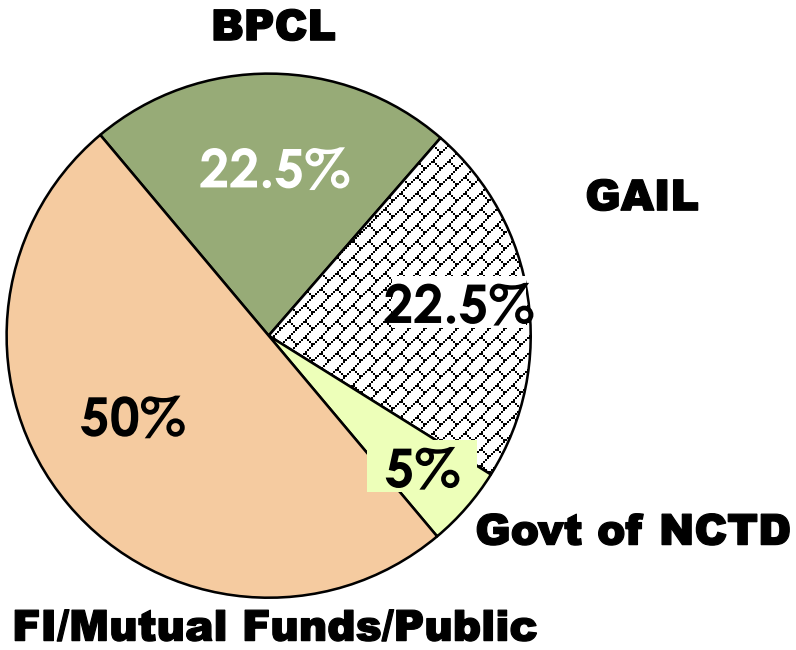
Steel NG Pipeline Repair due to External Damage

Shareholding Pattern

Incorporated in December 1998 as a Public Limited Company

	Promoters	% Share
i)	BPCL	22.5%
ii)	GAIL	22.5 %
iii)	Govt. of NCT of Delhi	5 %
iv)	FI, Mutual Funds, Insurance Companies, Public & Others	50%
	Total	**100 %**



Became Listed Company in Dec 2003 → Listed at BSE & NSE → Paid up capital Rs.140 Cr → No. of Shareholders > 1lacs

Equity shares of Rs.10 each has been split into Five shares of Rs. 2 each since Nov'17

Infrastructure & Customer Base

> 10 Lacs Nos.

Domestic

CNG

450 Nos.

> 3500 Nos.

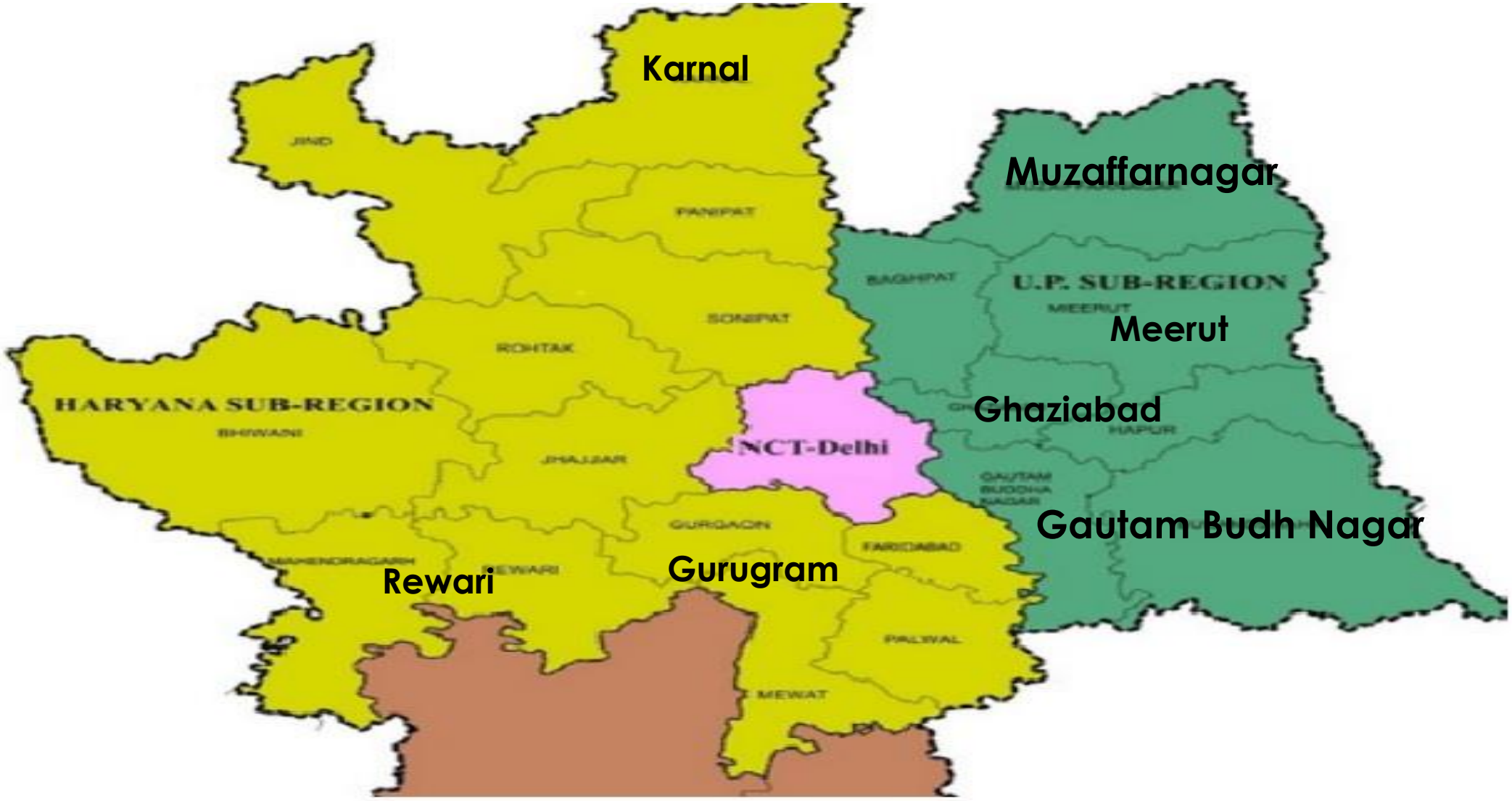
Commercials

Industries

> 1800 Nos.

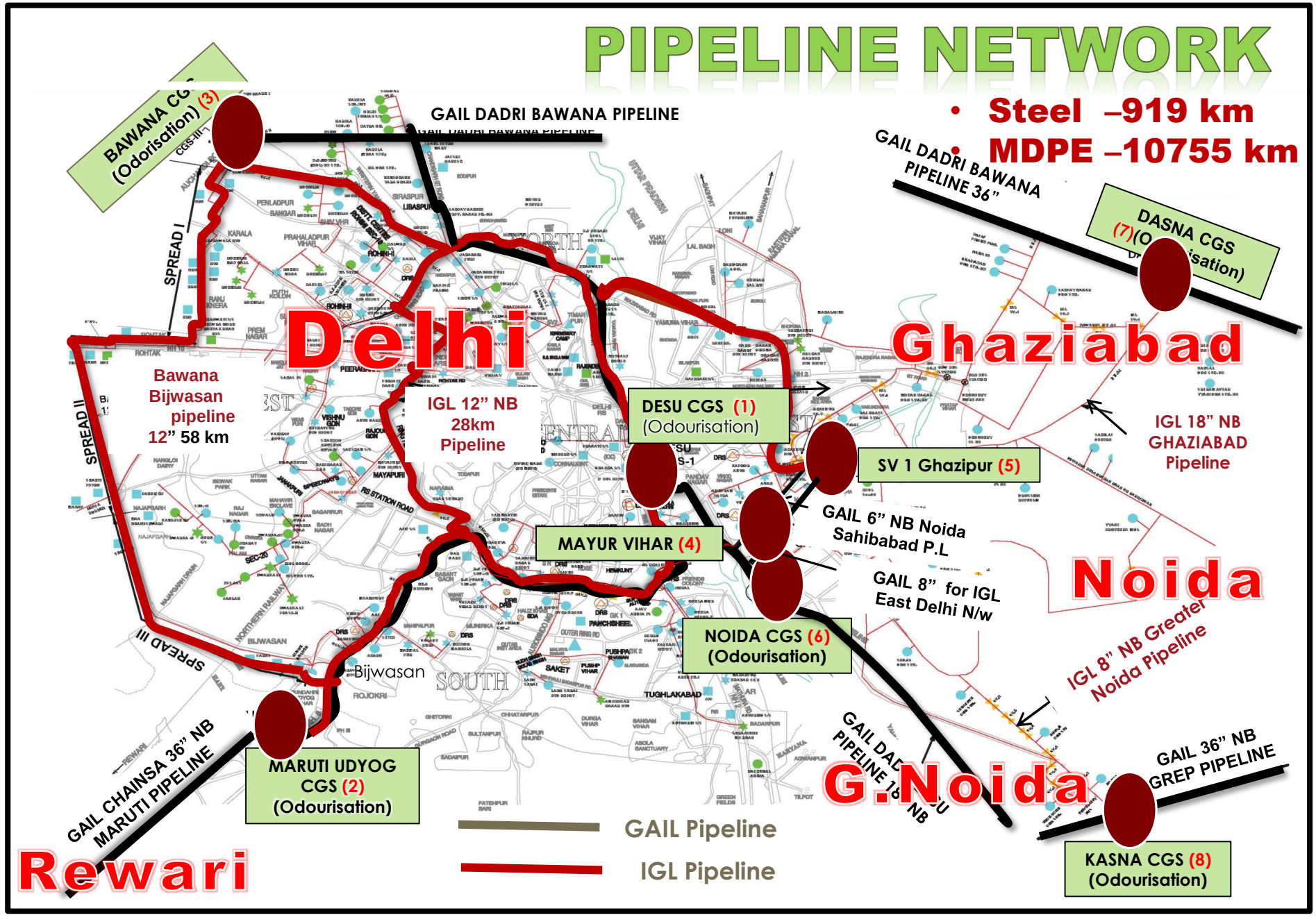
Pipeline Network is more than 11600 KM

Area of Operation



PIPELINE NETWORK

- Steel –919 km
- MDPE –10755 km



ASSETS OF STEEL PIPELINE IN DELHI & NCR

SECTIONALIZING VALVE- 76

TEST LEAD POINTS - 1575

TRANSFORMER RECTIFIER UNIT -27

U/G VALVE CHAMBERS - 547

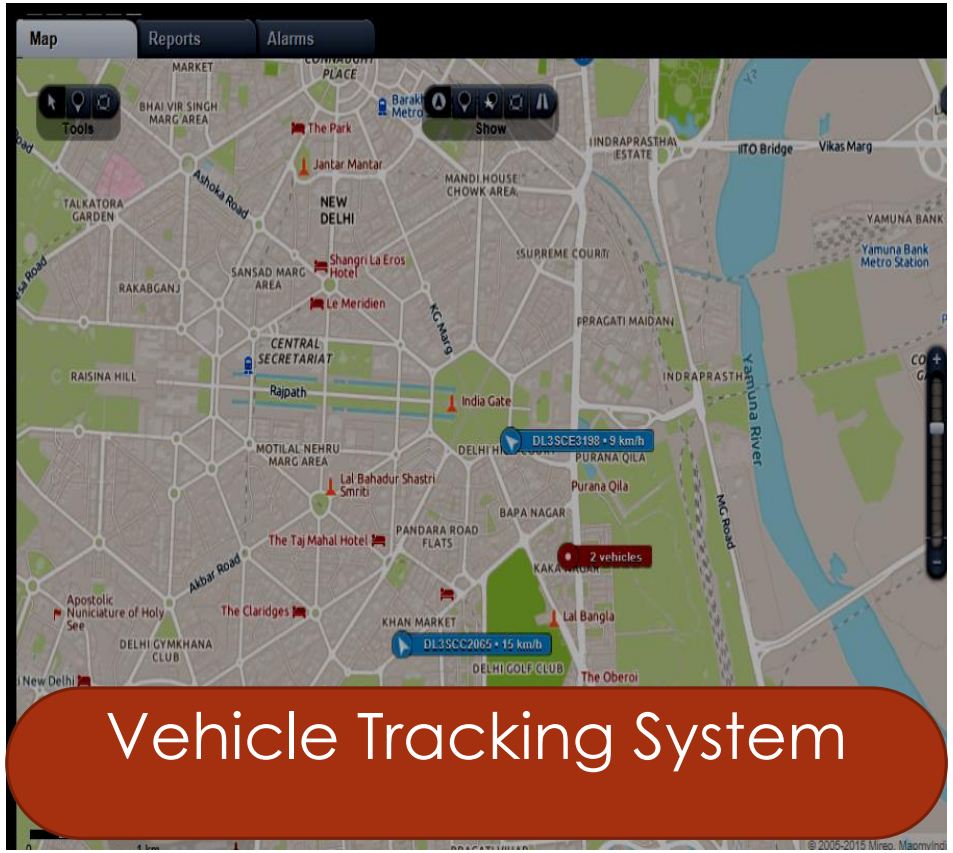
Biggest challenge-Third party intrusion/ miscreant activities

- **Third Party Digging**
- One of the biggest challenges for a CGD is to mitigate the chances of damage due to 'Third Party' diggings.

Precautionary Measures

Stone Marker

Pole Marker



Vehicle Tracking System

Static Guard

MPM (Motorcycle Patrol Man)

- Installation of Pipeline Markers at a distance of 50 Meters against the T4S requirement of 100 meters

MARKER ARE INSTALLED TO AVOID ANY THIRD PARTY DIGGING ACTIVITY

Preventive Measures- Assets

CCTV Operator	21
Motorcycle patrol Man	305
Security Guard	664
Armed Guard	75

MDPE Control Room 40

24*7

Steel Control Room- 8

SCADA Monitoring/VTS

Procedure to guide Third Party work near IGL pipeline

Intimation from Third party through patrolling guards , IGL emergency no. or submitting intimation letter

↓

After receipt of information at concerned control room, O&M team visits the execution site and conducts joint survey with third party representatives

↓

IGL pipeline is then guided through Pipeline Locator and As Built Drawing (ABD) by O&M team

↓

Joint survey report is generated mentioning sufficient depth and/or offset from IGL charged pipeline. In some cases, third party is asked to expose IGL pipeline.

↓

During Execution, IGL representative is present at site till the completion of work.

Case Study : 4’’ Pipeline Damage

Case Study : BACKGROUND

1500

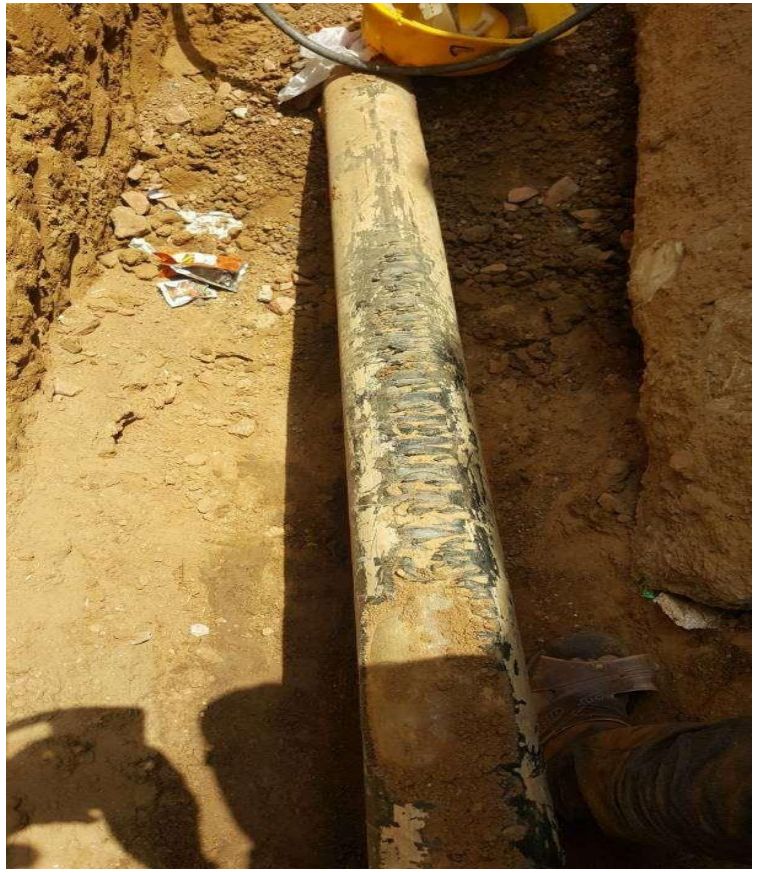
- Patroller see the reamer on Delhi airport road informed about all safety precaution activity i.e. pipeline locating and permission
- Work stopped and control room informed

1730

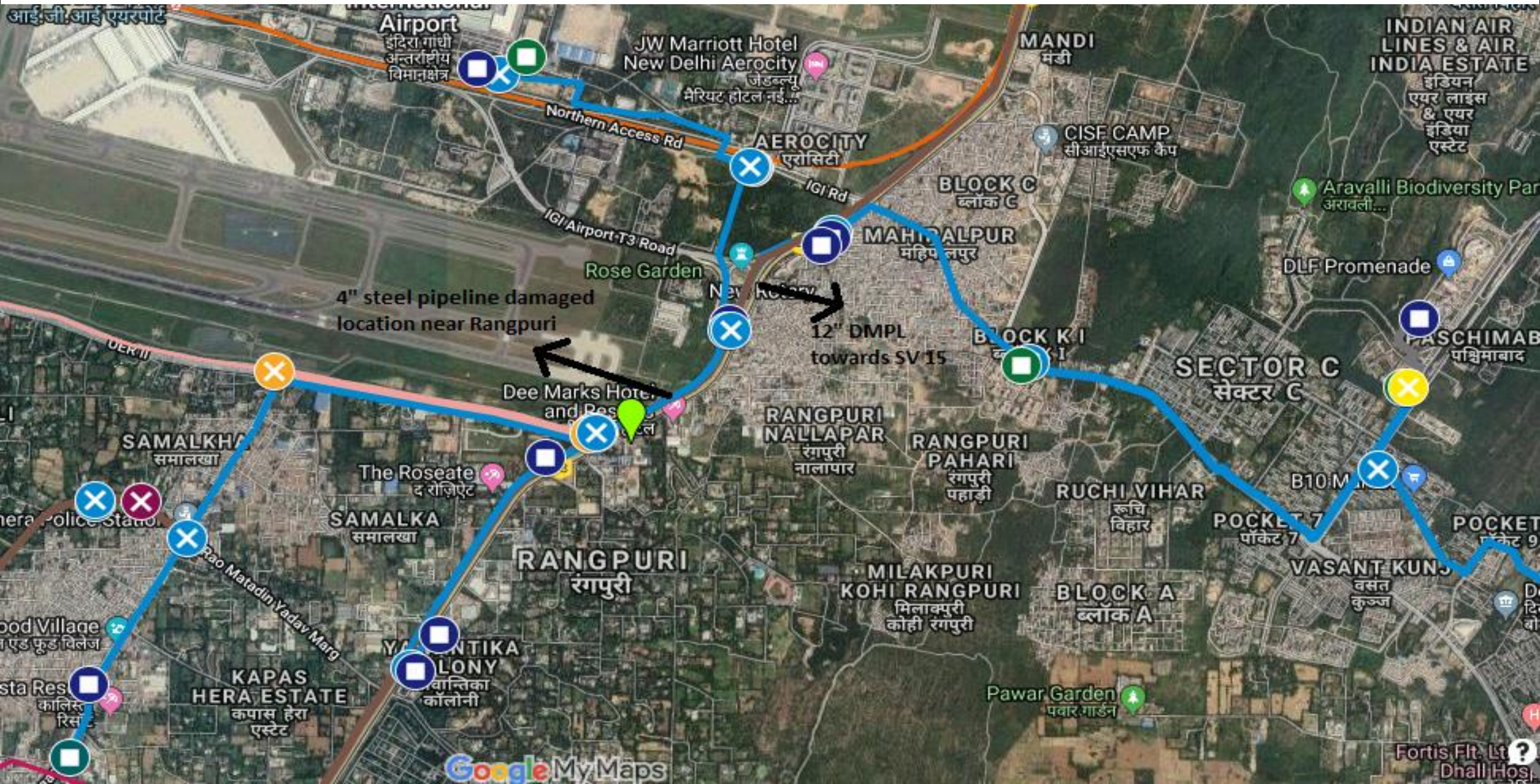
- Heavy leakage reported
- Pilot and reamer located
- Leakage from 2.5 mm patch observed
- On interrogation it was found that about 100 meter pipeline is damaged.

Case Study : BACKGROUND

Pipeline damaged surface



Damaged location



Possible Solutions

100 Meter PIPELINE LAYING

- ROU Clearance, Marking
- Trenching
- Welding
- Inspection(NDT)
- Lowering In
- Hydrotest
- Back Filling

Time Taken : Approx. 5 Days

REINFORCE Kit 4D

- Surface preparation/cleaning
- Wrapping
- Testing

Time Taken : 2-3Hours

Technology implanted during Repair

REINFORCE Kit 4D(composite sleeve is made of 400 g/m²
Kevlar® tape and ceramic reinforced epoxy resin)

Technology implanted during Repair

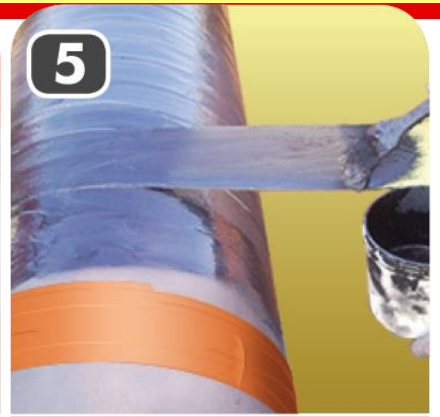
REINFORCE Kit 4D

Designed as per ISO 24.817 & ASME PCC-2

Surface preparation Sa2½ / St3 and roughness Rz > 60 μm

Filler application

Bi-component epoxy resin preparation



R4D wrapping

Coating protection & traceability tag

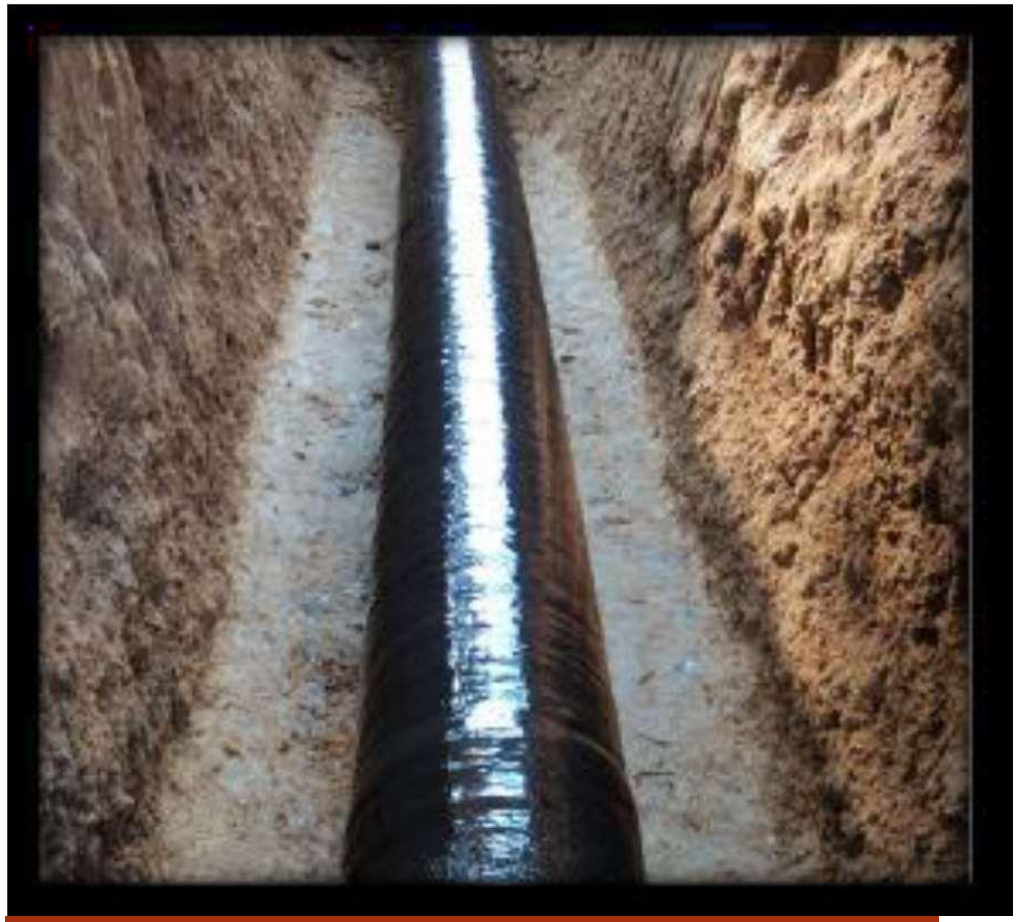
- REINFORCE Kit 4D (a composite repair system of 400 g/m² Kevlar®49 and R3X1060 Bonding Resin) designed as per ISO/TS 24817 and ASME PCC-2 standards.
- non-metallic technical alternative to metal clamps, welded sleeves and pipe replacement.
- “Kevlar” being the base which is a heat-resistant and strong synthetic fiber ensure pipeline joint strength.

Technology implanted during Repair- REINFORCE Kit 4D

- Advanced permanent composite repair system for pipelines and piping suffering from corrosion defects and mechanical damage.
- Engineered to restore pipe original integrity without shutdown.
- Restores the pipe integrity and prevents from further deterioration.

Comparison

Before



After

Analysis of the installation

- The above repair is in accordance with ISO/TS 24817 and with the defect specification provided by IGL

The installation of R4D was satisfactory and was in accordance with 3X Engineering approved installation procedure

- The damage caused to the pipeline was severe and shape was distorted, extra care was taken at the time of filler application

- Protection of R4D repair was crucial before curing, as the site was on highway with high probability of trespassing

Material Specifications

RESIN SPECIFICATION

Chemical Name- R3X1060

Chemical Family- Epoxy (bi-components)

Color- Black

Mixing ratio by weight- (Part A : Part B) = 2 : 1

Pack size- 1.7 kg/set

Solids- 100%

VOCs- None

Storage- Between +10°C (+50°F) and +32°C (+90°F) if long term storage

Shelf life- 2 years in unopened containers

FIBER SPECIFICATION

Fiber nature	Aramid Kevlar® 49
Fiber directions towards pipe axis	Hoop/axial (0 / 90°)
Fiber type	Woven type
Tensile strength	2900 MPa (420.5 Kpsi)
Tensile Modulus	110 GPa (15 950 Kpsi)

Composite Technical Specification

Percentage of Fiber in Volume	Up to 30%
Nominal ply Thickness	0.8 mm* (0.032inch) *depends on ambient temperature and viscosity
Total layers normal range (Typical)	4 to 30 layers
Density	1.35g/cm3(78.0lb/cu.ft.)
Application temperature	From +10 (50°F) to + 50°C (122°F)
Service temperature	From +10 (50°F) to + 50°C (122°F) Fully cured
Glass transition temperature (ASTM D7426)	+67°C(+167°F)

Curing time after job completion:

- given values could be shorten by using ATEX approved heating belts
- values just given as information

	25°C (77°F)	40°C (104°F)
Light load	36 days	24 hrs
Full load	72 days	48 hrs

Composite Mechanical Specification

Tensile Strength in Hoop direction long-term (ASTM D1598)	188 MPa (27 260 psi)
Tensile Strength in Axial direction long-term (ASTM D1598)	50 MPa (7250 psi)
Tensile Modulus in Hoop direction (ISO 527 or ASTM D3039)	30 GPa (4 350Kpsi)
Tensile Modulus in Axial direction (ISO 527or ASTM D3039)	10 GPa (1 450Kpsi)
Poisson's ratio (ISO 527 or ASTM D3039)	0.16
Shear Modulus (ASTM D5379)	3 GPa (435 Kpsi)
Impact resistance (ASTM G14)	11.2 J/m2
Resin Shore D hardness (ISO 868 or ASTM D2583)	83 Shore D, Resin hardness requirement: >73 shore D
Lap Shear Strength (BS EN 1465 or ASTM D3165)	16 MPa (2320 psi)
Cathodic disbondment (ASTM G95)	Passed
Fatigue test (defect dependent)	>35000 cycles (70-100% MAOP) with wall-through defect

Advantages

- The composite wrapping system can be successfully implemented in following circumstances:

i. External corrosion

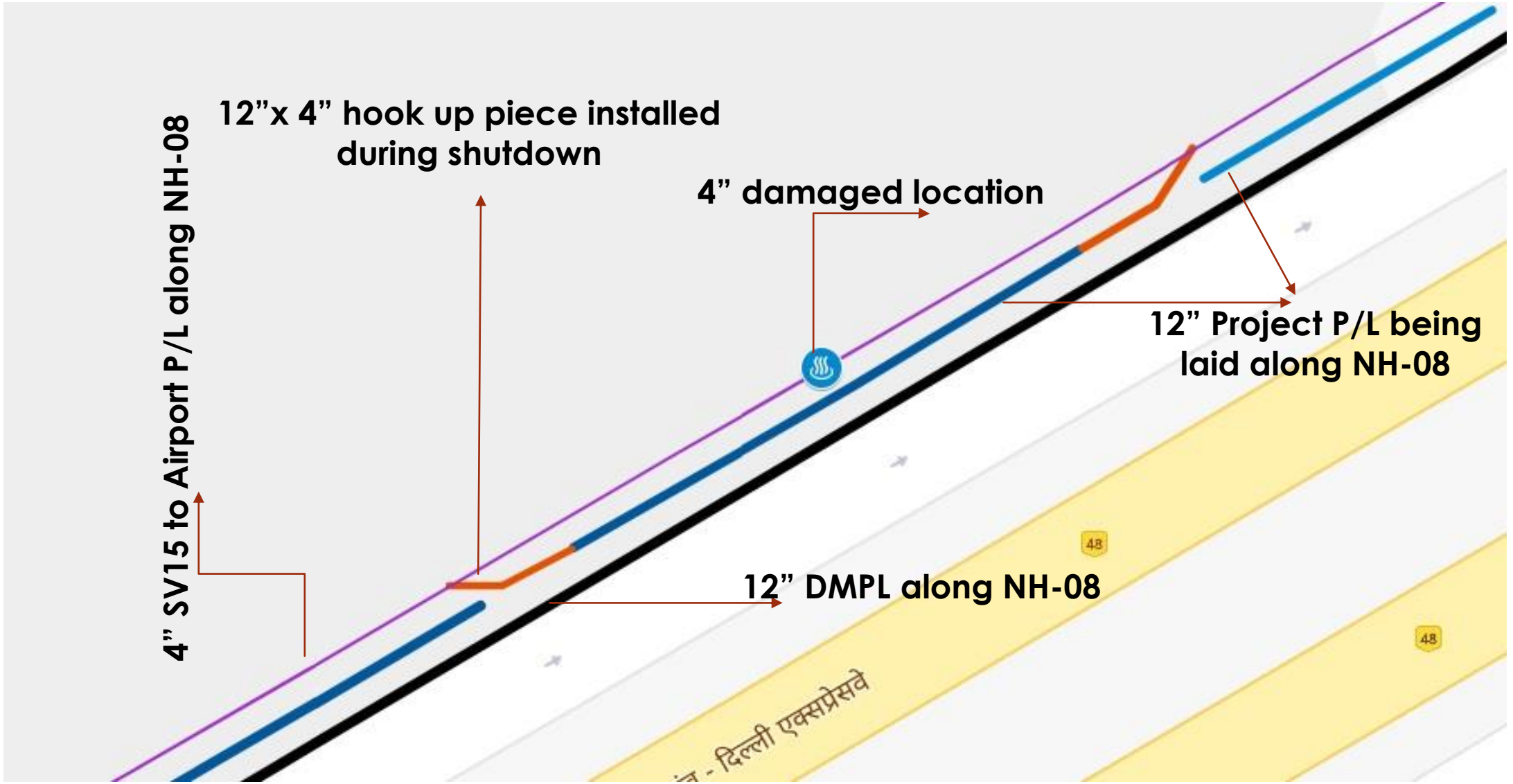
ii. Pitting

iii. Dents

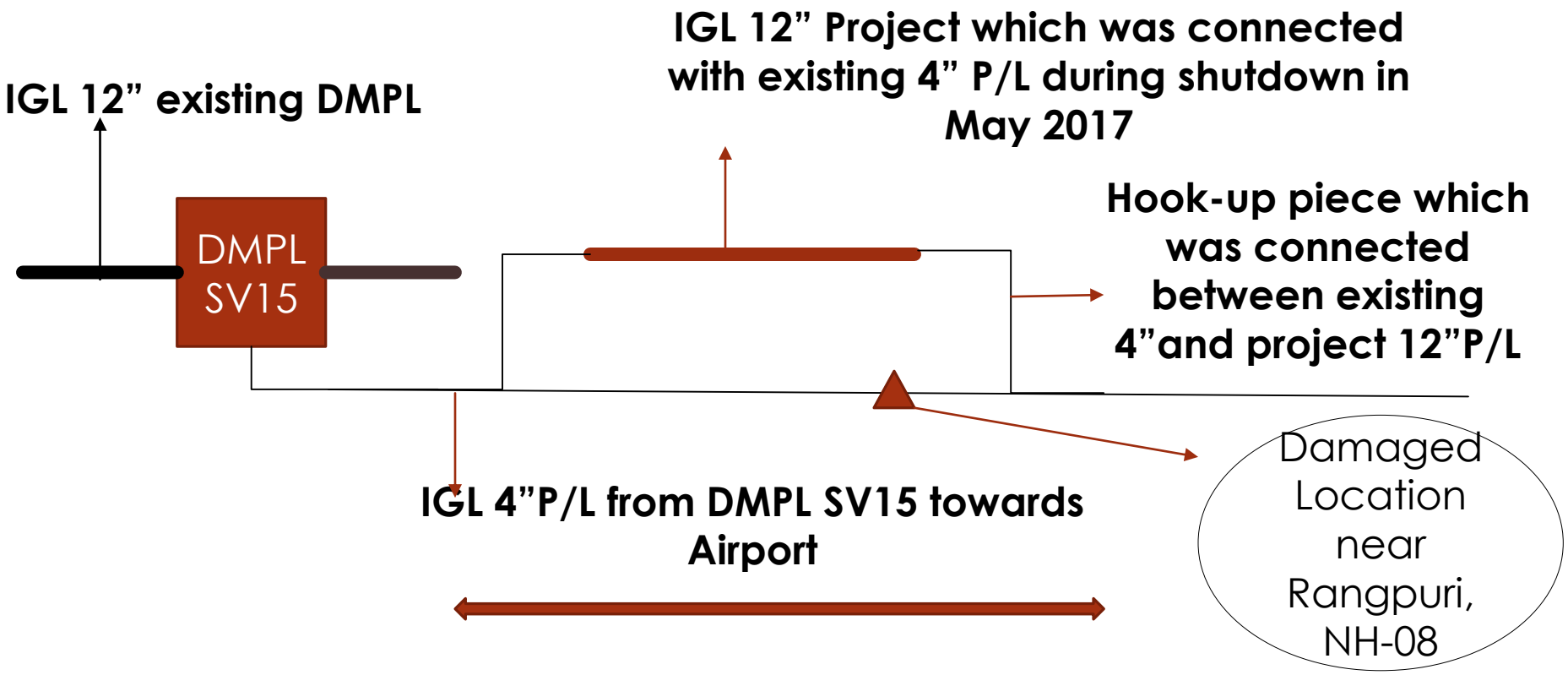
iv. Weld defects

v. Mechanical damages

New Pipeline laid after 25 Days of observation



Schematic diagram of Steel pipeline near damage location

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