their respective domestic manufacturers, why can't our government do the same? Our interest and electricity costs are one of the highest within this region. Practical implementation of the promise of 'ease of doing business' is still a long shot. Where regions like EU & The USA take immediate pre-emptive measures, our government takes more than 1 year to take remedial steps. Problem lies with us also, as not adequate representations and requests have been made by manufacturers as one industry. Sometimes we are so

focused on what is happening outside the country we forget to look inside.

3. Professional Behavior: Without going into specifics, I would request all my fellow manufacturers to not cave into the pressure from your distributors or customers. It's a classic case of 'one bad fish.' If an option is available to the downstream friends to take advantage of, they will take it. The question is why is it available?

Only recently in the last 2 years, our industry has managed to come together and successfully cooperate to counter various issues. We must remember that our unity is our strength, be it in front of the Indian government or representing our interests in front of upstream industry. We should keep up this trend, share ideas, share our resources and unutilized capacities. Efforts should be made to make our industry efficient as a whole and therefore, create a successful ecosystem.



Anish Bansal
(Managing Partner, Maven AB Inox LLP)

Use of Stainless Steel in Architecture, Building and Construction

Today stainless steel is the most sought after material by architects and builders for selective use in combination with existing materials in both interiors and exteriors, thanks to the sustained efforts by organizations such as ISSDA and its member companies. Stainless steel has an edge over steel, aluminium and other metals and alloys due its negligible maintenance cost and almost unlimited life. This article provides an overview of the factors in consideration for the use of stainless steel in the ABC sector.

Introduction

Stainless steel is perhaps the most versatile and youngest metal alloy ever to have been created and its growth has been magical. There has been an unprecedented growth and evolution in process technology and applications of stainless steel in just over 100 years since its creation by Harry Brearley at Sheffield UK.

Due to the encouragement shown and the opening of enormous opportunities, many fabricators use stainless steel exclusively for the ABC Sector and have since established themselves in various parts of the country. They have created a niche in this line by their fabrication skill and expertise. However well informed fabricators with trained workforce are far less than the demand.

Globally 15% of all stainless steel is used in the ABC sector, the breakup of which is shown below:

Building Cladding and Structures	49%
Public Space Architecture (Art and Transport)	22%
Water Resources Infrastructure	10%
Other ABC Infrastructure	8%
HVAC Systems	6%
Elevators and Escalators	5%

Figures approximate and taken from internet sources

Its wide use in outdoor and indoor applications has proven that stainless steel will qualify under a wide range of environmental factors and for everyday use. The following are some of the features due to which stainless steel is the preferred choice:

- Low maintenance cost

- Long life span
- Appearance, attractiveness and durability
- Ease of maintenance and cleaning
- Hygiene: Its chemical and bacteriological neutrality meets the stringent hygiene standards.
- Environment friendly – it need not be painted - avoiding lead poisoning and is fully recyclable.

Principal Uses of Stainless Steel in Architecture, Building and Construction

- Elevators and Escalators
- Handrail systems
- Wall façade panels and fascia cladding
- Entrances
- Windows and doors
- Pools
- Roofing systems
- Space frames
- Lifestyle products
- Furniture & accessories
- Interiors
- Clean room accessories
- Sculptures & monuments
- Signage
- Children's playgrounds
- Street lighting masts
- Fire proof doors

Using the correct grade of Stainless Steel

Stainless steels are available in several grades based on chemical composition and mechanical properties. Stainless steels are not rust and corrosion proof as commonly believed but are just more corrosion resistant than any other metal or metal alloy.

If the wrong type of stainless steel is used for the wrong application, then it will behave like any other iron-based metal and start corroding when exposed

to oxygen. If we were to take a piece of stainless steel and place it in salt water, the salt would destroy the protective layer faster than it could be repaired and result in corrosion.

The main factors to consider for selection of stainless steel of the correct specification, thickness and finish are:

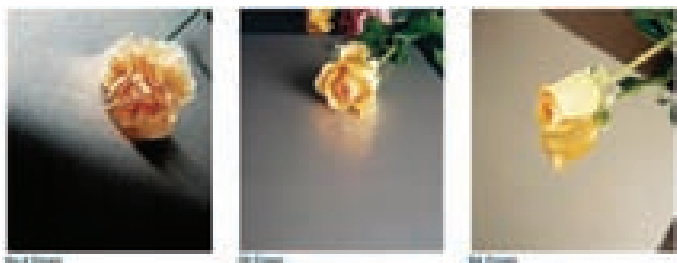
- Aesthetic aspects
- Service environment
- Types of surface finish required
- Visual consistency of large areas
- Optical flatness

Factors to be Considered during Designing of Structures and Facades:

- Avoid designs that restrict flow of water on an exterior surface since this too causes streaking
- Minimize horizontal surfaces and where necessary, make provisions to drain the dirt. Even joints should be so designed to minimize dirt accumulation.
- The beneficial effect of rain should be optimized by ensuring that rain washing occurs as uniformly as possible.
- Struts, clips and other fasteners with dissimilar metals should be insulated to prevent galvanic corrosion. They are best avoided by using only stainless steel for all fasteners.
- Avoid intricate designs, these collect dirt and make cleaning a difficult task.
- Fasteners should be concealed as much as possible for aesthetic reasons. The level of corrosion resistance of the fasteners should be equal to that of stainless steel.

Surface Finishes and Applications:

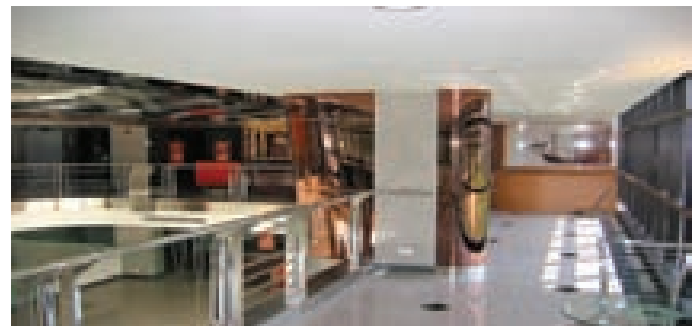
Appearance is a critical design element in architecture or other visible applications and hence correct grade and finish should be selected for each individual application. Surface finish of stainless steel is an important element in any architectural application. Since appearance is important, finish is a design element and must be specified to avoid getting a finish that is not appropriate to the specific use. The wrong finish can alter the desired effect.



Stainless Steel Finishes are produced by three basic methods:

- Polishing or buffing with abrasive wheels, belts or pads
- Rolling between polished or textured rolls
- Blasting with abrasive grit or glass beads

Combination of Stainless Steel Cladding in PVD coated and Etched Finishes:



Stainless Steel 316L Column Cladding at Madurai Airport:



Standard Finishes

I. Hot Rolled		
1	HRSS Black – Type 0	Hot Rolled – Not suitable for ABC
2	HRSS No.1	Dull and slightly rough surface. Quite suitable for structural applications in building industry. To be avoided for external applications.
II. Cold Rolled Annealed and Pickled		
1	No.2D, 2B	Architectural and building applications, which involve welding. Required finishes to be given after fabrication using mechanical operations like grinding, polishing and buffing.

2	BA	Glossy and brighter than 2B but not Mirror
III. Mechanically Polished		
1	No.4 Finish, No.3, Hairline, Brushed, Scotch Brite, Striped etc – Directional	These are unidirectional finish with restricted reflectivity. Recommended for applications in wall panels, column cladding, elevator door and interiors, escalator trim, furniture control panels, luggage handling equipment and similar applications
2	No.8 Mirror Polished	The most reflective finish and used selectively in architectural parts and reflectors
IV Rolled / Embossed		
1	Special Rolled – non directional	These are Embossed finishes like Canvass, Checks, Mosaic, 3D Cube, Moon-rock, slip free, hammer tone and many other finishes are offered by manufacturers for specific applications.
V PVD Colour / Etched		
1	Coloured	Manufactured using PVD process -Sheets with lasting and varied colours and directional and mirror finishes are available
2	Etched	Etched for designs by using chemicals – available in colour also

Colour Stainless Steel used in Crown Plaza E City Bangalore:



Conclusion:

Stainless steel is unmatched by any other metal alloy in terms of corrosion resistance, LCC, recyclability, sustainability, high strength to weight ratio, formability, ease of restoration and fire resistance. It is definitely very high on the LEED quotient - Leadership in Energy and Environmental Design. Wide range of finishes and grades make stainless steel most suited for architectural applications. It is essential to choose the right stainless-steel grade, correct fabrication process and proper finishing at site. The creative

passion of architects is the only limit in using stainless steel in architectural applications. The architect who dares to use stainless steel and selects the correct fabricator wins every time.



NP Rao - Managing Director, Pegasus Consulting

Over 35 years of multinational experience in New Zealand and Indian steel industry, specializing in stainless steel with a strong back ground of techno commercial sales & marketing. Expert in stainless steel technical consulting, marketing, sales management, customer experience management, and business development across industry and market segments. Experienced in offering consulting and conducting training courses with focus on specialist stainless steel product knowledge

Use of Non-magnetic property of Stainless Steel

Introduction

When Stainless Steel was first invented in 1913 accidentally, it was nearly having composition of currently known as grade 420. It was basically used as knife and surgical scalpels etc. because of its property of retaining the sharp edge for a longer period due to its hardness after heat treatment.

Today, stainless steel is best known for its resistance to corrosion, although it is having many other properties, combination of which allows a wide spectrum of application right from a tiniest structural part in artificial heart valves to Starship by Elon Musk.



In 1925, first Stainless steel tank was used to store Nitric acid thanks to its corrosion resistance.

In 1926, the first surgical implant was used and in 1928, first stainless steel fermenting vessel was used to brew beer, both due to hygienic aspect of SS.

In 1930s, first stainless steel train was built using its weight to strength ratio and hardening upon working properties, apart from corrosion resistance.

As is a well-known fact that Stainless Steel is commonly being used for its corrosion resistance, weight to strength ratio, work hardening properties, brightness and smoothness of surface, aesthetic appeal, hygienic properties, High and low temperature resistance, Ease of fabrication, not expensive as compared to specialist, non-corrosive exotic alloys and thus having a quiet low Life cycle costing.

However, one very special property is also being used for very special purpose, that is non-magnetism of Austenitic grades of Stainless Steel.



Now it is a common knowledge that Stainless Steels are group of alloys having a minimum of 11 percent of Chromium, which makes it corrosion resistance due to quick formation of an impermeable Chromium Oxide layer, which does not allow oxygen to penetrate further to oxidise the steel. However, there are more than 200 grades being made by adding various other alloying elements. These grades can be



broadly divided in 4 groups as: Ferritic Stainless Steel, Martensitic Stainless Steel, Austenitic Stainless Steel, Duplex Stainless Steel (having Ferritic and Austenitic structures) and Precipitation hardening stainless Steel.

Non-magnetic Stainless Steel

Out of these, Austenitic types of Stainless Steel are having very low magnetic permeability and hence can be called non-magnetic. Although these grades also convert to magnetic when cold worked since the austenite phase converts in to martensite, therefore selection of these grades and their use shall be done carefully.



This non-magnetic property can be used very effectively where strength of a steel and non-corrosiveness, in addition to non-magnetism, are required. There is hardly any other material with such strength and is non-magnetic. Nonferrous metals are usually nonmagnetic and have lower magnetic permeability than nonmagnetic steels. However, they are not as hard and tough as ferrous material, and their electric resistance is low.

Nonmagnetic materials are used for the production of parts that must not exert a magnetic effect on the operating system of measurement devices, instruments, and machines. They are used to make compass cases, parts for electrical measurement instruments and clocks, nonmagnetic springs, periscope tubes, bushings and collars through which pass cables carrying alternating current, and clamp bolts and housings for transformers and electric machines.

Stainless Steel can be used in various forms like wires, sheets and reinforcement bars, for its non-magnetic property

Non-magnetic Stainless Steel Wires

Nonmagnetic stainless steel having very high tensile strength and high resistivity, in the form of wires or flattened wires are used in electrical machines as armature binding wires in rotors & generators and

parts that shall not disturb a magnetic field.

Suitable grade provided in the BIS standard IS 10632 is having following composition:

C	Si	Mn	S, max	P, max	Ni	Cr	Co, max	Mo, max	Cu, max
0.08-0.13	0.4 - 0.8	0.8 - 1.2	0.03	0.03	13.0-14.0	13.0 - 14.0	0.3	0.3	0.2

Tensile strength of the above grade is expected to be ≥ 1470 N/mm² in cold-drawn condition and ≥ 1275 N/mm² in cold drawn and flattened by cold rolling condition.

The value of induction is expected to be not more than 0.06 tesla (600 Gauss) for a magnetic field $H = 400$ ampere turn/cm (500 Oersted). Minimum Electrical Resistivity is expected to be 65 microhm.cm

Non-magnetic Stainless Steel Sheets

In the form of sheet, strips and plates, because of their excellent corrosion resisting property and high strength, coupled with extremely low magnetic characteristic, austenitic non-magnetic stainless steel are recommended for parts in electrical machines, that shall not disturb the magnetic field while providing enough strength for mechanical support, specially in corrosive atmosphere. This is particularly suitable for nonmagnetic wedges, spacers and fingers in electrical machines. Suitable grade provided in the BIS standard IS 10632 is having following composition which is a modification of grade 305 (IS 6911):

C, max	Si, max	Mn	S, max	P, max	Ni	Cr	Co, max	Mo, max	Cu, max
0.08	0.75	1.0 - 2.0	0.03	0.03	12.0 - 13.0	17.0 - 19.0	0.3	0.3	0.25

Tensile strength of this grade is expected to be ≥ 588 N/mm² in soft (annealed) condition, 735 - 835 N/mm² in half hard condition and 882 - 980 N/mm² in hard condition. Minimum Electrical Resistivity is expected to be 78 microhm.cm and the value of permeability is expected to be not more than 1.02 at field 800 ampere turn/cm (1000 Oersted) at 50 percent cold-worked state.

Non-magnetic Stainless Steel Reinforcement Bars

There are also an increasing number of rebar applications, requiring controlled magnetic permeability, where carbon steel cannot be considered an option. Non-magnetic stainless steel rebar has been used successfully in electric motor foundations, and in the construction of buildings,



housing equipment such as heavy duty electric arc furnace, MRI and similar equipment in hospitals, radio and television stations etc.. In addition these non-magnetic stainless steels have been used in constructing “deperming” piers, where the proper



function of instrumentation is restored in docked ships before they return to sea.

The non-magnetic properties of these stainless steel rebar are well suited for military and scientific applications also where a neutral magnetic environment is a requirement, i.e. disturbance in electromagnetic fields are required to be avoided.

As such all Austenitic Stainless Steel are non-magnetic in annealed condition, however upon cold working, all these grades become magnetic to some extent which depends on the extend of cold working and the grades. Most common grade for general application among Austenitic grades is grade 304. However, its variant 304LN is better suited for rebar applications where non-magnetism is required. Grades 316LN and 18Cr-3Ni-12Mn (201A) are other grades which can

be used in different corrosive atmospheres requiring non-magnetic properties in the rebars.

Grade	C, max	Si, max	Mn	S, max S, max	P, max	Ni	Cr	N
304LN	0.030	0.75	2.0 max	0.03	0.045	8.0-12.0	18.0-20.0	0.10-0.16
316LN	0.030	0.75	2.0 max	0.030	0.045	10.0-14.0	16.0-18.0	0.10-0.16
201A	0.12	1.00	10.0-14.0	0.030 0.030	0.090	3.5-5.5	16.0-18.0	0.25 max

Cold Rolling, Hardness, and Permeability

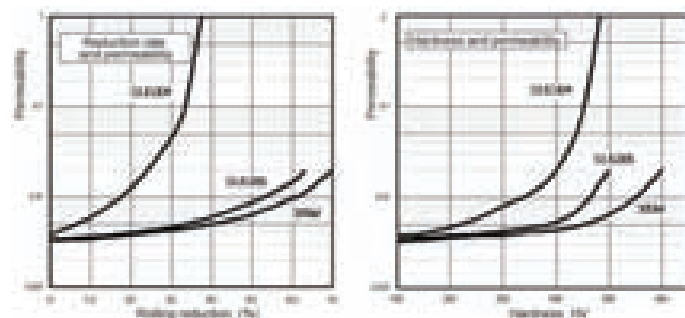
Austenitic stainless steels such as the common SUS304 grade are non-magnetic in a solidified (annealed) state, but demonstrate magnetism after cold rolling.

To enable SUS305M to take on stronger non-magnetic properties when cold worked than regular SUS305, the content of nickel and other components can be adjusted.

The charts below are correlation graphs that compare reduction rate and hardness against permeability for SUS304, SUS305, and SUS305M.

It can be seen that SUS305M grade demonstrates stronger non-magnetic properties compared to SUS304 and SUS305.

Correlation Graphs of Reduction Rate vs. Permeability (Left) and Hardness vs. Permeability (Right)



Nagendra Vijayvargia
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Consultant, ISSDA

FULLY FURNISHED STAINLESS STEEL MODULAR TOILET FOR LHB COACHES

The Indian Railways is one of the largest rail networks in the world used by over 1.3 billion people of India. It is now competing with global benchmarks and working rigorously in making every crucial part of passenger coaches complete with modernization. Stainless steel has played an integral part in this transformation by turning conventional coaches into modern transportation using the metal, which further helps in increasing the life-cycle of LHB coaches.

Indian Railways has also realized that the life-cycle & maintenance of stainless steel in toilets plays an important role in the success of modern coaches.

JSLL Stainless Steel Toilet was first introduced in an LHB coach with an attractive look, and hygienic and environment-friendly features. It was designed with suitable characteristics like anti-skid flooring, FRP countertop, and a full-view concealed mirror for spacious interiors. Apart from strength and durability, JSLL Stainless Steel Toilet adds a modern luxury touch to the LHB coaches resulting in a comfortable experience for passengers.

with concealed joints and round corners for better aesthetic, it has anti-graffiti coating to prevent any wall damage. JSLL's modern design has concealed plumbing with various wash basin options like Granite/ Marble finish with an FRP countertop.

BENEFIT TO INDIAN RAILWAY:

The JSLL SS Modern Toilet adds various benefits to Indian Railways. We provide a better life-cycle which is approximately 35 years. We also provide in-built Drawn Pan with better insulation and anti-dumping noise. The stainless steel floor is embossed with anti-skid patterns for better stability while walking, and the roof is designed to facilitate very easy for maintenance. The door is insulated and the mechanism based on bearing the makes is smooth and easy to the user. The maintenance cost is reduced to six times as compared to the existing models, and at the time of scraping, 40% of the RM is recovered which is an additional benefit over the existing and FRP models.



STAINLESS STEEL MODULAR TOILET



OBJECTIVE OF SS MODULAR TOILET

The new design for the Stainless Steel Modular Toilet provides an easy modular fitment for better productivity with zero maintenance cost, along with other essential elements. The SS Modular Toilet is the most durable and is suitable to fight water corrosion, along with being fire retardant. The usage of various modular and electrical items in this toilet, and its ergonomics, are very comfortable and appealing to the passengers. One of the most significant features of new age SS Modular Toilet is its insulated wall panels for long-lasting life with an anti-throttle feature- one of the key requirements for toilets in a train. Fitted



Cost Effective Stainless Steel for Girder Bridges

Steel bridges that are under severe chloride exposure due to marine environmental effects require frequent maintenance and repair activities to extend their service life and maintain an adequate performance level. The use of more sustainable materials, such as maintenance-free stainless steel, may increase the initial cost of the structure; however, the life-cycle cost, including the maintenance during the service life and their associated indirect effects, can be significantly reduced

Introduction

Steel bridges face the following issues:

- Aging and fatigue
- Increased axle load
- Higher longitudinal loads
- Replacement of old steel girders
- Corrosion in coastal areas

Hitherto, the content of sulphur and phosphorus in steel were higher than that in the present, resulting in brittle failure of the structures. There has been significant improvement in steel / stainless steel making technologies throughout the world over the last few decades, both in terms of metallurgical advances, and rolling and heat treatment process.

Advantages of Steel in Bridge Construction

Stainless steel is a very versatile material with many advantages over other materials. Steel bridges have the following advantages compared to concrete / PSC bridges:

- Reduced dead loads
- Economic foundations
- Simpler erection procedures
- Shorter execution time
- Easier rehabilitation
- Higher strength to weight ratio

The total weight of steel constructions is a fraction of the total weight of concrete bridges. Therefore, steel bridges can be used with long spans, even in earthquake-prone areas.

Steel is a sustainable material. When a steel bridge reaches the end of its useful life, the girders can be cut into manageable sizes to facilitate demolition, and returned to steelworks for recycling. With the increased emphasis of the green techniques for construction, steel is far “greener” in bridges.

Steel bridges can be easily repaired after accidental damages, earthquakes or floods and complete steel spans can be replaced without much delay

Steel has broad architectural possibilities. Steel bridges can be made to look light or heavy and can be sculpted to any shape or form.

Steel bridges now have a proven life span extending to well over a century.

The disadvantage of steel is the maintenance cost for the prevention of corrosion. This is where utility stainless steel steps in. The life of a stainless steel bridge that is scientifically designed, honestly and carefully built, and not overloaded, but properly maintained, is infinitely long.

The characteristics of these stainless steels are higher performance in tensile strength, toughness, weldability, cold formability, and corrosion resistance as compared to the traditionally used carbon steel grades.

While carbon steels have higher carbon content, in stainless steels, the carbon content is reduced to around 0.03 with other elements contributing to give it strength. The improved toughness and weldability of this steel is mainly gained through the required low sulphur level of about 0.006.

The corrosion resistance of the steel is enhanced by the introduction of alloy elements such as Nickel, Chromium, Manganese, Copper and Molybdenum and thus allow structures to be built without painting or other corrosion resistance techniques.

ASTM A1010 (UNS S41003) (409M-(Bridge)) is a lean alloyed stainless steel with 11% Chromium with superior corrosion resistance and is included in ASTM -709 for 2018, which is the specification for steel / stainless steel for bridge material.

Accelerated laboratory tests and exposure panels indicate that A1010 stainless steel outperforms weathering and galvanized steels in wet/dry salt-water environments and outperforms a variety of weathering steels in seaside locations.

Specified Mechanical Properties

	ASTM A240 UNS S41003		Grade 40 (Optional)		Grade 50 (Standard)	
Ultimate Tensile Strength, Min. ksi (MPa)	66 ksi	445 MPa	66 ksi	445 MPa	70 ksi	485 MPa
Yield Strength, min. ksi (MPa)	40 ksi	275 MPa	40 ksi	275 MPa	50 ksi	345 MPa
Elongation in 2 in. (50 mm), min.	18%	–	18%	–	18%	
Brinell Hardness, max.	223 HB *	–	–	–	–	

Specified Composition

Grade	C	Mn	P	S	Si	Cr	Ni	N	Mo
ASTM 1010 UNS S41003	0.03	1.50	0.040	0.010	1.00	10.5-12.5	1.50	0.030	–
Duracorr	0.025	1.50	0.040	0.010	0.70	11.0-12.5	1.00	0.030	0.20-0.35

(Maximum wt. %, except as noted)

Duracorr® is a low-cost, 12% chromium, dual-phase stainless steel product produced by ArcelorMittal USA.

When compared to weathering, painted or galvanized steels, it has life cycle cost advantages that permit its effective use in a wide variety of applications. Duracorr Grades 40 and 50 are formable, weldable and exhibit good toughness. Also, Duracorr 300, with a 300 HB nominal hardness, is available for applications where both abrasion and corrosion resistance are required.

Typical actual chemical composition (%) for Duracorr is :
C-0.019, Mn-1.0, Ti-<0.01, Si-0.44, Cr-11.11, Mo-0.26, Ni-0.62, N2-0.014, P-0.01, S-0.01



ASTM A1010 Stainless Steel Bridge Under installation- USA

Conclusion

High Performance Stainless Steel (Austenitic and Duplex grades) is being used on bridges successfully all over the world because of its inherent quality of better strength, resistance against fracture, toughness, weldability and a very good resistance against weathering / corrosion.

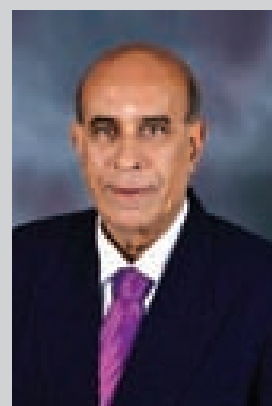
The weight of the structure is reduced tremendously reducing the cost of substructure and foundations resulting in reduced life cycle costs. The successful use of cost-effective ASTM-1010 (Duracorr), in the last ten years in the United States, has now paved the way for use of this grade of stainless steel in bridges, where initial cost is a big factor.

Suggestions and Recommendations

1. Studies could be conducted in India for the adoption of 409M (Bridge) steel in Indian weather and economic conditions.
2. A pilot project for one bridge may be undertaken to gain experience and assess outcomes.

KR Ananthanarayanan is Vice President, Pegasus Consulting and has over 48 years of stainless steel industry experience specializing in fabrication related areas. He worked at Bhabha Atomic Research Centre, Mumbai.

He is recognized in the country as a Stainless Steel specialist and expert and played a major role in introducing usage of Stainless Steel in Indian Railway Coaches and Wagons and worked with RDSO, India Mint. He is a member of several Indian Standards Committees for Bureau of Indian Standards.



Stainless Steel – The Ultimate Choice for Rail Coach Shell

Over the years Railcar shells moved from wood to Carbon Steel to Stainless Steel/Aluminium Alloy. There is a long term cost effectiveness of this shift in material specification, in terms of ease of maintenance, surface protection requirements, repair, as well as the inherent structural properties that these materials provide, enhancing both strength and safety characteristics of the car bodies.

Introduction

Most of the Rail Coach Shells built (and being built) use stainless steel or Aluminium Alloy. The initial capital cost for these car bodies is higher than that for carbon steel, so the question arises, "Why is the world moving to stainless steel /Aluminium Alloy for coach shell?"

It may be seen upon review of this paper, that there are considerable savings to be gained in terms of significant reductions in Life Cycle Costs (LCC), appreciable cost benefits arising from increased life expectancy, increased material strength providing an inherently higher level of passenger safety and most important, since stainless steel retains its mechanical properties better at high temperatures, it providing superior fire resistance .

Stainless Steel for Rail Cars

Since the introduction of stainless steel as coach shell material for the US rail sector by the Budd Company in 1932, stainless steel has become a significant contributor to the railway industry. Its selection as "The Material" in competition with either aluminum alloy extrusions or carbon steel is attributed to its properties of higher strength, fabricability, high temperature resistance, safety in collision instances, corrosion resistance and environmental friendliness.

The preference for stainless steel is also related to the need for longevity and the ability to obtain lower costs for large production runs where the automatic welding needed for a quality stainless steel car shell is economically viable.

Advantages of Stainless Steel over Corten Steel and Aluminium

There are three major materials used for the construction of rail coach shells: Corten steel, stainless steel and aluminum alloys. Stainless steel and aluminum alloys enjoy a reputation as the most advanced materials, both have a proven record of application

and both have been successfully used in construction of passenger rail coach shells for the past 50 years.

Major Characteristics of Construction Materials

Material	Yield Kg/mm ²	Ultimate Strength Kg/mm ²	% of Elongation	Specific Gravity	Yield/ Specific Gravity
Corten	350	490	18	7.9	44.3
St. Steel (301L ½ Hard)	770	1.050	15	7.9	97.4
Al Alloy (6000 series)	245	266	8	2.7	90.7

Mechanical Properties of Cold Worked SS301L

Condition	Tensile Strength, Min. (MPa)	0.2% Yield Strength, Min. (MPa)	Elongation In 2" (50mm) %, Min.
Annealed	515	205	40
1/4 Hard	862	517	25
1/2 Hard	1050	770	18*
3/4 Hard	1205	931	12*
Full Hard	1275	965	9*

Typical Hardness Values for SS301L

Condition	Brinell Hardness	Rockwell Hardness
Annealed	165	85 Rb
1/4 Hard	255	25 Rc
1/2 Hard	297	32 Rc
3/4 Hard	342	37 Rc
Full Hard	382	41 Rc

Advanced Structural Material

The question that comes naturally to mind when two materials are both characterized as advanced, is which of the two is better, stainless steel or aluminum alloy? Surprisingly, the issue is neither easy to analyze nor the answer unequivocal. In addition, frequently the designation of a "stainless steel" or "aluminum" car applies essentially to the structure from solebar, trough floor, cross bearer and above.

Maintainability

Both stainless steel and aluminum alloys have superior

resistance to the influence of atmospheric elements. Such a surface usually does not require painting and displays excellent resistance to the effects of aging.

Welded aluminum structures require finishing operations to be applied to the outer skin surface after the assembly of the structure has been completed. This frequently entails painting. A stainless steel outer skin surface requires no painting. Decals are usually used when color is desired on stainless steel.

While aluminum alloys are approximately three times lighter than stainless steel, the latter displays approximately three times higher strength (Table 1). Thus, theoretically it should be possible to build a stainless steel car body shell as light as aluminum one. This is attributed to the fact that it is difficult to fully utilize the strength of thin stainless steel sheets without making them vulnerable to a loss of stability. Consequently, stainless steel components may sometimes need fluting of panels. Stainless steel in Grade 301L is available in different strength levels and can be used advantageously.

Resistance to Elements of the Environment

From the point of view of corrosion resistance, both stainless steel and aluminum alloys enjoy a highly positive reputation.

Care must be taken in joining aluminum alloys with other metals. When joined without proper protective barriers, aluminum alloys develop a corrosive bridge with the adjacent materials and undergo deterioration. Many of the large urban developments in India suffer from high level of atmospheric pollution including automobile exhausts. Stainless steel offers greater corrosion protection than aluminum in such atmospheres.

Fire Resistance

Stainless steels are highly resistant to flame and heat. While stainless steels of the 300 Series still perform satisfactorily in the temperature range of 350 to 400 degree Celsius the tensile strength of aluminum alloys of the 6000 Series at 300 degree Celsius falls below 10% of the strength at room temperature. Stainless steel melts at around 1450 degree Celsius, while aluminum melts at around 600 degree Celsius.

Cost of Material

Both advanced materials, stainless steel and aluminum alloy, are more expensive than Corten steel. The cost of material varies depending on demand and availability, but in general cost terms, aluminum and Corten steel have an advantage over stainless steel.

Cost of Cutting, Forming, and Joining

Stainless steel and aluminum require training, skill, and specialized methods in manufacturing. The

same applies to the cost of the required tools and forming machines for laser cutting, laser welding and robotic spot welding. These tools do, however, lend themselves to achieving higher level of repeatable quality for long production run.

Repair and Maintenance

Repairing damaged railcars always constitutes a challenge to the transit operating authorities. Although stainless steel has excellent mechanical characteristics, it does require a good knowledge of its response to repair techniques to provide the anticipated performance when returned to service. In India now, in the regional rehabilitation workshops, stainless steel coaches are being repaired and adequate facilities exist for such maintenance work. However, if aluminum coaches must be rehabilitated, expenditure will be required for new machinery procurement with associated skill development for the workforce.

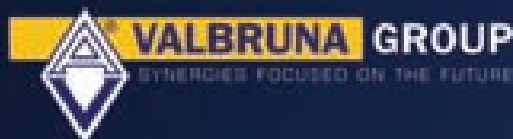
Conclusion

The long-standing dispute among supporters of different materials for the construction of transit vehicles has not yet been concluded and, quite likely, never will. In the Indian context, there are considerable savings to be realized in terms of significant reductions in Life Cycle Costs (LCC) of stainless steel car bodies. Appreciable cost benefits arise from increased life expectancy of the stainless steel car bodies; Increased material strength of stainless steel provides an inherently higher level of passenger safety.

Since stainless steel retains its mechanical properties better at high temperatures, it has superior fire resistance capabilities. Also by using 301L SS in higher strength levels, the weight of coaches can be optimized. India is already using utility ferritic stainless steel for mainline coaches in the modernized production facilities. The design yield strength of utility stainless steel is comparable to that of Corten steel (350 MPa). These cannot be cold worked to get higher strength.

However, when austenitic grade 301L is used at different strength levels (data per Table above) there will be weight reduction of the shell along with many other advantages. 301L grade SS is used in different strength levels by India based Metro car manufacturers with stainless steel produced in India. Major new shop facilities will not be required, to switch from utility ferritic stainless steel to high strength austenitic 301L stainless steel. No import of technology will be required either. Hence this paper strongly endorses the use of high strength austenitic 301L stainless steel for the manufacture of rail coach shells.

KR Ananthanarayanan is Vice President, Pegasus Consulting



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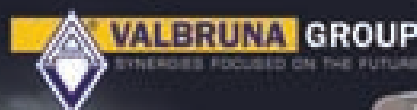
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Fire Safety: Stainless Steel Comes to Rescue

Fire safety installations are one of the most important part of any building specially commercial buildings designed for large gatherings. Government fire safety regulations mandates and makes it necessary for commercial buildings to equip with fire extinguishers readily available for situations leading to big and small fires. One of such requirements is to install

to make reservoirs close to the building structures or create reservoir on the roof of the building itself. In past concrete made large capacity water tanks have been used to store water.

Recently, Haryana Bhavan, Secunderabad a famous building frequently used for marriage party, spiritual occasion, events, meeting, and conference, has installed series of large Stainless-Steel overhead water tanks on the building roof top to store water exclusively for the purpose of firefighting. These installation of stainless-steel water tanks are for a function hall of a 6 storeyed building with over 20,000 sft ground space and over 1,00,000 sft total built up carpet area. It required over 54,000 Ltrs of Over Head Water Storage tanks as per Fire Safety Norms. Stainless Steel helped solve multiple challenges. It was a 15-year-old building and installation of a concrete tank would have put a load of 54 tons in one single area because of space constraint with only 2 terraces of 1200 sft each only available to build storage area. Stainless Steel Water Tanks provided the multi fold solution on account of its high strength, corrosion resistance and design possibilities to overcome challenges posed. Light weight tanks ensured the structural stability of the building. By installing multiple stainless-steel tanks spread evenly over full terrace area it helped distribution of load evenly for structural



water sprinklers connected through pipelines and an everlasting source of pressurized water. To create a constant source of water there has been a practice



stability. Stainless Steel tanks offers very high corrosion resistance and has very long service life. Since water in the tank remains stagnant for most of the time stainless steels helps in preventing formation of algae or any bacterial growth on the walls keeping the water clean enough to pass through pipes and nozzles when the requirement comes.

M/s Armarwood Industries Pvt Ltd is one of the largest Stainless-Steel Tank manufacturers in the country manufacturing stainless steel tanks of all sizes under the brand name 'NOVA'. For this project they developed a special model 1500 Ltrs Nova tank - just 3.25 feet diameter x 8.5 feet height fitting the requirement of space to optimised volume and easy to maintain. They installed total 36 tanks of 1500 Ltrs each on both the terraces (18 Tanks per Terrace) of combined volume of 54,000 liters. The tanks were made of 316 grade austenitic stainless steels in 0.6 mm thickness. 316 grade of stainless steel was selected to ensure high corrosion resistance and long service life.

Mr. Vinay Jain, Marketing Head of NOVA S.S Tanks, who has been instrumental in executing this project

commented that "Stainless Steel is an ideal choice for large water storage applications since it is one of the most hygienic and strong material. It is easier to install, clean and maintain" He also commented that "Haryana Bhawan, Secunderabad is one of the most prominent locations in the city and anyone travelling by metro trains nearby can see the tanks installed on the roof and remain in awe of these tanks for its aesthetic looks. It does face lift the entire function hall and maintains the beauty of it.

For more information Contact :
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Improved Machinability Stainless Steel development at Mukand Ltd

Introduction

In India, commercial production of stainless steels for critical applications gained momentum in the year 1985 with manufacture of standard austenitic and martensitic grades. Mukand embarked upon a program of continuous quality improvement through technological advancement. The production route was changed from duplex process of EAF-VOD to Triplex process of Ultra High Power Furnace (UHPF)-Oxygen bottom blown convertor (OTBC) – VOD. Downstream facilities for heat treatment, pickling and bright bar manufacture were installed and commissioned. These facilities are in operation since last 30 years and well established to manufacture different grades of stainless steels such as low interstitial ferritics, stabilized grades, welding grades and precipitation hardening grades, the recent addition being Duplex grade.

While developing newer grades, Mukand also decided to focus on improvement in the quality of existing products to meet enhanced customer expectation. One such area was the machinability of austenitic stainless steel grades. The machinable stainless steel developed initially and which continues to be popular are AISI 303 grade & AISI 416 grade in austenitic & martensitic varieties respectively. However, these grades have limitation related to corrosion resistance and weldability. Therefore, it was felt that there is a need for improving the machinability of regular austenitic grade of 304 for high speed machining applications. Some European steelmakers have already trade marked their grades as "Improved Machinability" steel.

Based on benchmark sample analysis and literature studies, we produced austenitic stainless steel of the 304L variety with defined process to achieve improved machinability. To test the machinability, we partnered with an outside Technical Institution to carry out independent tests to assess the performance of the steel. Bars produced from the 304L grade were tested & its machinability evaluated with regular 304L grade. Results were compared with the machinability grade of 303 which was taken as

a standard reference. Results showed that the new grade could achieve a higher machinability which was better than the regular 304L grade.

2.0 Technological features and steelmaking process route at Mukand

The technological features of steel making and casting facilities are given in Table I.

Table I. Manufacturing facilities

Process	Facility	Technical Features
Primary melting of scrap and Ferro alloys control of multielement chemistry and temperature.	Electric Arc Furnace Facility	<ul style="list-style-type: none"> Ultra High Power – 34 MVA Nominal Capacity – 40 MT Eccentric Bottom Tapping Computerized Process Control Bulk Alloy Addition System
Decarburization, temperature and chemistry control	Converter - Top Bottom Mixing	<ul style="list-style-type: none"> 40 MT Nominal Capacity Bulk Alloy Addition System
<ul style="list-style-type: none"> Decarburization under vacuum Desphosphorization Achieving targeted chemistry Temperature control 	Vacuum Oxygen Decarburization	<ul style="list-style-type: none"> Five stage steam ejectors Section capacity 1700 kg/hr at 40 mbars 187 kg/hr at 0.67 mbars Microprocessor controlled alloy addition system Inert gas purging – Argon / Nitrogen Wire injection for Ti, Ca, C, S
Continuous casting of blooms	Bloom Caster - 2 strands / 10.5 tonnes	<ul style="list-style-type: none"> 250 x 250 mm² or equivalent rectangular dies Submerged nozzle casting Auto Mold Level Control Electro Magnetic Stirrer (Mould / Secondary) Level II automation for primary / secondary casting

The bloom/billet stocks of stainless steel grades available for rolling are in the following sections: 250 sq. mm. 160 sq. mm and 125 sq. mm. The blooms are converted into billets by rolling in a 2-high reversing mill with automatic screw down mechanism. The mill has a walking beam furnace for ensuring uniform heating of blooms. The mill also rolls rounds up to 190 mm in diameter and Round Corner Squares (RCS) upto 160 sq. mm.

Rounds in section range of 24 mm - 90 mm dia. and squares from 50 mm - 75 mm cross section are rolled in a mechanised cross country mill.

The wire rods in size range of 5.5 mm to 34.0mm diameter in coil form and straight length bars in diameter 22 – 45mm are manufactured in an automatic wire rod mill equipped with computerized

2-Hi reversible roughing stand and a high speed finishing block mill with tungsten carbide roll grooves to ensure smooth surface and achieve good dimensional tolerance.

The finishing facilities consist of suitable heat treatment furnaces and a bright bar manufacturing unit with cold drawing, centreless grinding & peeling facilities. Sections ranging from 3mm to 180mm are produced.

3.0 Development of improved machinability steel

3.1 Grade selection for study

304LIM (improved machinability) steel was cast with necessary process changes to achieve the required composition enabling higher machinability. The cast stainless steel was rolled into bars of required size . It was decided to compare the machinability of this improved grade with the regular 304L grade & the resulphurised grade of 303. Table II shows the chemistry of the grades used to evaluate machinability.

Table II : Grade chemistry of steels used for study

Grade	C	mn	si	p	s	ni	cr	n2
304LIM (new grade)	0.022	1.73	0.27	0.037	0.030	8.15	18.23	0.0945
304LHS (regular grade)	0.021	1.60	0.33	0.035	0.030	8.07	18.24	0.0930
303	0.059	1.88	0.34	0.038	0.326	8.10	17.56	0.0610

The machinability of these three different steel grades was compared on the basis of surface roughness, chip morphology, cutting forces and tool wear in the dry turning process. All the three grades used for study were tested in solution annealed condition.

3.2 Experimental Procedure

A CNC Jobber XL lathe was used for machining 303, 304LIM and 304LHS on the selected parameters. The machining tests were conducted using uncoated cemented carbide cutting inserts. Coolant was not used in machining during the tests.

Parameters selected for evaluation of machinability is listed in Table III. The cutting speeds were chosen by taking into consideration the cutting tool manufacturer's recommendations , and also industrially used values for machining this material. Fig 1 shows the schematic representation of the cutting process.

Table-III Selected levels of cutting parameters

Cutting Speed	100-300 m/min
Feed	0.09-0.21 mm/rev
Depth of Cut	0.5 – 1.0 mm
Environment	Dry machining

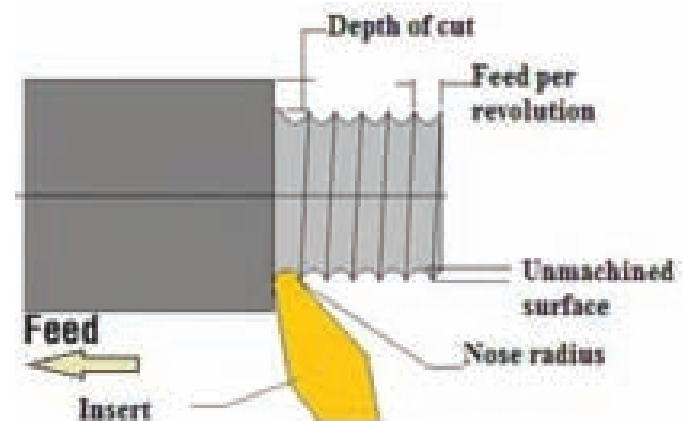


Fig.1 Schematic representation of the cutting process.

4.0 Performance Evaluation of the grades

Machinability was evaluated based on following measurements :

- Surface Roughness
- Cutting Forces
- Tool wear
- Chip Morphology

5.0 Results and Discussion

Data collected from the experimental machining trials was summarized and the typical results are presented as given below :

5.1 Surface roughness vs Number of cutting pass

Surface roughness measured and reported in terms of Ra value by varying the number of cutting passes for a given feed, speed and depth of cut. For each pass length of 160mm at a constant cutting speed of 120m/ min, Feed of 0.12mm/ rev, and Depth of

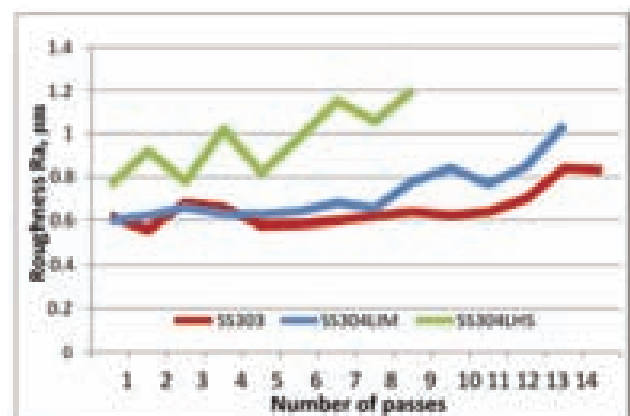


Fig.2 shows the comparative result for this study.

cut = 1mm was maintained, a number of cutting passes were made . For upto eight cutting passes, 304LIM matches 303 in lower roughness value; 304LHS is consistently higher in surface roughness.



Figure 3a & 3b. Change in cutting force with variation in feed and speed

5.2 Cutting Forces

The cutting force was measured by varying the feed and speed . It is understood that a lower cutting force indicates a better machinable steel.

From Fig.3a, it is observed that as feed increases, the cutting force also increases. This is because cutting force is dependent on the cross section of cut, and also on the feed rate. 304LIM shows lower cutting forces compared to 303 and 304LHS with increasing feed rate. However, with increasing speed and constant feed rate as seen in Fig.3b, the results are better for 303 grade.

5.3 Tool Wear

Wear is often observed on the flank face of the tool, and is related to the hardness of the tool material or coating. Harder materials provide greater flank and abrasive wear resistance. Tool wear also depends on the material under machining. Figure 4 shows the relation between the cutting passes and the tool wear. It is observed that flank Wear (tool wear) is lower in 304LIM compared to regular 304LHS grade.

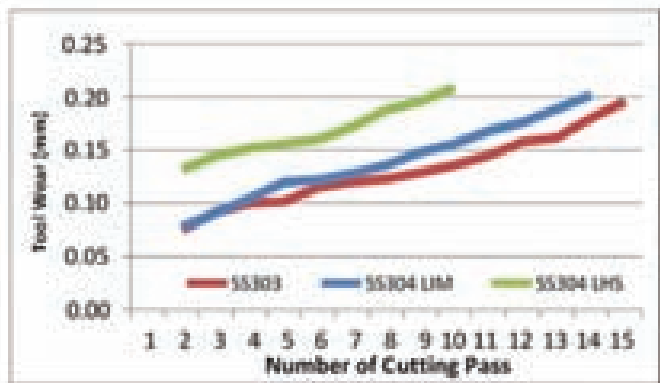


Figure 4. Change in flank wear with increase in number of cutting passes.

5.4 Chip morphology

Chip morphology refers to the form and structure

of the chips obtained after machining the material. The study of chip morphology is done with the help of visual inspection. Figure 5 shows the different types of chip formation as per international standard reference.

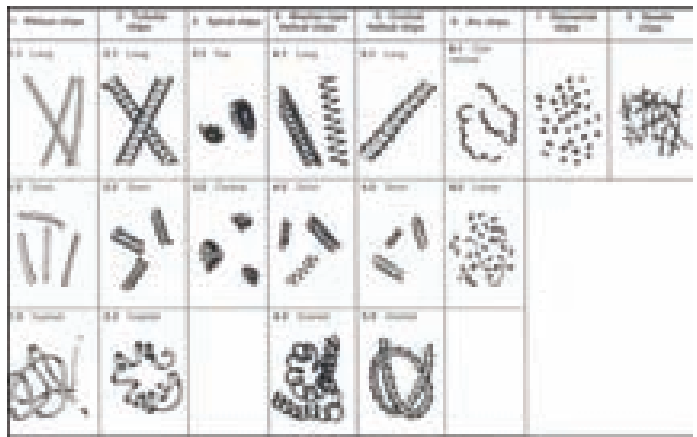


Figure 5. Types of chips according to ISO 3685-1977€

For this study, the chips were collected during various machining trials and the characteristics observed visually. The best chips (elemental type) were found in the case of 303 grade, while the 304LIM chips were of arc type (connected). The 304LIM chips were of favourable type for good machinability compared to the 304LHS chips, which were of washer type - short helical.



Figure 6. Chips from 304 LIM showed arc type chips compared to helical type for 304LHS.

6.0 Summary of results

The results obtained from the machinability tests could be summarized in terms of relative machinability performance as shown in Table-IV. Performance of 303 is taken as best and given a 100% value. A higher % value against a parameter indicates a better performance. The results indicate a higher machinability for 304LIM compared to the regular 304LHS .

Table-IV. Summary of results

	SS303	SS304LIM	SS304LHS
Tool Life	100%	93%	68%
Cutting Force	100%	95%	84%
Surface Roughness	100%	91%	86%
Chip Formation	100%	71%	69%

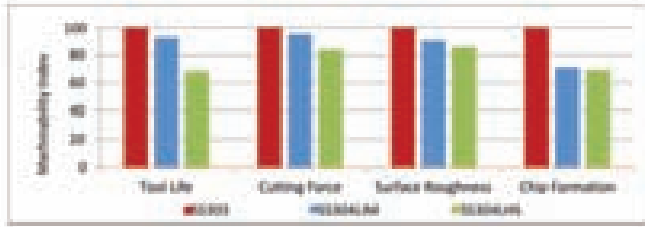


Figure 7. Machinability Index expressed as comparative bar graph

From the experimental observations and results, a comparative Machinability Index could be calculated. The calculation assumes 100% machinability index for 304 grade and allocates relative values of machinability to 304LIM and regular 304LHS.

Conclusion

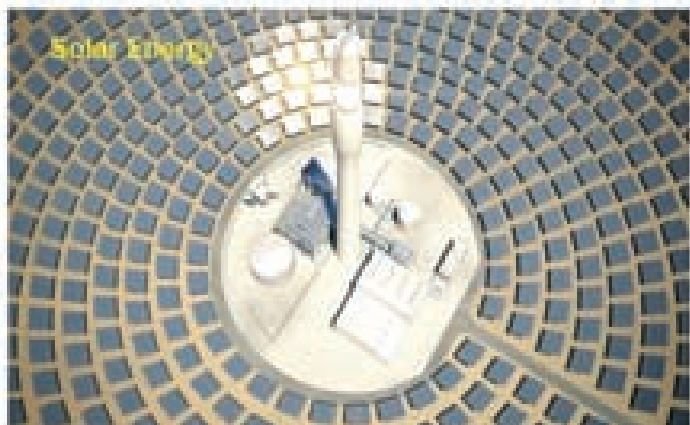
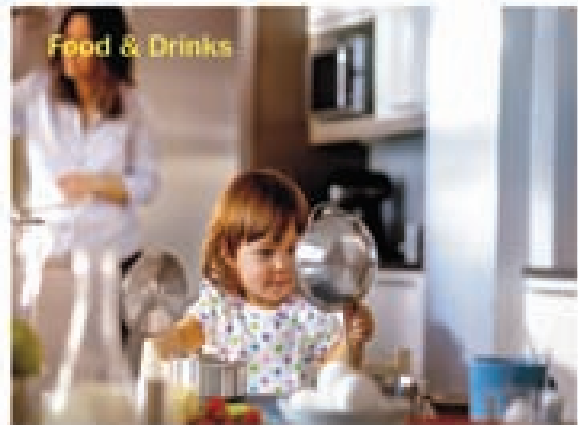
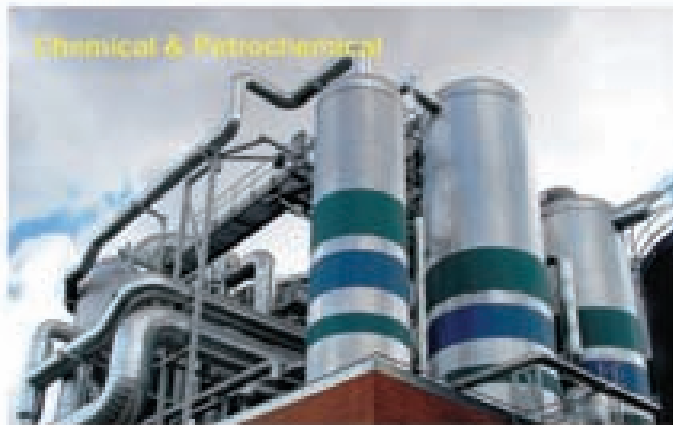
Mukand has been able to produce austenitic stainless steel with improved machinability for applications requiring high speed machining. This improvement in machinability could be achieved by controlling the composition through steelmaking process changes. Comparative studies indicate that the performance of 304LIM (Improved Machinability steel) is better than the regular 304LHS grade used for similar application. The product has found acceptance in both domestic and international markets.

Article Contributed by

Amit Gajbhiye, Nilesh Patil, Sunil Nair, Dominic Savio, S.V Panse
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Dedicated warrior on single use plastic finds smart solution in Stainless Steel

Meet Sameera Satija, a 45-year-old lady living in Gurugram's Millenium City for the last 20 years, fighting a battle against Plastic/Styrofoam disposables used in Bhandara/ Langar/Chabeel and other community events. Working as Auditor at The Comptroller and Auditor General (CAG), Sameera Satija started a Stainless Steel Crockery Bank to facilitate the distribution of stainless steel crockery for community events to curb the usage of plastic disposables, and at an absolutely no charge.

What made her start this initiative of a Stainless Steel Crockery Bank?

Sameera often encountered huge amounts of plastic disposables thrown around on roads after any Bhandara or Chabeel. In the rainy season, she saw the situation get more deteriorated when these disposables got stuck in the public drainage system set up by municipal corporations. Additionally, there are also many studies/facts available which have proven that Plastic/Styrofoam leaches harmful and carcinogenic (cancer-causing) chemicals into the food when hot food is served in them. The negative impact of plastic used in these public events is immense. Sameera has also tried educating the organizers about the hazardous effects of Plastic/Styrofoam on the health & environment, and organisers did understand this concern, but did not end up doing anything to avoid using plastic disposables. Everyone had their own excuses for not giving up plastic, and that is when Sameera had an idea of bridging this gap and starting her own crockery bank of Stainless Steel utensils. Because of its reusability, sustainable and environment-friendly properties, and the small investment that it required, she thought stainless steel was an ideal choice for this initiative of hers. Sameera started this as a non-paid initiative, where she distributes crockery for free at various community events like Bhandara, Chabeel & Langar.

How does this crockery bank work?

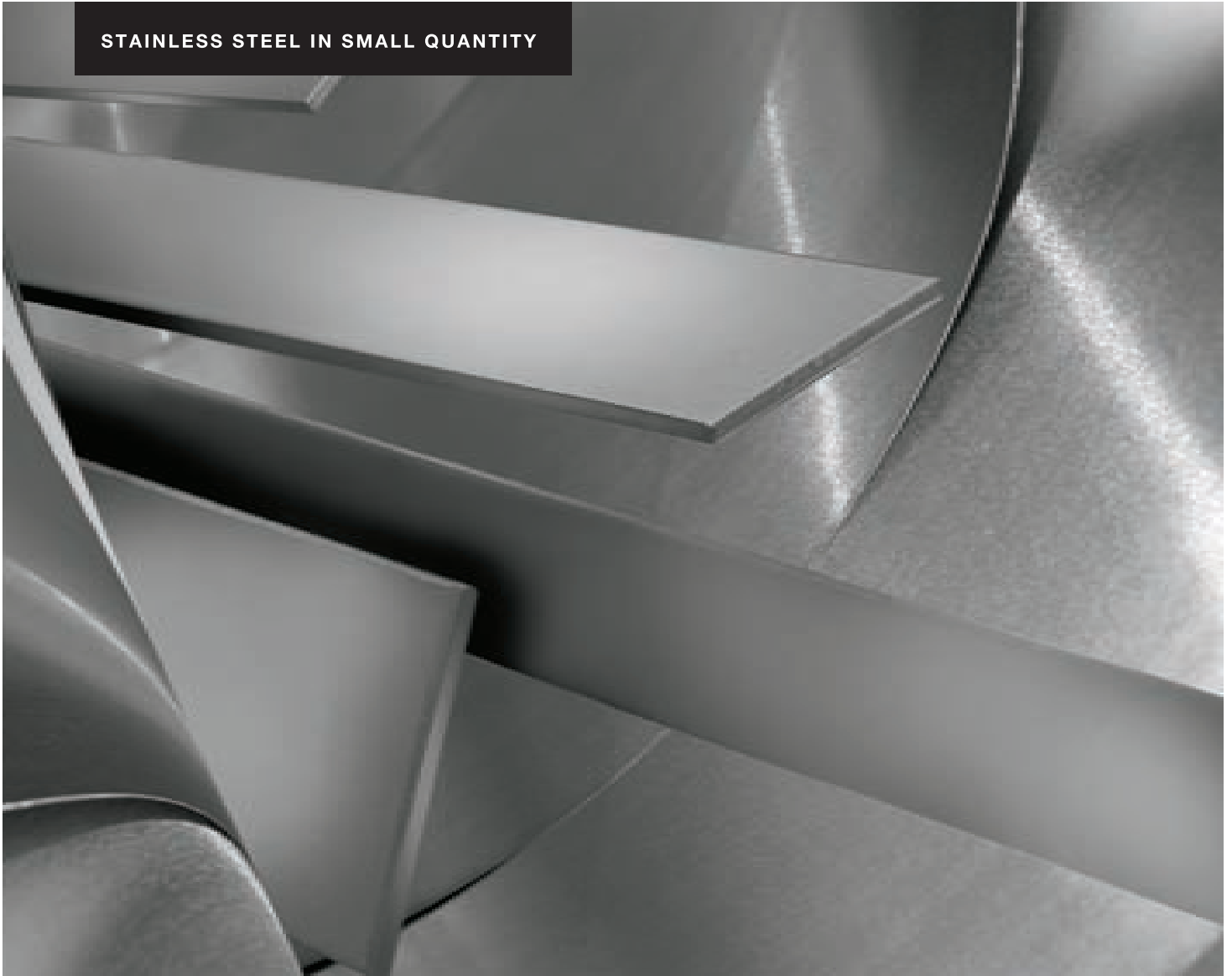
This crockery bank reaches out to people through two ways. The first platform used to spread awareness about the positive impact the crockery bank has towards the betterment of the environment and on people's health is social media. It is also to motivate

people to join them as volunteers. The second way is to visit the various locations that host Langars, Chabeels and Bhandaras, and give them free utensils so they can use them and return after use & wash. The Crockery Bank also reaches out to people by way of Facebook promotions and newspaper & radio ads to invite queries regarding utensil requirements. People can then collect this crockery from various bank locations spread across Delhi NCR. If anything is misplaced or not returned, the borrower has to bear the cost of missing items. After a lot of hard work and perseverance, the Crockery Bank is now several volunteers strong and the project has taken a new leap in the direction of making this society self-aware. As per the data available with Sameera Satija, she has been able to save 2,50,000 plastic plates so far. Numerous volunteers have joined her since it has started & taken the initiative across the city to fulfill utensil requirements. Sameera and her team are constantly on the move to find more volunteers for an even more effective result for this initiative. ISSDA is taking this as an opportunity to spread the initiative to the Stainless Society for effective results in other parts of the nation as well. We urge you all to come forward and embark on this stainless journey where you think beyond the limits of an individual and contribute your share to the betterment of the environment as well as the society.

The society welcomes this initiative of Ms Sameera Satija. Having received several accolades and recognition for her noble cause from different authorities in Delhi NCR, let us help her in this fight against plastic throughout India, and use sustainable stainless steel utensils.



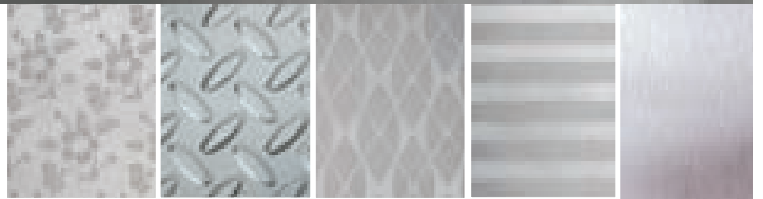
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SMART UNDERGROUND GARBAGE BINS

In an endeavour to make Delhi a smart, green and clean city, NDMC & SDMC approached Steel Authority of India Limited with a request for creating smart underground garbage disposal systems. Steel Authority of India Limited then commissioned Rathore Metal Art & Craft to manufacture and install SS 304 Smart Underground Garbage Bins, which are located at two prime commercial locations in Delhi- Bhikaji Cama Place and Pitampura Business Complex.

'Smart Underground Garbage Bins' is a pilot project under SAIL's CSR. Each of the smart bins consist of two collector bins on wheels, which are placed in underground pits. The pits are covered with a lid, which have a gas-filled lifting mechanism in them. Each mechanism is duly calibrated to the weight of the lid and the garbage dumping system fixed on it to facilitate ease of lifting of the lids. The weight of two bins and two lids is approximately 500 kg.

The provision of dumping garbage is through the chute fixed on the lid and the chute has self-closing spring-loaded doors which automatically close after the garbage is dumped. The bins from underground pits are brought out using a swinger-motorized hoist, which can remove and replace the filled bin with an empty one.

The disposal system is attached with a remote warning system and it indicates the control room by sending a signal whenever the bin is filled up. After receiving the signal, the control room sends collector vehicles to empty these bins.

The mobile underground garbage collector, the lid and the chute, are all made of SS 304 grade, and the lid is made of anti-slip SS plates.



The Smart Pole for Smart City

The Smart Cities Mission is an urban renewal and retrofitting program by the Government of India with an aim to develop 100 cities across the country, making them citizen-friendly and sustainable. It consists of innovative smart solutions for the city to provide better living standards for all. One of the smart ways to provide innovative solutions under this project is the Smart Pole. With its multiple offerings and characteristics like Wi-Fi Broadband, Smart LED Street Light, Environmental Sensors, Power Management, Parking Management, Digital/Static Advertisement, CCTV, EV Charging Station, Waste Management & Traffic Management, the Smart Pole is a powerhouse of benefits, with a single Smart Pole made to provide multiple system outputs. But what makes it so sturdy and sustainable to withstand different weather conditions?

These Smart Poles are built to last and made of SS 304 to provide sustainability with negligible maintenance. An average Smart Pole is made using 900kg of SS 304 and has a height of 9m - 12m. It also provides NDMC with a publicity space to spread awareness about various topics and earn from advertisements, just like they do with Bus Queue Shelters (BQS). These Smart Poles are manufactured by an Indian company called Energasia Smart Poles Pvt. Ltd. Since 2016, the company has installed 55 smart poles in Connaught Place, New Delhi, under NDMC Smart Cities Mission. If the Smart Poles are a success, a grid of 2000 Smart Poles will be set up in New Delhi over the next few years to positively affect citizens' quality of life. The unbeatable properties of stainless steel make it an ideal choice for Smart Poles.



SEMINAR on “STAINLESS STEEL - AN IDEAL SOLUTION FOR WATER MANAGEMENT”

ISSDA (Indian Stainless Steel Development Association) conducted a seminar on “STAINLESS STEEL - AN IDEAL SOLUTION FOR WATER MANAGEMENT” at Sheraton Grand Bangalore Hotel, Brigade Gateway, Bangalore on 20th September 2019.

Stainless steels offer lightweight, durable design solutions to the water industry. The resulting economic benefits are illustrated by examples from drinking water treatment and distribution, and waste water treatment installations. The same characteristics also enable stainless steels to contribute to environmental benefits through lack of contamination of drinking water, reduced environmental impact of the water industry and recyclability. Together, these make stainless steel an ideal material for the water industry.

More than 70 participants consisting of Architects, Civil engineers, Government organizations, like Bangalore Water Supply and Sewerage Board (BWSSB), PWD, Bruhat Bengaluru Mahanagara Palike (BBMP), etc, in addition to ISSDA members participated in this event.

The program started with the welcome address by President, ISSDA, KK Pahuja. He dealt on the growth of the usage of SS over the years in India. He has emphasized on the advantages of using SS like savings on the cost due to corrosion, aesthetics and life cycle cost analysis.

Then, SS Taneja, Executive Director, SAIL, Salem Steel Plant, Salem delivered his address on behalf of Stainless Steel Industry. He has recollected the pioneering efforts made by SAIL, SSP in developing the applications of SS from 1988 onwards. He has assured ISSDA that SAIL, SSP will get involved in the activities in increasing the penetration of usage of SS initiated by ISSDA.

David Nicholas, Consultant, Nickel Institute made his presentation “Stainless Steel an ideal solution for sustainable water management - A worldwide experience”. He explained the evolution of Stainless

Steel, various grades & their properties and the advantages of using SS for minimising the losses in storing and transportation of water with examples.

Next presentation “Stainless Steel Tanks for Healthy Water Storage & Transport” was given by Vinay Kumar Jain, Manufacturer of NOVA S.S Tanks, Hyderabad. He explained how they have developed SS water storage tanks over the years since 2005. He talked about the role of SS in supplying safe drinking water to every citizen.

N P Rao / K R Ananthanarayanan of Pegasus Consulting, Bangalore made a presentation on “Stainless Steel for Water Pipelines”. They explained with life cycle cost analysis the necessity of using Stainless Steel for water pipelines due to the properties like corrosion resistance, abrasion resistance and ease of maintenance.

Prasad Khataw of SS Techno Limited, Pune gave a presentation on “Use of Stainless Steel in Management of Zero Liquid Discharge”. He spoke



on the technology developed for ensuring zero loss of water and use of stainless steel for this purpose.

Rajeev Gupta, Head-Center of Excellence, Jindal Stainless presented on "Stainless Steel in Solar Water Heater applications". He has compared the different materials currently being used for solar water tanks and explained the advantages of using stainless steel.

MCV Prasad of Prakruthivanam, Madanapalle, AP explained the salient features of the simple water

filter made out of stainless steel developed by their organization.

Participants have expressed their pleasure in arranging such programs as the awareness about usage of SS in water management is limited. They were extremely satisfied with the knowledge gained and felt such programs should be conducted frequently and across the country.



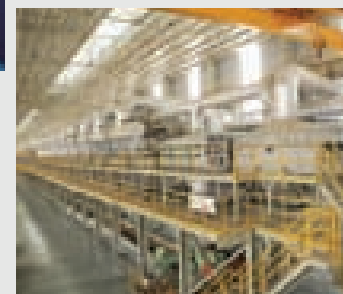
THINK STAINLESS, THINK CHROMENI.

OUR PRODUCT

We are producers of best in class Cold Rolled Stainless Steel Coils in both 200 & 300 series and our production of Cold Rolled Coils has started from June 2019. We are aiming at the production capacity of around 1 million ton per year of cold rolled coils by December 2019 and additional 1 million per year of cold rolled coils by 2022, apart from 4 million tons per year of hot rolled coils by 2025. We will be the 4th such facility Worldwide to accomplish such huge production capacity at a single location. Implementation of 5 stand Tandem DRAP (Direct Rolling Annealing Pickling + skin pass) line at our production facility for stainless steel cold rolling will help us reach faster production lead time which will complete the finishing process in minutes compared to weeks taken by the conventional methods.

STAINLESS STEEL COLD ROLLED COILS

Sl. No.	Grade	Width	
		Mill Edge	Slit Edge
1	CH1 (200 series)	1030*	1000*
2	304/304L (1.4301/1.4307)	1250	1219
3	316/316L (1.4401/1.4404)	1280	1250
Remarks	Thickness range: 0.4 mm to 2.0 mm		
	Unit weight :- 7.0 - 10.0 MT / 17.0 - 21.0 MT		
	*1030/1000 mm width coils subject to mill confirmation		
	ID :- 508 / 610 mm		
Finish	2B, With/Without Paper Interleaved		
	For thickness below 0.70mm we use Inside Paper Core in ID		
ASTM Standards	ASTM A240, ASME SA 240, ASTM A480, ASME SA 480		
EN Standard	EN 10088-2, EN 10028-7, EN 10088-4		
Flatness	According to EN ISO 9445		
Mill Test Certificate	AS PER EN 10204 3.1; CE		



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A Knowledge Sharing Session On “Stainless Steel Reinforcement Bars And Structures - An Ideal Solution For Long Lasting Infrastructure ”

Over the last three decades, premature deterioration of reinforced concrete structures has become a serious problem worldwide due to corrosion of the embedded steel. The estimated cost of repair is in excess of US\$550 billion. Corrosion of the steel is one of the major factors causing damage and loss. The solution, now favored by many policy makers worldwide, who have studied many alternative materials and design solutions, is simple: as it is the carbon steel that corrodes - use a steel that has proven to be highly resistant to chloride ion, - stainless steel. As focus sector for increasing the consumption of SS in India, it is planned to conduct workshops in all the major cities to make all the stakeholders aware. The availability of Stainless Steel reinforcement bars and structures in India has also increased now.

ISSDA (Indian Stainless Steel Development association) conducted a knowledge sharing session on “STAINLESS STEEL REINFORCEMENT BARS AND STRUCTURES - AN IDEAL SOLUTION FOR LONG LASTING INFRASTRUCTURE” in Hotel Green Park, CHENNAI on 22nd August 2019.

Invitations were sent to likely participants consisting of Architects, structural engineers, Government organizations, like Chennai Corporation, CMDA, PWD, ICF, Southern Railway, CMRC, AAI etc. and Educational & Research institutes like, CSIR, IIT & School of Architecture & Planning to participate in this event. The event received a good response with more than 120 participants attending.

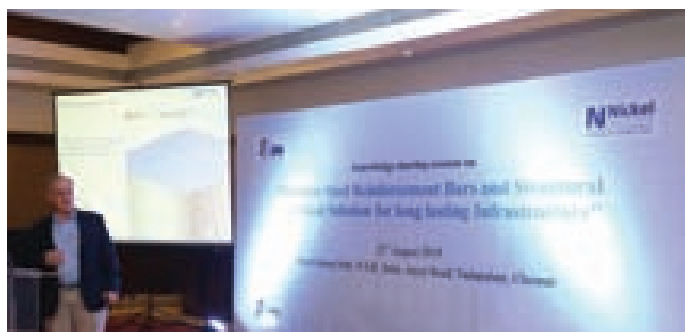
After welcoming the guests, the program started with the presentation by Dr Graham Sussex, Consultant, Nickel Institute - “Introducing Stainless Steel Reinforcement bars and global practices being

followed for a corrosion free civil structure”. He explained the advantages of using Stainless Steel and the selective use of SS reinforcement bars and structures with various examples. He dwelt on the practical issues and the UK & USA standards for SS reinforcement bars.

Rohit Kumar, Executive Director, ISSDA presented on “Indian Standard on Stainless Steel Reinforcement Bars and it's availability in India”. He explained salient features of IS 16551 : 2017 - Specification for high strength deformed stainless steel reinforcement bars and wires for concrete reinforcement.

Then, Dr Graham Sussex, Consultant, Nickel Institute gave a presentation on “ Advantage of using Stainless Steel Structures over Carbon Steel”. He has explained the basic reasons for using stainless steel in structural applications taking into consideration the life-cycle cost analysis with various live examples. He also indicated minor maintenance requirements of stainless steel structures.

Tushar Patil of Stalatube, India presented on “Light Weight structural solutions in Stainless Steel”. he also explained about the stainless steel structures being made Stalatube and available in India. J Ravindranath, retired DGM (Marketing) SAIL Salem Steel Plant and advisor to ISSDA proposed the vote of thanks. Participants expressed their pleasure in arranging such programs as the awareness about the availability stainless steel reinforcement bars and structures & their advantages is limited. They were extremely satisfied with the knowledge gained and felt such programs should be conducted frequently and at different locations in India.



ISSDA & Nickel Institute at Central Public Works Department

The Central Public Works Department of India, commonly referred to as the CPWD, is a premier Central Government authority in charge of public sector works.

A detailed presentation was made to Central Public Works department, Ministry of Housing and Urban Development at Delhi on 23rd August 2019 at their conference room. The presentation was attended by Director General and his full team of engineers, architects and designers. In his opening remarks Mr. K K Pahuja, President Indian Stainless Steel Development Association emphasized on the need of adopting stainless steel in more applications and project for a sustainable development. He also discussed

about the life cycle cost benefits of stainless steel. A combined detailed presentation discussing the properties of stainless steel and various application of it in architecture, building and construction was done by Dr Graham Sussex from Nickel Institute and Rohit Kumar from ISSDA. A practical demonstration on chemical method to differentiate between 200 series and 300 series grades of stainless steel was also performed. Officials of CPWD showed keen interest in understanding about the engineering properties of stainless steels for use in different application areas. A memento was given to representatives of ISSDA and Nickel Institute for sharing knowledge with the team of CPWD.



ISSDA Presentation at Public Works Department, Government of NCT of Delhi

ISSDA along with its member companies made a technical presentation to Public Works Department, Delhi on "Use of stainless steel for architecture building and construction" on 28th August 2019. This was attended by Engineer in Chief and his team of

engineers from PWD. This presentation resulted in discussion between ISSDA and PWD on possible use of stainless in foot over bridges and multi-level transit bus stations designs.



ISSDA Interaction at Chennai MetroPolitan Water Supply & Sewerage Board

In Chennai, a coastal city of about 10 million, rapid development and rampant construction have resulted into disturbance in water ecology of the city. The water short falls became so severe that city has to deploy water trucks to reach out to the people and start strict rationing of water. Despite acute water shortage Chennai still is incurring 30 to 40 % leakages through supply water pipelines. ISSDA along with representative from Nickel Institute made a presentation to team of officials of Chennai Metropolitan Water Supply & Sewerage Board explaining the need of using stainless steel for water transportation and storage for most efficient water management. Examples form around the world were shared to explain why stainless steel is now being used in water related applications for a healthy and hygienic distribution of potable water.





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Modernity in Tradition with Stainless Steel

The use of traditional building materials often find itself in a situation where it must fulfil the challenging requirements of demanding environment and also meet the modern building standards and living conditions. Traditional building materials and design have gained renewed attention in the green building movement but to meet the challenges of technology it has to integrate with materials which not only compliment but make it more useful in a cost effective way.

Stainless Steel is one of the most widely used material which have benefited from innovative technologies in both manufacture and application. It has made several traditional building materials, such as glass, wood, bamboo and others financially more feasible, environmental friendly and technically sound. The following project is one of the fine example of highlighting the combination of traditional looking bamboo structure and environmentally friendly stainless steel to fulfil the purpose of modern sanitation facility.



The project executed by Jindal Lifestyle Limited uses stainless steel interior, ceramic fixtures and bamboo, wood to create a sanitation facility at the beaches of Diu, India. Bamboo and leaf is one of the most widely used material culturally accepted around the area and the same has been used to build exterior

and roofing. Beach area is generally very corrosive environment and stainless steel is one of the material which can offer high corrosion resistance along with good strength and the reason it was selected to provide support for better structural stability. Sanitation The challenge was to offer modern amenities

Built with 304 stainless steel, the SS Panel offers added rigidity and robustness and is reliable under all weather conditions. Stainless Steel can be easily cleaned with non acidic, mild, chlorine free household cleaning

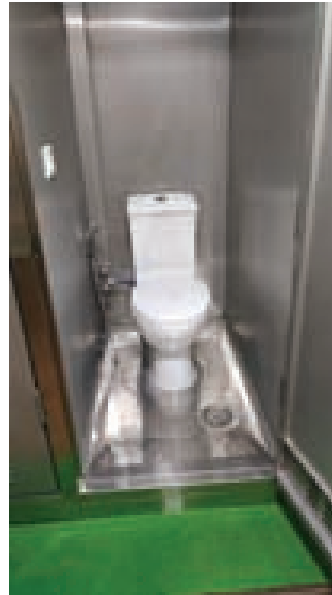


products. Stainless Steels are worldwide preferred for public bathroom surfaces exposed to urine splash, partitions, dispensers, sinks and other fittings because, unlike painted or plastic surfaces, it can be cleaned and sanitized using chemical free steam cleaning also. Use of PVD colored stainless steel in gold color makes it aesthetically pleasing andt gives user a



pleasing environment. The door frames are also made in stainless steel in combination with bamboo. Public installations are often prone to vandalism and stainless steel is known for its high impact, anti-scratch

resistance and is very much vandalism proof. These customized sanitation facilities are very user friendly and stainless steel helps to keep it clean 24X7 and enhance the service life manifolds.



For more details contact
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ISSDA made a technical presentation at Structural Engineering Division of Department of Civil Engineering of Indian Institute of Technology Chennai on 21 st August 2019. The technical presentation was attended by Graduate and post graduate students of the department along with professors. ISSDA was appreciated for the efforts of sharing knowledge with students on Stainless Steels.

Disclaimer

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Welding Wires



Fasteners



Profiles



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Wires



Flanges

6 Continents | 90 Countries | 50,000 SKUs
9,000 Employees | 10 Global Offices



What was once restricted to kitchens is now breathing life into the nation. Stainless steel is the soul of development across major economic fronts of our country. What actually started back in 1970 was an ambitious goal of shaping a stainless world. As Jindal Stainless inches closer to its golden jubilee, we celebrate the legacy of pioneering an era of stainless development in India.

To know more log on to www.jindalstainless.com

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