



# *RE-ENGINEERING WAY FORWARD OF VALUE MANAGEMENT IN EXISITING LARGE DIA OF SEWER NETWORKS REPLACEMENT - A S.O.E (State Own Enterprise) PROJECT – Cyber Valley, Selangor, MALAYSIA.*



The Institute for Infrastructure Asset Management, Malaysia,. ASIA

[www.iiam.org.my](http://www.iiam.org.my)

By: Mohd Syazwan; *Phd,MBA,MSc.BSc*

DRMGS IIAM PAPER ICUMAS 2018  
*Regional Director of Asia & President Malaysian Chapter.*



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# PROJECT OWNER'S

The Client



The Client's Consultant



# The Contracting TEAM's

Main Contractor



CONTRACTOR'S PROJECT  
CONSULTANT



PROJECT MANAGEMENT & RE-ENGINEERING  
CONSULTANT



TRENCHLESS SPECIALIST  
CONTRACTOR



# ABOUT THE PROJECT - SELANGOR CYBER VALLEY

- Selangor Cyber Valley which is developed by the Selangor State Development Corporation (PKNS) is poised to be transformed into a smart, green and sustainable development becoming an integrated urban growth centre valued at **RM16.9 billion**.
- 2,256 units of Selangorku houses will be provided. Selangor Cyber Valley, the eleventh urban centre built by PKNS, being built on a 526ha site in the Sepang District with progressive development implementation takes 20 years completions.



# The Project Location's



# THE CYBERVALLEY – SELANGOR STATE GOVERNMENT OWNED SUSTAINABLE GREEN TOWNSHIP

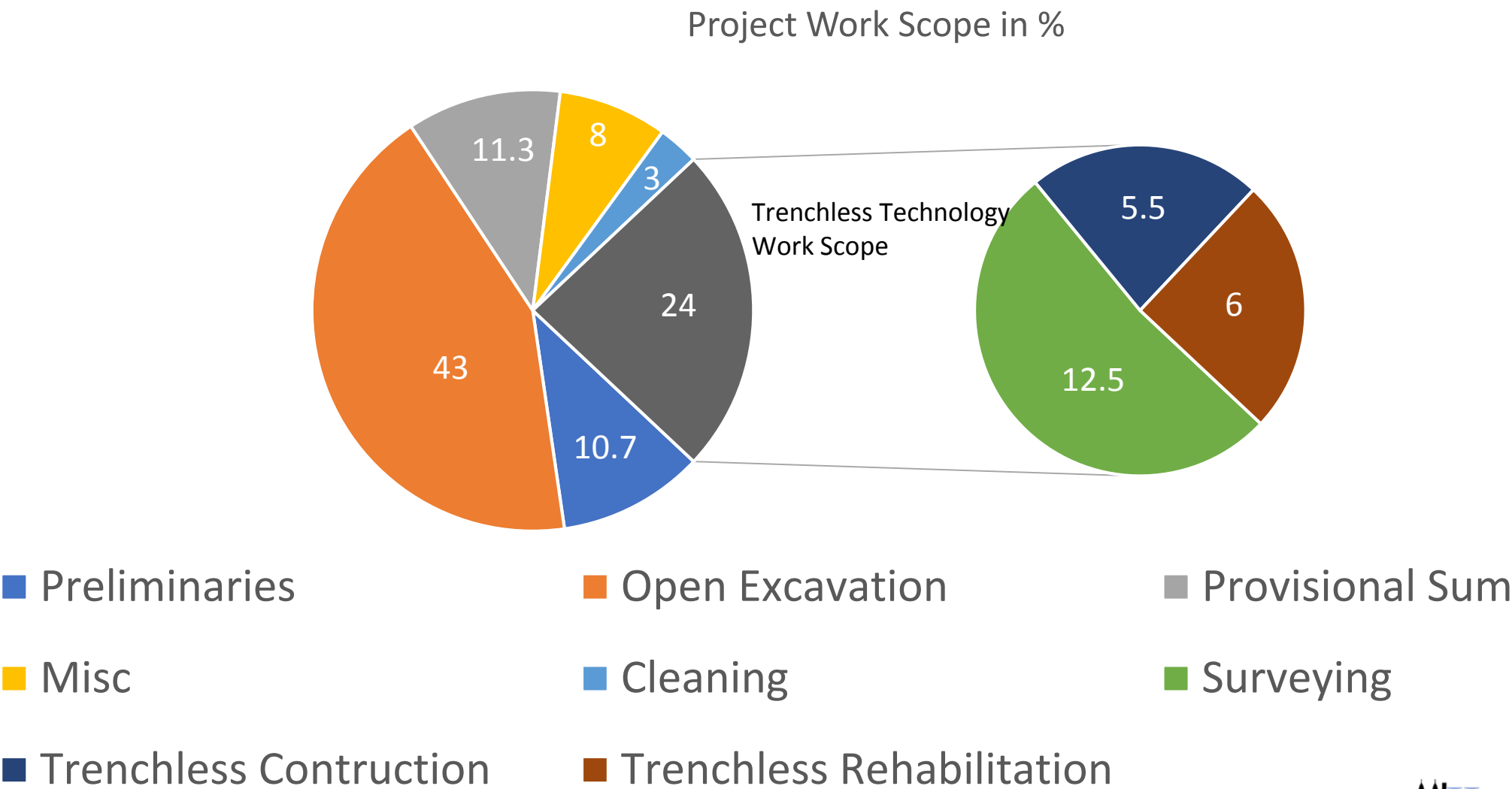


# PROJECT SCOPE OF WORKS

	ORIGINAL SCOPE OF WORK	REVISED SCOPE OF WORK
1	Preliminaries	Preliminaries (reduced)
2	Cleaning of sewer line: <ul style="list-style-type: none"> <li>i. Cleaning of sewer pipes</li> <li>ii. Plugging of manholes</li> <li>iii. Pre CCTV determination</li> </ul>	<ul style="list-style-type: none"> <li>i. Subsurface Utility Engineering (BIM)</li> <li>ii. Engineering Survey</li> </ul>
3	Reconstruction of sewer line: <ul style="list-style-type: none"> <li>i. Removal of existing sewer pipe</li> <li>ii. Base setup</li> <li>iii. Pipe replacement</li> <li>iv. Patch Liner</li> </ul>	Trenchless Rehabilitation Works <ul style="list-style-type: none"> <li>i. Cured-In-Place Pipe Spot Repair (CIPPSR)</li> <li>ii. Cured-In-Place Pipe (UV)</li> <li>iii. Grout-In-Place Pipe (GIPP)</li> <li>iv. Spray-In-Place Pipe (SIPP)</li> <li>v. Cast in Place Pipe</li> </ul>
4	Miscellaneous: <ul style="list-style-type: none"> <li>i. Utility Mapping</li> <li>ii. Relevel of manhole</li> <li>iii. Pipe Jacking</li> <li>iv. CCTV Inspection</li> </ul>	-Manhole Rehabilitation
5	Provisional Sum	



# Original Project Work Scope





# Methodology of Project Revised

- The Client ( PKNS ) has little knowledge of Trenchless Works and Green Constructions
- The Consultant is unaware of the Policies and Standards of Trenchless design and works
- The Client was in depressed situation in handing over the site to National Sewerage Company ( Future Asset Operator) the Project is 9 years long overdue.
- This delays is due to the Underground construction project management and supervisions failures from 2008 till the new award in 2017.

# Methodology of Project Revised

- Upon the award in late 2017 to SMSB, IEWM was appointed as the Project Management Consultant to :-
  - I. Review
  - II. Revised and to re-engineered
  - III. Cost Analysis and project budgeting with the award of contract value
  - IV. Propose new Concept and Technology for the successful completions.

IEWM, fully undertake the preliminary works and introduce the Subsurface Utility Engineering method to be carried out Internally and Externally to establish the followings :-

- I. Current situation
- II. Engineering Survey
- III. Root cause analysis to the failures
- IV. Soil Investigations
- V. Internal Condition Monitoring
- VI. Hydraulic Performance
- VII. External conditions
- VIII. Structural Analysis
- IX. Inertial Gyroscopic Mapping

# Methodology of Project Revised

- IEWM and the team took 3month to survey, analyse, review and model the new proposal for trenchless technology without cost increase from its original contract value.
- The cost factor and the method of Re-engineering became the most priority considerations for the Client.
- Both of this factor's has made the successful acceptance to the Client subsequent changes to the Condition of Contract Requirements.

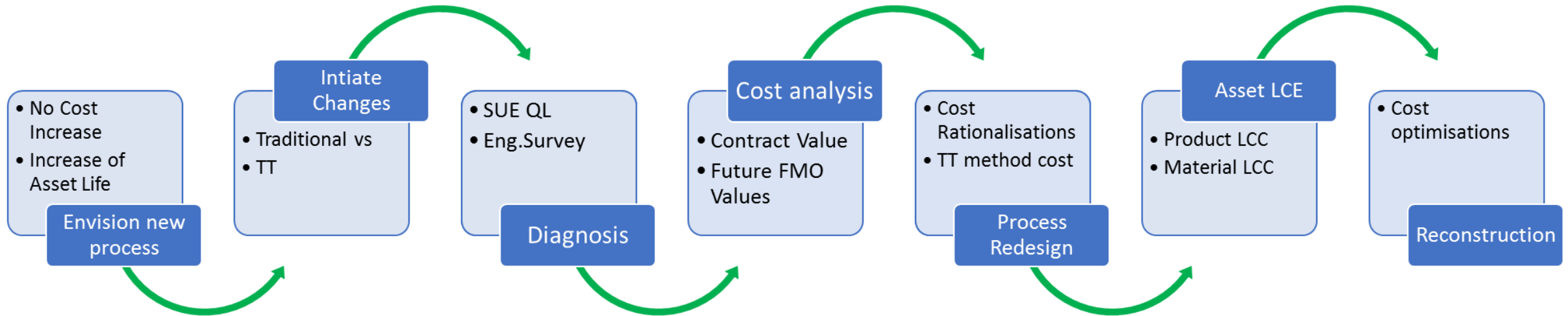


# RE-Engineering's Objectives

- ✓ ***Cost Optimisations*** – Is a continuous engineering process to ensure highest level of construction services and ensuring clients satisfaction maintained.
- ✓ ***Construction's Quality*** – Addressing and reforms the deficiencies' of past construction failure.
- ✓ ***Client's Objectives*** – Value added approach by providing S/BIM in the project handover.
- ✓ ***Stakeholder's Asset Lifecycle values*** – Providing the best quality ,innovative , product and materials.

# Our RE-Engineering Processes

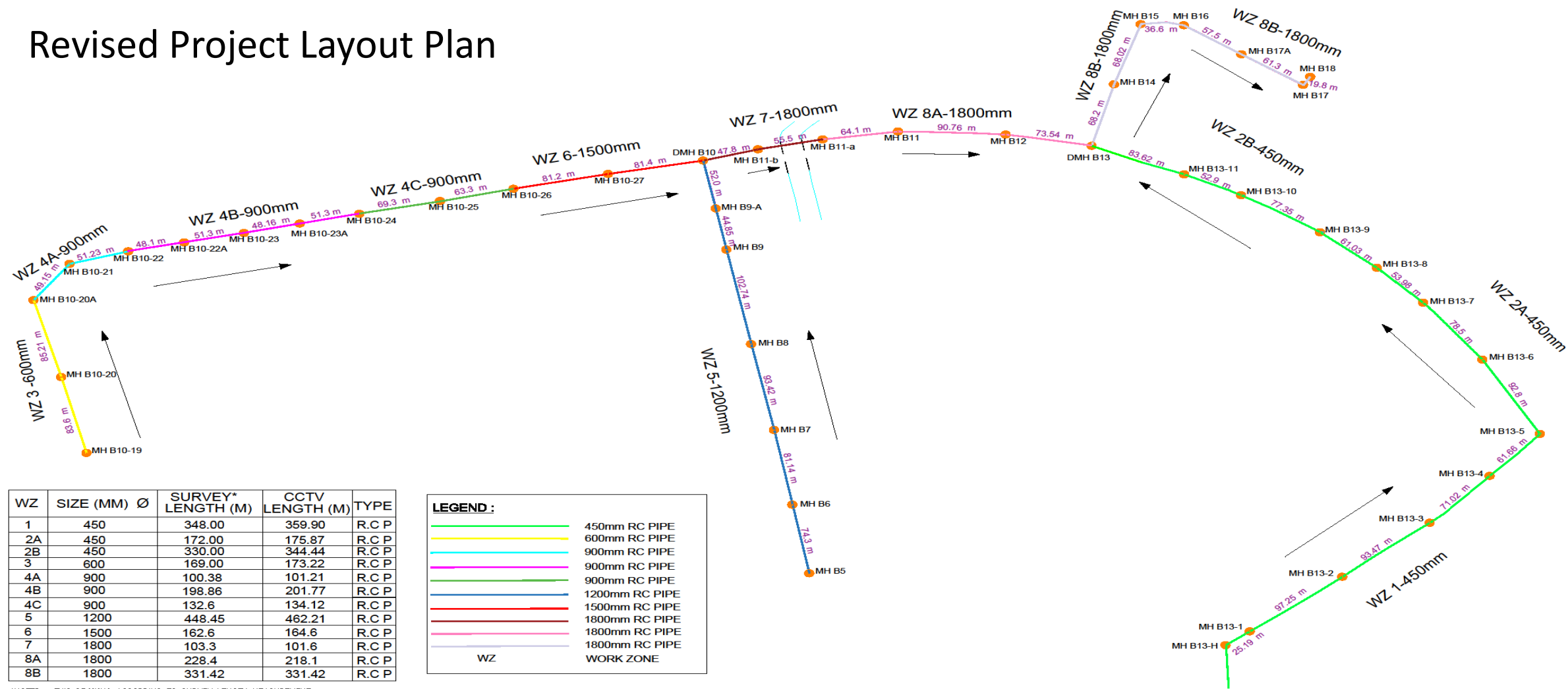
## The Process Flow Chart



# The Value Management Process

- The approach were introduced at the re-engineering stage in the projects' life cycle. ,
- Planned from the pre-trenchless design phase of the projects; and before design is approved by Client.
- A clear implementations of VM into Conventional underground infrastructure could provide an alternate as Trenchless Technology applications.
- VM programs was conducted in various stages from workshop's and presentations with internal and external stakeholders of this project.

# Revised Project Layout Plan



\*NOTED : THIS DRAWING ACCORDING TO SURVEY LENGTH MEASUREMENT

### SECTIONAL LOCATION PLAN OF TRENCHLESS REHABILITATION WORKS PROPOSED FOR EXISTING SEWER NETWORK

APPROVED BY: DR MOHAMMAD SAKRINTI BEN HAMZAH DESIGN BY: MUHAMMAD ASYRAF CHECKED BY: DR MOHD SYAZWAN DRAWN BY: SITI HANIS SCALE: 1:0.7 DRAWING NO.: 0001/2019/001/CPY/PLA/01 DATE: NOV 2019	DATE: _____ DESCRIPTION: _____ DETAIL: _____ LOCATION PLAN: _____ REV. NO. 0 DATE: _____ NOY 2019	PROJECT DETAIL : PROPOSED TRENCHLESS REHABILITATION WORK FOR ALL EXISTING R.C PIPE SEWER NETWORKS	 MKQ LOGO MKKQUEE TECH SONS SDN BHD 100-1, KECIL, KUALA KANGAR, PERAK 34000 TEL: 05-366-10000, 05-366-10001, 05-366-10002 FAX: 05-366-10003 E-MAIL: info@mkq.com.my WWW.MKQ.COM.MY	TRENCHLESS SPECIALIST CONTRACTOR  PERUNDING JPNS SDN BHD 100-1, KECIL, KUALA KANGAR, PERAK 34000 TEL: 05-366-10000, 05-366-10001, 05-366-10002 FAX: 05-366-10003 E-MAIL: info@perundingjpns.com.my WWW.PERUNDINGJPNS.COM.MY	DESIGN BY  SUMUR MUTIARA SDN BHD 100-1, KECIL, KUALA KANGAR, PERAK 34000 TEL: 05-366-10000, 05-366-10001, 05-366-10002 FAX: 05-366-10003 E-MAIL: info@sumurmutiara.com.my WWW.SUMURMUTIARA.COM.MY	CONTRACTOR :  GITEC DR YG TAN, GITEC PERUNDING SDN BHD 100-1, KECIL, KUALA KANGAR, PERAK 34000 TEL: 05-366-10000, 05-366-10001, 05-366-10002 FAX: 05-366-10003 E-MAIL: info@gitec.com.my WWW.GITEC.COM.MY	 PKNS PROBABT TITLE: KERJA-KERJA MEMBAHARU/ULI SISTEM PAM PEMULUTAN/UTAMA BERSEAS 1600MM 1200MM, 1000MM, 800MM, 600MM, 400MM, 300MM, 200MM, 150MM, 100MM, 75MM, 50MM, 40MM, 30MM, 25MM, 20MM, 15MM, 10MM, 7.5MM, 5MM, 4MM, 3MM, 2.5MM, 2MM, 1.5MM, 1MM, 0.75MM, 0.5MM, 0.4MM, 0.3MM, 0.25MM, 0.2MM, 0.15MM, 0.1MM, 0.075MM, 0.05MM, 0.04MM, 0.03MM, 0.025MM, 0.02MM, 0.015MM, 0.01MM, 0.0075MM, 0.005MM, 0.004MM, 0.003MM, 0.0025MM, 0.002MM, 0.0015MM, 0.001MM, 0.00075MM, 0.0005MM, 0.0004MM, 0.0003MM, 0.00025MM, 0.0002MM, 0.00015MM, 0.0001MM, 0.000075MM, 0.00005MM, 0.00004MM, 0.00003MM, 0.000025MM, 0.00002MM, 0.000015MM, 0.00001MM, 0.0000075MM, 0.000005MM, 0.000004MM, 0.000003MM, 0.0000025MM, 0.000002MM, 0.0000015MM, 0.000001MM, 0.00000075MM, 0.0000005MM, 0.0000004MM, 0.0000003MM, 0.00000025MM, 0.0000002MM, 0.00000015MM, 0.0000001MM, 0.000000075MM, 0.00000005MM, 0.00000004MM, 0.00000003MM, 0.000000025MM, 0.00000002MM, 0.000000015MM, 0.00000001MM, 0.0000000075MM, 0.000000005MM, 0.000000004MM, 0.000000003MM, 0.0000000025MM, 0.000000002MM, 0.0000000015MM, 0.000000001MM, 0.00000000075MM, 0.0000000005MM, 0.0000000004MM, 0.0000000003MM, 0.00000000025MM, 0.0000000002MM, 0.00000000015MM, 0.0000000001MM, 0.000000000075MM, 0.00000000005MM, 0.00000000004MM, 0.00000000003MM, 0.000000000025MM, 0.00000000002MM, 0.000000000015MM, 0.00000000001MM, 0.0000000000075MM, 0.000000000005MM, 0.000000000004MM, 0.000000000003MM, 0.0000000000025MM, 0.000000000002MM, 0.0000000000015MM, 0.000000000001MM, 0.00000000000075MM, 0.0000000000005MM, 0.0000000000004MM, 0.0000000000003MM, 0.00000000000025MM, 0.0000000000002MM, 0.00000000000015MM, 0.0000000000001MM, 0.000000000000075MM, 0.00000000000005MM, 0.00000000000004MM, 0.00000000000003MM, 0.000000000000025MM, 0.00000000000002MM, 0.000000000000015MM, 0.00000000000001MM, 0.0000000000000075MM, 0.000000000000005MM, 0.000000000000004MM, 0.000000000000003MM, 0.0000000000000025MM, 0.000000000000002MM, 0.0000000000000015MM, 0.000000000000001MM, 0.00000000000000075MM, 0.0000000000000005MM, 0.0000000000000004MM, 0.0000000000000003MM, 0.00000000000000025MM, 0.0000000000000002MM, 0.00000000000000015MM, 0.0000000000000001MM, 0.000000000000000075MM, 0.00000000000000005MM, 0.00000000000000004MM, 0.00000000000000003MM, 0.000000000000000025MM, 0.00000000000000002MM, 0.000000000000000015MM, 0.00000000000000001MM, 0.0000000000000000075MM, 0.000000000000000005MM, 0.000000000000000004MM, 0.000000000000000003MM, 0.0000000000000000025MM, 0.000000000000000002MM, 0.0000000000000000015MM, 0.000000000000000001MM, 0.00000000000000000075MM, 0.0000000000000000005MM, 0.0000000000000000004MM, 0.0000000000000000003MM, 0.00000000000000000025MM, 0.0000000000000000002MM, 0.00000000000000000015MM, 0.0000000000000000001MM, 0.000000000000000000075MM, 0.00000000000000000005MM, 0.00000000000000000004MM, 0.00000000000000000003MM, 0.000000000000000000025MM, 0.00000000000000000002MM, 0.000000000000000000015MM, 0.00000000000000000001MM, 0.0000000000000000000075MM, 0.000000000000000000005MM, 0.000000000000000000004MM, 0.000000000000000000003MM, 0.0000000000000000000025MM, 0.000000000000000000002MM, 0.0000000000000000000015MM, 0.000000000000000000001MM, 0.00000000000000000000075MM, 0.0000000000000000000005MM, 0.0000000000000000000004MM, 0.0000000000000000000003
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## PROPOSAL - RE-ENGINEERING According to WRc SRM BS-EN 752:2008 Standard

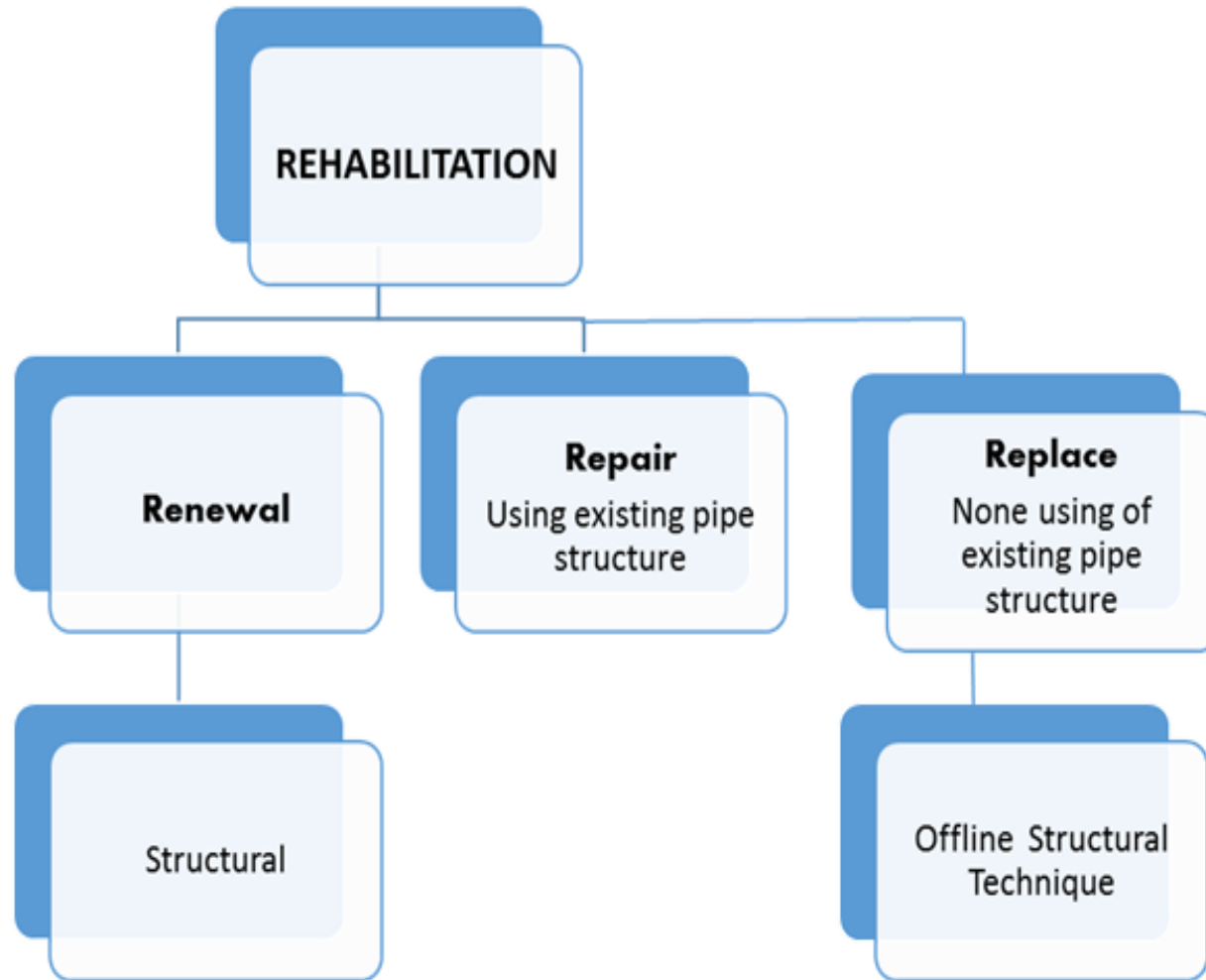
Work Zone	Size	Length Meter	MH	MH	Pipe Sectional Asset Integrity Descriptive
WZ 4a	900	49.15	B10-20A	B10-21	Structural Deficiency Low
WZ 4a	900	51.23	B10-21	B10-22	Structural Deficiency Low
WZ 4 b	900	268.16	B10-22	B10- 25	Hydraulic Deficiency High
WZ 4c	900	63.3	B10- 25	B10- 26	Structural Deficiency Medium
WZ 5	1200	74.3	B5	B 6	Structural Deficiency Low
WZ 5	1200	81.4	B 6	B 7	Structural Deficiency Low
WZ 5	1200	93.2	B 7	B 8	Structural Deficiency Low
WZ 5	1200	102	B 8	B 9	Structural Deficiency Low
WZ 5	1200	44.85	B 9	B 9a	Structural Deficiency Medium
WZ 5	1200	52	B 9a	DMH - B10	Drop Manhole
WZ 6	1500	81.2	B10- 26	B10- 27	Structural Deficiency Low
WZ 6	1500	81.4	B10- 27	DMH - B10	Structural Deficiency Medium



## VALUE -ENGINEERING DESIGN According to WRc SRM BS-EN 752:2008 & ASTM Standard

WORKZONE	PIPE SIZE ND (mm)	LENGTH (m)	PROPOSED REHAB. METHOD
1	450	348	CIPP-SR
2A	450	172	CIPP-SR
2B	450	345	CIPP-LINER
3	600	169	CIPP-SR
4A	900	100	INJECTION GROUTING
4B	900	205	SPRAY IN PLACE PIPE
4C	900	132	INJECTION GROUTING
5	1200	448	INJECTION GROUTING
6	1500	163	INJECTION GROUTING
7	1800	103	INJECTION GROUTING & SIPP
8A	1800	400	CAST IN PLACE PIPE
8B	1800	331	INJECTION GROUTING & SIPP

# Trenchless Rehabilitation of 3R (Repair, Renewal, and Replace)



- Designed in accordance with WRc Sewer Rehabilitation concept.
- Latest technology option that able to optimise the existing 'right of ways' and to provide cost saving with increasing of asset life.

# CLASSIFICATIONS OF T3R

## ***Classifications of “Trenchless 3 R” Rehabilitation***

### **1. Trenchless Repair**

Rectification of local damages or defects in the internal body / joints of a pipe.

### **2. Trenchless Renewal**

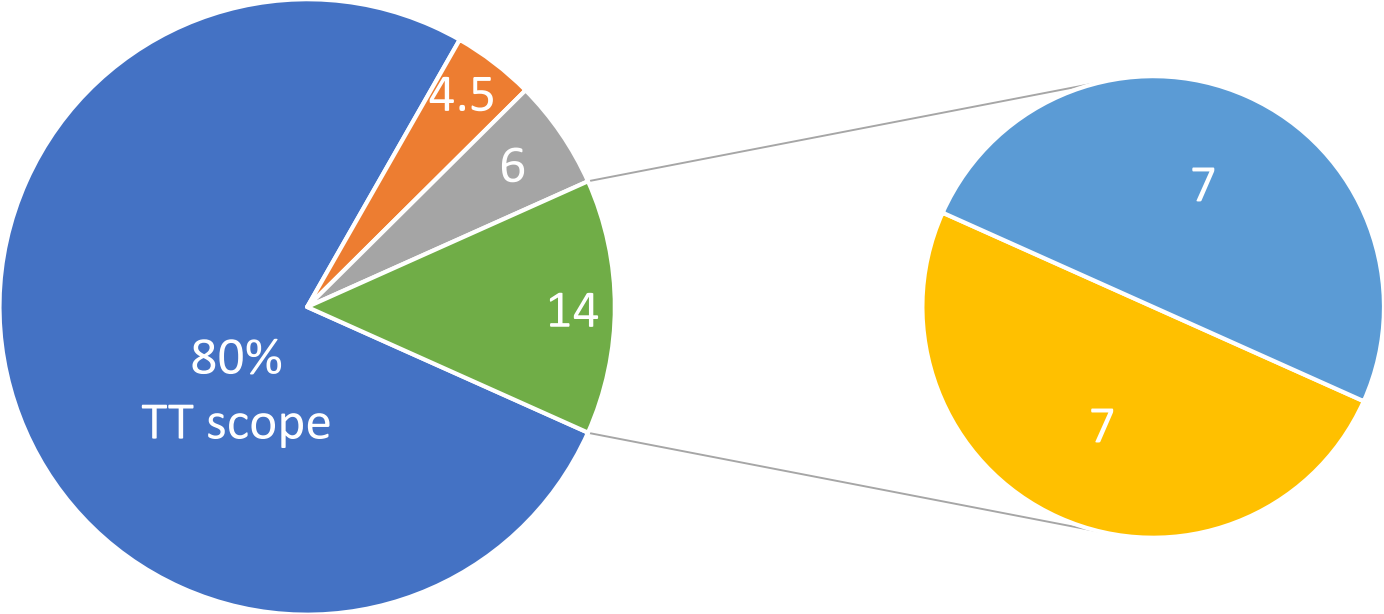
Renewal of existing structural condition by using the existing pipe

### **3. Trenchless Replacement**

Since there is no more major structural integrity failure nor any future requirements for upgrading.

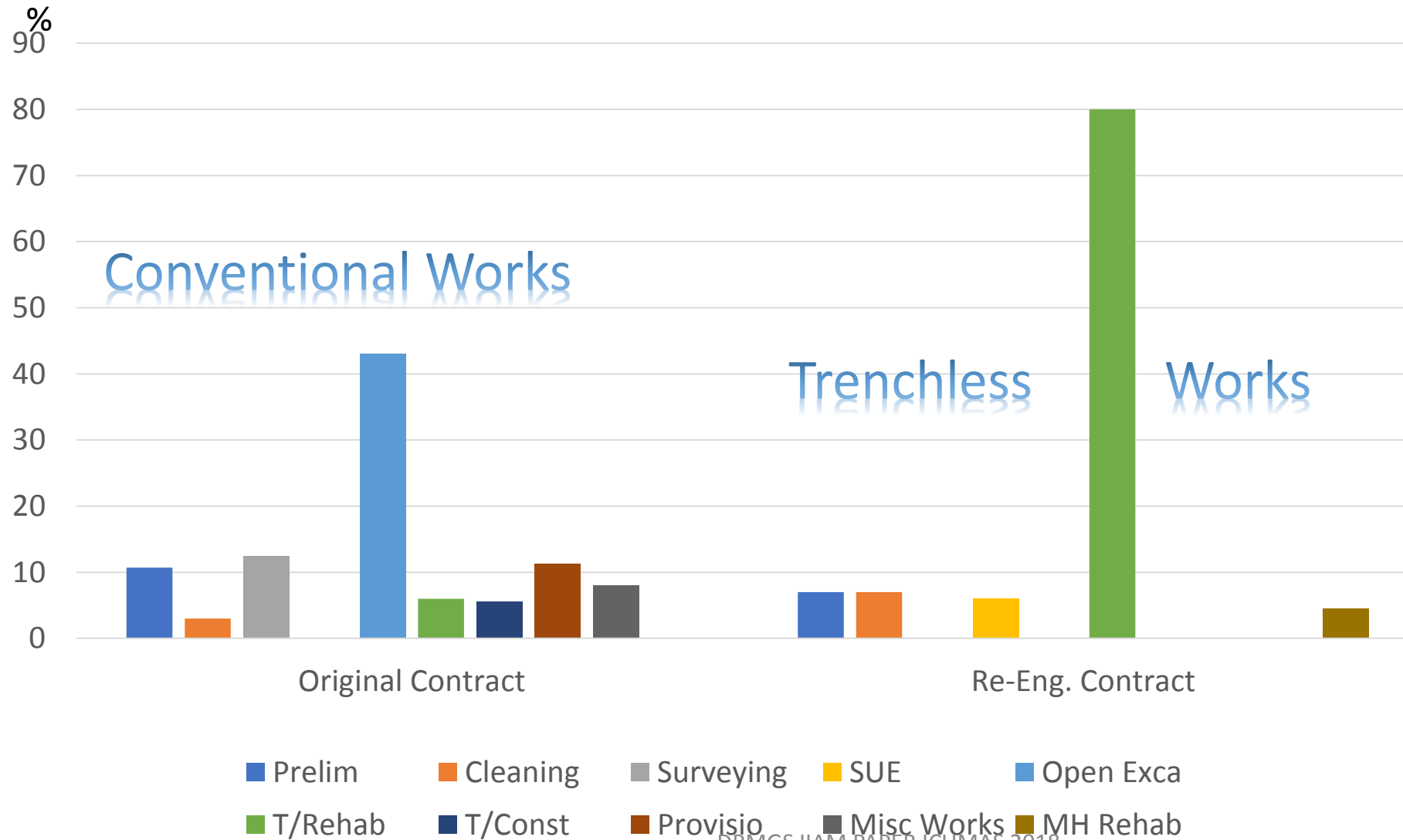
# Revised Re-engineering Work Scope

New Work Scope in %



- Trenchless Rehabilitation
- Manholes Rehabilitation
- SUE Related Works
- Preliminaries
- Cleaning

# Contractual Scope of Work Comparison Traditional vs Trenchless

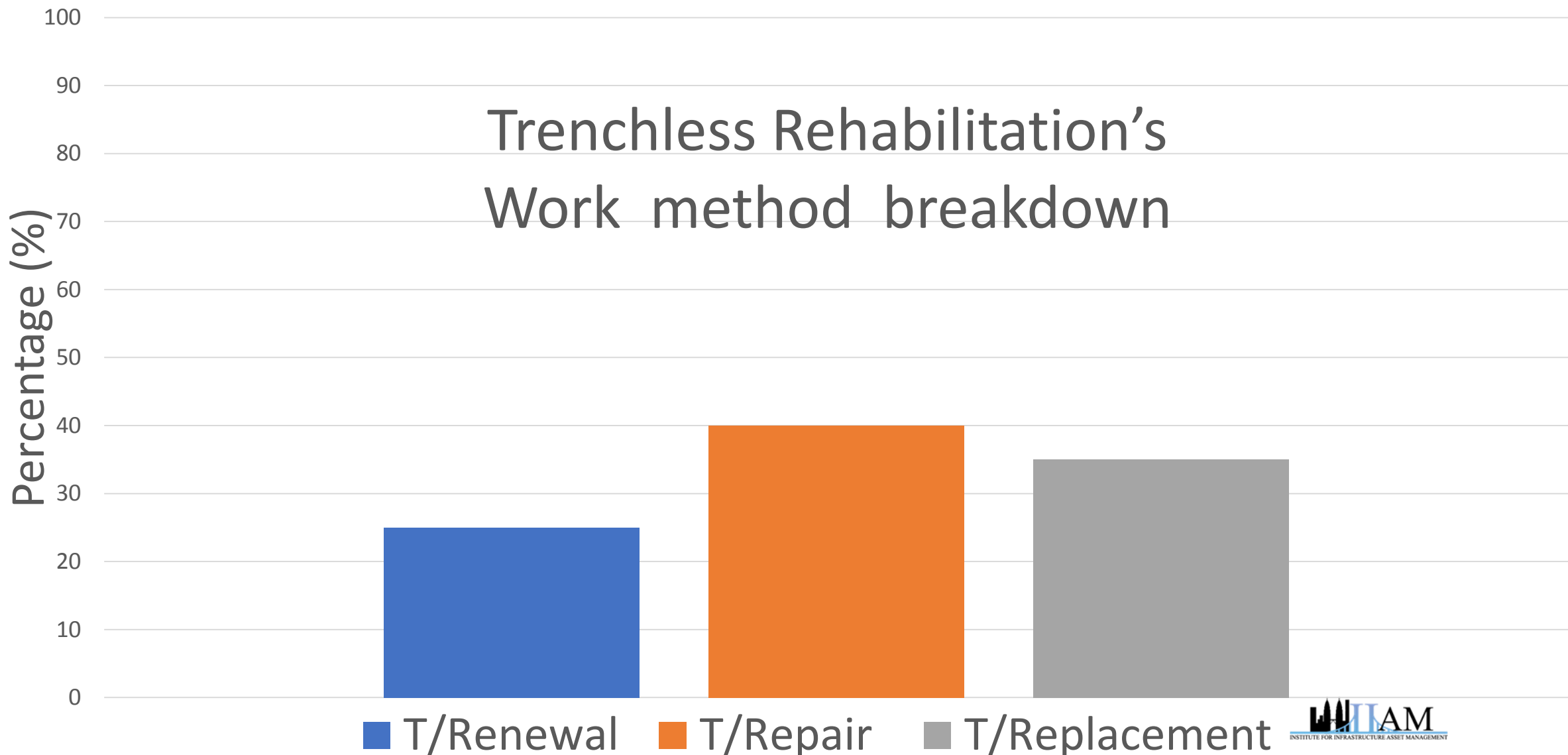


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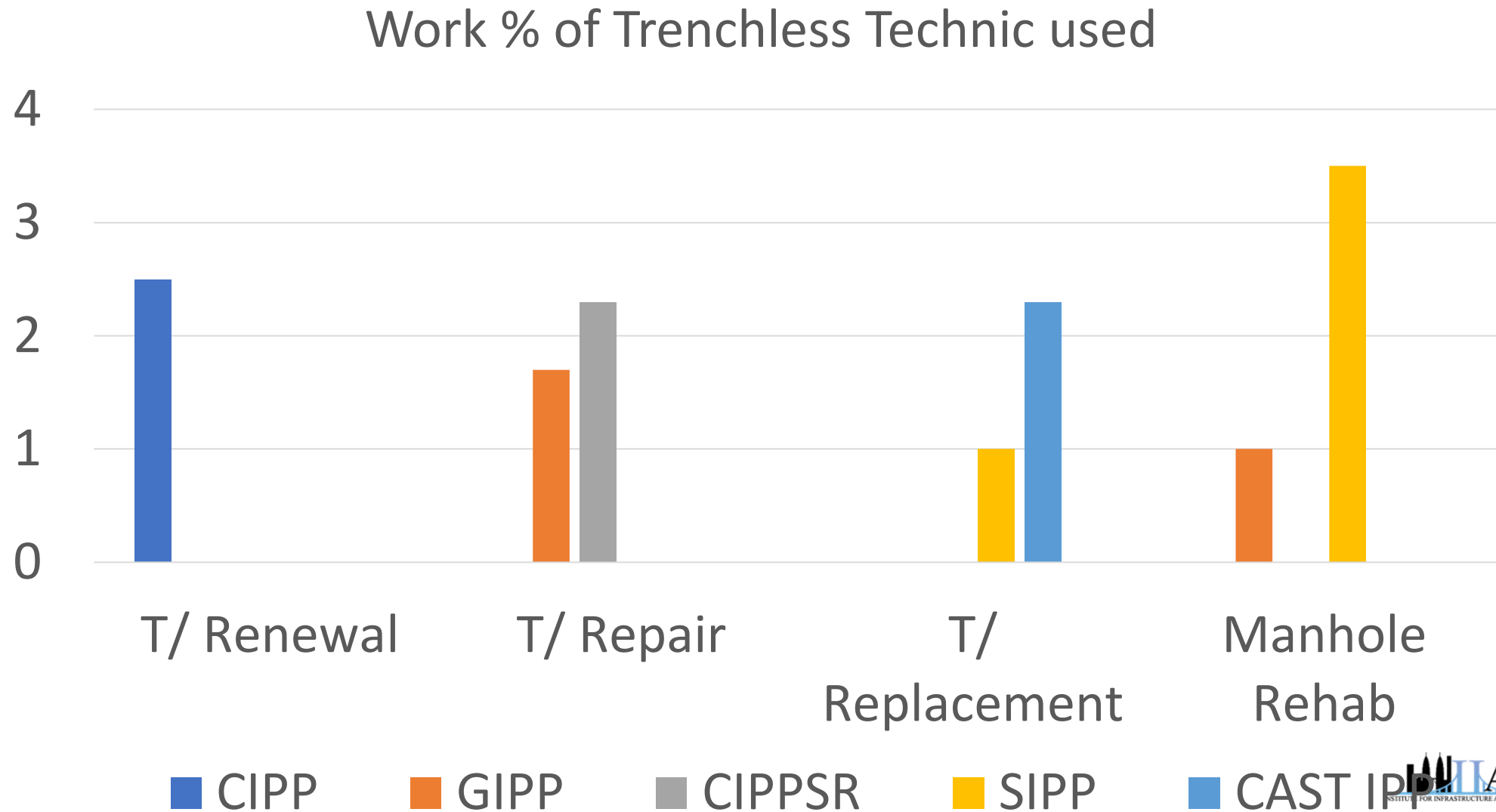
AT PROGRESS  
IT'S EASY BEING GREEN



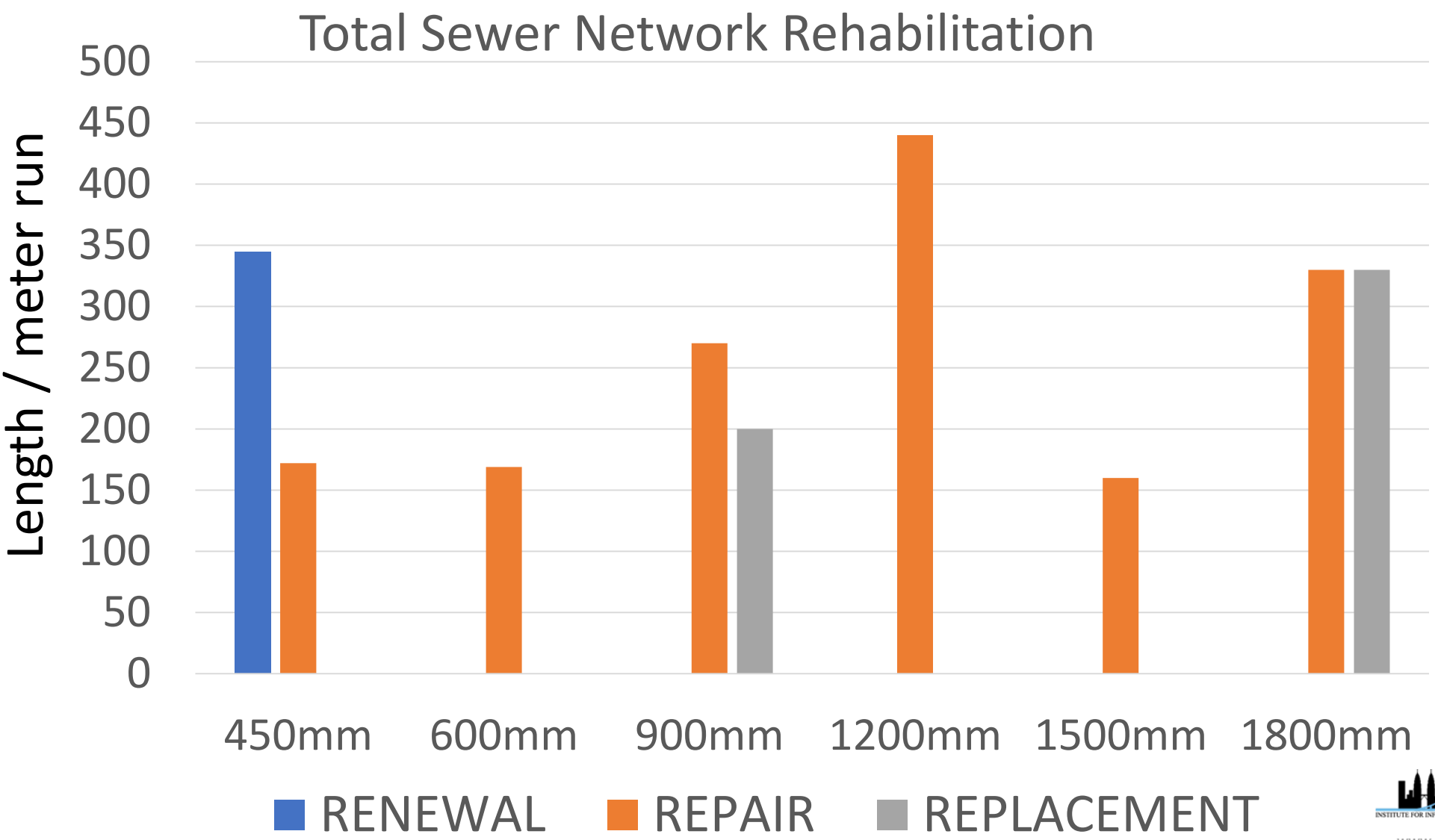
# Proposed Trenchless Rehabilitation's - 3R



# 1. Comparison of Trenchless Technic applied in the project



## 2. Comparison of Sewer Network use Trenchless Technic



## METHODOLOGY OF DESIGN CALCULATION

Existing sewer repair / reconstruction works must be based on the good judgement and practice of WRc BS EN Standard (MSCC 4 -5) by a competent CCTV Inspector.

Sewer pipe CCTV inspections should be used as a fundamental basis to perform INTERNAL CONDITION GRADING – INTERNAL CONDITION RATING, 3D-GYROSCOPIC SURVEY and EXTERNAL DETAILS for Evaluation and Assessment.

# PIPE INTERNAL CONDITION GRADING WRc BS EN Standard

INFRASTRUCTURE ENVIRO-WATER MANAGEMENT SDN BHD			
NO. 59-2, JALAN BS 1/1, PUSAT PERNIAGAAN OLIVE HILL SEK 1,43300 SERI KEMBANGAN,			
SELANGOR, DARUL EHSAN TEL : +6 03-8940 4005 FAX : +6 03-8940 6005			
Project & Engineering Department			


ICG SUMMARISATION FORM				IEWM/F/PED/ 003	
				REV NO: 0	Page 1/7

Client No	IEWM/SM/09/21- 2017	INTERNAL CONDITION GRADING			
Specialist Contractor	MK Quick Technology Sdn.Bhd.	Cert No:			
CCTV Inspector	Daniel			Date Start	28-Sep-17
Location of Survey	Cybervalley PKNS			Date Finish	27-Oct-17
Survey Section / Area	Work Zone 4	Pipe Size	900 mm	Material	RCP


NO	Structural Defect	Manholes			Structural Defect Grade
	Defect Types	From	To	Location	
				m/r	
1	Infiltration, seeping at joint, from 6 to 12 o'clock	MH B10-20A	MH B10-21	4.49	3
2	Infiltration, seeping at joint, from 6 to 12 o'clock	MH B10-20A	MH B10-21	10.82	3
3	Infiltration, dripping at joint, from 12 to 3 o'clock	MH B10-20A	MH B10-21	23.46	3
4	Infiltration, dripping at joint, from 11 to 1 o'clock	MH B10-20A	MH B10-21	26.74	3
5	Surface damage, visible reinforcement, from 12 to	MH B10-20A	MH B10-21	40.33	3



# PIPE INTERNAL CONDITION RATING WRc BS EN Standard

<b>INFRASTRUCTURE ENVIRO-WATER MANAGEMENT SDN BHD</b> NO. 59-2, JALAN BS 1/1, PUSAT PERNIAGAAN OLIVE HILL SEK 1, 43300 SERI KEMBANGAN, SELANGOR, DARUL EHSAN TEL : +6 03-8940 4005 FAX : +6 03-8940 6005 <b>Project &amp; Engineering Department</b>								
<b>ICG SUMMARIZATION FORM</b>						IEWM/F/PED/ 003		
						REV NO: 0	Page 1/6	
<b>Client No</b>		IEWM/SM/09/21- 2017		<b>INTERNAL CONDITION GRADING AND RATING</b>				
<b>Specialist Contractor</b>		MK Quick Technology Sdn.Bhd.			<b>Cert No:</b>			
<b>CCTV Inspector</b>		Daniel			<b>Date Start</b>		29-Sep-17	
<b>Location of Survey</b>		Cybervalley PKNS			<b>Date Finish</b>		1-Nov-17	
<b>Survey Section / Area</b>		Work Zone 5		<b>Pipe Size</b>	1200 mm	<b>Material</b>	RCP	
<b>No</b>	<b>Manhole Pipeline</b>							
1	<b>MH B6 to MH B5 (78.20 m)</b>							
	<b>Occurences *</b>				<b>Ratings *</b>			
	<b>Grades *</b>	<b>Structural</b>	<b>O&amp;M</b>	<b>Overall</b>	<b>Structural</b>	<b>O&amp;M</b>	<b>Overall</b>	
	<b>1</b>	8	0	8	8	0	8	
	<b>2</b>	3	0	3	6	0	6	
	<b>3</b>	1	0	1	3	0	3	
	<b>4</b>	0	0	0	0	0	0	
	<b>5</b>	0	0	0	0	0	0	
<b>Totals</b>		12	0	12	17	0	17	

# Summary Proposed Design

Perunding JPNS Sdn.Bhd

W2146-Design Sheet

Trenchless Engineering Dept.

KERJA-KERJA MEMBAIKPULIH SISTEM PAIP PEMBENTUNGAN UTAMA BERSAIZ 1800MM, 1600MM, 1200MM, 800MM, 600MM DAN 450MM DIAMETER SERTA LAIN-LAIN KERJA BERKAITAN DI FASA 1, SELANGOR CYBER VALLEY, MUKIM DENGKIL, DAERAH SEPANG, SELANGOR DARUL EHSAN BAGI TUJUAN PENYERAHAN KEPADA INDAH WATER KONSORTIUM SDN BHD

KONTRAK NO: PKN5/JKWS/SCV/KON-1/2016

Design Calculation Summary

Client: SUMUR MUTIARA SDN.BHD

Trenchless Specialist: INFRASTRUCTURE ENVIRO WATER MANAGEMENT SDN.BHD

Proposed Work Zone 1	Pipe Size :	450mm	CIPPOR	Polyester Glass Fibre Matt
Work Zone 2a		450mm	CIPPOR	Polyester Glass Fibre Matt
Work Zone 2b		450mm	CIPP	GFRP
Work Zone 3		600mm	CIPPOR	Polyester Glass Fibre Matt

Date: 11/12/2017

## ASTM/WRc Calc

Φ	WZ	Depth (m)	Flex mod short term	Flex mod long term	thickness ASTM calc	Liner	Liner thickness t	Dia -2*t	Size after relining	Area lost in %	Area Pre Rehab	Area Post Rehab
450	1	3.5 - 4.0	8400	4500	3.5	T1	4	442	441.5	0.3%	0.159	0.090
450	2a	3.7 - 4.8	8400	4500	3.5	T1	4	440	439.5	4.9%	0.159	0.152
450	2b	4.8 - 4.8	250,000	4500	4.5	T2	5	440	439.5	4.9%	0.159	0.152
600	3	3.2- 4.0	8,400	3500	5.3	T2	6	588	587.3	4.4%	0.283	0.271

## Calc including soil, and traffic load

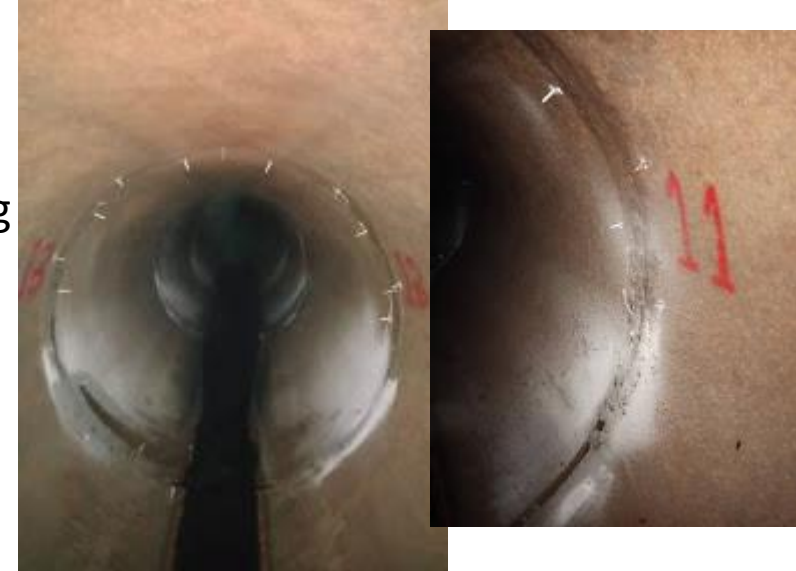
Φ	WZ	Depth	Flex mod short term	Flex mod long term	thickness EN calc	Liner	Liner thickness t	Dia -2*t	Size after relining	Area lost in %	Area Pre Rehab	Area Post Rehab
450	1	3.5 - 4.0	11000	4500	3.7	T1	4	442	441.5	3.9%	0.159	0.153
450	2a	3.7 - 4.8	12000	4500	4	T1x2	7	436	435.5	6.8%	0.159	0.149
450	2b	4.8 - 4.8	250000	8700	5	T2	5	440	439.5	4.9%	0.159	0.152
600	3	3.2- 4.0	12000	4500	6	T1x2	8	584	583.3	5.8%	0.283	0.267

# Trenchless Rehabilitation Methods Selected

UV CIPSR  
450mm / 600mm



GiPP  
Injection Grouting  
900/1200/1500  
1800mm



GiPP  
Roots in habitor 1200mm



CIPP  
UV Curing  
450mm

Geo Cast in Place Pipe  
900 / 1800mm



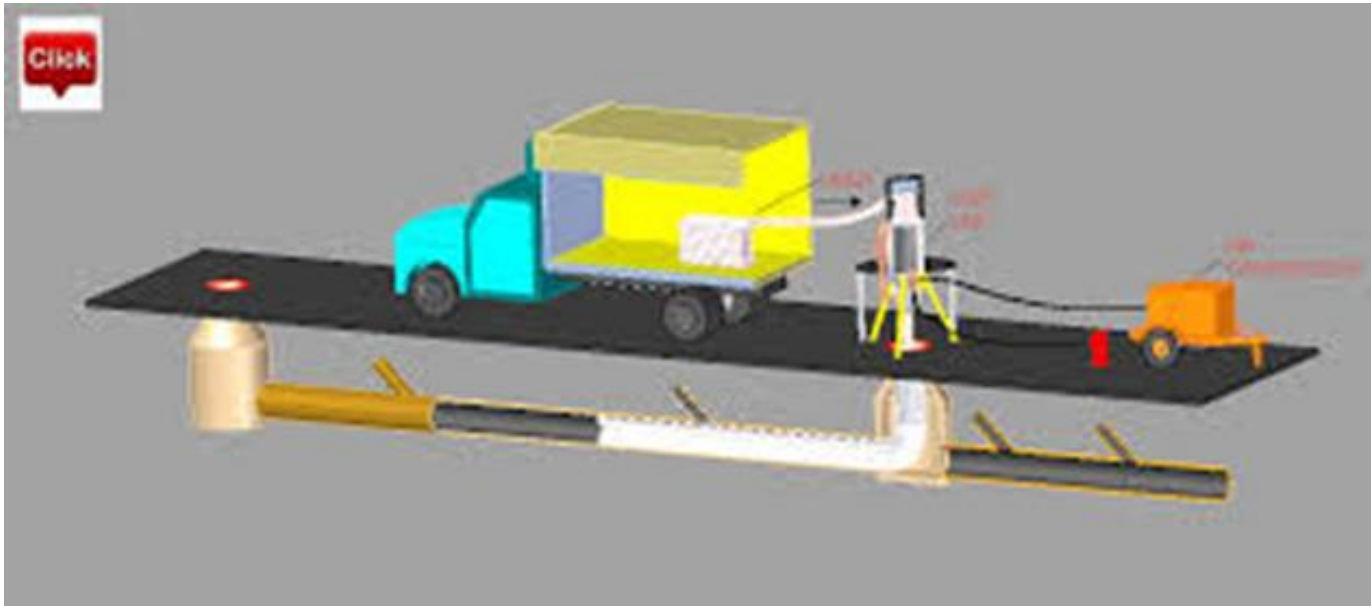
MANHOLE REHAB  
Cementitious  
Grouting



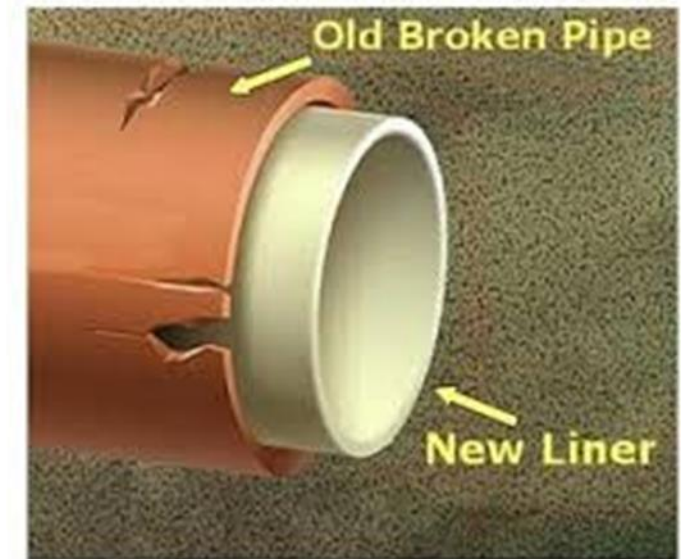
UV CIPP  
rehabilitation



# CIPP



Typical Process at Site UV CIPP



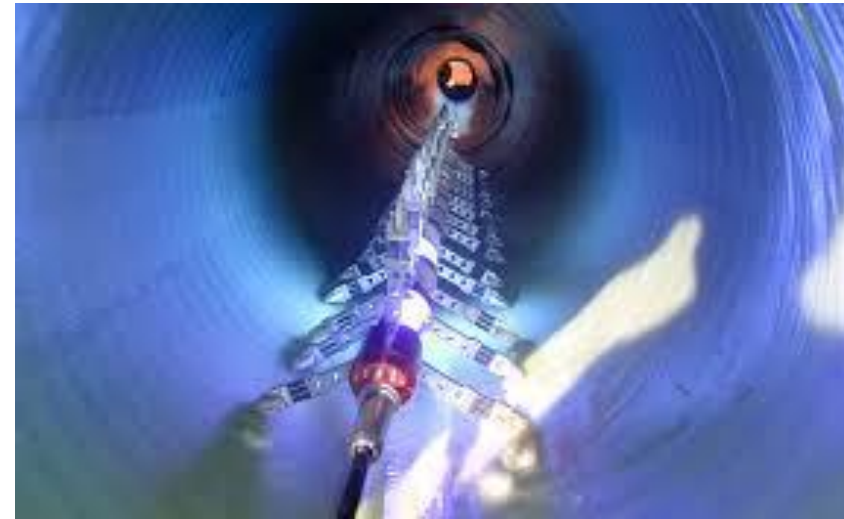
Typical Sewer Defects



Impregnated  
GFRP liner  
Step 1



UV light Curing  
inside pipe  
Step 3



Liner insertion into pipe  
Step 2



UV light Curing inside pipe  
Step 4 ( 3-6 hours, MH to MH)



Step 5 - Finished curing inside pipe



# CIPPSR INSTALLATION METHOD

Preparation of the CRF fiberglass mat.

Wrap stretch film with overlapping edges around the packer.

Pour resin and hardener into the container used for mixing.

Pour a partial amount of the epros Silicate Resin system onto the fiberglass mat.

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Wrap the impregnated fiberglass mat around the packer.

Fold the fiberglass mat again & apply Silicate Resin onto the top of fiberglass mat.

Fold over one third of CRF fiberglass & apply the Silicat Resin onto the other side of fiberglass mat.

Spread the epros Silicate Resin system uniformly with the hand spatula.

Fix the fiberglass mat with a binder wire.

Introduce & move the packer down to the point of repair.

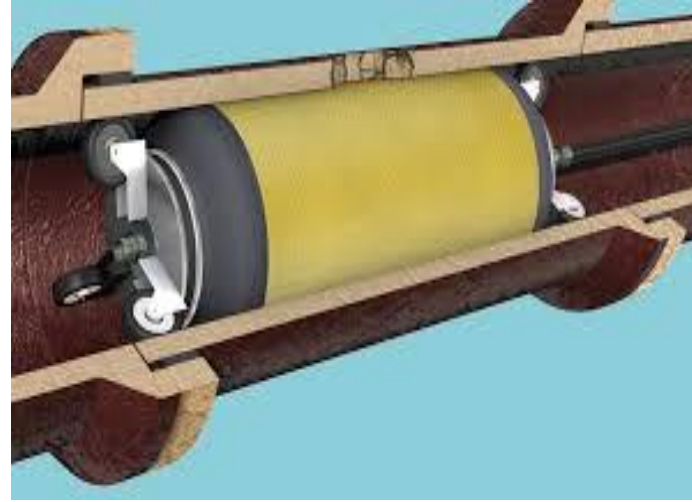
Inflate the packer at the permissible pressure.

After complete cure, deflate the packer and remove it from the line.

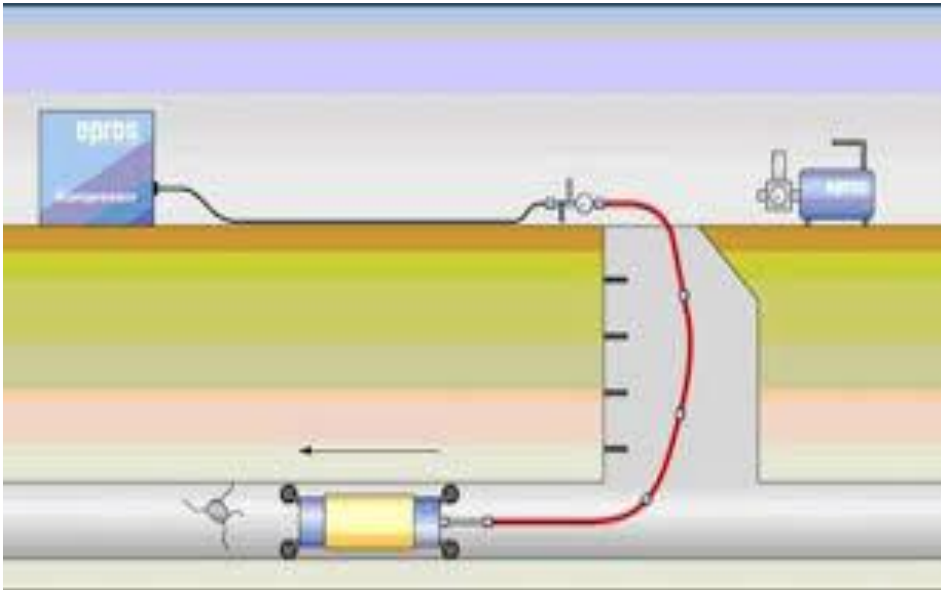
# CIPPSR



Step 1



Step 3



Step 2



Step 4



Step 5, Finished  
Cured Patch

# CURED IN PLACE PIPE SPOT REPAIR (CIPPSR)

## **CiPPSR Patch Liner Repair System**

The **Epros / Saertex Patch Liner system** is a repair method for defective pipe sections in sewage lines. It is effective “no-dig” or trenchless technology alternative for sewer line repair. It serves from short to medium-term structural renovation of sewers.

The **Epros / Saertex patch liner repair system** is used in sewers under disrupted service conditions.

Warranty Period = 15 years

Design Life = 15 years

# MATERIAL & EQUIPMENT



CRF(+) fiber glass mat



Packer



Translucent wrapping layer



Patch Resin Component A  
(Hardener)



Patch Resin Component B  
(Resin)

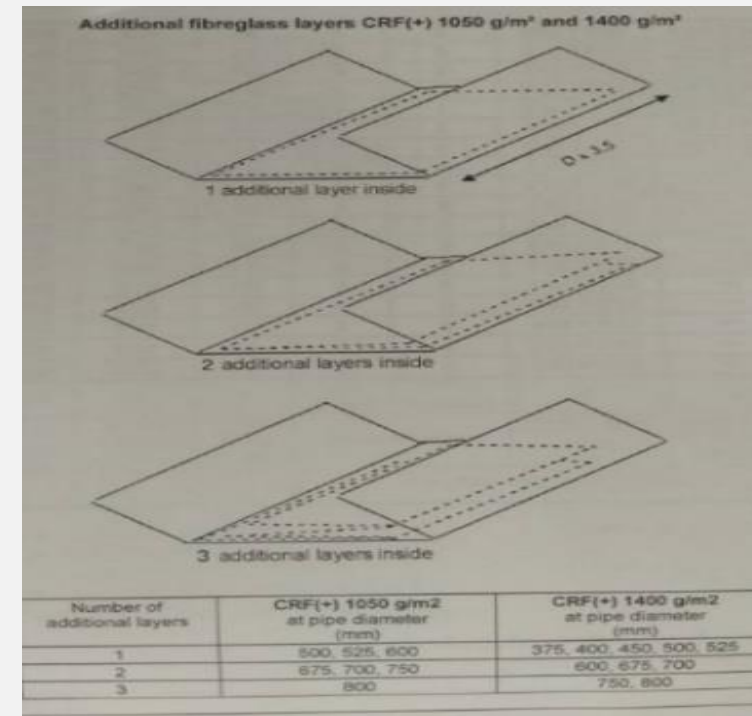
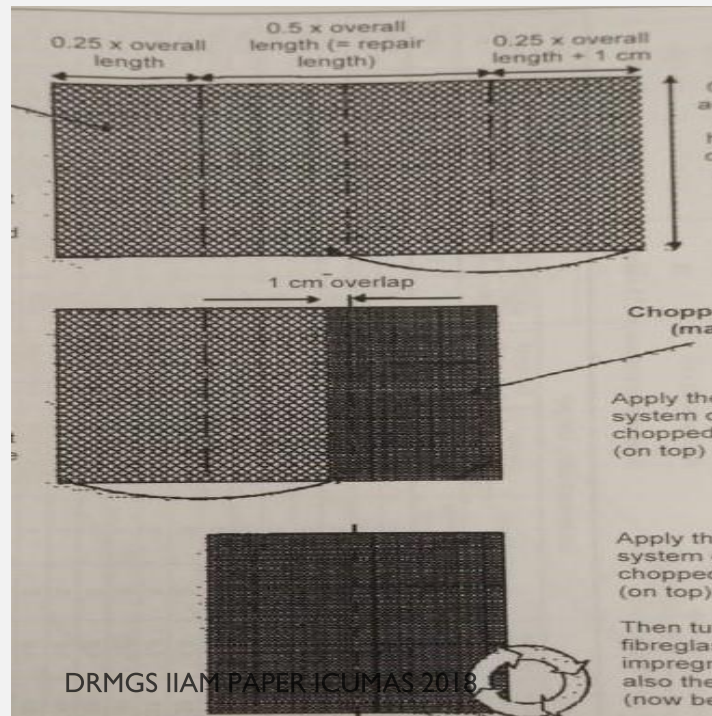


Air Compressor



# CRF FIBERGLASS MAT

Type	CRF Fibre glass mat 1050 g/m <sup>2</sup>	CRF Fibre glass mat 1400 g/m <sup>2</sup>
Mass per unit area	1050 g/m <sup>2</sup> + 10%	1400 g/m <sup>2</sup> + 10%
Min Thickness	1.6 mm ± 15%	1.9 mm ± 10%
Width	400 mm to 2500 mm	400 mm to 2500 mm
Standard	ISO 3374,ISO 5025	ISO 3374, ISO 5025



# CIPPSR PROGRESS AT WORK



Wrap stretch film



Pour & Spread the Silicate Resin uniformly with the hand spatula



Wrap the impregnated fiberglass mat around the packer



Move the packer down to the point of repair



Inflate the packer at the permissible pressure



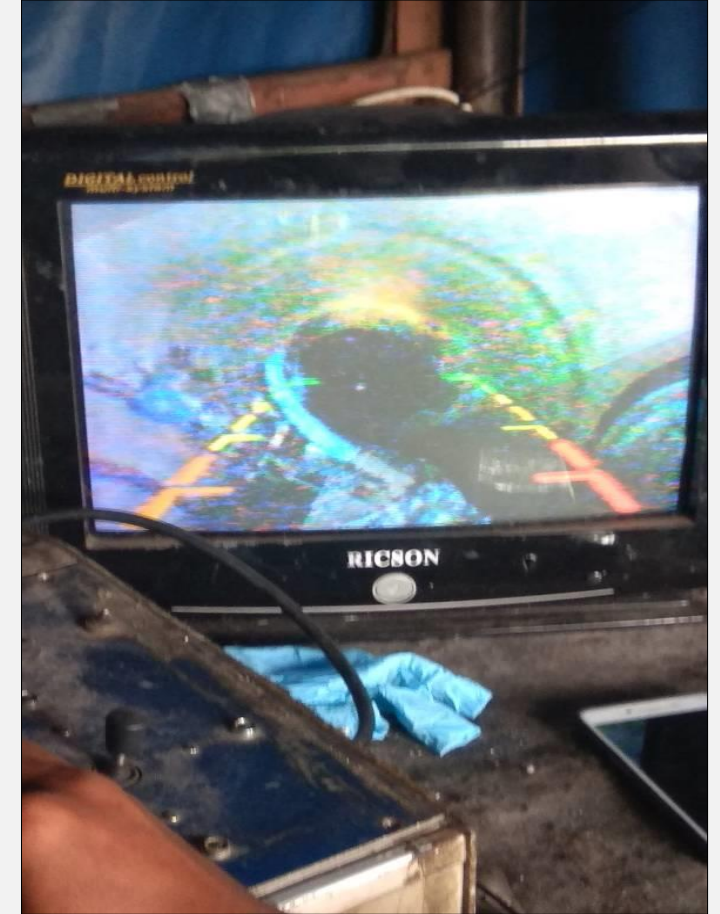
Post CCTV inspection



## ADDITIONAL WORKS



Robotic Cutter Crawler Machine



CCTV Equipment



## LIST OF DEFECTIVE PATCHING

Removal of existing defective old patches. List as per below:

<b>No</b>	<b>From MH</b>	<b>To MH</b>	<b>Meter</b>
<b>1</b>	<b>MHBI3-2 to MHBI3-3</b>		<b>47.15</b>
<b>2</b>			<b>50.4</b>
<b>3</b>			<b>57.36</b>
<b>4</b>			<b>84.48</b>
<b>5</b>	<b>MHBI3-3 to MHBI3-4</b>		<b>13.75</b>
<b>6</b>			<b>17.00</b>
<b>7</b>			<b>39.00</b>
<b>8</b>			<b>56.40</b>
<b>9</b>	<b>MHBI3-6 to MHBI3-7</b>		<b>51.34</b>
<b>10</b>	<b>MHBI3-7 to MHBI3-8</b>		<b>18.27</b>

# INSPECTION & SAMPLING DEFECTIVE OLD PATCHES

Removed defective patches. Sampling and tagging.



MHBI3-2 TO MHBI3-3,  
47.15 m



MHBI3-2 TO MHBI3-3,  
50.4 m



MHBI3-2 TO MHBI3-3,  
57.36 m



DRMGS IIAM PAPER ICUMAS 2018  
MHBI3-2 TO MHBI3-3,  
84.48 m



MHBI3-3 TO MHBI3-4,  
13.75 m

# INSPECTION & SAMPLING DEFECTIVE OLD PATCHES



MHB13-3 TO MHB13-4,  
17.00 m



MHB13-3 TO MHB13-4,  
39.00 m



MHB13-3 TO MHB13-4,  
56.40 m



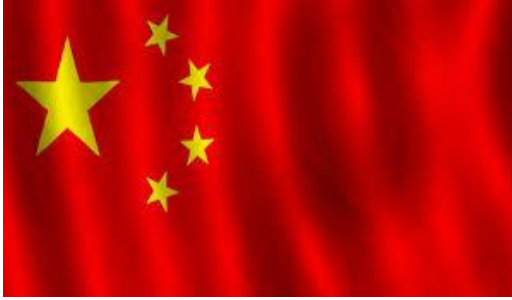
DRMGS IIAM PAPER ICN 145 013  
MHB13-6 TO MHB13-7,  
51.34 m



MHB13-7 TO MHB13-8,  
18.27 m



# Procurements of Technology & Technical Partners



CHINA



INDIA



NETHERLAND



GERMANY



CZECH REPUBLIC



SWITZERLAND



USA

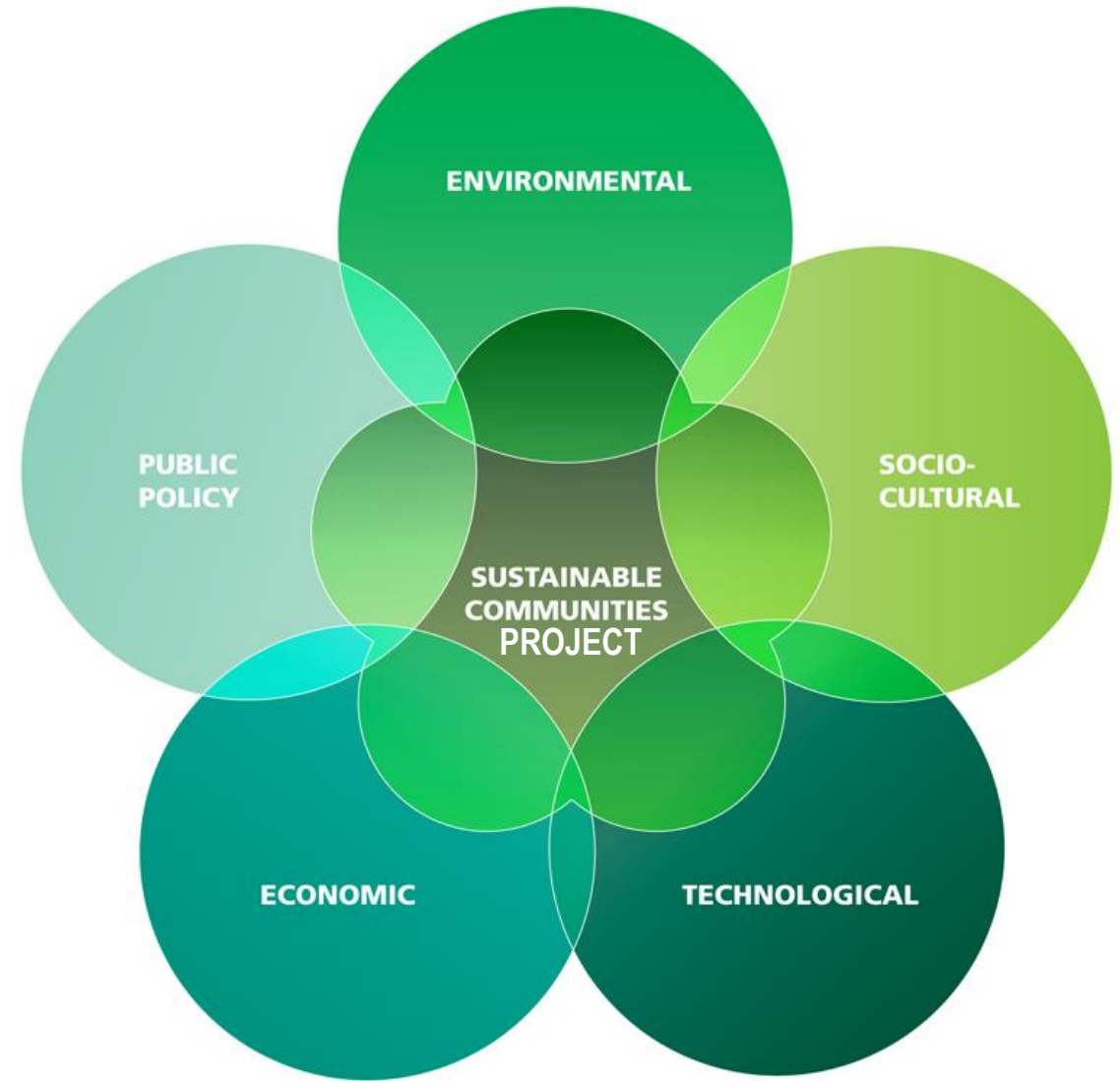


BELGIUM

DRMGS IIAM PAPER ICUMAS 2018

# Sustainability's -

- In furtherance of our vision of enhancing quality of life, the Group is committed towards achieving sustainability that will benefit our stakeholders, the environment, our people and the communities in which we serve.
- Implementing the 5 domains of Sustainability into Project.
  - ✓ Environmental
  - ✓ Public policy
  - ✓ Social cultural
  - ✓ Economic
  - ✓ Technological

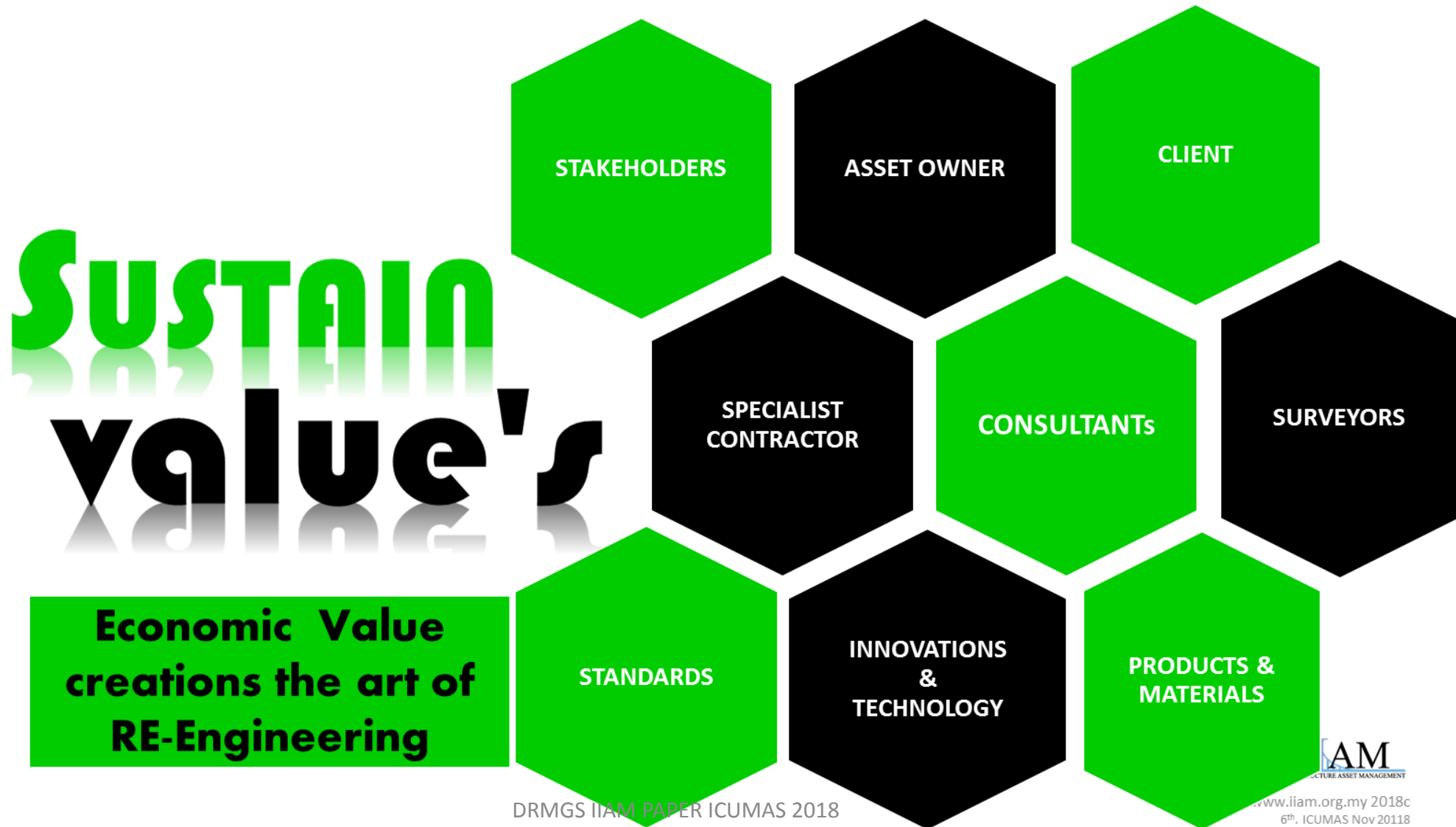


# Sustainability's - Social Objectives :-

- Creating Jobs for fresh engineering graduates
- Humanising existing skill work force
- Increasing Constructions Quality
- Harmonising International Construction Standards
- Providing better Eco-values



# Sustainability's – Economic Objectives





# Sustainability's -

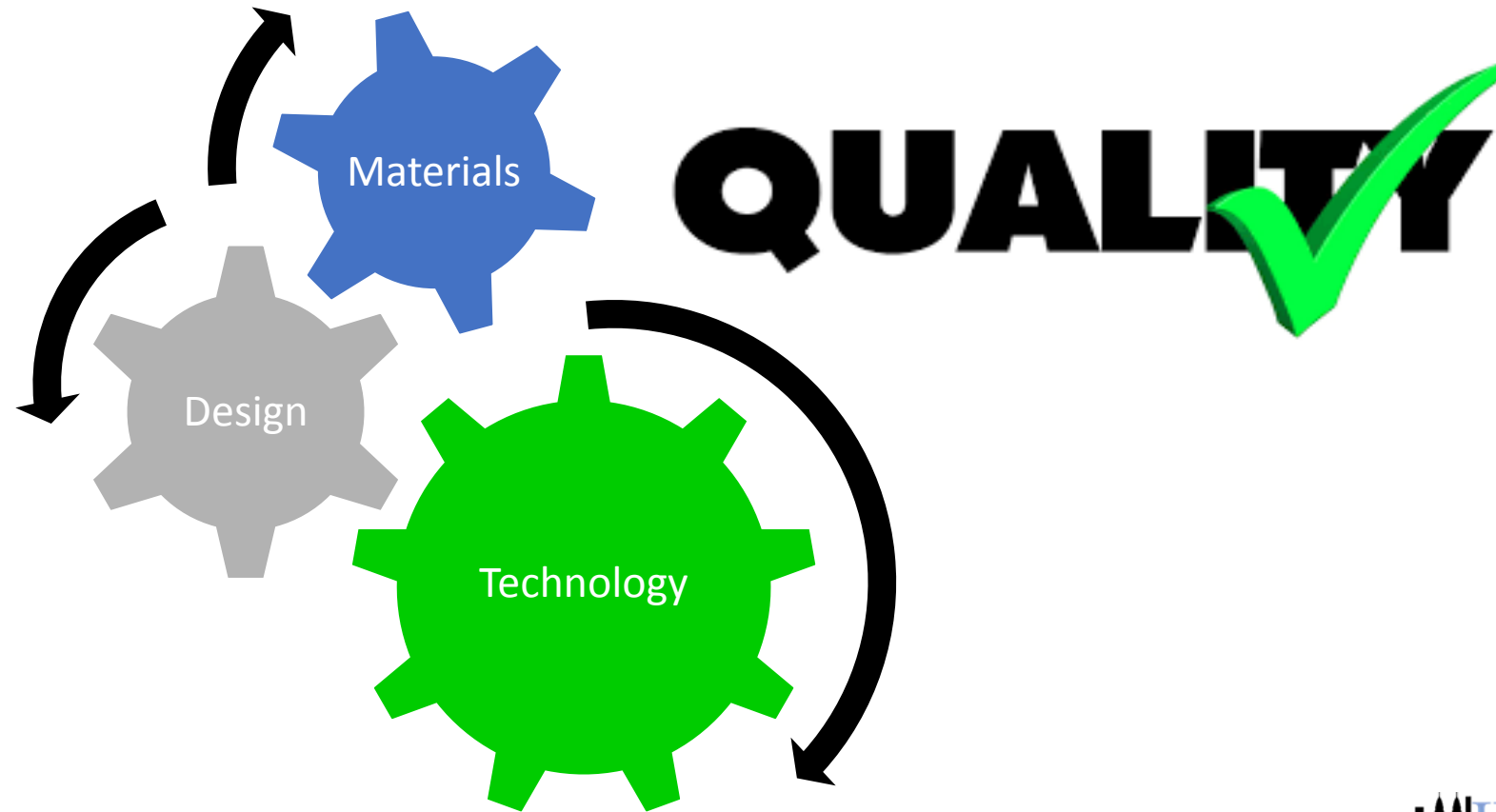
- Environmental Objectives



The 1<sup>st</sup> Trenchless Rehabilitation Project site in Malaysia to use Green Cement and Geo-polymer and polymer base chemicals



# Embarking New Industry Standard's in Malaysia



# Embarking New Industry Standard's in Malaysia

## ❑ Design Selections

To define design , it is a vital role to accumulate information's and data accuracy with advance tools, e.g. ***Gyroscopic , CCTV c/w*** inclinometer system.

## ❑ Technology selections

To define ***technology selection's*** is vital for all Underground Re-engineering works to acquire 100% information and modelling prior to Contracting process.

## ❑ Material Selections

To define with ***design lifecycles, product specifications & standard and must be able to enforce value creations.***

# The Project Enables to set new requirements

<b>Trenchless Installation Techniques</b>	<b>T/Methods</b>	<b>Materials /Products</b>	<b>Lifespan</b>	<b>Extended Lifespan</b>
Cured in Place Pipe ( CIPP)	Renewal	GRP	50 years	70 years
Cured in Place Pipe Spot Repair ( CIPPSR)	Repair	GRP	None	15 years
Grout in Place Pipe ( GIPP)	Repair	Polyurethane & Epoxy	None	15 years
Spray in Place Pipe ( SIPP) Cast in Place Pipe	Replacement	Geo polymer Geo cement	None	30 years

# PROPOSED MANHOLES REHABILITATION

- **TITLE :** CADANGAN MEMBAIKIPULIH LURANG PEMBENTUNGAN SEDIA ADA DI FASA 1, SELANGOR CYBER VALLEY, MUKIM DENGKIL, DAERAH SELANGOR DARUL EHSAN.  
SEPANG,

## REHABILITATION OF EXISTING MANHOLES

Manhole rehabilitation is defined as the process of repairing, upgrading or replacing a manhole system. Manholes are the most important part of a sewer network as they are the access points for any kind of repair work to be carried out in the sewer network. Manholes need to be maintained and kept in good condition to carry out quick repairs, and to prevent injury to workers who use these manholes for going underground. Regular inspection and repair of these component parts will ensure a longer life of the manhole and lessen costs of replacement in case of failure.

## PROPOSE MANHOLE REHABILITATION SUMMARY

- Based on the manhole inspection jointly conducted by Sumur Mutiara and Perunding JPNS for the sewer rehabilitation works at Fasa 1, Selangor Cybervalley, we have identified a total number of **42 manholes** throughout the sewer network. As per our inspection, we have verified that **27 manholes** require rehabilitation. Furthermore, there are several manholes not according to specifications and requirements of Suruhanjaya Perkhidmatan Air Negara (SPAN) Malaysian Sewerage Industry Guidelines. For further information, please refer Appendix A and Appendix B.

No	Description	Quantity
1	Inspection of manholes	42
2	Total defective manholes	27

# CONCLUSIONS OF THE INSPECTIONS

Defects classified to WRc 2005 BS-EN Standard as follows:-

No	Defect	No	Defect
1	Manhole position is above Ground Level	9	Leaking at the channel of pipe
2	Circumference Crack at the benching	10	Crack occur below RC slab
3	Visible reinforcement below RC slab	11	The internal dimension does not meet the standard by SPAN MSIG, volume 3
4	Circumference crack at the wall of manhole	12	The gap between the barrel of manhole
5	Manhole position is above ground level	13	Wet manhole condition due to seepage
6	Leaking at the benching	14	The damage concrete around the manhole cover
7	Concrete spalling at the frame of manhole	15	Intrusion of pipe 101.6 mm (UPVC).
8	Broken occurs at the wall of manhole	16	Intrusion of pipe 150 mm (UPVC) from the drainage

## RECOMMENDATION FOR REHABILITATION OF EXISTING MANHOLES

- Based on the findings by Sumur Mutiara and Perunding JPNS at Fasa I, Selangor Cybervalley, the proposed rehabilitation works requires to be carried prior to handing –over as is listed below:

No	Description	Rehabilitation works	Quantity
1	Sealing of leaking existing manholes	Sealing of leaking manholes with approved urethane base polymer gel or equivalent all in accordance with specification.	13
2	Rehabilitation works to manhole (walls, slabs and benching)	The works shall include grouting, coating, plastering, replacing of damaged or missing item such as bricks of manholes.	22
3	Application of epoxy resin mortar (HAC resin mortar)	Allow for applying 5mm thick HAC resin mortar or equivalent for against hydrogen sulphide corrosion to manhole walls, slabs and benching as per specification. Please refer Appendix A for further information.	42
4	Upgrading of existing manhole barrel  DRMGS IIAM PAPER ICUMAS 2018	Allow for provision upgrading of existing manhole barrel of 1200mm internal dimension to the following sizes in accordance to SPAN MSIG Vol 3 Standard. Please refer Appendix B for further information.	14

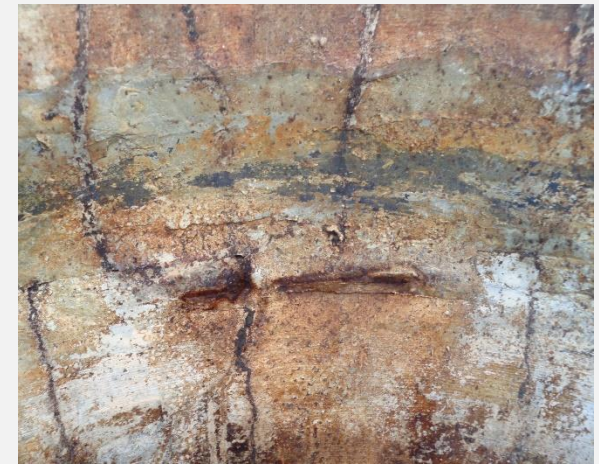


# LIST OF PROPOSE MANHOLES REHABILITATION

Pipe Size	Total defective manholes	Remarks
450 mm	6	MH B13 – 3, MH B13 – 4, MH B13 – 8, MH B13 – 9, MH B13 – 10, MH B13 - 11
600 mm	1	MH B10 – 19
900 mm	2	MH B10 – 23, MH B10 – 24
1200 mm	4	MH B5, MH B8, MH B9, MH B 9A
1500 mm	3	MH B10 – 26, MH B10 – 27, DMH B10
1800 mm	11	MH B11-b, MH B11-a, MH B11, MH B12, DMH B13, MH B14, MH B15, MH B16, MH B17 A, MH B17, MH B18
<b>TOTAL</b>	<b>27</b>	

# DEFECTIVES MANHOLES

- Leaking & crack of manholes



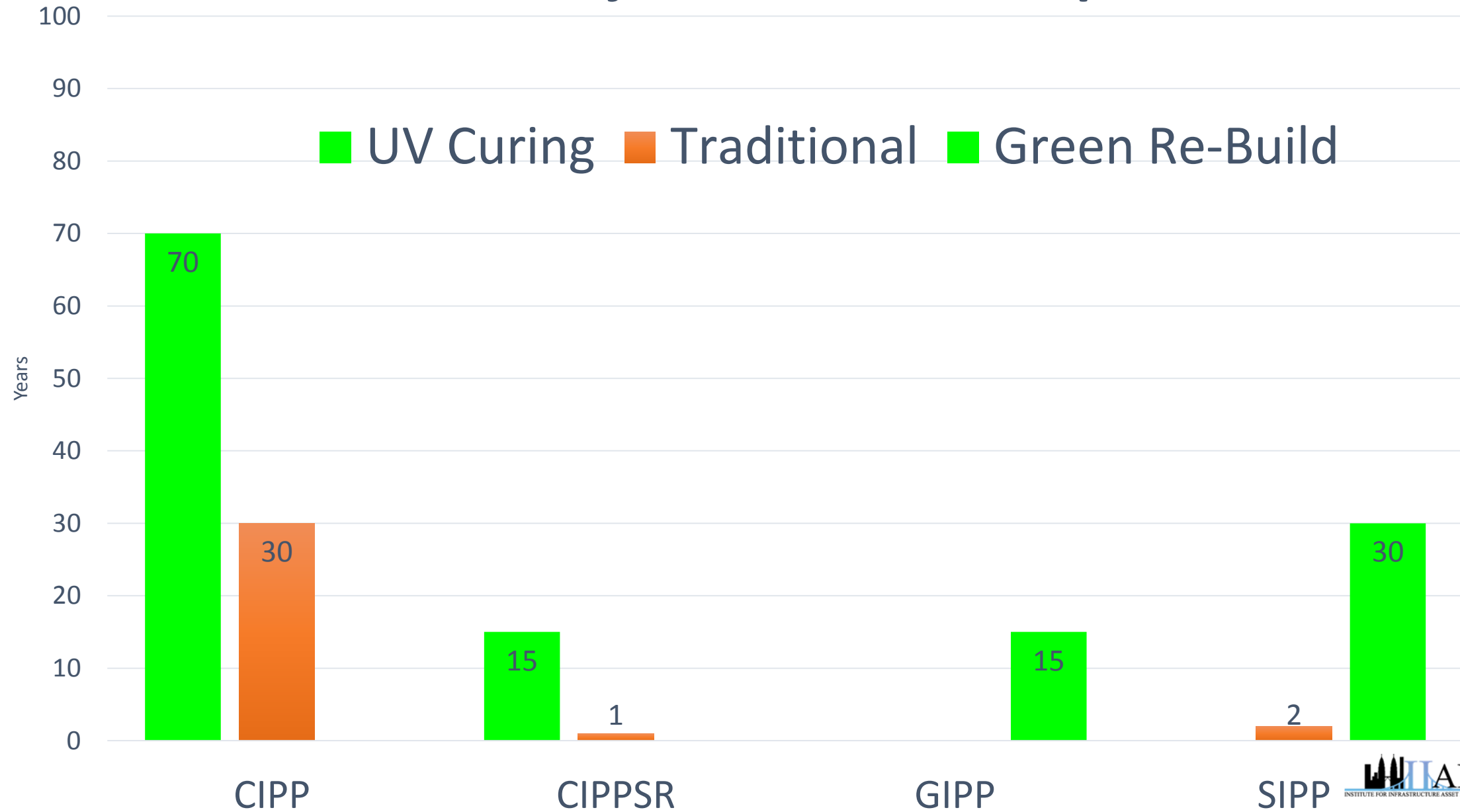


# PICTURES OF DEFECTS

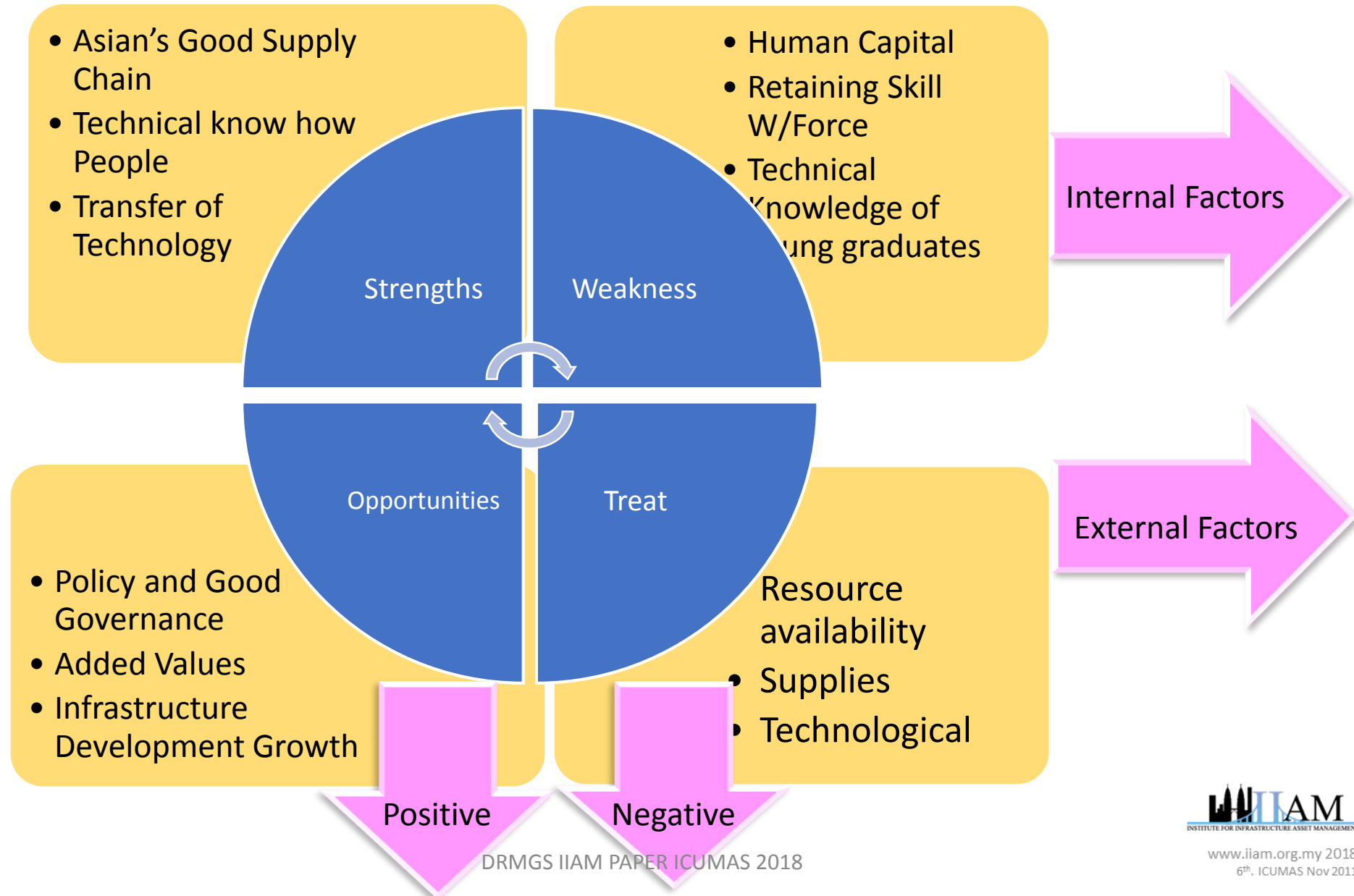
- Visible reinforcement below RC slab & Minimum internal dimension



# Projected Asset Life span



# MANAGING RISK – The SWOT



# Project Conclusions

- ❑ The Risk were managed well through various Technical Talks among the stakeholders
- ❑ The work completion scheduled in Feb 2019 with 78% completion as at Nov 2018.
- ❑ The Project Team is currently embarking to incorporate the BIM Technology into this project as added values.
- ❑ The project is set to become a Role Model of Trenchless Rehabilitation Technology in Malaysia.
- ❑ The Project has incorporated “ WORKMANSHIP WARRANTIES” up to 15years.
- ❑ The is also introducing the 1<sup>st</sup> UV CIPPSR in partnership with China ‘(Wuhan Easy-sight Technology Co.,Ltd)



谢谢  
Thank You



**Courtesy of :-**



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SUMUR MUTIARA SB IEVVM SB , PERUNDING JPNS SB