Re-routing of Section of 42” SBHT Pipeline near Umbrahat beach for Permanent Protection
36” & 42” SBHT Pipelines

Bassein Field

OIL & GAS FIELDS WEST COAST OFFSHORE

HAZIRA

36”

42”

SBHT Pipelines

Mumbai High

URAN

LEGEND

- OIL FIELD
- GAS FIELD
**TIDAL CONDITIONS AT UMBHRAT**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum high water spring</td>
<td>+7.4m</td>
</tr>
<tr>
<td>Maximum high water neap</td>
<td>+6.0</td>
</tr>
<tr>
<td>Mean sea level</td>
<td>+4.5m</td>
</tr>
<tr>
<td>Minimum low water neap</td>
<td>+3.1m</td>
</tr>
<tr>
<td>Minimum low water level spring</td>
<td>+1.7m</td>
</tr>
</tbody>
</table>
Laid in 1995-96 for transportation of sour gas and associated condensate from South Bassein giant gas field to Hazira Plant.

Subsea portion of around 221 Km. and 23 Km. of onshore portion.

Has three sectionalizing valve stations between Land Fall Point (Umbrahat Beach) and Hazira Plant.

Laying Contractor: Consortium of Hyundai Heavy Industries, S. Korea and Offshore Hyundai International Vanutu.
Issue: Exposure of 42” SBHT at Umbhurat

Pipeline was exposed at Umbrahat beach
## Basic Details of SBHT Pipeline

<table>
<thead>
<tr>
<th></th>
<th>42” (BPB)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pipe line length:</strong></td>
<td></td>
</tr>
<tr>
<td>Offshore</td>
<td>221 Km</td>
</tr>
<tr>
<td>Onshore</td>
<td>23 Km</td>
</tr>
<tr>
<td><strong>Land fall point</strong></td>
<td>Umbhrat</td>
</tr>
<tr>
<td><strong>Pipe grade</strong></td>
<td>API 5 LX -60</td>
</tr>
<tr>
<td><strong>Wall thickness</strong></td>
<td>28/ 30/ 32 mm</td>
</tr>
<tr>
<td><strong>Pressure (Design )</strong></td>
<td>120 Kg/cm²</td>
</tr>
<tr>
<td>**Temp. (Design) **</td>
<td>66 deg C</td>
</tr>
<tr>
<td><strong>Design capacity</strong></td>
<td>37 MMSCMD</td>
</tr>
</tbody>
</table>
## Basic Details of 42” SBHT Pipeline

<table>
<thead>
<tr>
<th>Pressure</th>
<th>79.91 Kg/cm² (BPB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput (Gas)</td>
<td></td>
</tr>
<tr>
<td>BPA</td>
<td>7.33 MMSCMD</td>
</tr>
<tr>
<td>BPB</td>
<td>5.08 MMSCMD</td>
</tr>
<tr>
<td>PANNA</td>
<td>5.83 MMSCMD</td>
</tr>
<tr>
<td>TAPTI</td>
<td>0.00</td>
</tr>
<tr>
<td>B-55</td>
<td>1.91 MMSCMD</td>
</tr>
<tr>
<td>Mumbai high</td>
<td>1.53 MMSCMD</td>
</tr>
<tr>
<td>TOTAL</td>
<td>21.68 MMSCMD</td>
</tr>
<tr>
<td>Throughput (Condensate)</td>
<td></td>
</tr>
<tr>
<td>BPA</td>
<td>----</td>
</tr>
<tr>
<td>BPB</td>
<td>1300 m³/D</td>
</tr>
</tbody>
</table>
Exposures-2009

- Pipeline has history of exposure including damage to concrete coating since 2007 at Umbhrat beach due to wave action and shifting beach sand.
Remedial measures-2009
Exposures-2010

- In Aug, 2010 exposure of approx. 300 mtr with concrete coating damage (including upstream of IJ & 80 mtr section repaired in 2009) was observed.
- Pipeline shifted by about 3M
- Observed vibration & swing action in the pipeline.
Remedial Measures

Extensive repair works were taken covering following activities:

- Removal of damage coating
- Composite repair of weld joints.
- Wrapping of protective coating
- CP augmentation (anode installation)
- Laying of geotextile fabric, installation of geotube
- Laying of sand bags & geotextile fabric.
- Installation of gabion.
Remedial Measures

Typical features of Geotextile tube and filling method.
Remedial Measures
Remedial Measures
Remedial Measures
Remedial Measures
Remedial Measures
Remedial Measures in Tatter
Pipeline drifted: Cyclonic Effect

Pipeline Position after protection work in Dec, 2012

Drifted Pipeline after cyclonic storm on 15/16, June, 2014
Permanent solution: rerouting of 1.9 km portion

Original Pipeline Route

Open Trenching & Cofferdam

Open Trenching

Proposed re-routing of 1.9 km of Pipeline

Horizontal Direction Drilling (HDD)
Proposed rerouted pipeline layout
## Project Information

<table>
<thead>
<tr>
<th>Rerouting of 42” SBHT Pipeline project</th>
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</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
</tr>
<tr>
<td><strong>Contractor</strong></td>
</tr>
<tr>
<td><strong>NOA Date</strong></td>
</tr>
<tr>
<td><strong>Overall Scheduled Completion</strong></td>
</tr>
<tr>
<td><strong>Hot Tapping Sub-contractor</strong></td>
</tr>
<tr>
<td><strong>PMC Consultant</strong></td>
</tr>
</tbody>
</table>
## Agencies/Sub-Contractors

<table>
<thead>
<tr>
<th>Activity</th>
<th>Sub-Activity</th>
<th>Agency/Sub Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management</td>
<td></td>
<td>LTHE Mumbai</td>
</tr>
<tr>
<td>Survey</td>
<td>Pre-Engineering</td>
<td>Fugro &amp; LTHE</td>
</tr>
<tr>
<td></td>
<td>Pre-Construction</td>
<td>M.K. Soil</td>
</tr>
<tr>
<td>Design Engineering</td>
<td></td>
<td>L&amp;T Gulf, Faridabad</td>
</tr>
<tr>
<td>Procurement</td>
<td></td>
<td>LTHE, Mumbai</td>
</tr>
<tr>
<td>Construction</td>
<td>HDD</td>
<td>LTHE</td>
</tr>
<tr>
<td></td>
<td>SV Station</td>
<td>LTHE/HCP</td>
</tr>
<tr>
<td></td>
<td>Cofferdam</td>
<td>LTHE/L&amp;T Geo</td>
</tr>
<tr>
<td></td>
<td>Pipe laying</td>
<td>LTHE</td>
</tr>
<tr>
<td>Hot Tapping, Hook-up &amp; Testing</td>
<td></td>
<td>TD Williamson</td>
</tr>
</tbody>
</table>
Laying of approx. 42” x 1.9 km rerouted Pipeline

Approx. 400 m with concrete coating from Hook up point (HK-01) near shore to HDD entry point.

Approx. 1.1 km by Horizontal Directional Drilling (HDD) technique.

Approx. 400 m from HDD Exit point to Hook up point (HK-02)

Hot tapping to isolate the existing pipeline section & Hook up new line at HK-01 & HK-02.

Dismantling of 42” Valve at existing SV-1 & Old pipeline for the exposed portion & hand over to ONGC’s yard and beach cleaning.

New SV Station
<table>
<thead>
<tr>
<th>Execution Methodology and Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site Survey</strong></td>
</tr>
<tr>
<td>Pre-Engineering, Pipe Routing, Topography</td>
</tr>
<tr>
<td>Survey Trackers &amp; Equipments</td>
</tr>
<tr>
<td><strong>Construction of New SV Station</strong></td>
</tr>
<tr>
<td>Const. of SV Station Bldg Installation of SV Valves, E&amp;I &amp; Mechanical Items</td>
</tr>
<tr>
<td>Earth Movers, Cranes, Hydra &amp; other construction equipments</td>
</tr>
<tr>
<td><strong>Laying of New Pipeline by trenchless method</strong></td>
</tr>
<tr>
<td>Horizontal Directional Drilling (HDD)</td>
</tr>
<tr>
<td>300 – 350 T HDD Rig with all accessories</td>
</tr>
<tr>
<td><strong>Laying of New Pipeline from HK-01 to HDD Start</strong></td>
</tr>
<tr>
<td>Sheet Piling; Trenching; Continuous De-watering</td>
</tr>
<tr>
<td>Sheet Piling Equipment and Crane</td>
</tr>
<tr>
<td><strong>Laying of New Pipeline from HDD Finish to HK-02</strong></td>
</tr>
<tr>
<td>Open Cut Trenching Method</td>
</tr>
<tr>
<td>Earth Movers and Laying Equipments</td>
</tr>
<tr>
<td><strong>Isolation &amp; De-commissionning of Existing Line</strong></td>
</tr>
<tr>
<td>Hot Tapping &amp; Stoppling, Flaring, Inertisation and Cutting</td>
</tr>
<tr>
<td>Hot Tapping &amp; Stoppling Equipment; Temporary Flare</td>
</tr>
<tr>
<td><strong>Hook-up of New Line</strong></td>
</tr>
<tr>
<td>Welding of new line with existing line at hook-up points</td>
</tr>
<tr>
<td>Welding Machines, 100 T Crane etc</td>
</tr>
</tbody>
</table>
Pipe laying by trenching
Steps for Pipeline laying by trenching

1. Surveying and staking
   • Route finalization,
   • Surveys and stakes the right-of-way and temporary workspace.

2. Preparing the right-of-way
   • Top soil is removed and stockpiled for future reclamation.
   • Right-of-way is then levelled and graded to provide access for construction equipment.

3. Digging the trench
   • Trench is dug and the centre line of the trench is surveyed and re-staked.

4. Stringing the pipe
   • Individual lengths of pipe are brought in from stock pile sites and laid out end-to-end along the right-of-way.
Steps for Pipeline laying by trenching

5. Bending and joining the pipe

- Individual joints of pipe are bent to fit the terrain using a hydraulic bending machine.
- Welders join the pipes together.
- Welding shacks are placed over the joint to prevent the wind from affecting the weld.
- Welds are then inspected and certified by X-ray or ultrasonic methods.

6. Coating the pipeline

- Both inside and outside the pipeline coated to prevent it from corroding.
- Composition of the internal coating varies with the nature of the product to be transported.
- Pipes arrive at the construction site pre-coated, however the welded joints coated at the site.

7. Positioning the pipeline

- Welded pipeline is lowered into the trench using bulldozers with special cranes called side booms.

8. Installing valves and fittings

- Valves and other fittings are installed after the pipeline is in the trench.
- Valves are used once the line is operational to shut off or isolate part of the pipeline.

9. Backfilling the trench

- Once the pipeline is in place in the trench the topsoil is replaced in the sequence in which it was removed and the land is re-contoured for restoration.
Pipe laying by HDD

Horizontal Directional Drilling Machine

Contd...
Horizontal Directional Drilling (HDD) is a trenchless construction method utilizing equipment and techniques from horizontal oil well drilling technology and conventional road boring.

HDD is a preferred pipe laying method in many situations for the installation of oil and gas pipelines under watercourses, roads, rail lines, steep slopes and other obstacles where conventional open trench construction is not feasible or will cause adverse disturbances to environmental features, land use or physical obstacles.

HDD installation involves four main steps:

1) **Pre-site planning**
   - Study existing geological data and conducting field investigations to assess the subsurface conditions and characteristics likely to be encountered during the drill to establish HDD’s geo-technical feasibility.
   - A drill path is then designed to meet the requirements of the crossing
   - Appropriate drill entry and exit locations are selected.

2) **Drilling a pilot hole**
   - An HDD drill rig and supporting equipment set-up at selected drill entry location.
   - A pilot hole is drilled along the predetermined drill path.
   - Horizontal and vertical coordinates are monitored periodically along the pilot hole.
   - Pilot hole path is tracked using a surface monitoring system.
• Drilling fluid is injected under pressure ahead of the drill bit to:
  o Provide Hydraulic power to the down hole mud motor
  o Transport drill cuttings to the surface,
  o Clean build-up on drill bit & cool it, reduce the friction between the drill and bore wall, and
  o Stabilize the bore hole.

3) Expanding the pilot hole by reaming

• Remove down hole assembly from the drill string upon breaking the ground surface at exit location
• Replaced with a back reamer.
• Pull back drill string through the bore hole to enlarge the diameter of the drill hole.

4) Pull back of pre-fabricated pipe

• Pipe is welded into a pipe string or drag section, that is slightly longer than the length of the drill, on the exit side of the bore hole. The pipe is typically coated with a corrosion and abrasion resistant covering and is hydrostatically pretested to ensure pipeline integrity.
• Pipe string is pulled over rollers into the exit hole and the pull back continues until the entire pipe string has been pulled into the bore hole.
• External coating of the pipe string visible at the entry point is inspected for damage upon completion of the pull back.
Facilities at SV Station

- Sectionalizing Valves
- Field Instruments
- Emergency DG
- Solar System
- Battery Bank
- Communication Tower
- Cold Vent
- Hi-mast Lighting
- Approach Road
- Guard Room
Coffer Dam at Sea side for Hot Tapping

Cofferdam:

- To give workers a dry work space when construction is done below the water level,
- Temporary enclosures to keep out water for construction of the permanent facility,
- Sheet piles are driven around the work site,
- Seal concrete is placed into the bottom to prevent water from seeping in from underneath the sheet piling, and the water is pumped out.
Construction of Coffer Dam

Fig 1: Driving of sheet piles upto the required level.

Fig 2: Fixing of struts

Fig 3: Balance excavation works upto bottom level of pipeline.

Fig 4: Placing of pipeline within the trench

Fig 5: Backfilling after pipe laying and Retrieval of sheet piles

Fig 6: DEWATERING SYSTEM
Cofferdam at sea-side for hot tapping
Coffer dam at sea side for hot tapping
Hot tapping Overview

- Pipeline Plugging Machine
- Temporary Bypass
- Isolation Valve
- Section with Stuck Pig
- Blind Flange
- Lock-O-Ring Flange
- New Section of Pipeline
Hot tapping tools as used

Sealing Element for stopple

Stopple with Sealing element

Cutter used
Hot tapping work
Hot tapping work

Sandwich valve installation in process
Hot tapping work

Sandwich valve installed at HK-02

Temporary Flare Stack
Successful execution of the project

Pipeline flow normalised on 21st July 2015.
Safely executed
Re-routing Project

Save Beaches
help people

Thank you