Ennore-based Gas Pipeline (ETBPL)

Challenges & Best Practices

Ennore – Thiruvallur – Bengaluru – Puducherry – Nagapattinam – Madurai – Tuticorin Natural Gas Pipeline

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Construction Challenges • Design Compliance • Statutory Audits • Best Practices • Cost & Schedule Optimization

SPEAKER PROFILE

ETBPL – Challenges & Best Practices

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CGM (EPCM) | IOCL PLHO, Noida

30	EPCM	OISD
Years	Projects	Exposure

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E EDUCATION **B.E. Mechanical • MBA (HR)**

1 CURRENT ROLE

CGM (EPCM), IOCL PLHO – Noida

- Leads EPCM projects across Pipelines, Refinery, LNG and other project domains.
- Provides project leadership, coordination and execution oversight.

2 REGULATORY & INDUSTRY EXPOSURE

Previously served as Director (Pipeline), OISD

- External safety & port audits; accident / incident investigations.
- Organizational audits, OISD standard revision and MoPNG / industry coordination.

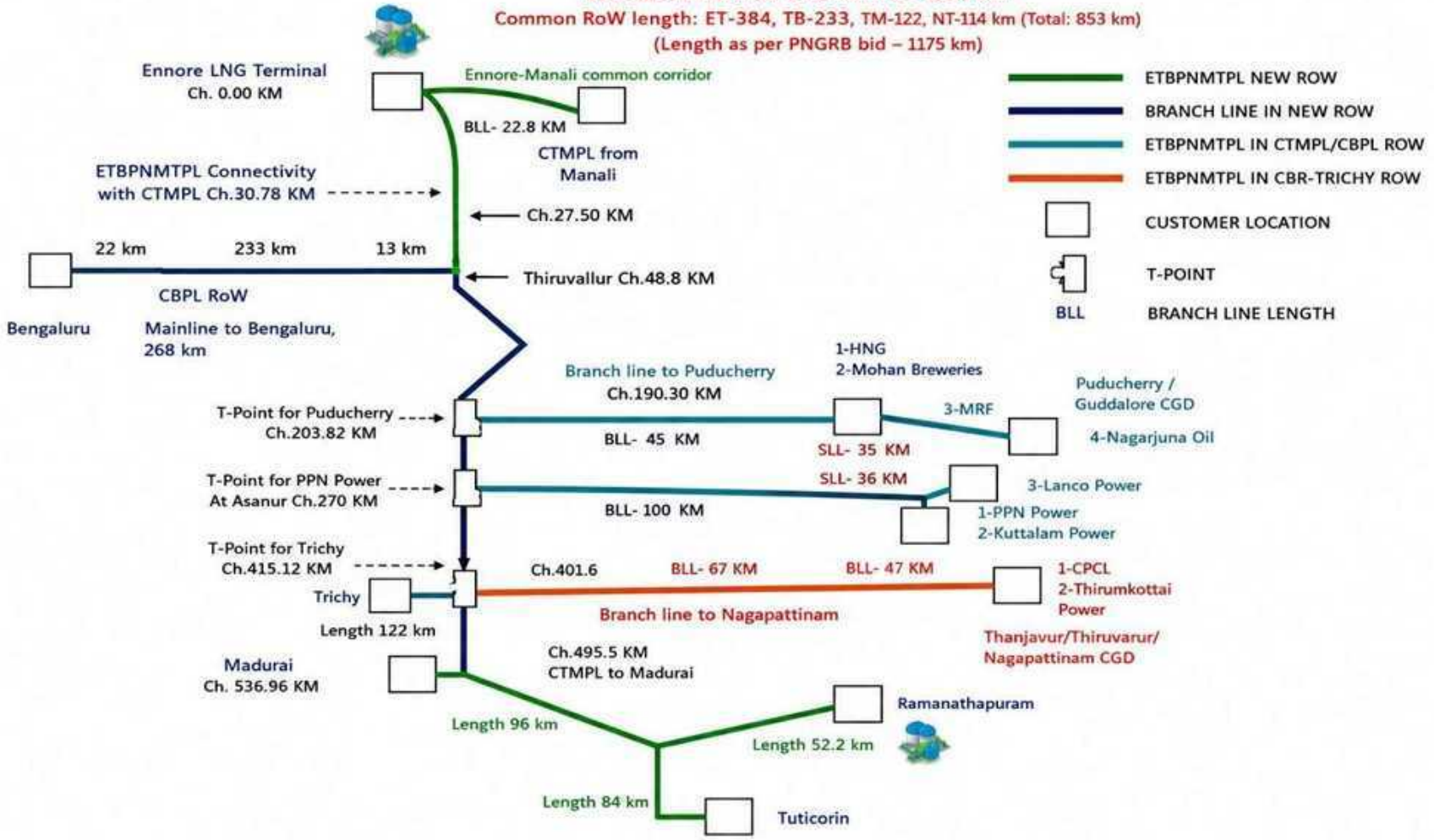
3 30 YEARS OF PIPELINE EXPERIENCE

- Pipeline project construction and execution
- Operations & Maintenance (O&M)
- Predictive & Mainline Maintenance
- M&C, Technical Services (TS), HSE and IS
- Assignments across station, base, Regional Office and Head Office
- Cross-functional experience spanning project, operations and safety functions

PIPELINE PROJECTS **O&M** **HSE** **AUDITS** **OISD STANDARDS** **EPCM LEADERSHIP**

LINE DIAGRAM

ETBPNMTPL rerouting along CTMPL common ROW



DESIGN & ENGINEERING RELATED CHALLENGES

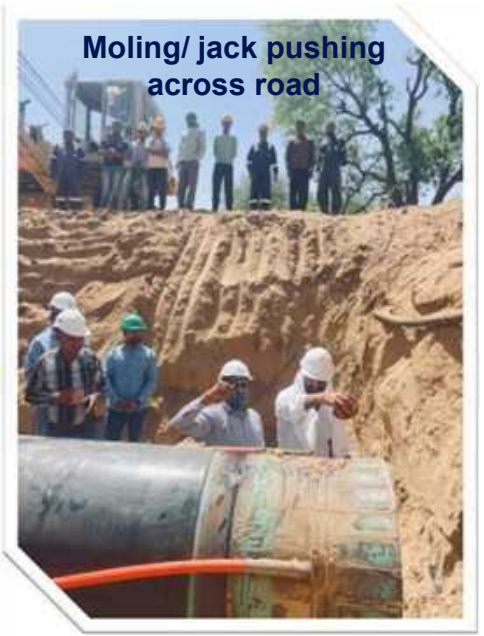
CHALLENGE

Changes from the Original Detailed Engineering Survey during execution, especially due to:

- Pipeline re-routing based on actual site conditions
- Change from Open-Cut crossing to HDD / SHDD crossings

BEST PRACTICE / SOLUTION

Field survey by a Specialist Execution Team during the initial stage to validate actual site conditions and accurately finalize the crossing methodology, minimizing deviations at later stages.

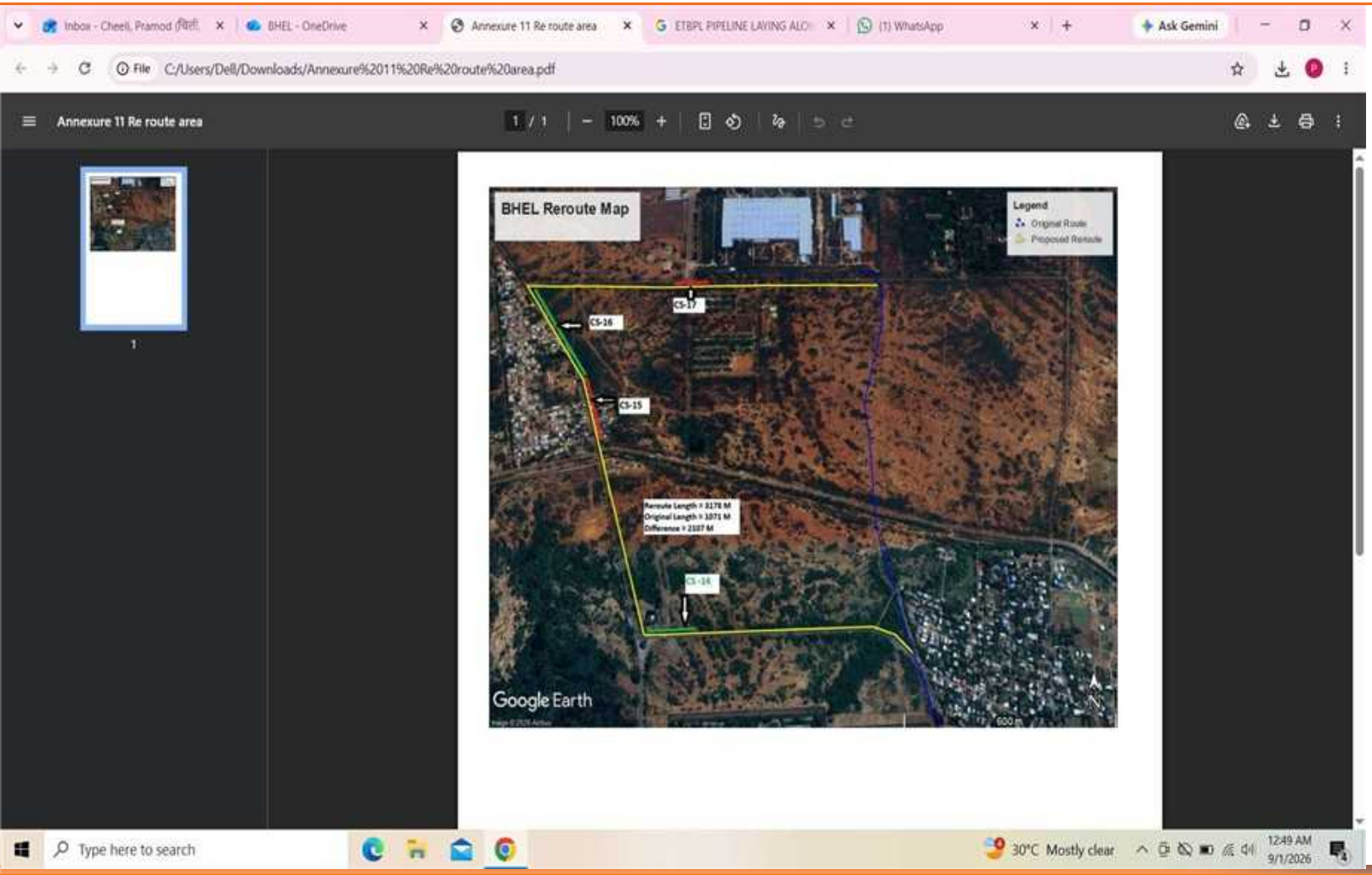


EARLY FIELD VALIDATION WORKFLOW

1. DES Review	2. Specialist Field Survey	3. Freeze Route & Crossing Method	4. Execute

Managing field-driven design changes before they become execution deviations

DESIGN & ENGINEERING RELATED CHALLENGES



Long pending ROU hindrance on account of permission from Defense. Resolved by re-routing of pipeline.

SV/DT/RT STATIONS – CHALLENGE & SOLUTION

⚠ Key Challenge

ETBPL sectionalizing valve station area limitation (30mx30m) resulted in difficulty in providing future customer connections and in conversion of SV to DT for new customers.

Solution Adopted

Make every SV station suitable for DT with optimum size, future customer connectivity and optional pigging facilities.

Adopt a prefabricated double-storey FRP building to accommodate control and utility functions within the constrained station area.

FRP Building

FRP Building

Optional Pigging Facility

✓ **Best Practice:** Plan SV stations for future DT functionality at design stage to avoid later land, layout and cost constraints.

DESIGN / SAFETY CHALLENGE – SV LOCATIONS

OISD inter-distance compliance vs. compact SV station layout

CHALLENGE

OISD inter-distance requirement for cold vent from other facilities can constrain available space at SV locations.

BEST PRACTICE

Assess cold-vent need based on the criticality and surrounding area of each SV location.

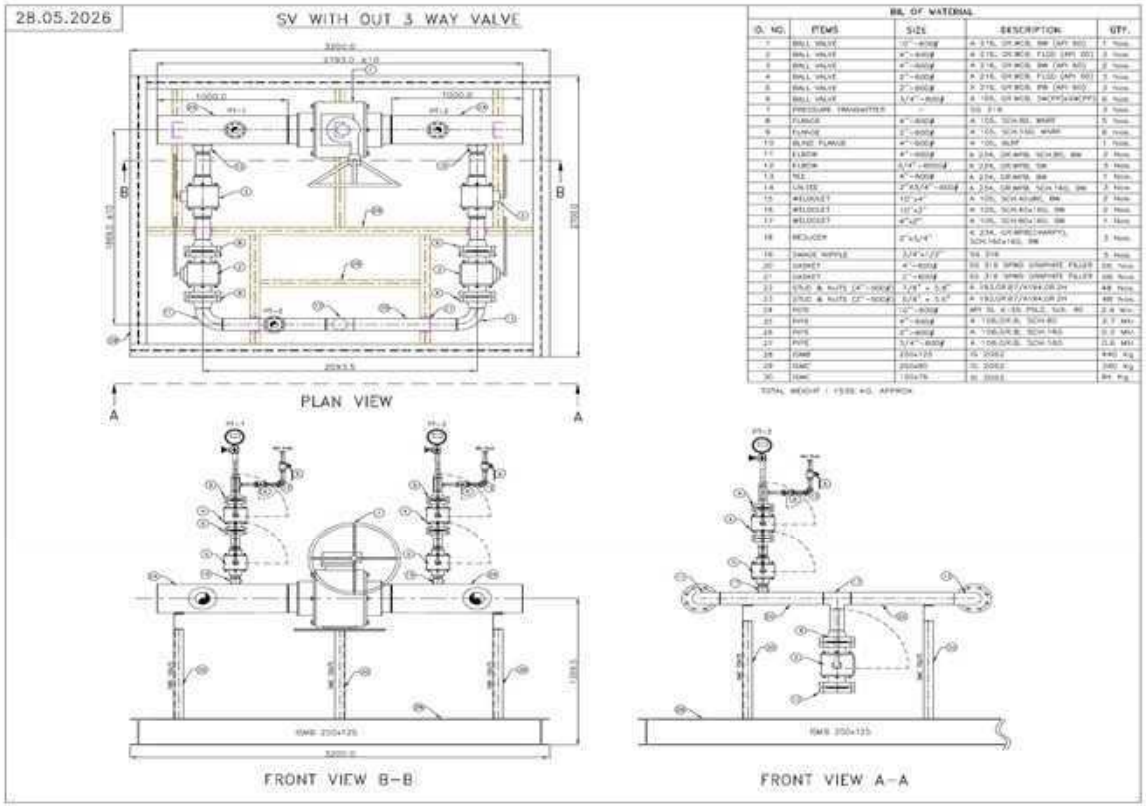
Plan mandatory cold vents only at selected SVs where justified by safety / location risk.

Keep provision for future cold vent and pigging facilities at other SV stations.

COMPACT OPTION

Shorter barrel arrangement can be considered using a 3-way pig valve / temporary barrel, subject to detailed engineering and applicable safety requirements.

SV LAYOUT – SKETCH (without 3 way valve)



Selective SV approach • Future-ready provision • Compact footprint

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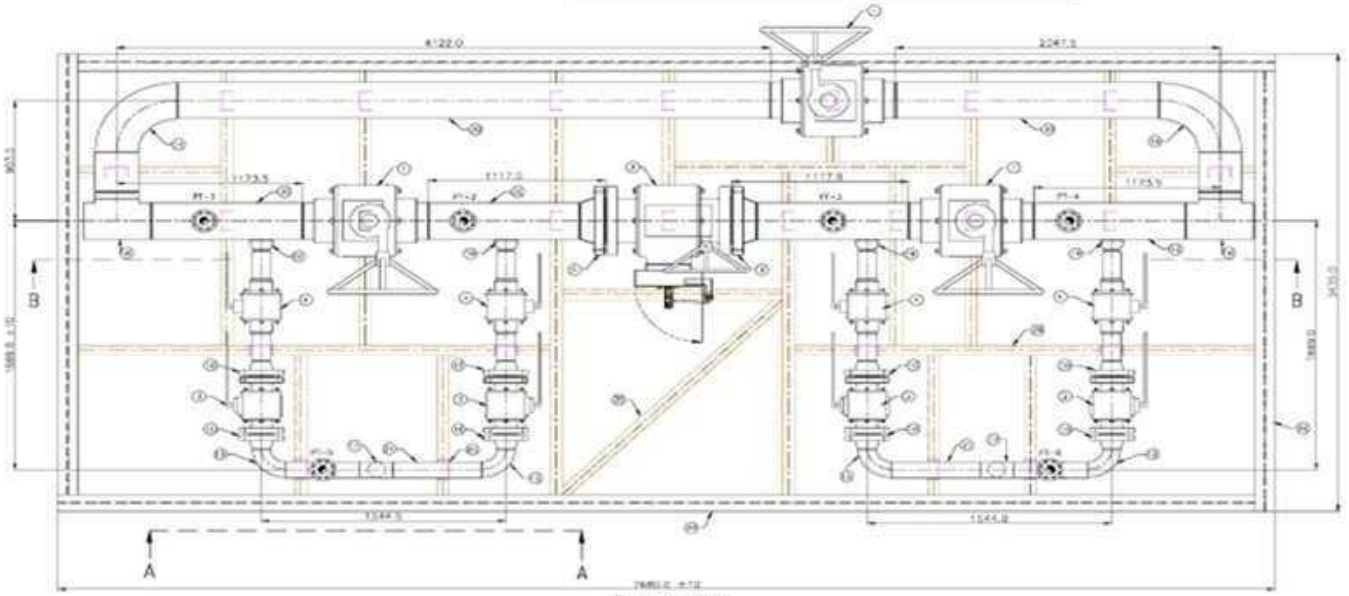
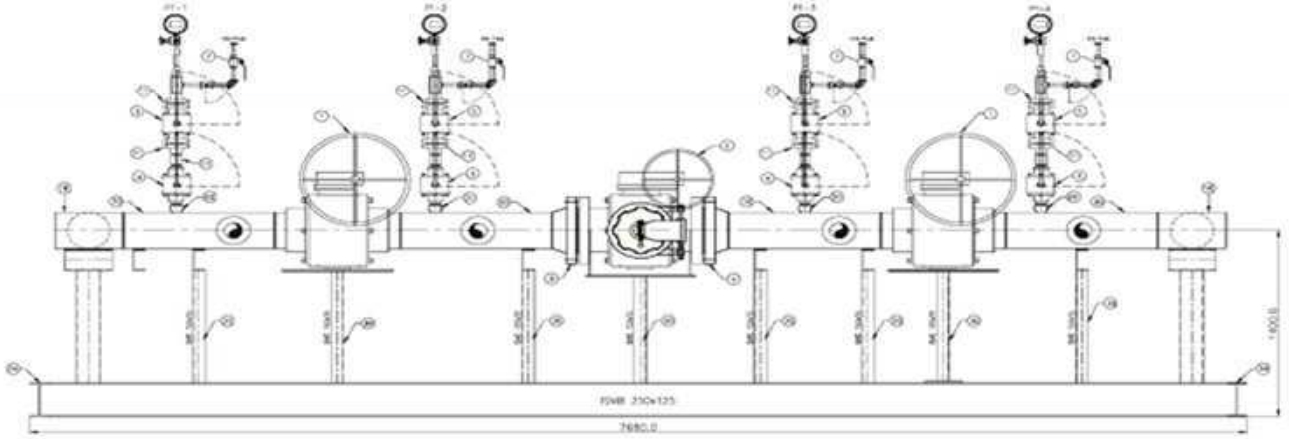
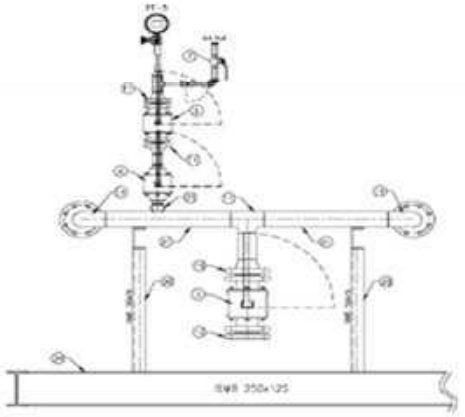
SV WITH 3 WAY VALVE 10"-600#



PLAN VIEW



FRONT VIEW B-B



FRONT VIEW A-A

BILL OF MATERIAL

I.D. NO.	ITEMS	SIZE	DESCRIPTION	QTY.
1	BALL VALVE	10"-600#	A 216, GR.WCB, RF, API 6D	3 Nos.
2	SWAY VALVE (TRG. VALVE)	10"-600#	A 216, GR.WCB, FLGD, API 6D	1 Nos.
3	BALL VALVE	4"-600#	A 216, GR.WCB, FLGD, API 6D	6 Nos.
4	BALL VALVE	4"-600#	A 216, GR.WCB, RF, API 6D	4 Nos.
5	BALL VALVE	2"-600#	A 216, GR.WCB, FLGD, API 6D	8 Nos.
6	BALL VALVE	2"-600#	A 216, GR.WCB, RF, API 6D	6 Nos.
7	BALL VALVE	1/4"-800#	A 105, GR.WCB, SWOF*SW(RF)	12 Nos.
8	PRESSURE TRANSMITTER	-	SS 316	6 Nos.
9	FLANGE	10"-600#	A 694 GR. F-70, SCH.40, RFWN	2 Nos.
10	FLANGE	4"-600#	A 105, SCH.80, RFWN	10 Nos.
11	FLANGE	2"-600#	A 105, SCH.160, RFWN	12 Nos.
12	BLIND FLANGE	4"-600#	A 105, RF	2 Nos.
13	ELBOW	4"-600#	A 234, GR.WPB, SCH.80, BW	4 Nos.
14	ELBOW	10"-600#	A 234, GR.WPB, SCH.80, BW	2 Nos.
15	ELBOW	3/4"-6000#	A 234, GR.WPB, BW	6 Nos.
16	UN 90°	2"X1/4"-600#	A 234, GR.WPB, SCH.160, BW	6 Nos.
17	TEE	4"-600#	A 234, GR.WPB, SCH.80, BW	2 Nos.
18	TEE (CROSS WAY)	10"-600#	A 105, GR.WPB, SCH.80, BW	2 Nos.
19	REDUCER	10"x4"	A 105, SCH.80x80, BW	4 Nos.
20	REDUCER	10"x2"	A 105, SCH.80x160, BW	4 Nos.
21	REDUCER	4"x2"	A 105, SCH.80x160, BW	2 Nos.
22	REDUCER	2"x3/4"	A 234, GR.WPB (SWAGED) SCH.160x160, BW	6 Nos.
23	SWAGE NIPPLE	2"X1"/2"	SS 316	6 Nos.
24	GASKET	10"-600#	SS 316 SPIRO GRAPHITE FILLED	2 Nos.
25	GASKET	4"-600#	SS 316 SPIRO GRAPHITE FILLED	10 Nos.
26	GASKET	2"-600#	SS 316 SPIRO GRAPHITE FILLED	12 Nos.
27	STUD & NUTS (10"-600#)	1 1/4"X8.5"	A 193 GR.B7/A194 GR.2H	32 Nos.
28	STUD & NUTS (4"-600#)	7/8" x 5.5"	A 193 GR.B7/A194 GR.2H	96 Nos.
29	STUD & NUTS (2"-600#)	5/8" x 5.5"	A 193 GR.B7/A194 GR.2H	96 Nos.
30	PIPE	10"-600#	API 5L X-65 PSL2 SCH. 80	12.0 MTR.
31	PIPE	4"-600#	A 106 GR.B, SCH.80	0.7 MTR.
32	PIPE	2"-600#	A 106 GR.B, SCH.160	2.0 MTR.
33	PIPE	3/4"-600#	A 106 GR.B, SCH.160	1.2 MTR.
34	SMB	310x125	IS 2062	650 Kg.
35	SMC	200x90	IS 2062	350 Kg.
36	SMC	150x75	IS 2062	250 Kg.

TOTAL WEIGHT : 4585 KG APPROX.

IndianOil

SV LAYOUT – SKETCH
(with 3 way valve)

MAINLINE LAYING - ROU AVAILABILITY

Unavailability of hindrance free ROU

CHALLENGE

Non availability of hindrance free ROW for laying NG Pipelines due to higher land & crop compensation in southern states

BEST PRACTICE

Pipeline route changed from Agricultural land to NH/SH corridor and permission from NH/SH obtained for laying pipelines. Wherever, multi utilities are available along road, SHDD/HDD crossings being adopted

Laying of PL along NH/SH

LAND RELATED CONSTRAINTS – SV/ DT/ RT LOCATIONS

SL	Challenge	Solutions
1	Unavailability of land parcel when pipeline is laid along the road	Provision of underground SV in road ROU can be kept. And for its remote operation RTU, battery bank, inverter can be installed on overhead platform.
2	Space / layout constraints for scraper launching & receiving barrels in existing land parcel at DT (converted from SV) and RT (customer end). Also pigging activity shall be hampered due to space constraints.	• Provide pigging facility of shorter barrels i.e. 3-way pig valve barrel. This will also facilitate water flushing for emergency evacuation in case of LPG pipeline • Use selectively at DT / RT locations where pig launching or receiving is required. • Improves accessibility, operability and future maintenance. • Always consider piggable pipelines irrespective of length to monitor pipeline integrity

IMPLEMENTABLE MEASURES FOR CONSTRAINED LOCATIONS

3 Way Valve

UG SV

Smart SV

3 WAY VALVE OPERATION

Assembly set up and pig launch

PIG retrieval

SV converted locations and customer-end constraints

SPACE CONSTRAINT FOR ENTRY IN SV

! Challenge

SV entry & existing mainline piping length issues based on depth of mainline due to road crossing outside SV

Requirement of Hot pulled bends instead of cold bends - Space constraints inside SV

✓ Solution Adopted

During finalizing SV lands, aspect of pipeline depth with respect to outside road crossing, requirement of hot pulled bends, pipeline route inside SV to be considered.

Accordingly engineering design to be finalized. Adequate space to be kept for future provision of DT in the event of SV becoming DT.

CABLE LAYING

Challenge

- Conventional made of cable laying is underground. Generally it is done in the last stage after civil, mechanical jobs.
- Soil is disturbed again for cable laying jobs and electrical works get delayed due to this leading project delay.

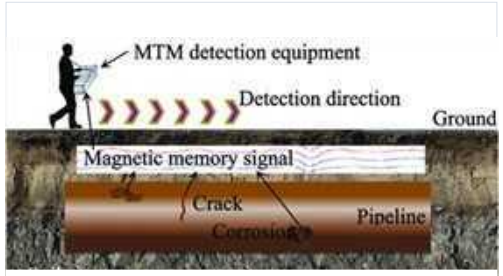
Solution Adopted

- Aboveground cable laying through trays is being done through independent route (boundary wall can also be used for trays), which can be completed before hand and electrical works can be completed once equipment is installed.

Aboveground cable laying through cable trays

Ennore-based Gas Pipeline (ETBPL)

- **OISD / PNGRB AUDIT-RELATED CHALLENGES**

AUDIT CHALLENGE	BEST PRACTICE / MITIGATION	• FIELD EXAMPLE / METHOD
Legacy design vs. revised standards Pipeline designed before revised standards may receive audit observations requiring retrofits or additional safeguards.	**Implement revised requirements during construction wherever technically feasible.** Where modification is impracticable: document standards gap analysis, risk assessment and management-approved mitigation plan for statutory submission. Examples: blast-proof wall where inter-distance cannot be met; composite wrapping / protection of critical valve-bonnet flange.	 Blast-proof wall – physical risk mitigation
Mainline wall-thickness compliance Some legacy pipe sections may be below the minimum thickness stipulated in the revised standard, despite original design checks.	**For already-laid sections, undertake formal standards gap / risk assessment and implement enhanced integrity controls.** Piggable pipeline: strengthened ILI program, increased inspection frequency and defect assessment / repair. Non-piggable / difficult sections: external methods such as MTM / tomography, supported by additional patrolling, QRT preparedness and regular health monitoring.	 MTM / external screening for buried pipeline

- **Gap Analysis → Risk Assessment → Mitigation Plan → Management Approval → Statutory Submission → Enhanced Monitoring**

Ennore-based Gas Pipeline (ETBPL) – Challenges & Best Practices

1 Station Design Optimization

- Shift from conventional civil buildings in SV stations to pre-fab LGSF buildings for electrical panels, SCADA panels and control room functions.
- Adopt solar-based power supply with optional DG backup to reduce space requirement and improve execution speed.
- Use gear-based globe valve for easier operation.

Gear-Based Globe Valve

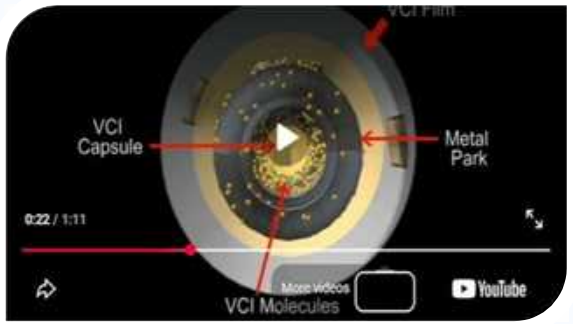
2 Operability & Future Readiness

- Use electric MOV ball valves in place of GOV, powered through solar panels with smart battery management.
- Use mechanized spectacle blind for scraper barrels where bolt removal is cumbersome.

Mechanized Spectacle Blind

3 Integrity & Maintenance

- Provide future provision for connecting existing cold vent with new customer line cold vent.
- Introduce VCI chemical immediately after hydrotest and swabbing of mainline to reduce internal corrosion until nitrogen purging and commissioning.



VCI Corrosion Protection

Key Takeaway

Adopt compact, low-maintenance, future-ready station designs and proactive corrosion-control features to optimize space, execution time and long-term operability.

Optimization of Time and Cost and Way Forward

- Solar based GOV operation with pre-fab building shall save electricity & space. It will also save considerable time & cost
- Underground SV with control panel on overhead platform for remote operation shall save substantial space and related costs.

SL	Problem	Way Forward
1	Disposal of plastic waste generated during construction	Inclusion of 1% payment towards environmental care.
2	Potential site obstacles to address challenges especially in rainy seasons	Employ drones for aerial surveys, inspection of pipeline routes, and monitoring construction progress
3	Delay in providing structural platform for O&M upon commissioning	Should be included in design as per prevalent code in auto-CAD 3D drawing issued for construction
4	Leakages in ball valves, GOV upon delivery at site & installation	All threaded connection for drain, PT tubings etc. shall be tested before commissioning at operating pressure

Thank You