Pipeline Design
Critical Factors and The Impact on Pipeline Repair Feasibility

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Penspen Integrity
“Know and Manage your Pipeline Risk”

Penspen Integrity is an independent specialist pipeline engineering consultancy. We provide services including:
- Integrity management
- Defect assessment
- Risk analysis
- Corrosion
- Cathodic protection (CP) advice and field support,
- Pigging consultancy
- Smart pig data analysis
- Direct assessment
- Training
- Research
Pipeline Design

- **Drivers**
  - Cost
  - Schedule

- **Issues Covered**
  - Route + Shore Approaches
  - Hydraulics – Diameter and Pressure
  - Materials
  - Configuration
  - Construction
  - Strength – Wall thickness
  - Stability, Buckling, Spans
  - Fittings (flanges, valves, pig traps etc.)

- Design HAZID
Route

- Steep Slopes
  - Difficult to work
- Deep Water
  - Diverless systems
- Burial
  - Excavation required
- Access problems
  - e.g. Sand waves

30 degree slopes

sand waves
Materials

- High Toughness / Good Ductility
  - Prevents running fracture
- Corrosion control by CRA liner
  - Clamps will not work
  - Special connectors required
- Flexibles
  - Different problems
Configuration

- HPHT – Snake Lay
  - Repair may introduce local restraint
Fittings

- Flanges
  - Ease section replacement
  - Potential source of leaks
- Valves
  - Allow isolation
- Pig traps
  - Enable the deployment of isolation tools
Spare Pipe

- Minimum 3 pipe lengths
- May be 1 to 2% of total length
Design HAZID

- Identify the Hazards
- Identify Potential Damage
- Identify Suitable Repairs
Hazard - Internal Corrosion

- **Damage**
  - Deep pits
  - Cracking
  - Leaks

- **Repair**
  - Clamp - temporary solution
  - Corrosion must be controlled
  - Replacement
Hazard – Anchor Damage

- Damage
  - Dent,
  - Gouge,
  - Bending,
  - Rupture

- Repair
  - Grouted sleeve
  - Section replacement
Hazard – sea bed movement

- **Damage** –
  - Bending strains
  - Collapse
  - Rupture

- **Repair**
  - Excavation
  - Replacement
Hazard - Spanning

- **Damage**
  - Fatigue cracking,
  - Rupture.

- **Repair**
  - Span support
  - Structural Clamp
  - Replacement
Summary

- Pipeline design is generally not influenced by repair
  - Slopes
  - HPHT – snake lay
  - Bundles
  - Flexibles
- The design HAZID provides an opportunity to identify hazards, damage and repair options.