

The Punj Lloyd Magazine

update

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**Punj Lloyd Builds
Motor Spirit Quality
Upgradation Unit,
Barauni, India**

Bangalore Metro Reach 1



With the rapid pace of development globally, nations have increased their focus on creating infrastructure that can provide integrated solutions to the public at large. The need of the hour is to provide public transport systems to ensure easier, smoother and faster travel. Mass transit systems are meant to encourage the public to adopt affordable transport solutions, save fuel and decrease the pressure on existing infrastructure.



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An Overview

After the success of the Delhi Metro, where Punj Lloyd was involved in the construction of an elevated viaduct with four stations on the Inderlok-Mundka corridor, and the stretch between Kirtinagar-Tilaknagar, the Company is now proud to execute metro stations for Bangalore Metro Rail Corporation Limited (BMRCL). A joint venture of Government of India and Government of Karnataka, BMRC has been entrusted with the responsibility of implementation of the Bangalore Metro Rail project.

Bangalore is one of the most developed and progressive cities of India. Rapid growth has resulted in severe traffic congestion and the city is in dire need of a multi-modal transport system. The Bangalore Metro Rail Project will contribute immensely to realign the traffic situation of this metropolitan city, ensuring seamless travel for the commuter.

Adding to the beauty of Bangalore's skyline, the Bangalore Metro, popularly called the Namma Metro, will significantly contribute to the reduction of carbon emissions, adding to comfort while travelling.

The Pride of Bangalore-Namma Metro

To the delight of the people of Bangalore, the first stretch of the Namma Metro, between Baiyappanahalli and M G Road, was launched in October 2011.

Snaking its way through the bustling commercial and residential areas of Bangalore, the sleek Bangalore Metro, promises the commuter rapid connectivity, convenience, affordability, frequency, reliability and safety. This is the first metro rail project in India commissioned with 750V DC Third Rail on Standard Gauge¹.

Namma Metro's first 12-day cumulative revenue was Rs 1 crore (US\$199,500)².

Phase I of Bangalore Metro, consisting of two corridors of double line electrified-The East-West corridor and the North-South corridor, will

Section	Line	Route
Reach-1	East Line	Cricket Stadium to Baiyappanahalli (6.7 km)
Reach-2	West Line	Leprosy Hospital to Mysore Road (6.4 km)
Reach-3	North Line	Sampige Road to Yeshwanthpur (5.1 km)
Reach-3A	First North Extension Line	Yeshwanthpur to Peenya Industry (4.8 km)
Reach-3B	Second North Extension Line	Peenya Industry to Nagasandra (2.5 Km)
Reach-4	South Line	National College to Rashtreeya Vidyalaya Road (4.1 km)
Reach-4A	South Extension Line	Rashtreeya Vidyalaya Road to Puttenahalli (3.9 km)
UG 1	North-South Underground Line	Between Sampige Road and National College (4.0 km)
UG 2	East-West Underground Line	Between Cricket stadium and Magadi Road (4.8 km)

Line	Elevated Length (km)	Underground Length (km)	Total Length (km)	Stations
Purple Line	13.22	4.88	18.10	17
Green Line	20.20	4	24.20	25
Total	33.42	8.88	42.30	42

cover a total of 42.30 km.

Implementation of the elevated parts of Phase I has been divided into 4 'reaches' and 2 underground sections connecting Reach-1 and Reach-2 in the East-West Corridor and Reach-3 and Reach-4 in the North-South Corridor respectively.

The East-West corridor or the Purple Line is 18.10 km long, starting from Baiyappanahalli and terminating at Mysore Road terminal, via Swami Vivekananda Road, Indiranagar, Halasuru, Trinity, Mahatma Gandhi Road, Cubbon Park, Vidhana Soudha, Sir M Visveshwaraya, Kempegowda, City Railway Station, Magadi Road, Hosahalli, Vijayanagar, Attiguppe and Deepanjali Nagar.

The North-South corridor or the Green Line is 24.20 km long, and will start at Nagasandra and terminate at Puttenahalli, via Dasarahalli, Jalahalli, Peenya, Yeshwanthpur, Sandal Soap Factory, Mahalakshmi, Rajajinagar, Kuvempu Road, Srirampura, Sampige Road, Kempegowda, Chickpete, Krishna Rajendra Market, National College, Lalbagh, South End Circle, Jayanagar, Rashtreeya Vidyalaya Road, Banashankari, and Jaya Prakash Nagar stations.

The metro will be a complementary mode of transport, running in tandem with other transport systems of buses and the

mono rail. Feeder bus services will be provided to all the metro stations. Bus bays and parking facilities for private vehicles will be available at all major stations. Moreover, the Bangalore Metro will be integrated with the railways and other modes of transport at Baiyappanahalli railway station in the East, Yeshwantpur railway station in the North, Bangalore city railway station and Kempegowda bus stand in city centre.

Punj Lloyd's Scope of Work

BMRC awarded Punj Lloyd eight Metro Stations across three Reaches:

Reach 1

- M G Road Station
- Trinity Circle Station

Reach 2

- Magadi Road Station
- Deepanjali Nagar Station
- Mysore Road Terminal Station

Reach 3

- Rajajinagar Station
- Malleshwaram Station
- Kuvempu Station

The work involved construction of these eight metro stations starting from the pile foundation, piers, girders, station buildings including all architectural, fire protection to installing of electronic systems.



Adding to the beauty of Bangalore's skyline, the Bangalore Metro, also popularly called the Namma Metro, will significantly contribute to the reduction of carbon emissions, adding to comfort while travelling.



This is the first Metro Rail project in India commissioned with 750V DC Third Rail on Standard Gauge





Building infrastructure in the busiest part of a city is never easy. Punj Lloyd was conscious of this fact, adopting best practices of HSEQ throughout project execution.

Both the stations in Reach 1 have already been completed and are operational.

Gliding smoothly

As you walk into the metro station, the vibrant green and purple house colours of the Namma Metro, grab your attention. What also strikes one is the smooth and sleek finish of the entire station, from the granite flooring, the escalator or the ticket counter. A truly unique project for Punj Lloyd as other than the structural work, this project also included the finishing and MEP (Mechanical, Electrical and Plumbing) work which matches international standards.

Being an MRT infrastructure project, every aspect of the project was planned to add to the experience of the traveler. Various colours of marble and granite were used, exceeding 13,000 sqm of area while brick and block masonry was across 1,100 sqm. Over 30,000 sqm of wall was painted, while false ceiling installed was nearly 3,650 sqm at all the levels. Aluminum

composite panel work, along with the structural glazing work, covering all the external surfaces was approximately 9,300 sqm. All public health and environment systems, as well as the fire protection and safety systems were installed by Punj Lloyd.

Structural Work

A total of 3,000 MT of structural steel had to be fabricated and erected at the stations in the form of arch trusses, purlins, staircases, foot over bridge etc. Structural work amounted to 73,972 m³ of concrete, TMT requirement being 15,300 MT.

A total of 978 piles had to be bored, varying in diameter from 600 mm to 1,600 mm. 1,377 precast girders were cast at a yard, located on the outskirts of the city. They were transported from the yard via trailers and erected at site; the highest erection being at a height of 25 m from the ground level. The longest girder measured 19 m and the heaviest, 50 MT.

Unique Technologies

For the casting of pre-tensioned and post-tensioned girders, prestressing technology was used. Out of the 1,377 girders, 997 were prestressed concrete (PSC) girders. One of the distinguishing features of the Bangalore Metro Project was the use of steam curing, wherein steam is continuously supplied and a temperature of 70° C maintained, resulting in concrete attaining 85 per cent strength in a single day. With the use of this unique technology,



the rate of production of the girders was increased and the cycle time of a normal pre-tensioned girder was reduced to two and a half days instead of a nine day casting cycle. This ensured rapid progress of precast girder production.

Central Precast Yard

The Central Precast Yard, situated 20 km from the city, was a great asset and served a multipurpose role. Not only was it used for casting structures, but the procurement, inventory and plant & equipment teams, operated out of there. Fabrication work for the project was also done at the central precast yard as well as storage of surplus staging and shuttering material. The labour camp, housing over 200 workmen, within the precast yard, sprawled across 1,600 sqm. The workers' camp was well maintained and inspections were undertaken regularly to ensure that a clean and healthy environment was provided to the workers.

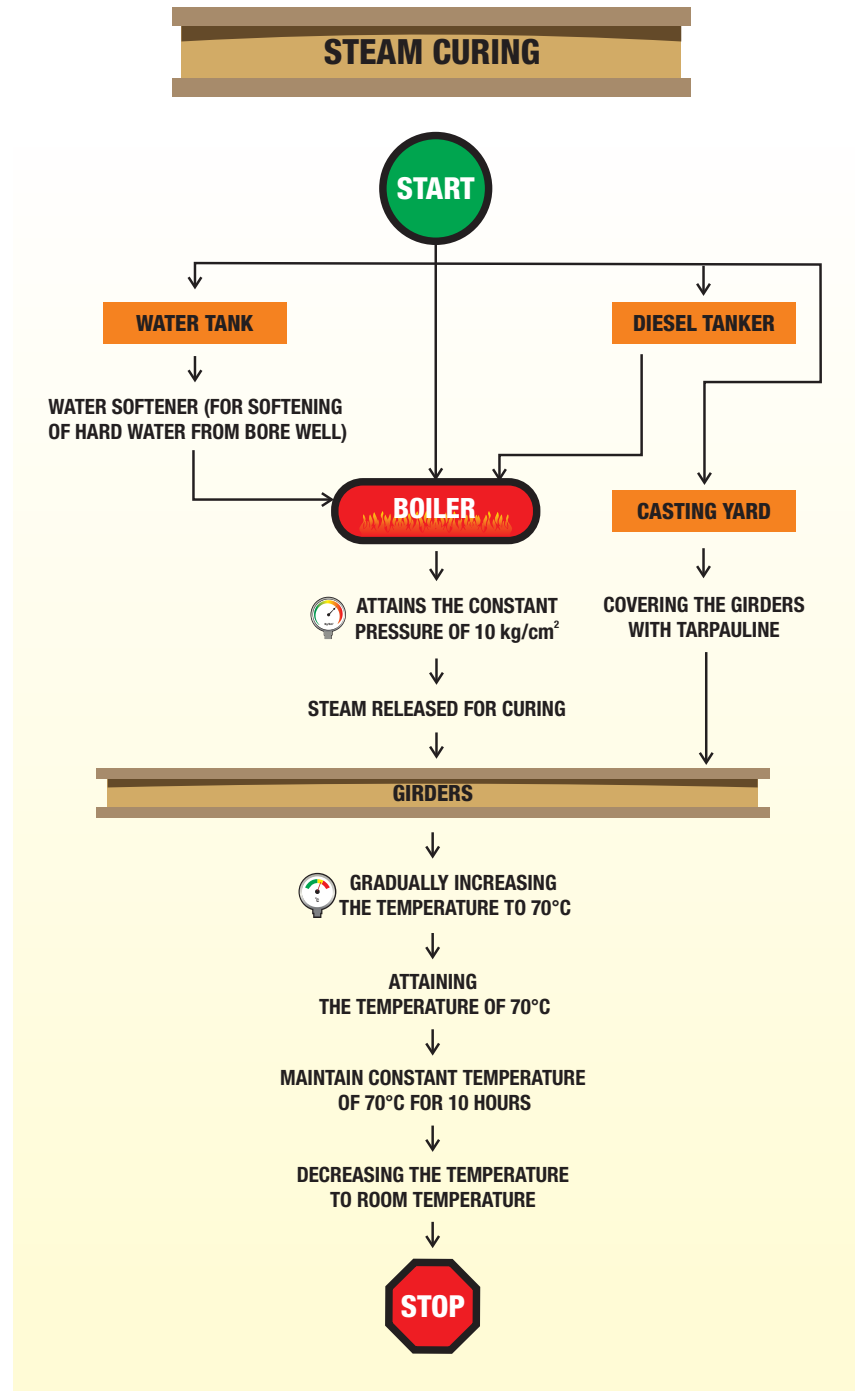
Adopting Best Practices

Building infrastructure in the busiest part of a city is never easy. Punj Lloyd was conscious of this fact, adopting best practices of HSEQ – health, safety, environment and quality, throughout project execution.

SAFETY

Fastening the safety belt

Safety of workmen is extremely important to us at all our construction sites. However greater vigilance is



required in sites like that of the Metro because it involves the safety of the public, due to its location.

All workers were mandated to wear Personal Protective Equipment (PPE). Workmen operating at heights were given special and repeated training. Weekly Tool Box meetings were held. Personnel were not permitted to enter the premises



It was with great pride that Punj Lloyd received the Safety Award for 3 million manhours without loss time accident for the Bangalore Metro Reach 3.

without undergoing the safety induction programme, briefing them about potential hazards at site and their management. To ensure that safety was not compromised, the senior management monitored the programmes, increasing focus on safe working. As many as 727 HSE trainings and 9,454 tool box talks were conducted at site, amounting to 22,577 safety training man-hours.

Mock drills at site checked the readiness of the team. The project clocked 11,019,868 safe man-hours till December 2011, driving

over 2.6 million safe kilometers.

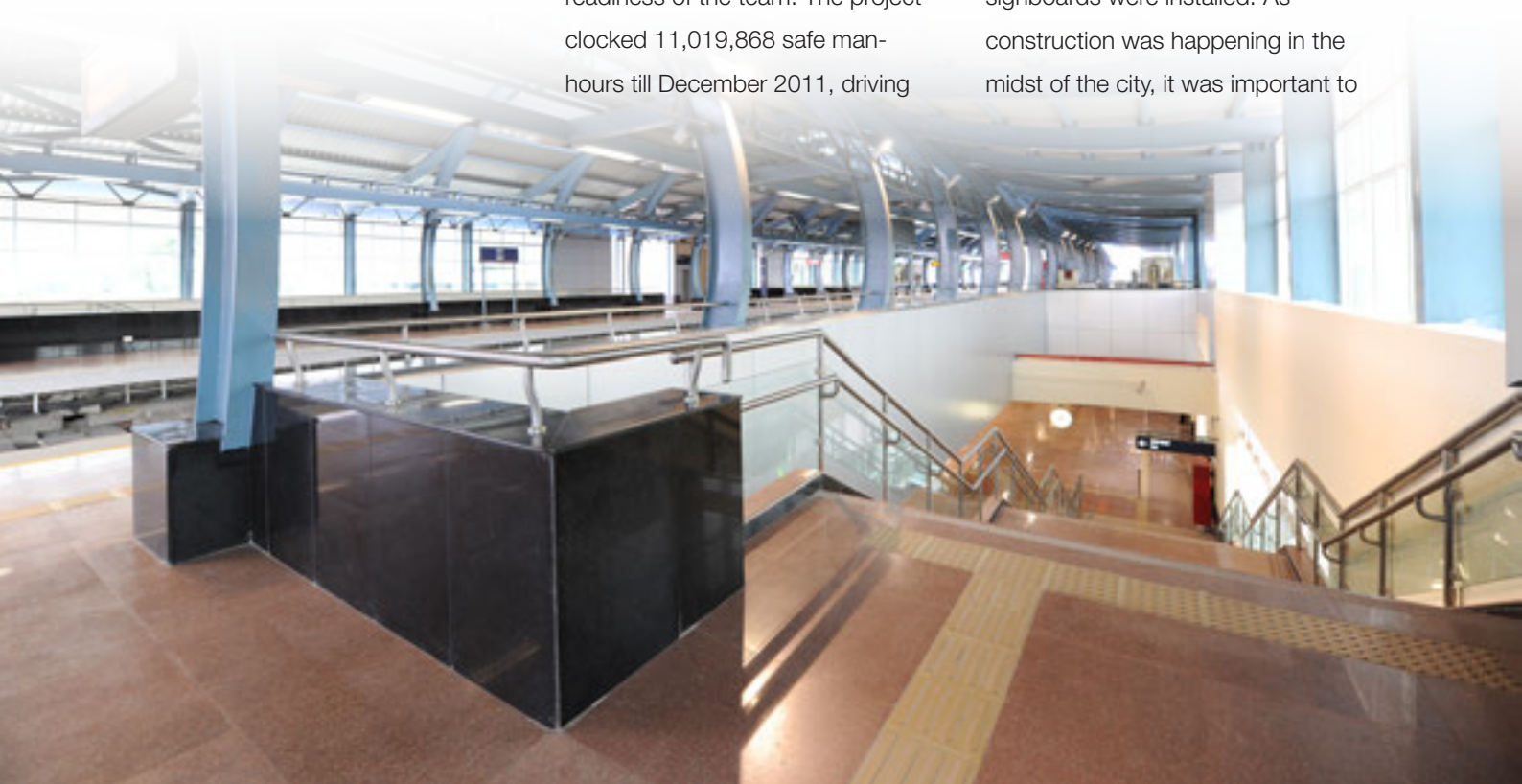
Regular inspections by the Resident Construction Manager and Project Managers were undertaken to keep a vigilant eye. Till date, approximately 250 such inspections have been carried out.

Apart from all these activities, Safety Week is celebrated with great fervor every year. Workers are encouraged to ensure not just their own safety but that of their colleagues. Prizes are given to individuals, appreciating their focus on safe practices.

It was with great pride that Punj Lloyd received the Safety Award for 3 million manhours without loss time accident for the Bangalore Metro Reach 3.

Public Safety

To ensure safety on the road, various signboards were installed. As construction was happening in the midst of the city, it was important to





differentiate the work site from the normal public space. Barricading was done to prevent unauthorised personnel from entering the area of work.

Healthy living

While safety at the work site is important, general health and well being of the staff is equally important. On the 1st of December every year, Punj Lloyd observes World AIDS Day where the employees at all sites worldwide take various initiatives to raise awareness about AIDS and its preventive measures.

Environment

While human life is precious, Punj Lloyd is equally conscious of protecting the flora and fauna. In rapidly growing cities, infrastructure development is always perceived to be at the cost of the environment. In constructing iconic landmarks globally, Punj Lloyd has always

displayed environment sensitivity, minimising its impact on the environment or offsetting the impact of its construction activity with well planned environment initiatives. The Bangalore Metro site was no exception. Various initiatives including those for greening were undertaken. Tree plantation was done in the precast yard which played a central role in the site operations.

Foot Over Bridge at MG Road Station

Mahatma Gandhi Road (M G Road) is one of the busiest roads in Bangalore. The foot over bridge was intended to join the Metro Station to the Plaza building across the road.

In order to erect the bridge, the road had to be blocked for 48 hours. This put the project team under intense pressure. They were aware that it was impossible to block the road in the heart of the city beyond





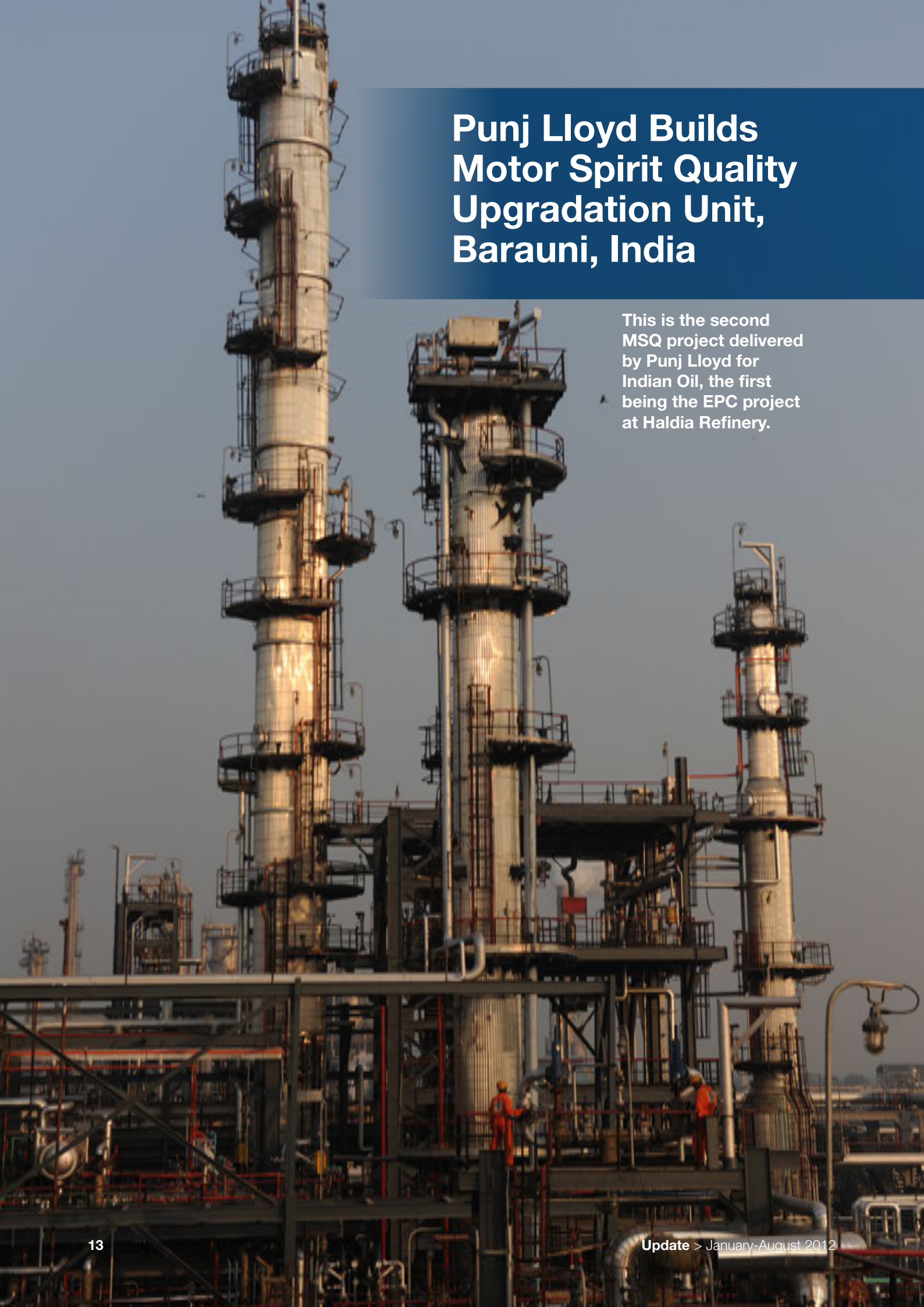
48 hours, given its importance and location. Accepting the challenge, the team set to work, erecting the entire structure in 36 hours, 12 hours before the scheduled time. The two main girders weighed approximately 140 MT. Two 250 MT hydraulic cranes were used for erection, while a 40 MT and 25 MT crane, were used to hold the structures.

Project Status

Reach-1 Stations: M G Road Station and Trinity Circle were the first to have been completed among all contractors and have been handed over to the Client. The Reach-1 line was inaugurated in October 2011. The rest of the six stations are being completed. The Plaza Building Block B of M G Road Station is also being constructed by Punj Lloyd. ♦

Achievements

- Punj Lloyd was the First Contractor to hand over the metro stations in Reach 1.
- The inauguration of the Reach 1 of the Bangalore Metro was a very proud moment for the project team which had been relentlessly working to deliver state-of-the art infrastructure to the city.
- Small achievements made way for this large victory !
- Casting the maximum number of girders - 126 in a month over any other contractor.
- Reducing girder casting time by use of unique technology. To produce 6 girders, the girder cycle time was 58 hours, using this technology.
- The largest and the deepest pile cast by any contractor was that of Punj Lloyd - 1,600 mm dia, 42 m deep.
- The Foot Over Bridge at M G Road Station, weighing over 150 MT, was erected in a mere 36 hours
- The largest volume of concrete work was at Trinity Circle - 672 m³ in 48 hours for the raft of the basement including underground water tank.
- Over 1,500 MT of structural steel in-house fabrication has been erected for the permanent structures.



Punj Lloyd Builds Motor Spirit Quality Upgradation Unit, Barauni, India

This is the second MSQ project delivered by Punj Lloyd for Indian Oil, the first being the EPC project at Haldia Refinery.

The plant layout built in enhanced safety as per Oil Industry Safety Directorate (OISD) guidelines, at the design stage itself. This included the formulation of a disaster management plan and accident analysis.



R Prasad

Resident Construction Manager, Barauni Project

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In a landmark move last year, India switched to eco-friendly Bharat Stage BS III and BS IV, equivalent to Euro III and Euro-IV petrol and diesel. The ultra-low sulphur and benzene BS III and BS IV petrol and diesel not only reduce exhaust emission from vehicles but also improve the power and efficiency of the engines.

As one of India's leading EPC companies, Punj Lloyd played its part in building infrastructure that could help attain the above objective. The Motor Spirit Quality Upgradation Unit at Indian Oil's Barauni Refinery was designed to produce gasoline with Bharat Stage III specifications. This is the second MSQ project delivered by Punj Lloyd for Indian Oil, the first being the EPC project at Haldia Refinery.

The MSQ unit at Barauni is based on Axens technology on a Lump Sum Turnkey basis, producing a MS pool based on Axens NHDT, Isomerisation, Prime G+ and NSU/HDT/CRU processes. A total of five product streams are sent to the MS pool, out of which two are wild and three controlled streams. Wild

streams comprised Light Cracked Naphtha and Heart Cut Naphtha coming from Prime G+ unit, whereas controlled stream comprised Isomerate coming from ISOM unit, Reformate coming from RSU and Desulphurised Heart Cut Naphtha coming from Prime-G+.

The project also comprised constructing a Nitrogen Plant, H2 bullet, control room, substation, air compressor, five In Side Battery Limit (ISBL) tanks, and four Out Side Battery Limit (OSBL) tanks, besides four prominent units which were:

- NHDT unit
- C5-C6 Isomerisation Unit
- Reformate Splitter Unit
- Prime-G+ Unit

Engineering

Cutting edge engineering was delivered by Punj Lloyd Group's engineering arm, PL Engineering.

The plant layout built in enhanced safety as per Oil Industry Safety Directorate (OISD) guidelines, at the design stage itself. This included the formulation of a disaster management plan and accident analysis. All aspects of hazard prevention including locations of gas detectors, fire extinguishers etc. were built in during the engineering stage. The placement of equipment as per the flow diagram and distance between equipment maintained as

PARAMETER	Pre BIS 2000	BIS-2000	BS-II	BS-III	EURO-IV
Sulphur, wppm	2000 (leaded)	1000/500	500	150	50
Benzene, Vol per cent	5.0	5/3	3.0	1.0	1.0
Aromatics, Vol per cent	-	-	-	42.0	35.0
Olefins, Vol per cent (Regular/Premium)	-	-	-	21/18	21/18
RON, (Regular/premium)	87	88/93	88/93	91/95	91/95

per OISD ensured least piping and rework.

The Technology

The Motor Spirit produced by Axens technology will have 50 wppm sulphur, aromatic 35 vol per cent and high octane number, indicative of a high performance fuel.

Reformate Splitter

The purpose of this unit is to remove benzene by fractionating full reformate into two cuts through reformate splitter:

- a light reformate with high benzene content for the Isomerisation unit (Unit 802)
- a heavy reformate with low benzene content to gasoline pool (containing less than 1.0 vol ppm benzene).

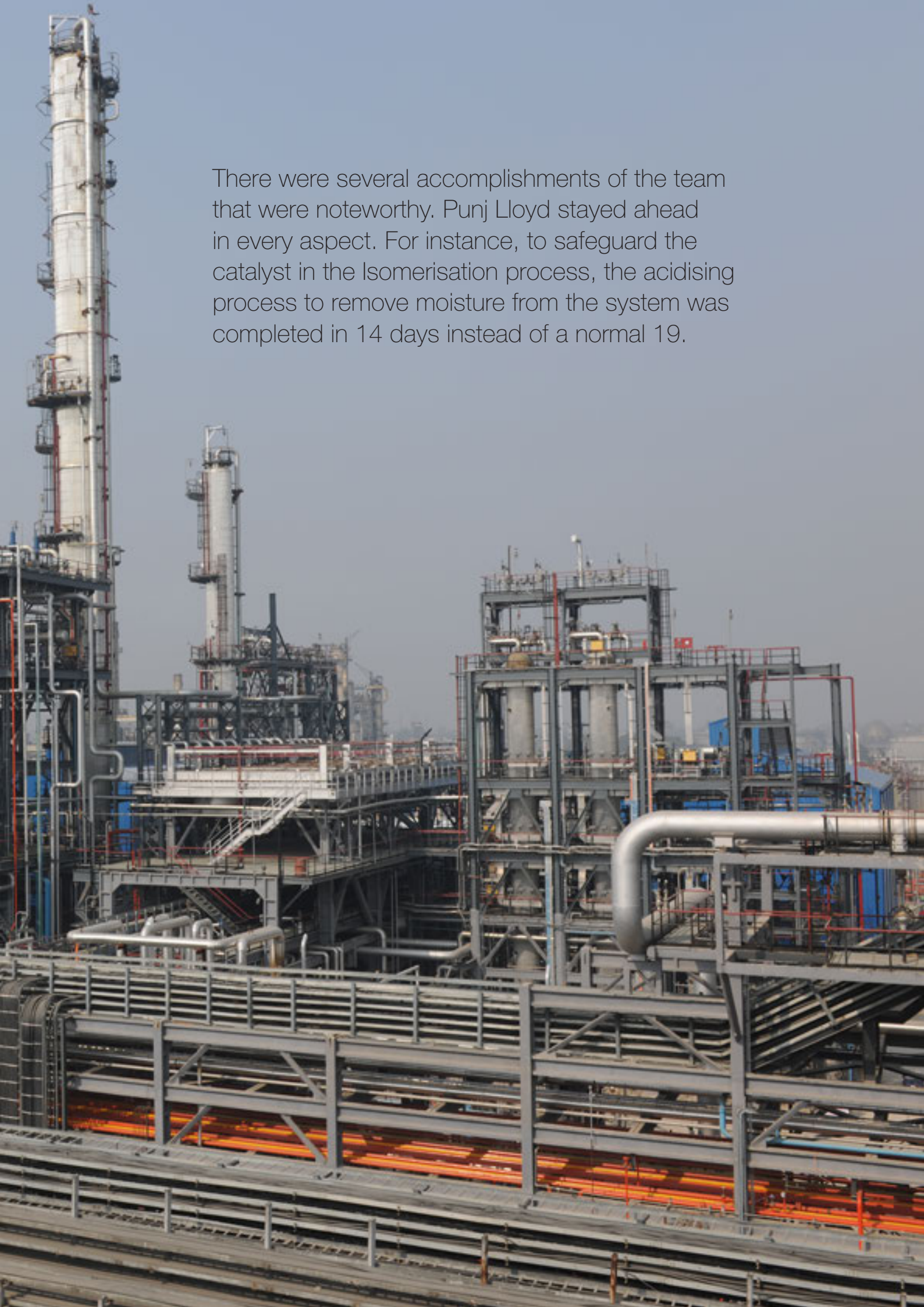
Naphtha Hydrotreating-NHDT

Naphtha Hydrotreating produces clean desulphurised naphtha cut suitable to be processed in the NHDT splitter after removal of all impurities which are currently poisons for the catalysts (sulphur, nitrogen, water, halogens, diolefins, olefins, arsenic, mercury and other metals).

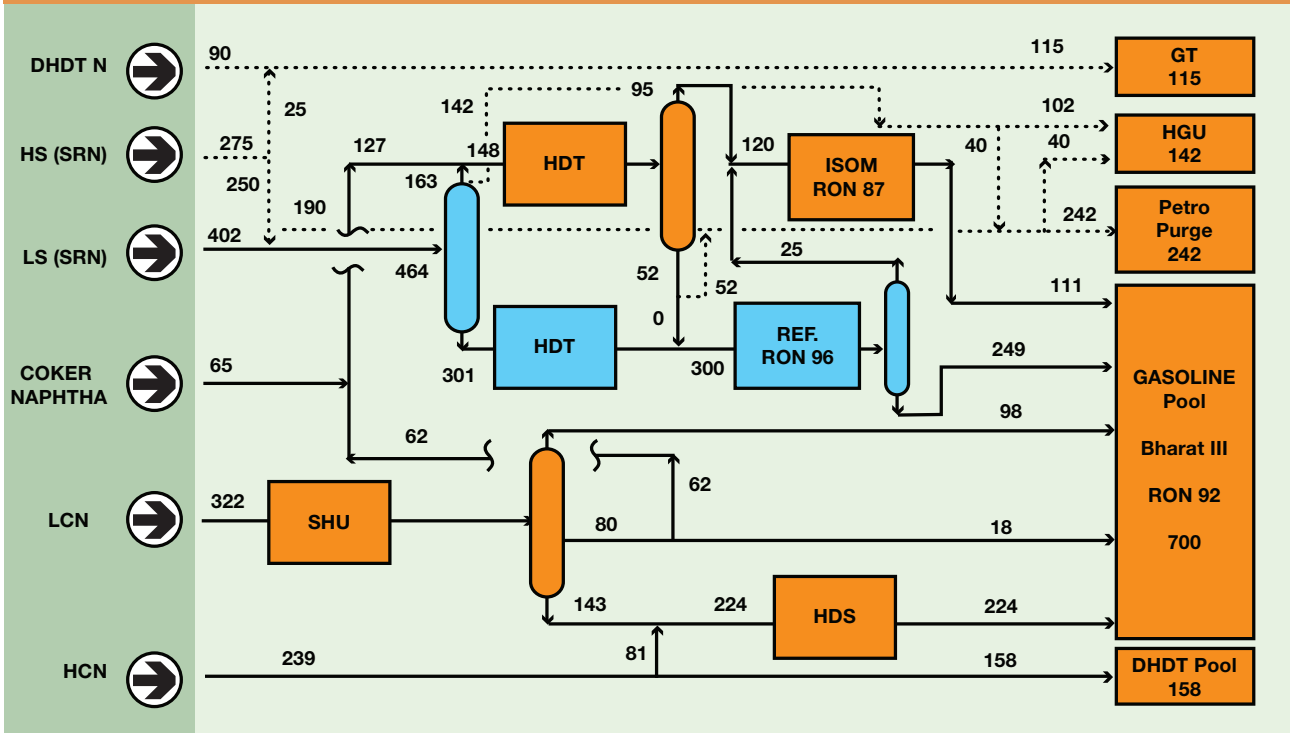
MS Quality Unit		
Process Units	Capacity (TMTPA)	Service
Reformer Splitter Unit	274	Recover Light Straight Ends from Reformate for Isomerisation
Naphtha Hydro-Treating Unit for ISOM	183	Remove Sulphur from Naptha for Isomerisation
Isomerisation Unit (ISOM)	126	Isomerise Light Ends
Prime G+		
Selective Hydro-treating Unit (SHU) + LCN Splitter	322	Remove Sulphur from Light FCC Gasoline
Hydro-Desulphurisation Unit (HDS)	224	Remove Sulphur from Heavy FCC Gasoline
Utilities/ Auto Blending		Steam, Condensate, Nitrogen, Auto Blending
Heavy De-sulphurised FCC Gasoline		from Prime G+ Heavy Ends Desulphurisation Section
Heavy Reformate		from RSU
Isomerase		from Isomerisation Section
Light Cycle Naptha (FCC Gasoline)		Buffer storage for Prime G+ Selective Hydrogenation Section feed



There were several accomplishments of the team that were noteworthy. Punj Lloyd stayed ahead in every aspect. For instance, to safeguard the catalyst in the Isomerisation process, the acidising process to remove moisture from the system was completed in 14 days instead of a normal 19.



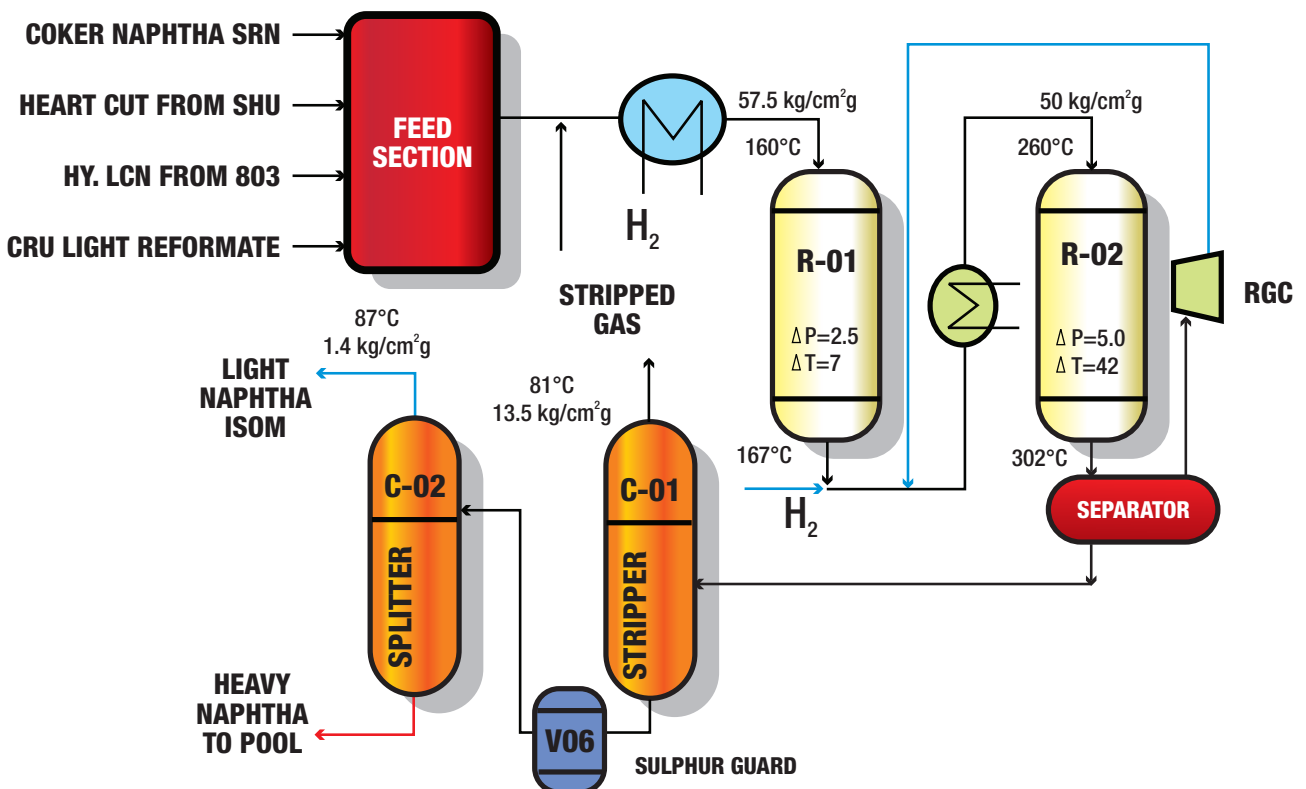
BLOCK FLOW DIAGRAM - MSQ PROJECT



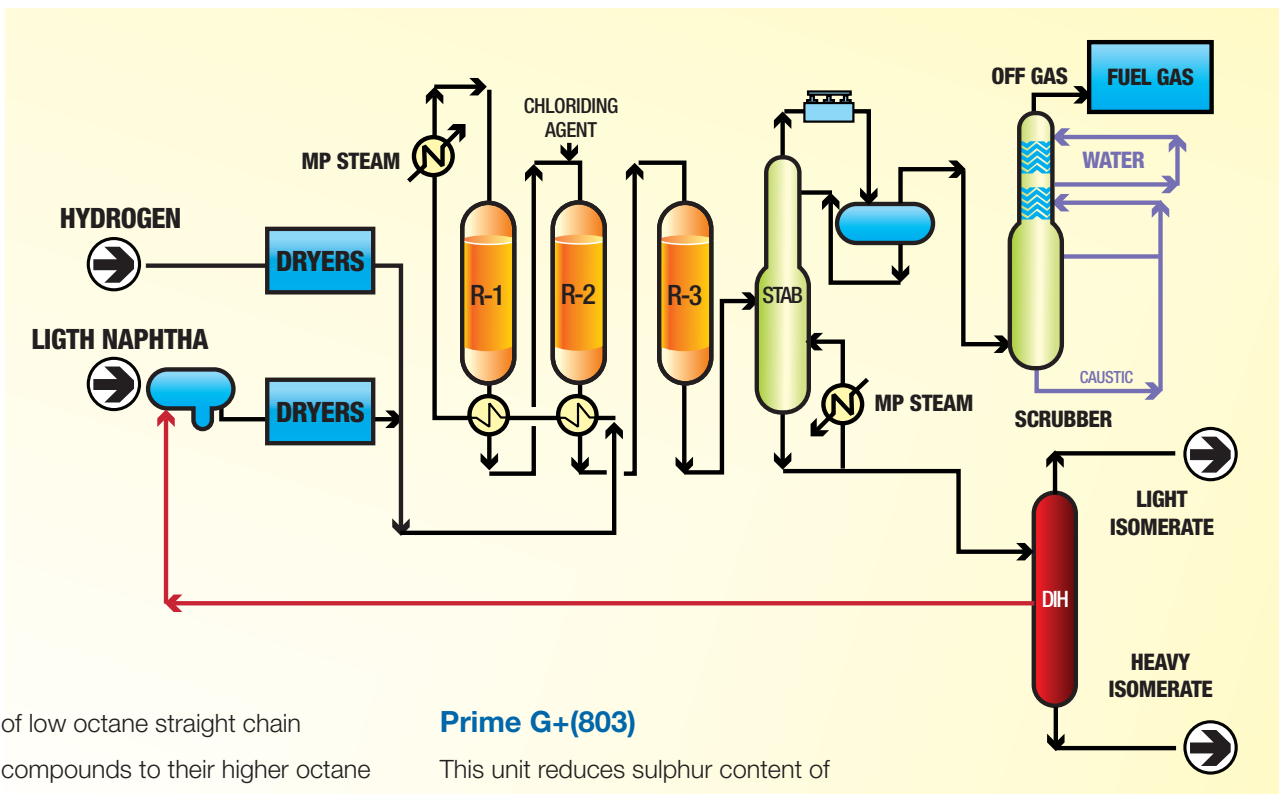
- The unit design capacity is 183,000 MTPA (Metric Tons per Annum), based on an on-stream factor of 8,000 h/year.
- The product contains less than 0.5 wt. ppm sulphur and 0.5 wt. ppm nitrogen.

Isomerisation

Isomerisation is the conversion







Prime G+(803)

This unit reduces sulphur content of the Low Cut Naphtha gasoline as well as part of the Heart Cut Naphtha gasoline, coming from the Refinery Fluid Catalytic cracking in order to meet the applicable motor spirit fuel specification, while minimising octane losses.

The basic design utilises Axens' Prime G+ process, which is a catalytic process for hydro-desulphurisation of gasoline.

The design capacity of the unit is 322,000 MTPA for the Selective

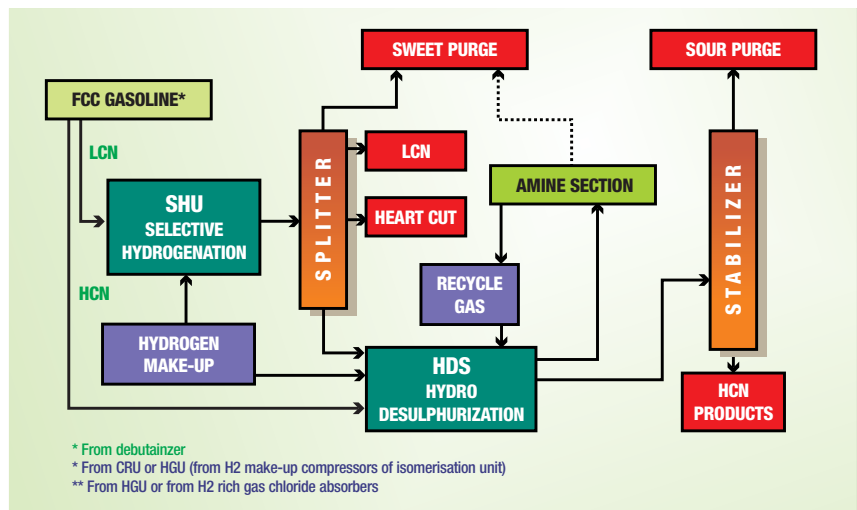
Hydrogenation Unit and 81,000 MTPA for the HDS section/Stabiliser.

Huge quantum of work

As this was an operating refinery, commencing the piling work on undulated marshy land was quite a challenge. The construction team however overcame all hurdles and successfully completed 1635 piles of 500 mm dia involving 6,500 cum concreting. An overall concreting

of low octane straight chain compounds to their higher octane branched isomers. The light hydro-treated naphtha and light reformat feed is dried and passed over an activated chloride platinum based catalyst in the presence of once through hydrogen, also dried. The Isomerisation reactor temperatures are kept low in the range of 120-170°C, taking advantage of the higher equilibrium concentration of isomers at lower temperatures and minimising hydrocracking. The reaction requires a very low partial pressure of hydrogen, enabling once through hydrogen to be used. Prior to Isomerisation reactions, a fixed bed reactor for catalytic saturation of benzene in the presence of hydrogen is provided.

A de-isohexaniser tower is included in the flow scheme in order to recycle the low octane C6 n-paraffins and methyl pentanes back to the reactor circuit to obtain a high octane product.



* From debutanizer
 * From CRU or HGU (from H2 make-up compressors of isomerisation unit)
 ** From HGU or from H2 rich gas chloride absorbers

5,900 MT structural steel with 40,000 sqm fire-proofing supported the entire piping and equipment.

of 26,500 cum including one blast-proof control room building of 900 sqm floor area and one double storied sub-station building of 2,700 sqm floor area was completed within a stringent time schedule.

Construction of four storage tanks and five motor spirit blending tanks was also within the project scope of work. 18,000 sqm of concrete paved plant was accessed from all four sides by 9,000 sqm bituminous road.

Fabrication and Erection

5,900 MT structural steel with 40,000 sqm fire-proofing supported the entire piping and equipment. The project required the installation and commissioning of over 312 different types of equipment including 162 static, 118 rotary and 32 in package.

A 60 m high Deisohexaner column, weighing 106 MT had to be transported to the site. As it was difficult to transport it in one piece, the column was split into two and then welded vertically in situ followed by hydrotesting which required skilled workmanship.

In a short span of 20 months, a huge quantum of piping work had to be completed. A network of piping was laid beneath the plant area including hook up of cooling and fire water with the existing refinery.

Working in offsite areas of a running refinery was extremely

challenging and risky, but the diligence and expertise of the Punj Lloyd team ensured safety at work. An overall 120 km of pipe was laid throughout the entire refinery. After relentless hard work, successful commissioning was achieved in December 2010.

Advanced Features

Instrumentation and control for the MSQ project, Barauni assumed high importance as an advanced technology called the 'Foundation Field' (FF) bus was used the first time in the history of Indian Oil Corporation. Rarely used in refineries, the project team deployed the foundation field bus technology along with smart instrumentation, wherein major critical loops were kept on FF and all non critical loops on smart instrumentation control.

A total of 57 marshalling cabinets were installed in the control room to cover the complete field control, along with six operator consoles, four engineering stations and one large video display unit. As many as 5,424 field instruments were installed to transmit the complete plant process data to DCS and ESD for operational control. The field instruments were connected to the control room with various types of cables. Beside this, the plant was monitored through eight CCTV cameras in the field.

Auto Bus Transfer scheme was





With the adoption of advanced safety features, the team clocked over 14,700,000 man-hours without any lost time incident.







implemented through numerical relays and not the conventional type hardware. In order to prevent loss of power in any bus, PMCC and MCC were equipped with numerical relays and multifunction meters for combined metering parameters. These were connected to substation SCADA to monitor all metering and protection features of any breaker feeder.

Achievements

Installation in a live refinery is always full of challenges. However, with rich expertise in process plants, Punj Lloyd commissioned the plant one month after mechanical completion.

Punj Lloyd proactively adopted OISD guidelines in the design stage itself. It complied with the HAZOP study (Hazard and Operability Study), a structured and systematic examination of a process in order to

identify and evaluate problems that may represent risks to personnel or equipment, or prevent efficient operation.

There were several accomplishments of the team that were noteworthy. Punj Lloyd stayed ahead in every aspect. For instance, to safeguard the catalyst in the Isomerisation process, the acidising process to remove moisture from the system was completed in 14 days instead of a normal 19.

The offsite was outside the battery limit hence enhanced safety was required. The entire area was covered using tin. What was remarkable was that the entire unit has to be barricaded as while the Prime G+ was under construction, the NDHT was under commissioning and the hydrocarbon was already flowing. This required extremely high levels of safety. The

Construction of four storage tanks and five motor spirit blending tanks was also within the project scope of work. 18,000 sqm of concrete paved plant was accessed from all four sides by 9,000 sqm bituminous road.

Installation in a live refinery is always full of challenges. However, with rich expertise in process plants, Punj Lloyd commissioned the plant one month after mechanical completion.



underground system has to be blinded from the Prime G+ side as the underground network is common for all the plants.

Procurement was a big challenge for this fast track project, which was under the direct monitoring of the Supreme Court of India. The value of procured material was high comprising 271 mechanical equipment, 1,845 electrical, 5,424 instruments, 300 km cables and 120 km pipes. In this project, Punj Lloyd was awarded the complete electrical & instrumentation work on a turnkey basis in order to expedite delivery.

Crisis management, including planning for fire & gas hazards, was extensive.

The fire and safety system was connected to the existing fire and safety control room of the refinery. After hazardous area classification, a complete fire fighting equipment layout detailing fire extinguishers and gas detectors at strategic locations near each of the units was made. Enhanced features of safety were built in at the engineering stage. From markings of fire tender entry, anticipating water demand & water velocity to the fire water ring around the plant and the water supply from independent tie-in points of existing fire water system were all worked upon. Fire hydrants were positioned at a distance of 30 m around high hazard area. Enhanced vigilance

was maintained with monitors at strategic locations. A strong public address system was available along with manual call points.

Further safety was ensured in every possible way with OWS systems being provided with vent pipes and the vent pipes being placed higher than nearby structures, separate earthing of electrical and instrument equipment, air fin coolers and hydro carbon pumps provided with sprinklers, hooters inside the compressors area, among others.

With the adoption of such advanced safety features, the team clocked over 14,700,000 man-hours without any lost time incident. ♦



Sembawang Engineers and Constructors adopts Muhammadiyah Welfare Home, in Singapore

A Corporate Philanthropy Program



Khoo Kim Seng

Public Relations Manager (MRT DTL C919)
Sembawang Engineers and Constructors

Nikki Lee

Public Relations Officer (MRT DTL C919)
Sembawang Engineers and Constructors

As part of its outreach effort, Sembawang Engineers and Constructors Pte Ltd (Sembawang), one of the leading engineering, procurement and construction companies of South East Asia, has adopted the Muhammadiyah Welfare Home, a children's home appointed by the Ministry of Community Development, Youth and Sports (MCYS) and gazetted under the Children and Young Persons Act Cap 38.

The Home is also a charitable approved institution of a public character registered under the Charities Act Cap 37. Established on December 27, 1989, currently, there are 70 residents housed at the home, a mix of juvenile delinquent cases, those classified as Beyond Parental Control, and those under compassionate grounds. The Home also cares for children who have had a history of abuse and neglect. Residents are usually referred by the Juvenile Court, Ministry of Community Development, Youth & Sports or other organisations. The residents undergo 2 to 3 years of rehabilitation programme.

Sembawang has revamped the home's facilities by creating a new learning hub. These include four fully fitted classrooms with brand new equipment, educational reading material and sundries. Sharing the aspiration of 'Knowledge is Power', both Sembawang and the Muhammadiyah Welfare Home hope that the Learning Hub@MWH would be fully utilised by the boys to study, excel and secure a better future, to break away from their challenged circumstances and move on to become a contributing member of society. Through the creation of this hub,



both Sembawang and the Home hope to highlight the importance of knowledge, regardless of age, circumstances and limitations.

Commenting on the adoption, Richard Grosvenor, President and CEO, Sembawang, said, "Life is a struggle and therefore an endurance test-nobody should start off feeling

less than anybody else. A company is what a company does. We Create and We Care".

Apart from the classrooms, Sembawang, together with personal contributions from its Senior Management, also sponsored one refitted restroom to enhance the quality of amenities for the boys, new

bed sheets and bath towels, 300 chairs for Home's events, two projectors and six laptops, yearly subscriptions of The Straits Times and Berita Harian newspapers, and the National Geographic Kids magazine. Together, this sponsorship amounted to more than S\$ 113,000. ♦

Sculptors of Modern Infrastructure

Chiam Soon Kiam

Senior Manager - Corporate Communication
Sembawang Engineers and Constructors

In a way, construction is akin to art! Sculpturing masterpieces, from concept to design to final finish! Carved in time, these designs live through centuries, reflective of their histories.

Sembawang, in its journey as one of the largest EPC companies in Asia Pacific, has shaped many such iconic landmarks. Beckoning people from all over the world, its headquarters in Singapore itself is the proud host of striking infrastructure. With extensive work in Mass and Light Rapid Transport and urban infrastructure, Sembawang has contributed greatly to Singapore being one of the most efficient countries of the world.

Capturing the essence of this creation, President & CEO, Ric Grosvenor, in a philosophical moment wrote :

“WE CREATE”

*Down through the ages the baton gets passed
This sacred fire to build everlast
The desire to triumph the will to succeed
Both in men and in women who carry this seed
For no one can explain it this creating of dreams
It lives like an eagle so sacred it seems
So we struggle through mud as we twist and we toil
The sinews of greatness in the arms of turmoil
From the soul of an artist this sand it is cast
Will it outlive its maker—will it outlive its class
No matter the question it vexes them not
For these creators of dreams give all that they've got.*

R F Grosvenor



In this context, we introduce a landmark Sembawang project that created an infrastructure that had greatly enhanced connectivity in the country.

The Circle Line, which is a Mass Rapid Transit line in Singapore, is a significant part of Singapore's growing rail system. The 33.3 km line and 28 stations fully-underground orbital route links all the radial lines leading to the city thereby providing essential connectivity. Since all the MRT routes cross through some of the busiest areas in Singapore, all of its stations are located underground, freeing up land for other developments.

Sembawang built the final stage of the Circle Line, known as Stage

5 Contract C856. The project comprised the construction and completion of four MRT stations (Pasir Panjang, Telok Blangah, Haw Par Villa and Labrador Park, the latter two being civil-defence stations), HarbourFront Station fit-out works, 3.7 km of twin bored tunnels, six cross passages and three overhead bridges.

The 5.8 m diameter twin bored tunnels were constructed by tunnel boring machine. Other works included 640 m of cut-and-cover tunnels, civil works, and architectural and building services for the four stations. The stations and tunnels are largely located below busy public roads and within a built-up corridor.

A major challenge in itself, the

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tunnel had to be excavated through variable ground conditions, under shop-houses, close to buildings, pipelines, power cables and gas lines, and finally link to other underground stations.

Engineering Challenges

The project was located underground, in a complex geological strata profile with highly-variable ground conditions that involved excavating highly alternating sedimentary and alluvial deposits.

The ground conditions were



mainly sedimentary rock, with highly varied weathering conditions. While tunnelling hard-rock material, the boring machine often bored into alluvial soft clay and fluvial sands at close intervals. As such, the project team encountered many mixed-face conditions when tunnelling and had to change methodologies frequently for those different situations.

The other major challenge was

ground-water levels. Tunnelling activity has the potential to partially drain water-laden clay and caused unwanted ground movement and settlement. Sembawang used three pressure-balanced 6.6 m diameter Herrenknecht earth-pressure-balance tunnel boring machines equipped with rock cutterheads dressed with 41 17-inch cutterdisks to ensure adequate allowance and minimise disruption when tunnelling. The water table was also monitored closely and intensively to ensure it was within tolerable limits.

Another major challenge was that all the underground sites were situated below public roads and existing buildings. In addition, viaducts, utilities, drains and canals were located within the vicinities of the underground sites. Due to site constraints, Sembawang had to navigate its way below a range of structures, from public roads to residential housing and commercial blocks. The tunnel alignment ran along the path of an elevated 3-lane dual carriageway, the West Coast Highway, at one section, passing very close and between its piled foundations with less than 2 m clearance from the tunnel boring machine's outer curvature to the bored piles of the viaduct pier.



Coupled with challenging ground conditions and a need for lane-for-lane replacement when diverting traffic in the affected areas, the construction works had to be frequently re-scheduled or re-sequenced. Equipment planning and execution of the works had to be carried out with care and detail. State-of-the-art monitoring systems were supplemented with traditional instrumentation to keep track of progress to ensure the safety of structures above and the public in general.

Environmental Impact

Sembawang took considerable measures to minimize environmental impact to residents, businesses and the public during the construction stage. Careful planning was done to minimise noise and dust pollution levels, which were monitored and





kept within limits, when practicable. Equipment designed to keep noise and vibration to a minimum was used along with rescheduling works at appropriate times.

Temporary works were also constructed in sequence with the progress of permanent works to minimise impact on the environment.

Public Relations

Construction activities inevitably affect large and varied communities. The complexity of the project also accentuated the importance of

regular community engagements with the wide range of stakeholders along the project vicinity.

Sembawang established good rapport and actively engaged local communities and interest groups to seek their understanding and support. To keep in touch with stakeholders, Sembawang organised programmes such as Community Talks, Stakeholders’ Site Visits and Stakeholders’ Engagement to allow them to understand our work better.

Our public-relation officers were meticulous in ensuring that our

project moved with a minimum of disturbance to the community. They dealt with feedback and complaints from the public; planned and carried out dialogues with property owners, residents, Management Corporations, Residents Committees and Citizens Consultative Committees. Newsletters and other material were printed to update and inform them of the progress of our work and happenings. Our officers were also active in mitigating inconvenience and disputes for the community.





Consultative Committee on 17 August 2012 at Telok Blangah Community Centre to thank the residential community, clubs and other stakeholders for their support and active cooperation from start through to completion of Circle Line Stage 5 Contract 856 construction.

The event paid tribute to all stakeholders who had shown great understanding throughout the entire duration of the project, enduring the noise, dust and vibrations that are inevitably generated from work sites due to the nature of construction work. That unstinted support from the community ensured the successful completion of the project.

Throughout this project, Sembawang played its part in improving the quality of transport infrastructure by speeding up travel

Finale

The Circle Line was built in various stages. The first stage was opened for service on 28 May 2009.

Sembawang's section, being the final stage of the Circle Line, was opened for service on 8 October 2011.

To mark the successful completion of the project, Sembawang jointly organised an event with Telok Blangah Citizens'



for all commuters, breathing life into the newly connected sub-regional centres. Visiting friends and relatives is now easier and more pleasurable with the quality of life greatly improved.

Well done, Sembawang.



Showcasing Competence

Intertraffic Exhibition

Punj Lloyd is renowned for executing a diverse range of technologically challenging and complex infrastructure projects.

From transportation - Metro Systems, Airports, Seaports, Highways and Expressways to the entire gamut of buildings-commercial, industrial, townships and industrial parks, our services extend to utilities-water treatment plants and reservoir. We undertake these projects variously under Build, Own and Operate (BOO), as well as Build, Own, Operate and Transfer (BOOT) basis.

To showcase this wealth of expertise in civil infrastructure to international, national visitors and clients, Punj Lloyd exhibited at the Intertraffic Exhibition in New Delhi.

The exhibition reflected how at every stage of the project, the Punj Lloyd team is passionately engaged

in adding value. From tapping into the capabilities of its in-house design division, to precast solutions that help achieve fast-track construction. The goal is always to create high-quality infrastructure that embodies aesthetics, economics, serviceability of the development and sustainability of the environment.

The exhibition was also a platform to interact with the Group's different value partners in infrastructure projects-manufacturers, suppliers, planners, consultancy firms, ITS Traffic Management companies, safety, parking & environment service providers. ♦

Def Expo 2012

Other than its EPC capabilities in Energy and Infrastructure, the Group has strategically diversified into the defence industry and developed capability and infrastructure that can be effectively leveraged for Aerospace & Defence programs.

To showcase its Defence expertise, Punj Lloyd had a large presence in the Def Expo 2012.

Punj Lloyd has set up a world class greenfield manufacturing facility on 65 acres of land at Malanpur, near Gwalior. The facility has capability to undertake fabrication, precision

machining, welding & heat treatment and final testing of components and assemblies.

The Group has a multi pronged defence strategy with an objective to:

- Become a supplier of choice to the Indian armed forces
- Be a preferred partner for transfer of technology from global primes by setting up manufacturing facilities in India
- Be a part of the global defence equipment supply chain
- Undertake maintenance, repair and overhaul of defence equipment
- Work in partnership with global primes to meet offset requirements as per the Indian Defence Procurement Procedure.

Punj Lloyd has identified key technological partners and plans to manufacture defence products at its facility for the Indian Armed Forces' requirements. The Group is actively



pursuing artillery and air defence programs and is all set to field its solution for upgraded Zu 23-2B air defence gun for NCNC trials.

The Group is committed to work with DRDO and OFB to indigenously develop genuine force multipliers to provide a decisive edge to the Indian Armed Forces. ♦

CSR Live Week

There is no higher religion than human service. To work for the common good is the greatest creed."

Woodrow T. Wilson

This quote mirrors Punj Lloyd's guiding principles in its Corporate Social Responsibility (CSR) initiatives. This forms the basis of our belief of universal giving.

Consequently, Community Development is at the heart of the Company's CSR initiatives. Across diverse geographies and with global communities, the company works in harmony with local cultures, to empower societies. ♦

Punj Lloyd participated in the CSR Live Week, an initiative to provide a common platform to share the various welfare programmes being implemented by companies.

Akin to its global business operations, Punj Lloyd community initiatives keep sustainability at its core, addressing social, environmental and economic concerns. From community enrichment at global project sites to the holistic welfare of Indian migrant labourers, its programmes benefit societies with different needs. Its integrated and inclusive village development approach has set an example of a model Indian village. It believes that support to national and international art and culture forums preserves the rich cultural heritage of India.

The company sees every need in society as an opportunity to serve. After all, goodness is what good businesses deliver. This diversity of activities across global populations truly renders Punj Lloyd's CSR enduring. ♦



Towards making India 'Design Enabled'

As a diversified global

construction group with a strong focus on design and engineering, Punj Lloyd took a significant step to promote cross cultural design in India.

Inaugurated by Urban Development Minister, Kamal Nath, IDF represented the country's first and most influential international design platform, bringing together doyens of the global design world.



A pioneering nine-day celebration of India's distinctive design aesthetic and its interaction with the international design world, this inaugural forum began with Design Week, which featured movie screenings, exhibitions and workshops and culminated with the two day Design Forum, featuring talks by design virtuosos at New Delhi.

Speaking at the Forum, Chairman Atul Punj said: "In the West, design plays an integral role in improving the quality of life. In India, it must have

relevance for the masses.”

Punj Lloyd support to the India Design Forum will be a foundation towards design playing a key role in driving planned development, economic and industrial growth of the nation.

Leading by Thought

Chairman Atul Punj shares his thoughts on India Design Forum and the importance of integrating design in everyday life.

Why did you choose to participate in the India Design Forum?

One of its kind, India Design Forum is an ideal platform to promote cross cultural design and philosophy. The quality of international speakers and their complete mastery over design and its various nuances attracted immense interest. As a diversified global construction group with a strong focus on design and engineering, the forum is of great relevance to us.

What is the one thing that you would like to discover in India?

I would definitely like to see sustainable cities develop in India. I would also like to see fantastic designs in public utilities, buildings and infrastructure. Today in India design is distant from the life of the common man; hence a synchronised integration of design in India's everyday life is what I would like to see.

What is the quality you wish every designer had?

Ability to see the potential of a design. Looking around, even in your daily life, you see a plethora

of objects that could have been designed far better, had some thought being given during their creation!

What do you appreciate most among designers?

A streak of madness and the urge to create something new and different! ♦

Safety Week Celebration

At Malanpur: The Manufacturing & Systems Integration Division (MSID), established by Punj Lloyd in Malanpur to serve as a hub for artillery, air defence systems, armoured vehicles, upgrades and modifications for Indian Defence requirements, has in a short span of time since its inception received the ISO 9001, 14001, OHSAS 18001 certification, reflecting its adherence to best industry practices and systems.

The division celebrated the 41st National Safety Week from March 4-11, 2012. The programme commenced with flag hoisting, following which the workers pledged to observe safety rules and regulations. A number of safety drills were performed which included fire fighting mock drill, plant safety inspection and HSE



training. In addition, health & TT vaccination camp was organised wherein 68 MSID team members underwent general fitness test & were administered the TT vaccination. The week concluded with the distribution of prizes to the winners of Quiz, Poster and Slogan competitions.

Gurgaon : Simultaneously, the Corporate office at Gurgaon also had the Senior Management of Punj Lloyd and the employees take the Safety pledge. ♦

Arrest the change

Increasingly climate change

is being recognised as the major,



overriding environmental issue of our time, and the single greatest challenge facing the entire globe.

Punj Lloyd teamed with Robert Swan, the first person to have walked both the North and the South





Pole, and other corporates to lead the Ganges Expedition from Gangotri to the Goumukh Glacier. This expedition focused on clean water, sanitation and renewable energy in schools, homes and the workplace as well as the importance of water in the Indian Tiger Reserves. ♦

Inauguration of Bayfront Station

It was a proud moment for Sembawang when Land Transport Authority (LTA) inaugurated BayFront station on January 14, 2012 where Sembawang was the EPC contractor. The station is part of Sembawang's Mass Rapid Transit (MRT) Downtown Line (DTL) Stage 1 C906 project. When completed, the Downtown Line will be a 42 km line that facilitates direct travel from the northwestern and eastern areas of the island to the Central Business District (CBD) and Marina Bay. The Line also provides a strategic



transport link to support and develop Marina Bay area. This station is set to be the future interchange between the Downtown Line and Circle Line.

Sembawang is proud to leave a footprint right in the centre of Singapore's bustling Marina Bay development. ♦

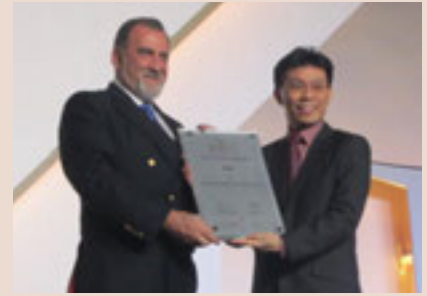
Launch of Equarius Hotel

The 20 units of Beach Villas and the eco-luxurious hotels, the 172-room Equarius Hotel™ were opened for business at Resorts World™ Sentosa on February 16, 2012. Located at the west zone of the integrated resort, the iconic resort-style architecture development has panoramic views of the waterfront, Keppel Bay and Labrador Park. The Equarius Hotel™ and Beach Villas were part of the scope of Sembawang's project which included the construction of its world-class destination spa-ESPA™: set to be the world's largest oceanarium-the Marine Life Park, and the water theme park.

When Sembawang's project is completed and launched, Resorts World™ Sentosa will be the first integrated resort to be positioned as Asia's top family-holiday destination. ♦

Sembawang Declared a STAR

Sembawang has been conferred the STAR Green and Gracious Builder Award by the Building and



Construction Authority in May 2012. The Green and Gracious Builder Award aims to raise environmental consciousness and professionalism of builders. It recognises progressive builders who take the effort to address environmental and public concerns arising from construction work and serves to develop a more positive image of the industry over time.

It was a moment of great pride for the entire Group as SEC has scaled to the STAR category from its 'Excellent' the previous year. In 2011, Sembawang also won two productivity awards, Best Value Added Productivity (VAP) Builder Award and Best Value Added Productivity Improvement Builder Award, all conferred by BCA.

On receiving the award, President & CEO, Ric Grosvenor said "Sembawang is delighted to receive the Green and Gracious Award. There is nothing better than being recognised for an initiative as relevant as this. Measures to ensure sustainability of business and the environment need to be high on the agenda for all organisations. It is the combined efforts of all companies that will result in a positive, measurable impact in saving our environment." ♦



Atul Punj at the India-Sri Lanka CEOs' Forum in Colombo, with Anand Sharma, Hon'ble Minister for Commerce, Industry and Textiles, S R Rao, Commerce Secretary of India and Ashok Kantha, High Commissioner of India to Sri Lanka, calling upon Mahindra Rajapaksa, Hon'ble President of Sri Lanka (centre) and Mr Rishad Bathiudeen, Commerce Minister of Sri Lanka (bottom left). ♦



Punj Lloyd Group team (L-R) Sunil Krishna, Rajat Seksaria, S S Raju, Luv Chhabra along with former Commissioner, Delhi Police, V K Gupta, and the entire Delhi Police team at the Concession Agreement Signing for the development of Police Residential Complex at Dheerpur, Delhi on Design, Build, Finance, Operate and Transfer basis. ♦

Concession Agreement Signing for

Development of Police Residential Complex at Dheerpur, Delhi

on Design Build Finance Operate and Transfer (DBFOT) Basis by

Delhi Police and **Indraprastha Metropolitan Development Ltd**
(a Punj Lloyd Group Company)

Employees at the Tree Plantation drive at the Biodiversity Park, Gurgaon



World Environment Day being celebrated at the Manufacturing & Systems Integration Division (MSID), Malanpur, India.



Atul Punj (1st from right) as part of CII CEO Delegation to Myanmar on occasion of the visit of Dr Manmohan Singh, Hon'ble Prime Minister of India.



A K Tewari, GM (MM) of ONGC and Sunil

Sardana, Sr General Manager-Marketing, Punj Lloyd, signing the WO-16 and SB-14 pipeline project.



Union Minister for Energy of Myanmar, U Than Htay

receives Atul Punj, Chairman Punj Lloyd along with Director, P K Gupta. Myanmar occupies a critical geo-strategic position in the world. It is a meeting point of South Asia, East Asia and South-East Asia. Closer engagement with Myanmar will give a boost to India's Look East Policy. In particular, Punj Lloyd made its maiden foray into Myanmar,

securing the Myanmar-China oil and gas pipeline project comprising 183 kms of oil pipeline and 205 kms of gas pipeline. The project will be implemented from 2012-13. ♦

Middle East projects update

Oil & Gas Export Pipelines, Kashagan Project, Kazakhstan

Punj Lloyd Kazakhstan has

received an appreciation letter from Client AGIP KCO for the Kashagan Field Development programme. The client has commended Punj Lloyd for overcoming challenging barriers like remoteness of site, vagaries of nature and yet maintaining high standards of safety and quality.

The project entailed Detailed Engineering, Procurement and Construction of (24" dia) 49.5 km oil pipeline with two crossings by horizontal directional drilling method and 90 km gas pipeline in Atyrau region of western Kazakhstan.



AGIP KCO has also awarded Punj Lloyd the safety certificate for 9 million safe man hours. Commenting on the occasion, Atul Jain, President & CEO, MEA & CIS said "This is a double victory for us. Not only has our execution been appreciated but we have also been recognised for delivering without compromising on safety". ♦

NDIA Project, Qatar

The Project team at the New

Doha International Airport project (NDIA) has received a certificate for completing 8 million manhours without lost time injury.

The project involved the design, engineering, procurement, construction, start-up and commissioning of the Fuel systems

for New Doha International Airport. The objective being to filter A-1 Jet Fuel to achieve 1 ppm purity and provision to fill fuel in sixteen aircraft simultaneously within a stipulated time. The work includes the fuel receiving station that unloads Jet A1 fuel from tankers or receives through pipeline from Qatar Petroleum and delivers the filtered product into fuel farm storage tanks, each of 9,000 cub mtr capacity using fuel hydrant pumps.

A 35 km pipeline network is spread across the airport facility to cater to 183 aircraft filling points.



On the occasion, President & CEO, MEA & CIS, Ravindra Kansal, congratulated the team saying "It is an achievement. Good going and keep it up. Please wish entire project team of NDIA". ♦

Ground Breaking Ceremony at Falcon Project, Dubai



The EPC contract for Falcon Jetfuel Pipeline & Bulk Terminal Facilities was awarded to Punj Lloyd by Emirates National Oil Company (ENOC), wholly-owned by the Government of Dubai. Valued at Rs 623 crore (USD 126.86 Million), the project is scheduled for commissioning by 2013.

The scope of work for the project entails engineering, procurement and construction of jetfuel pipeline 24"/20"/16" x 60 km, 141,000 m³



terminal and associated facilities required for jetfuel handling in the tank farm including tanks, filtration system, fast flush system, pumping & pigging stations, buildings, E&I etc. The project will help establish a storage facility at Jebel Ali Free Zone Area (JAFZA), which is one of the world's largest and the fastest growing free zones, for the distribution of various petroleum products to Dubai International Airport (DIA). ♦

Punj Lloyd gets Phase II of Qatar's First Polysilicon Project

Punj Lloyd Group is executing the first polysilicon plant of Qatar. Awarded by Qatar Solar Technologies (QSTec), the contract was part of QSTec's plans to set up a plant worth



approximately US\$1bn in Qatar, to manufacture high-purity solar grade polysilicon. Very recently, Punj Lloyd has also received the Phase II of this project. With phase II expansion, the combined value of this project is Rs 4,033 crores (US\$ 724.25 million) for a capacity of 8,000 MTPA. ♦

2012 MEA-CIS Region Leadership meeting



In a Leadership Meeting organised at Abu Dhabi in May, the MEA CIS team got together to discuss business plans, process improvement and growth initiatives for the region. The meetings were addressed by the CEOs who prompted the employees to continue the regional momentum and success through improved team work. All attendees participated with great enthusiasm in all team events including Treasure Hunt and Dragon Boat race. ♦



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