# CIVIL ENGINEERING CONSTRUCTION

# SBC2253

## OIL AND GAS STRUCTURE

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# INTRODUCTION

- Pipeline transport is a transportation of goods through a pipe. Most commonly, used for the transmission of liquid, water and gases utilities.
- Therefore sewage, slurry, water and the most important are those transporting oil and natural gas.
- Often these pipelines are inspected and cleaned using pipeline inspection gauges (foam-pig).

# INTRODUCTION (CONT'D)

- Pipelines for water, gas and sewage vary in size depending on the service requirements.
- Pipeline developments affect large numbers of people who own or occupy land, and they therefore involve an encroachment on the rights of the individual.
- This had led to the development of legislation to control the construction of pipelines.

# PIPELINES MATERIALS

- Materials for pipelines can vary from cast iron to glass-fiber concrete.
- The material will vary with the type and purpose of the pipeline.
- Many industrial and government standards exist for the production of pipelines.
- The manufacturing of pipe uses many materials including ceramic, metal, concrete, and plastic .

# PIPELINES MATERIALS CONT'D)

- Metal pipes are commonly made from unfinished, black (lacquer), or galvanized steel, brass, and ductile iron.
- Plastic tubing is widely used for its light weight, chemical resistance, non-corrosive properties, and ease of making connections .
- Plastic materials include polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polyethylene (PE), cross-linked high-density polyethylene (PEX), polybutylene (PB), and acrylonitrile butadiene styrene (ABS).

# PIPELINES MATERIALS CONT'D)

- Pipe may also be made from concrete or ceramic. These pipes are usually used for low pressure applications such as gravity flow or drainage .
- A prestressed pipe is made using two different techniques:
  - The first method has a steel cylinder which has been lined with concrete and after the concrete cures the prestressing wire is wound directly on the steel cylinder and the exterior is then coated with cement mortar.

# PIPELINES MATERIALS CONT'D)

  - The second method encases the steel cylinder in concrete which is then prestessed after the concrete cures and the exterior is then coated with cement mortar
- Reinforced concrete can be used for large diameter concrete pipes .
- Many different standards exist for pipe sizes, and their prevalence varies depending on industry and geographical area

# OIL AND NATURAL GAS PIPELINES

- Pipelines are generally the most economical way to transport large quantities of oil or natural gas over land .
- Compared to railroad, they have lower cost per unit and also higher capacity .
- Although pipelines can be built even under the sea, that process is both economically and technically very demanding, so the majority of oil at sea is transported by tanker ships .

# OIL AND NATURAL GAS PIPELINES (CONT'D)

- Oil pipelines are made from steel or plastic tubes with inner diameter from 30 to 120 cm (about 12 to 47 inches) .
- Where possible, they are built above the surface
- However, in more developed, urban, environmentally sensitive or potentially dangerous areas they are buried underground at a typical depth of about 1.3 - 1.6 metres (about 3 feet) .

# OIL AND NATURAL GAS PIPELINES (CONT'D)

- The oil is kept in motion by a system of pump stations built along the pipeline and usually flows at speed of about 1 to 6 m/s .
- Multi-product pipelines are used to transport two or more different products in sequence in the same pipeline .
- Usually in multi-product pipelines there is no physical separation between the different products .

# OIL AND NATURAL GAS PIPELINES (CONT'D)

- Some mixing of adjacent products occurs, producing interface.
- This interface is removed from the pipeline at receiving facilities and segregated to prevent contamination.
- Crude oil contains varying amounts of wax, or paraffin, and in colder climates wax buildup may occur within a pipeline.

Interface - A thin layer or boundary between two different substances or two phases of a single substance

# OIL AND NATURAL GAS PIPELINES (CONT'D)

- To clear wax deposition, mechanical pigs may be sent along the line periodically.
- For natural gas, smaller feeder lines are used to distribute the fuel to homes and businesses downstream of larger transportation pipelines, similarly constructed of carbon steel and varying in size from 12 inches in diameter to 48 inches in diameter.

# OIL AND NATURAL GAS PIPELINES (CONT'D)

- The gas is pressurized by compressor stations spaced approximately every 70–100 miles and is odorless unless mixed with a mercaptan odorant where identified by the proper regulating body .
- Fuel pipelines must be protected from corrosion .
- Often, the most economical method of corrosion control is by use of pipeline coating in conjunction with cathodic protection and technology to monitor the pipeline .

**Cathodic protection** (**CP**) is a technique to control the corrosion of a metal surface by making that surface the cathode of an electrochemical cell

# OIL AND NATURAL GAS PIPELINES (CONT'D)

- Pipelines conveying flammable or explosive material such as natural gas or oil pose special safety concerns
  - June 4, 1989 - sparks from two passing trains detonated gas leaking from an LPG pipeline near Ufa, Russia. Up to 645 people were reported killed
  - May 12, 2006 - an oil pipeline ruptured outside Lagos, Nigeria. Up to 200 people may have been killed
  - And many more...

# WATER PIPELINES

- Pipelines are useful for transporting water for drinking or irrigation over long distances when it needs to move over hills, or where canals or channels are poor choices due to considerations of evaporation, pollution, or environmental impact.
- The water pipelines scheme require significant infrastructure in power generation to support the pumping stations .

WATER PIPELINE MADE OF PVC

LEAKAGE FROM A WATER PIPELINE

Preparation and excavation of  trench for the pipe installation

‘Fitting 45 Degree/bend

# PIPELINES FOR SEWAGE / SEWER

- Pipelines for sewage are always referred to as sewer.
- A sewer is an artificial conduit (or pipe) or system of conduits used to remove sewage (human liquid waste) and to provide drainage.
- In the 20th century developed world, sewers are usually pipelines that begin with connecting pipes from buildings to one or more levels of larger underground horizontal mains, which terminate at sewage treatment facilities.
- Vertical pipes, called manholes, connect the mains to the surface.
- Sewers are generally gravity powered, though pumps may be used if necessary .

PVC SANITARY SEWER INSTALLATION

# PIPELINE INSPECTION GAUGE

- A pipeline inspection gauge or foam - pig in the pipeline industry is a tool that is sent down a pipeline and propelled by the pressure of the product in the pipeline itself. It is the chief device used in pigging.
- There are four main uses for pigs.
  - physical separation between different liquids being transported in pipelines;
  - internal cleaning of pipelines;
  - inspection of the condition of pipeline walls (also known as an Inline Inspection (ILI) tool);
  - capturing and recording geometric information relating to pipelines (e.g. size, position)


A pig used in natural gas pipelines

SEWER PIPELINE REPAIR WORKS

# PIPELINES CONSTRUCTION

PIPELINES CONSTRUCTION

# WATER PIPES INSTALLATION PROJECT
# SERI GADING,
# BATU PAHAT, JOHOR
# -Polyethylene Pipe

# WATER PIPES INSTALLATION METHODS - Polyethylene Pipe

- Study plan (new installation or replacement)
- Loading, unloading and storing excavation
- Pipe jointing
- Pipe laying
  - Normal laying
  - Abnormal laying
  - Crossing (m.s pipe)
  - Pipe jacking (reinforced concrete pipe)

# WATER PIPES INSTALLATION METHODS - Polyethylene Pipe

- Fitting installation including all chambers
  - Fitting (bends, tees, elbows, reducers etc.)
  - Specials-valve
- Pipe testing
  - Pressure test
  - Leakage test
- Tapping
- Meters installation
- Finishes

# Preparation For The Chasis Process

# loading and setting pipe into chasis

# Placing the cutter

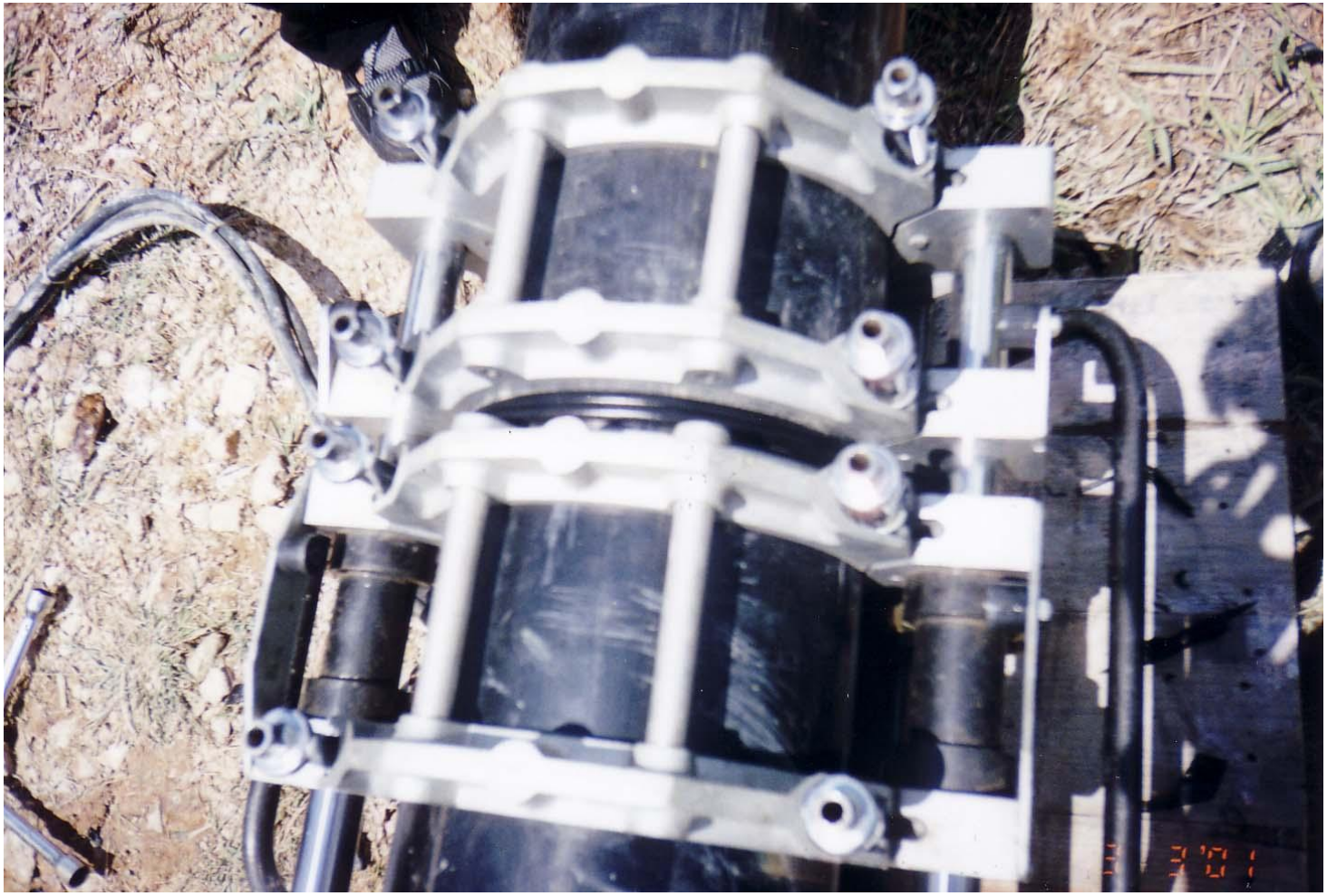
# Cutting edge of pipe

# Checking the evennes

# Placing the heater

# Heating the edge of pipe

# Pressing and cooling time (beading formation)



# Loosen the nuts of clamps

# Unloading the jointed pipe

# Finished jointed pipe

# Genset used for power supply

# THANK YOU