International Aramoon Corp.

"Pipe Inspection and Rehabilitation"

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SAWEA
Al-Khobar KSA
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Nobody would like to wait until the problem appears above ground

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Everybody would like to avoid digging in congested areas

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Even though Nobody wants to have accidents

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Pipe Inspection & Rehabilitation:

- Over Pumping
- Jet Cleaning
- CCTV Inspection
- Internal Lining by CIPP-UV

Pipe Inspection

Pneumatic Plugs:

Rubber plugs with variable diameters to isolate the pipeline section under inspection or rehabilitation.

Pipe Inspection

Over Pumping (By Pass):

To divert the flow away from the pipeline section which will be inspected or rehabilitated.

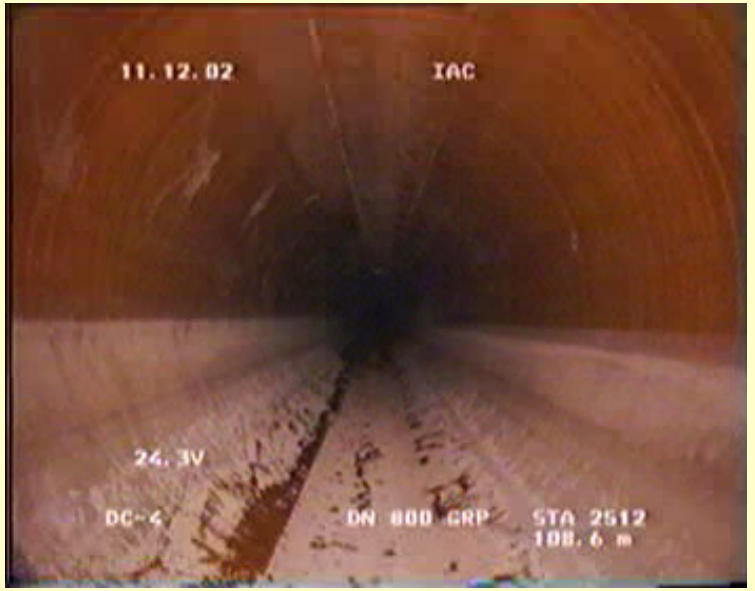
Pipe Inspection

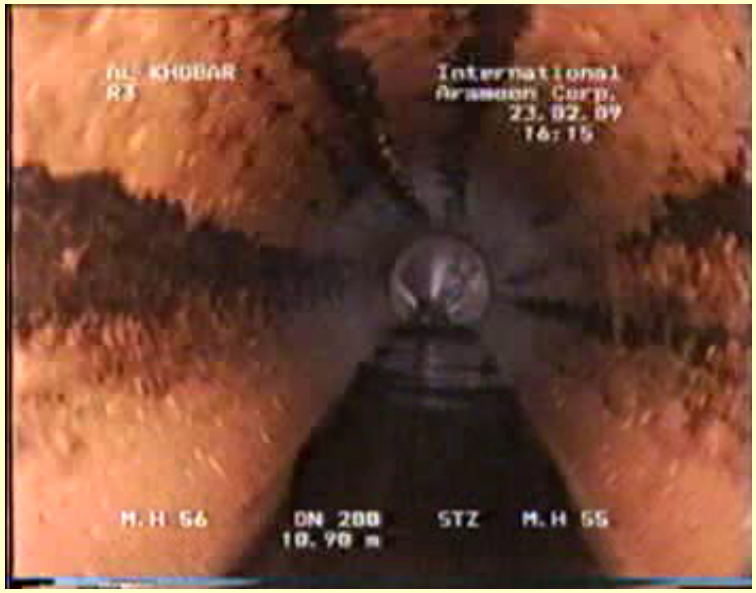
Jet Cleaning:

To remove debris and dirt inside the pipe by using high water pressure flow.

Advantage of Jet Cleaning:

- Allows easy & accurate camera inspection.
- Facilitates repair & rehabilitation works.
- Enhances the efficiency of the sewer system.





Pipe Inspection

Vaccum:

The debris and other wastes are removed from the pipelines using vacuum machine which will draw wastes outside the manholes.

Pipe Inspection

CCTV Camera Inspection:

- CCTV is the proper way to get information and see clearly the internal pipe condition without excavation.

- CCTV inspection is cost effective and easy to understand without disturbance above ground.

- It relies on the skills of the operator/contractor for recording observations & capturing an image of the pipe that allows suitable diagnosis of any defects.

Pipe Inspection

CCTV Camera Inspection:

- The information obtained by CCTV can be used for analyzing & assessment of pipe condition for preventive maintenance program and/or repair or rehabilitation works.

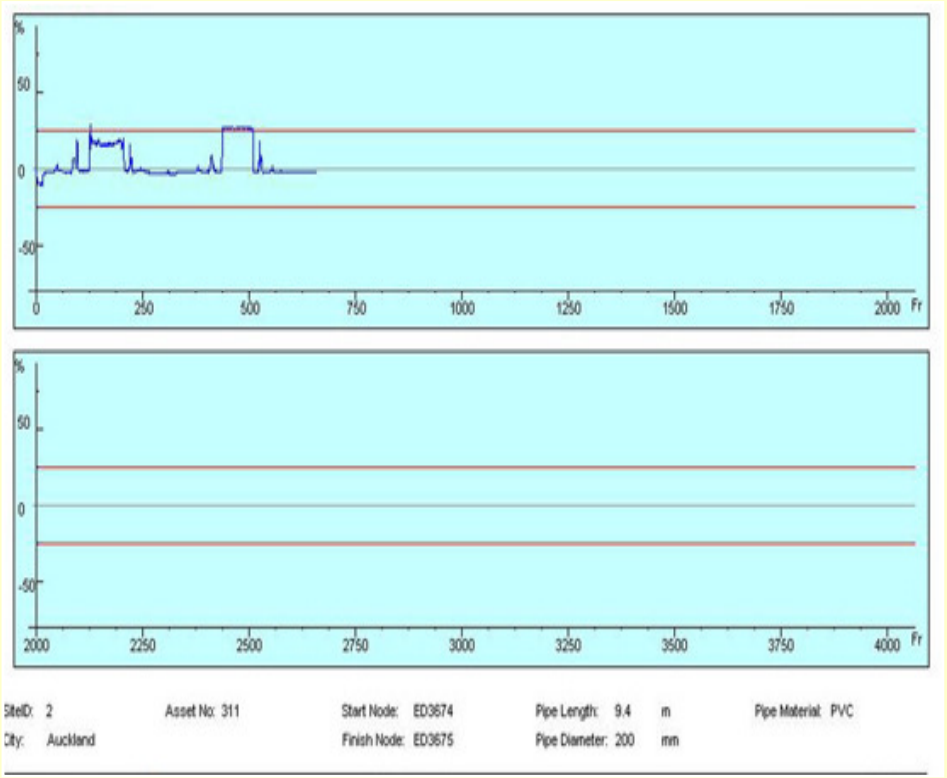
- It gives an indication for any changes in the pipe condition since pervious inspection.

- Beside checking the pipe condition, CCTV is used during & after completing rehabilitation work or installation of new pipe.

Pipe Inspection

CCTV Camera Inspection:

The development of the digital CCTV camera has made significant improvements to the quality and amount of information available through digitizing the images and allowing measurement of defects and intelligent analysis capabilities.

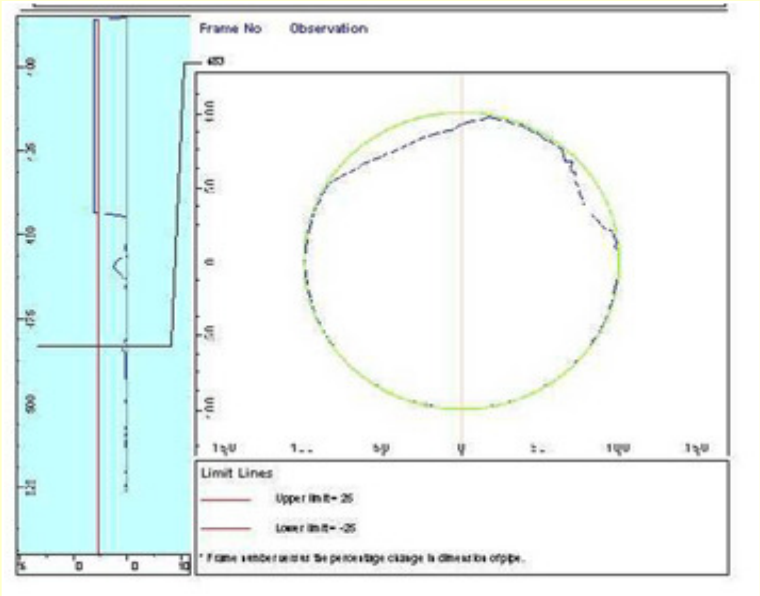


Laser Profiler Pipe Capacity analysis Report

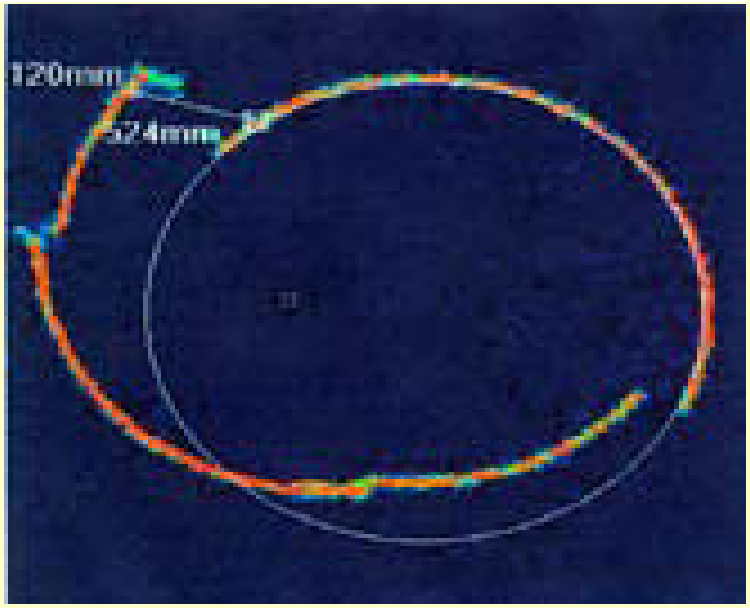
Pipe Inspection

CCTV Camera Inspection:

Laser profiling equipment is being used in conjunction with CCTV inspections to determine deformation in pipes.



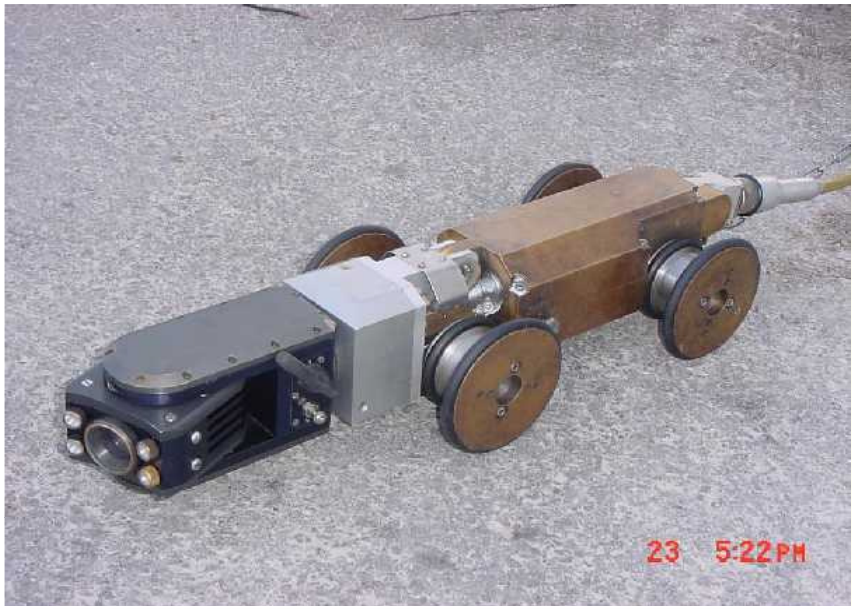
Sonar technology is also becoming a common tool in application where flow within a pipeline and an image below the water surface is needed.

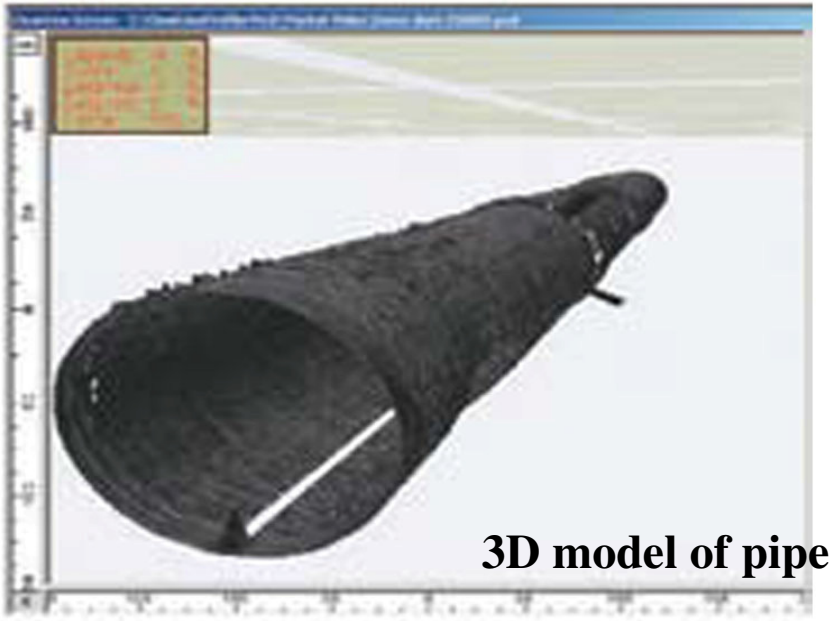


Pipe Inspection

CCTV Specification:

- Pan & Tilt high resolution colour camera.
- Rotate 360 degree.
- Cable length 200m to 600m.
- Sewer Asset Management Software for survey reports as per standard.
- Fiber optics CCTV for long distances, if lines do not have access points.
- Range can go for more than 1000mm.





3D model of pipe

CCTV Control Unit

Pipe Inspection

Pipe Defects

Pipe Inspection

Pipe Defects

Pipe Inspection

Technical Report:

- Show & evaluate the internal pipe defects.
- Record of the pipe defects.
- Evaluate pipeline condition.
- Technical recommendations for rehabilitation or replacement based on existing conditions.

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No- Dig Test & Repair for Water & Sewer Network

فحص و إصلاح شبكات المياه والصرف الصحي بدون حفر

Line ID : 03/P.Line/600

City :	Al Khobar
Sector :	Sewer Line Pressure Section
Street :	W3S Al Jazaer St.
Plan-nr.:	KS-1012
Line-nr.:	
House connection-nr.:	0
Traffic :	Main road – suburban/rural (all other roads with h
Water protection zone :	Water protection zone 1
Line type :	Foul
Material :	Glass fiber reinforced plastic
Coating/Liner :	None
Profile type :	Circular
Height / DN :	600
Year of construction:	1982

Start manhole AVC 5

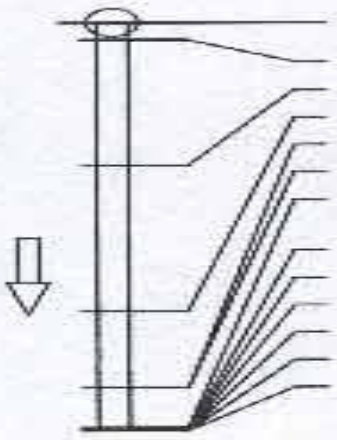
						End manhole : STA 3414		
h Cover	17.80	mNN	*Center length :*	0.00	m	*h* Cover	9.41	mNN
Depth:	1.75	m	*Pipe length :*	12.00	m	*Depth:*	2.19	m
h Soil	16.05	mNN	*Line length :*	0.00	m	*h* Soil	7.22	mNN

CCTV survey dated: 21/12/02

Operator:	Radie S. Fabian	Report nr.:	34/Dhahran/600
City:	Al Khobar	Sector:	Sewer Line Pressure Section
Street:	W3S Al Jazaer St.		
Plan nr.:	KS-1012	Line ID.:	03/P.Line/600
Line nr.:			
from manhole:	AVC 5	to manhole:	STA 3414
Line type:	Foul	Weather:	Dry
Survey direction:	Survey downstream	Water protection zone:	Water protection zone 1
Nom. diameter:	600	Material:	Glass fiber reinforced plastic
Line length:	0.00	Pipe length:	12.00

Video tape nr.: Inspection
Reason of survey: Assessment of complete remedial or renovation works
Position in traffic: Main road - suburban/rural (all other roads with h
Comments:

M 1:3600



Path	Shortcut	Anomalie description	Pos.	Video	Photo
2.60	LS	Line start		000021	
13.70	II	Joint inspection		000215	
97.10	II	Joint inspection		000920	
191.90	II	Joint inspection		001718	
242.30	MP--3	Damaged Pipe (Hole) 5:00		002143	1
242.30	MP--	Pipe Damaged (Hole) 7:00 o clock		002159	2
268.50	MP--	Pipe damaged Circumferencial, 3:00 to 9:00 o clock position		002508	3
269.60	PO--	Protruding Cable from 3:00 to 9:00 O Clock		003101	
270.20	PO--	Protruding Cable, pipe wall, 4:00 to 8:00 o clock		002638	4
270.40	SA	Survey abandoned		003033	
270.60	PO--	Protruding Cable		002747	5
270.80	PO--	Protruding Cable Number 2 4:00 to 9:00 o clock		002843	6
270.60	PO--	Protruding Cable Number 2 at 3:00 at 9:00 o clock		002850	

Defect photo

Number : 3, 4

Line-nr.: 03/P.Line/600
Start manhole: AVC 5
Report nr.: 34/Dhahran/600
End manhole: STA 3414

Photo: 3
Position: 268.50
State: MP--

Description:

Pipe damaged Circumferencial. 3:00 to 9:00 o clock position

Photo: 4
Position: 270.20
State: PO--

Description:

Protruding Cable. pipe wall, 4:00 to 8.00 o clock

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Pipe Rehabilitation

Pipe Rehabilitation

Introduction for CIPP-UV:

- It is Cured In Place Pipe system using Ultra Violet light for curing whereby a lining is directly cast against a host pipe.

- CIPP is the dominant rehabilitation system worldwide to renovate existing pipelines.

-CIPP is a jointless, seamless, pipe-within-a-pipe.

-CIPP has the capability to rehabilitate pipes ranging in diameter from 150mm – and above 1000mm.

Pipe Rehabilitation

Cont/ Introduction:

- They come in combination with reinforcement out of fiberglass.

- CIPP-UV light uses cured resin on polyester or vinyl ester basis.

- Fiberglass reinforcement forms part of the composite structure and is not a resin carrier.

- It is applicable for Gravity Network.

Pipe Rehabilitation

Product Design

Pipe Rehabilitation

Product Design:

The combination of polyester or Vinyl ester resin and fiberglass reinforcement will:

- Enhance the strength and other mechanical properties of liner material,

- Maintain chemical resistance demanded by the corrosive environment,

- Create a high quality liner able to withstand attacks from aggressive chemical compounds including acids (e.g. Sulphuric Acid).

Pipe Rehabilitation

Cont/ Product Design:

- After CIPP been manufactured, the soft tube can be safely stored at room temperature for up to 6 months.

- The Strength and Elastic modulus enable high liner stiffness to be achieved with relatively thin wall sections.

- High material properties and therefore thin wall thickness of the liner ensures maximum flow capacity with minimal cross section (diameter) reduction.

-The high Elastic modulus of the cured liner makes it appropriate for both structural and non-structural applications.

Pipe Rehabilitation

Cont/ Product Design:

- The CIPP-UV liner system utilizes both inner and outer protective tubing's to:
    - Prevent undesired resin outflow during the WIP operation,
    - Ensure uniform liner thickness over the whole run,
    - Ensure proper bonding between the resin and the multiple fiberglass layers.

- The protective foils do not allow any mechanical lock to be developed between the liner and the existing host pipe.

- The inner foil is removed after the in-situ curing to prevent undesired delamination between the foil and the composite in the future.

Pipe Rehabilitation

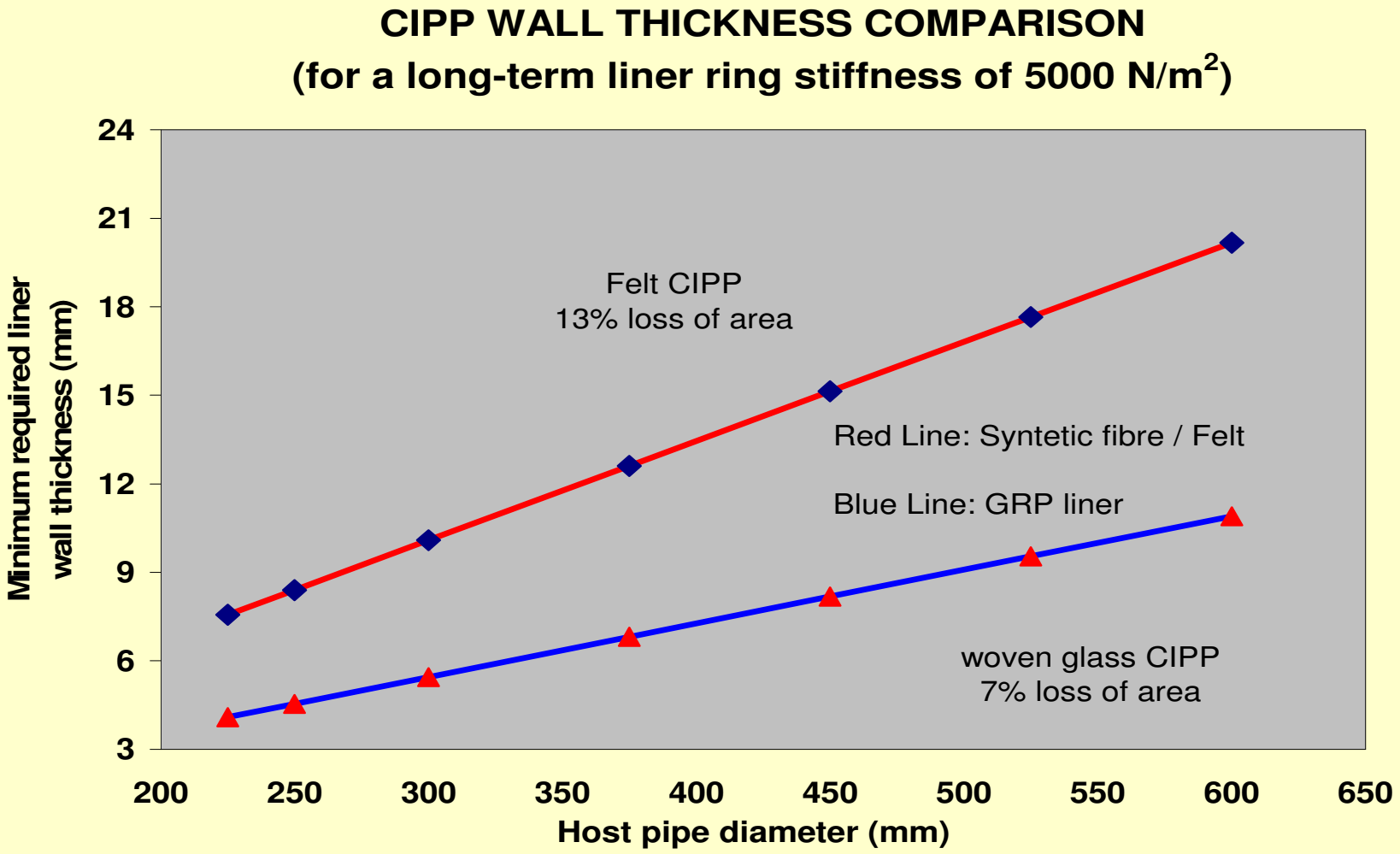
Mechanical Properties

Item	CIPP-UV (N/mm2)	PVC Pipe (N/mm2)	Clay Pipe (N/mm2)	GRP Pipe (N/mm2)
Modulus of Elasticity	10,000	2,895	50,000	9,300
Tensile Strength	170	51	Up to 20	150
Bending Strength	150	99	Up to 40	140

Reference: Manufacturer in KSA

Pipe Rehabilitation

Cont/ Product Design:



Pipe Rehabilitation

How Does CIPP-UV Work?

Pipe Rehabilitation

CIPP-UV Application:

- Over pumping, Jet Cleaning & CCTV inspection and cutting sharp edges, if needed, must be done before the rehabilitation in order to get the host pipe ready for work.

- A resin is impregnated into a flexible tube of fiber reinforcement.

Pipe Rehabilitation

Pipe Rehabilitation

Cont/ CIPP-UV Application:

- The tube is then Winched In Place (WIP) into the pipe and held under pressure.

- Installed lengths up to 220m have been achieved.

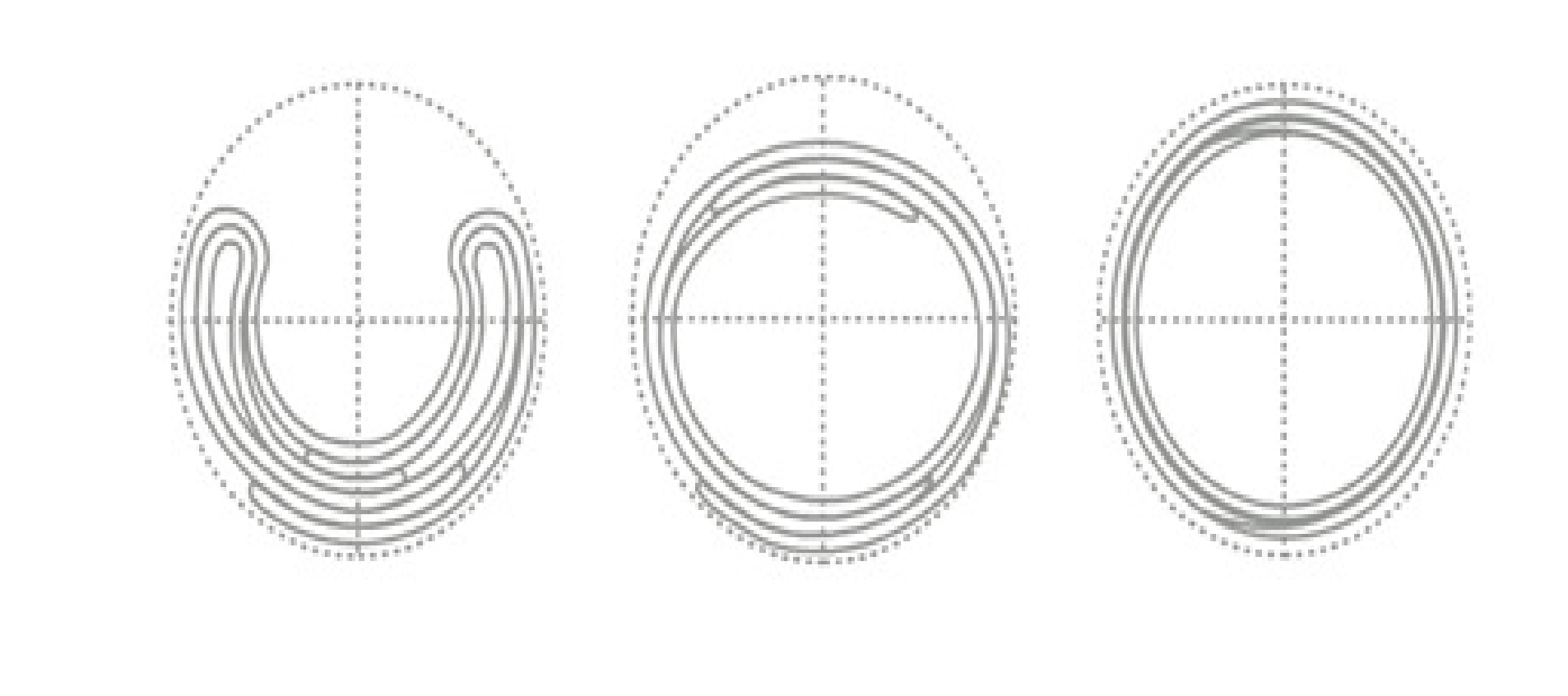
Pipe Rehabilitation

Cont/ CIPP-UV Application:

- A compressed air inflation process is used for field installation of the lining material.

Pipe Rehabilitation

Cont/ CIPP-UV Application:

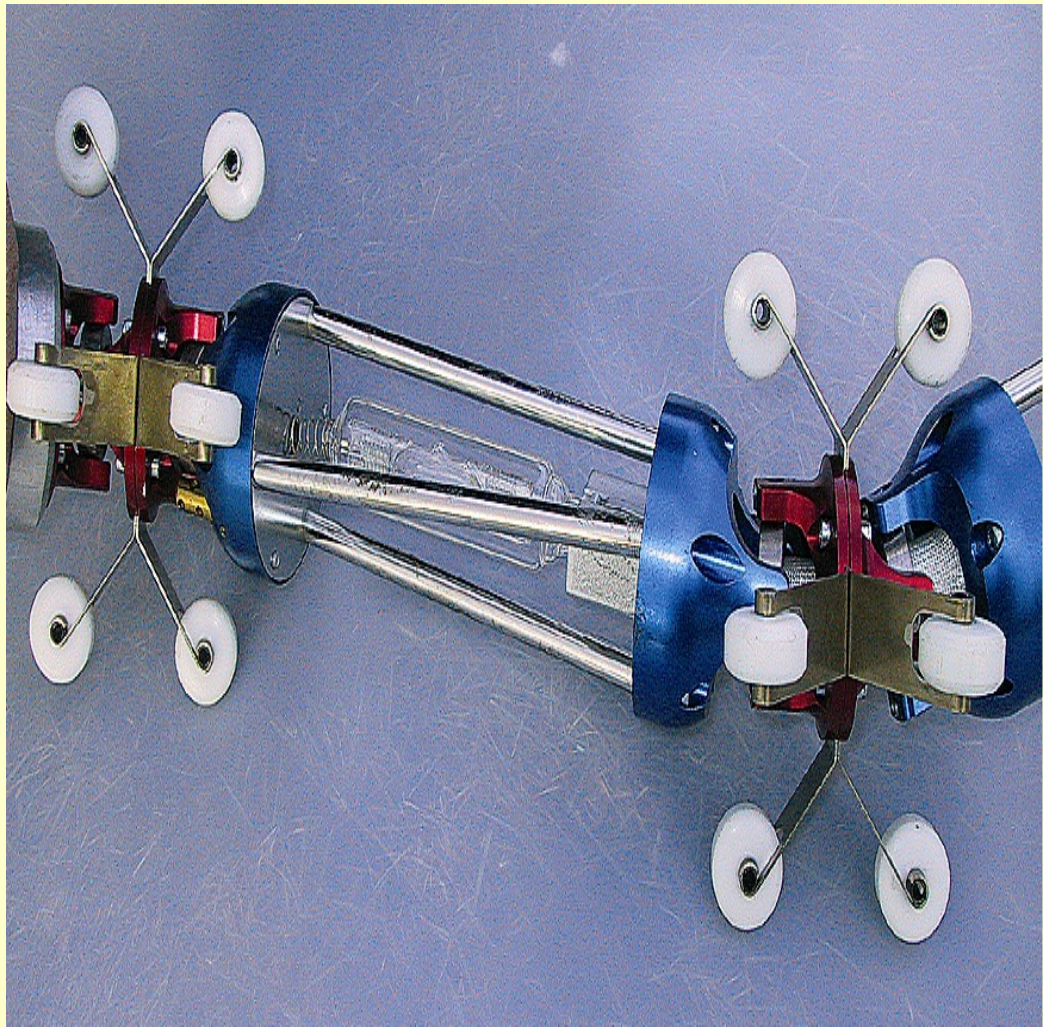


CIPP-UV Liner Structure (showing the expanding action on inflation)

Pipe Rehabilitation

Cont/ CIPP-UV Application:

- The Winched In Place (WIP) and expanded tube is then cured in situ by pulling through, at a controlled speed, an Ultra Violet (UV) light train of a specific wave length built up from a number of separate medium pressure UV discharge lamps.



Pipe Rehabilitation

Pipe Rehabilitation

Cont/ CIPP-UV Application:

- Curing rates for light cured systems vary in relation to diameter and liner thickness but are typically 30m to 60m an hour.

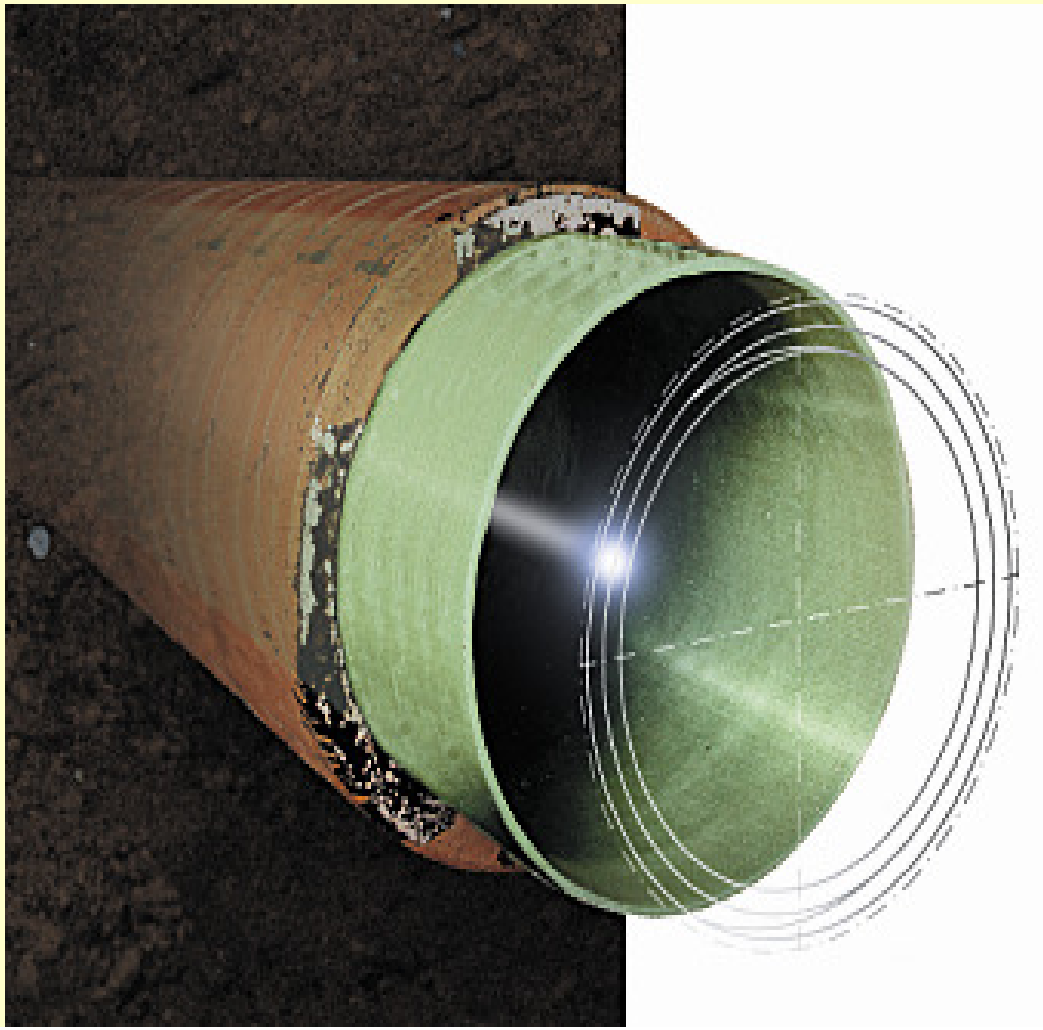
- UV-light curing will not be effected by temperature or ground water around the pipe.

Pipe Rehabilitation

Cont/ CIPP-UV Application:

- After the curing process a structural composite lining is formed.

- CIPP-UV liner will consist of up to (5) multiple layers of fiberglass reinforcement, resin, internal & external protective tubing of transparent thermoplastic material.



Pipe Rehabilitation

Cont/ CIPP-UV Application:

- Lateral re-opening can therefore be done immediately after curing of a UV-light system.

- Pipeline is ready for service.

Pipe Rehabilitation

Installation time for CIPP-UV light curing system for length of 50m and pipe diameter of 300mm:	
CIPP-UV-light Cured System	
Working steps	**Time Required**
Setting up of construction site **Insertion / calibration of liner** **--** **Curing of liner** **--**	**2.5 hours** **--** **1.5 hours** **--**
Opening of liner ends, remove of construction site	**1.5 hours**
Total time required	**5.5 hours**

Pipe Rehabilitation

CIPP-UV Advantage

Pipe Rehabilitation

Advantages:

- High structural strength and durable system.

- Thin wall reduces loss of capacity, particular important in small diameter host pipes.

- Fast installation which limits the disturbance of the environment to a minimum.

- CIPP-UV is environmentally friendly.

- No waste products from the curing cycle to be disposed of e.g. process water.

- CIPP-UV is a good system for countries where the temperatures are high.

- Resistant to corrosion & harsh sewage environment.

Pipe Rehabilitation

Cont/ Advantage:

- In case the liner would not be properly expanded, damaged or otherwise in a dissatisfying condition, corrective steps can be taken including removing the uncured liner out of the host pipe.

- The UV light curing has also a very positive effect as it limits the thermal expansion of the liner during the curing process.

- After the curing, the shrinking deformations are correspondingly also much smaller compared with a heat cured, carrier material system.

- Existing trees, traffic flows, social and commercial life and running production in industrial operations remain virtually unaffected.

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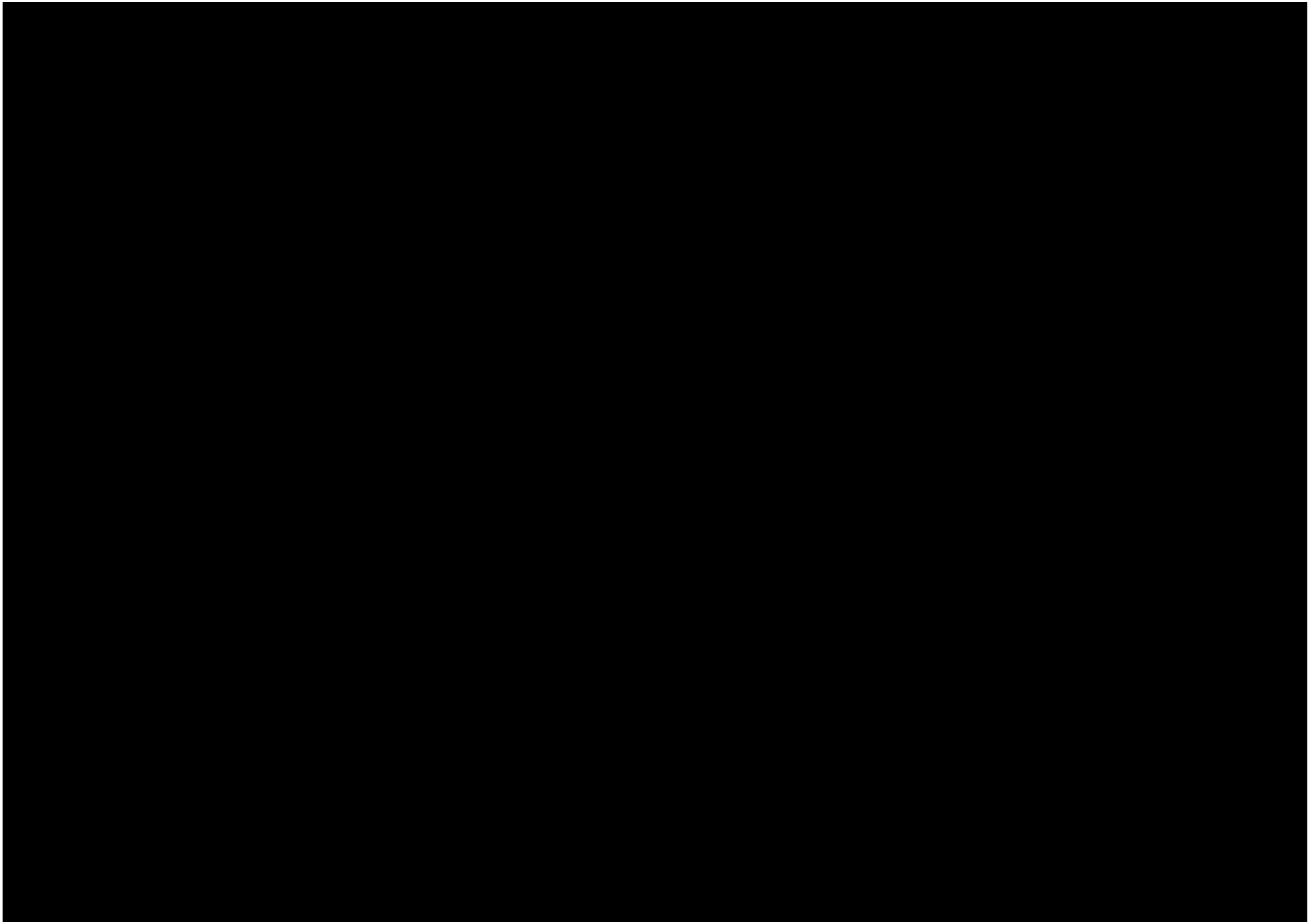
Inspection & Rehabilitation Projects in KSA

- 1050mm reinforced concrete pipe in Madina.
- 400mm AC pipe For in Hofuf.
- 600mm & 800mm GRP pipes in Jazaer str. in Al-Khobar.
- 400mm DI pipe in Dammam.
- 500mm fiberglass pipe King Fahad tunnel in Dammam.
- 200mm to 500mm clay pipes in SWCC Al-Khobar.
- 400mm clay pipe for in Jubail Industrial city.
- Water Leak Detection for major cities e.g. Riyadh, Dammam, Al-Khobar, Ahsa, Qatif, Jubail, Madina & Tabuk, etc.

Pipe Inspection

Clips for Pipes before & after Rehabilitation



Pipe Rehabilitation

Conclusion:

- This technology could reduce the total project value.
- Quick process.
- Less disruption & less environmental impact.
- Make reliable new pipe without excavation that can take structural load.
- Flow moves with less friction with internal surface.
- No damages to other underground utilities.
- Well proven & successful Technology worldwide.
- Trenchless Technology can be applied in any circumstances.
- It is available locally.

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Thank You

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