

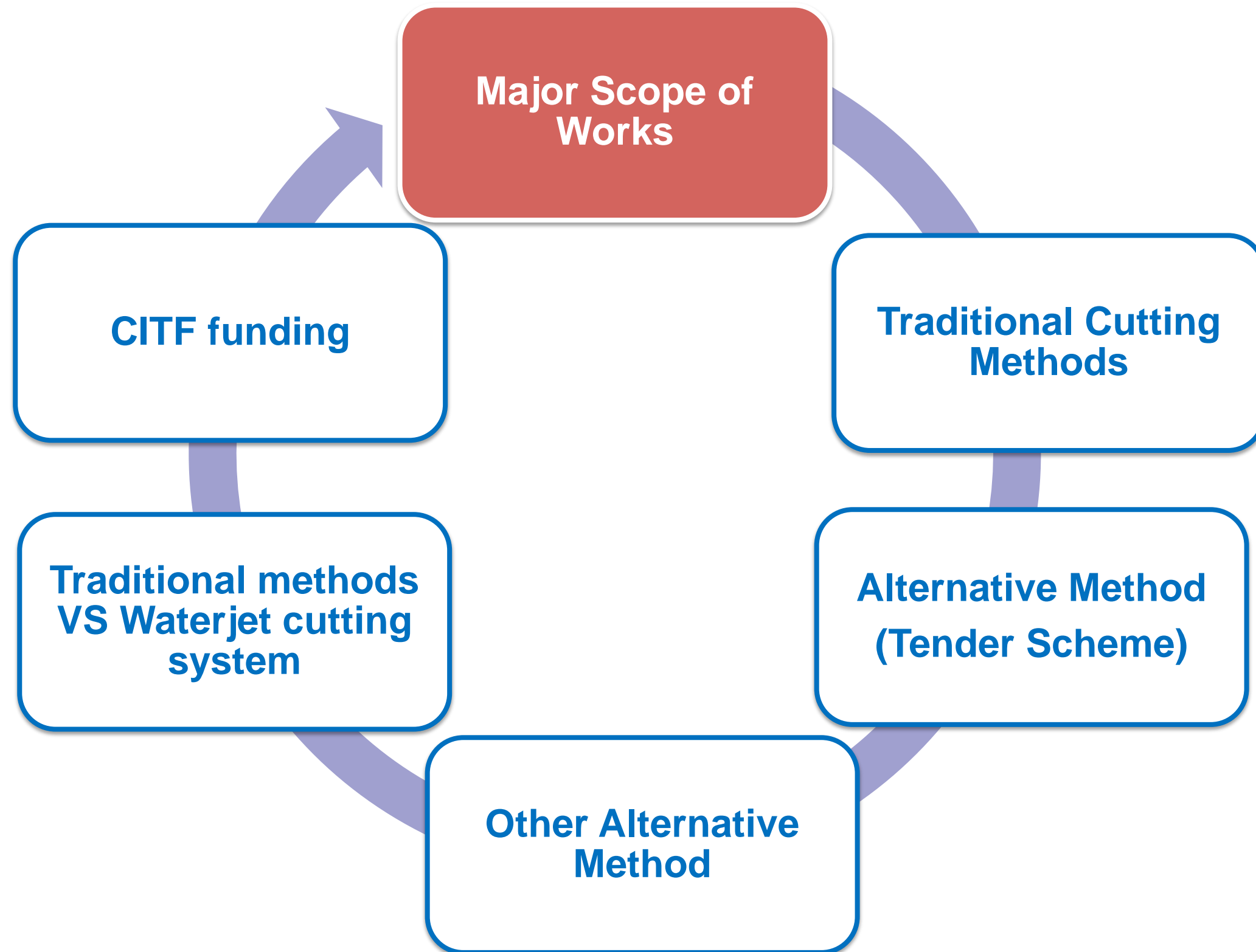


**HY/2014/07**

## **Central Kowloon Route – Kai Tak West High pressure waterjet cutting system**

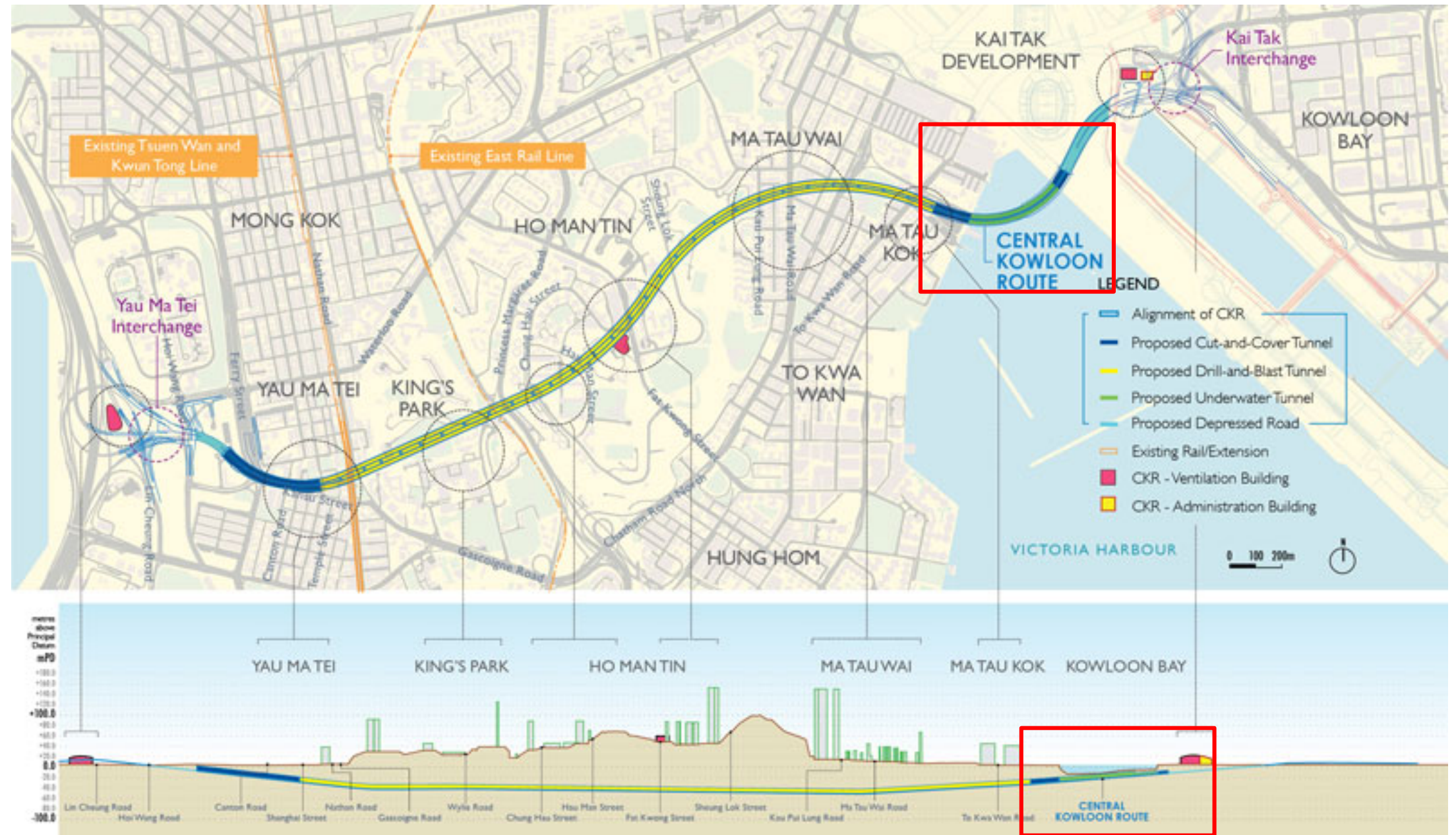
Speaker: Wong Tsz Chung, David (王子聰)  
Senior Project Manager

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# Major Scope of Works

- Contract No.: HY/2014/07
- Project: Central Kowloon Route – Kai Tak West
- Construction Period: Jan 2018 to Jan 2025
- Client: Highways Department
- Resident Engineer: Arup – Mott MacDonald Joint Venture
- Contractor: Gammon Construction Limited
- Contract Sum: HK \$6.24Billion



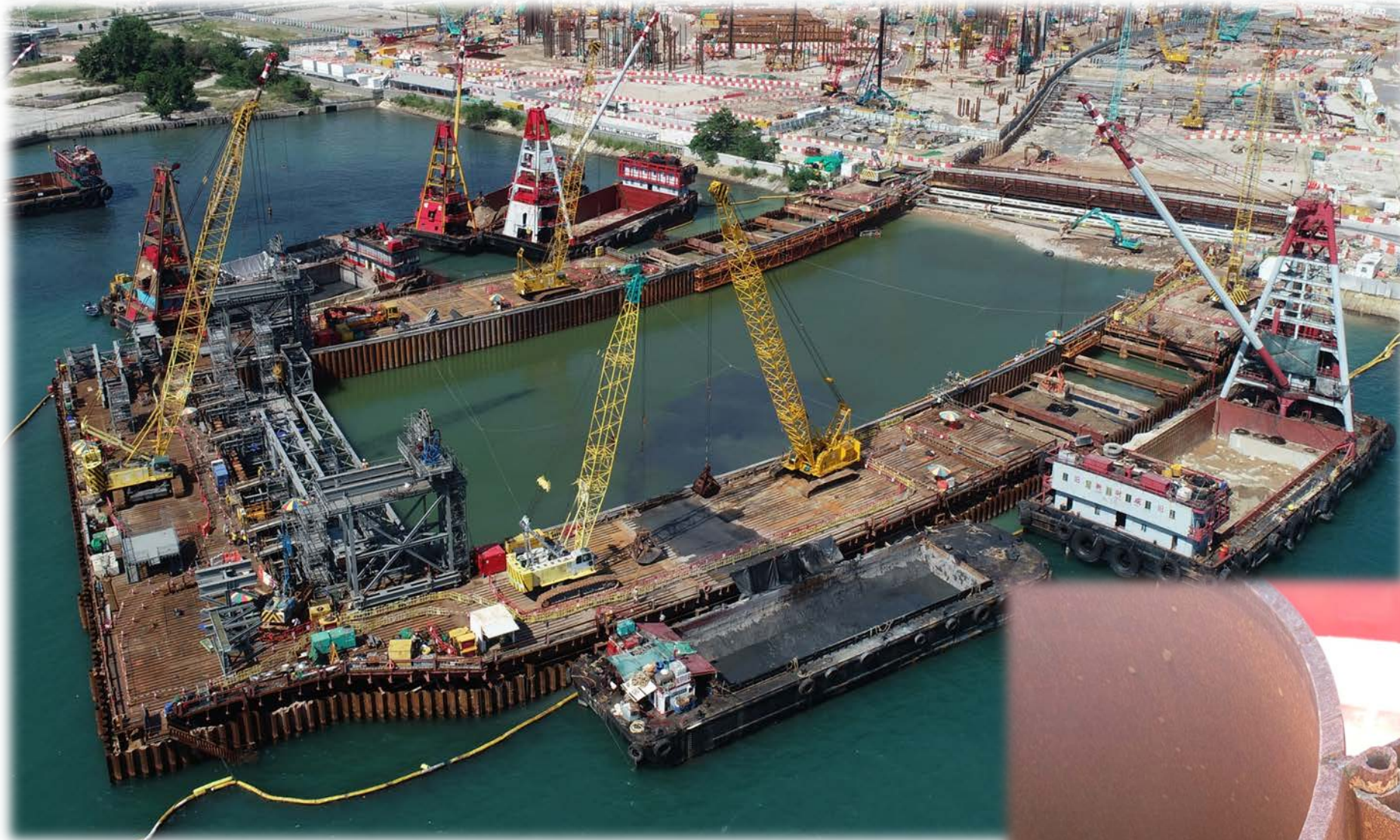
# Major Scope of Works

1. 50x30m access shaft with noise enclosure at MTK;
2. 100m long C&C tunnel at MTK;
3. Demolition and re-provisioning of MTK Public Pier;
4. 140m long UWT (Stage 1);
5. 240m long UWT (Stage 2);
6. 60m long C&C tunnel at Kai Tak;
7. 130m long depressed road and 200m long underpass at Kai Tak;
8. 390m long underground tunnel ventilation adit at Kai Tak;
9. Seawall demolition and construction of new landing steps; and
10. Barging Point enclosure and conveyor system.

(total tunnel length ~900m)



# Major Scope of Works



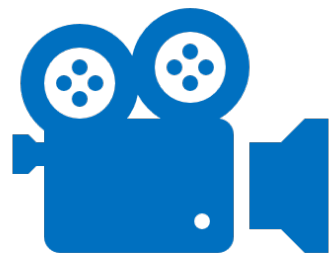
Clutch pipe pile: dia. 813mm x 25mm thk

UWT stage 1: 461nos. of pipe piles  
Construction period: 25 months  
Removal period: 51days

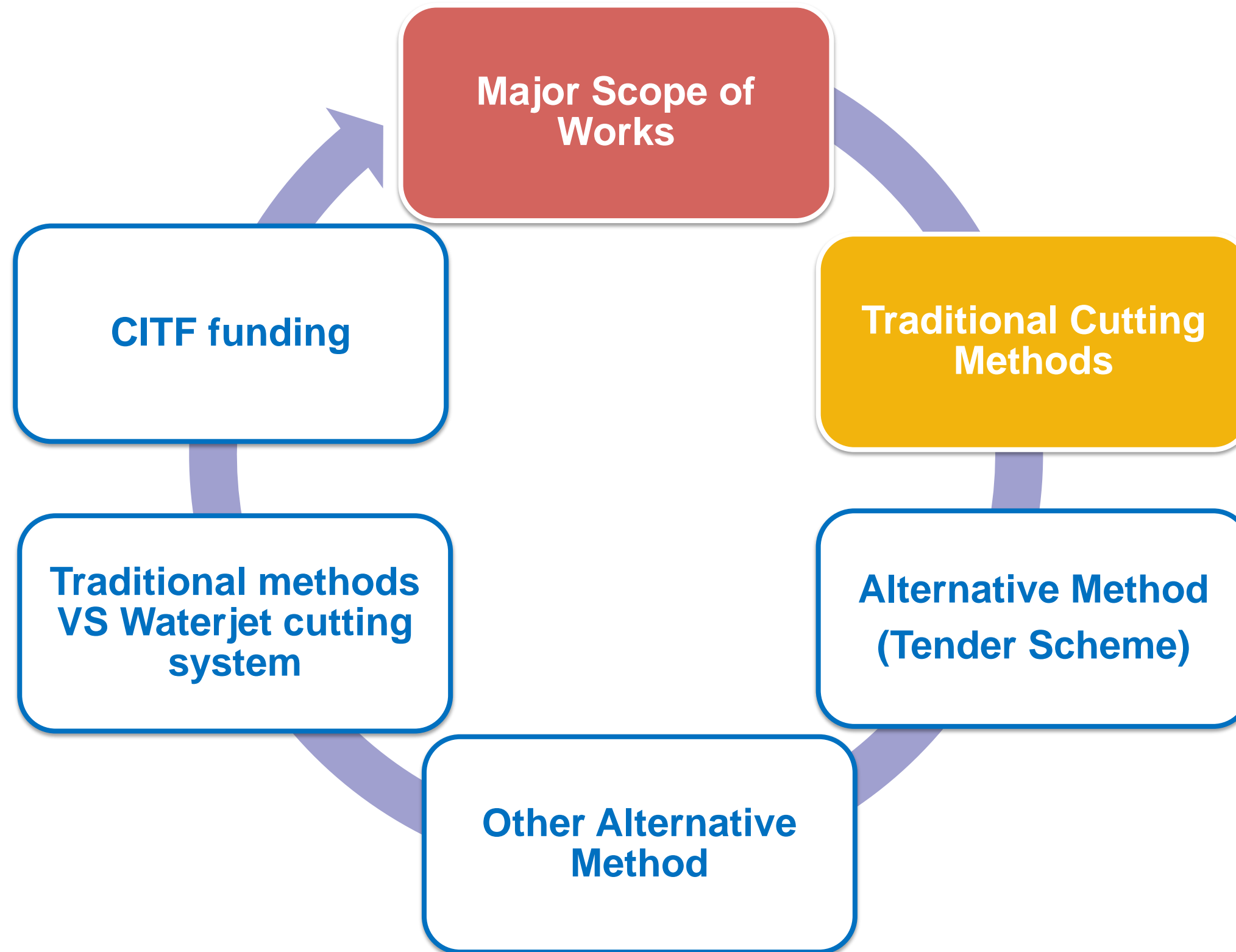
UWT stage 2: 497nos. of pipe piles  
Construction period: 25 months  
Removal period: 58days



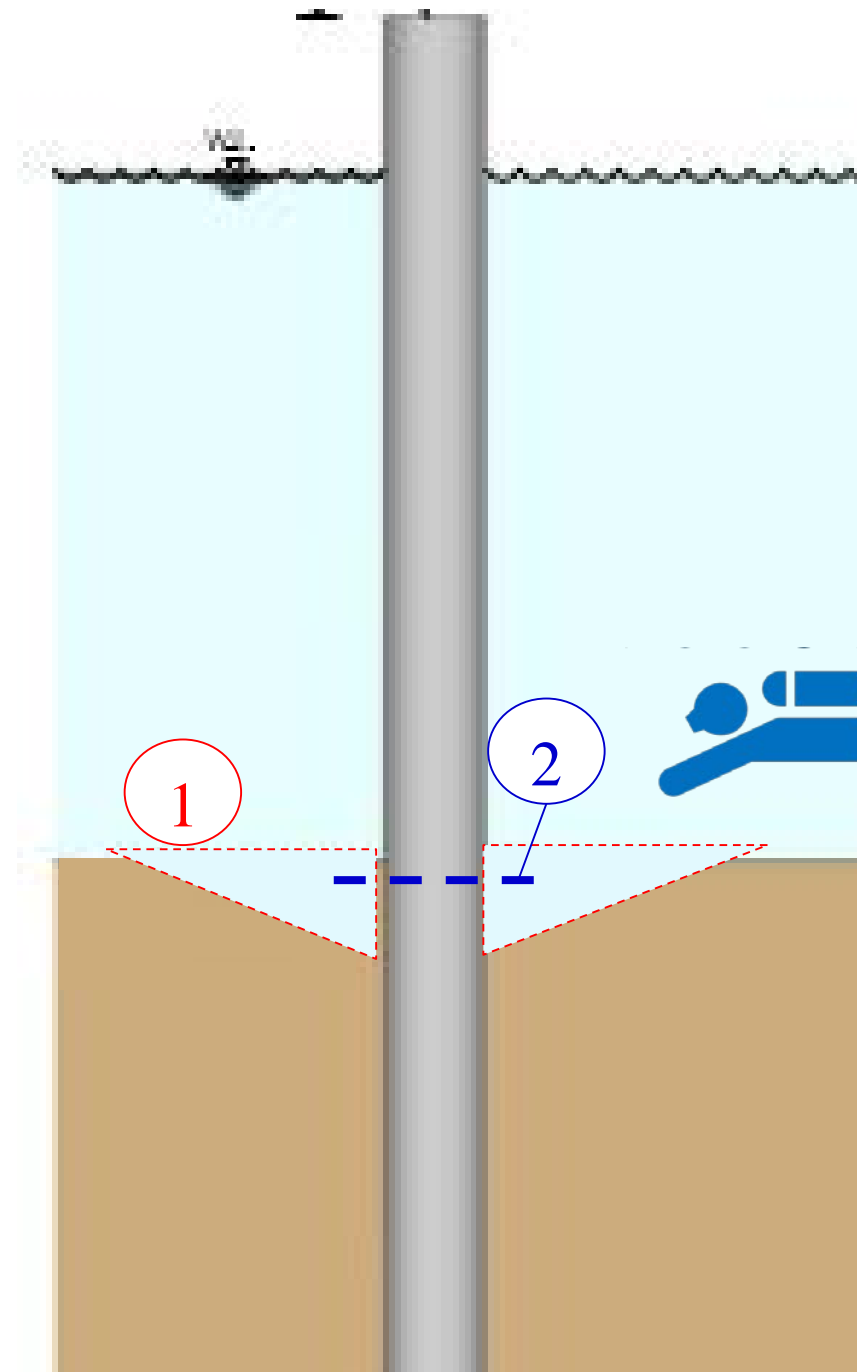
Clutch pipe piles



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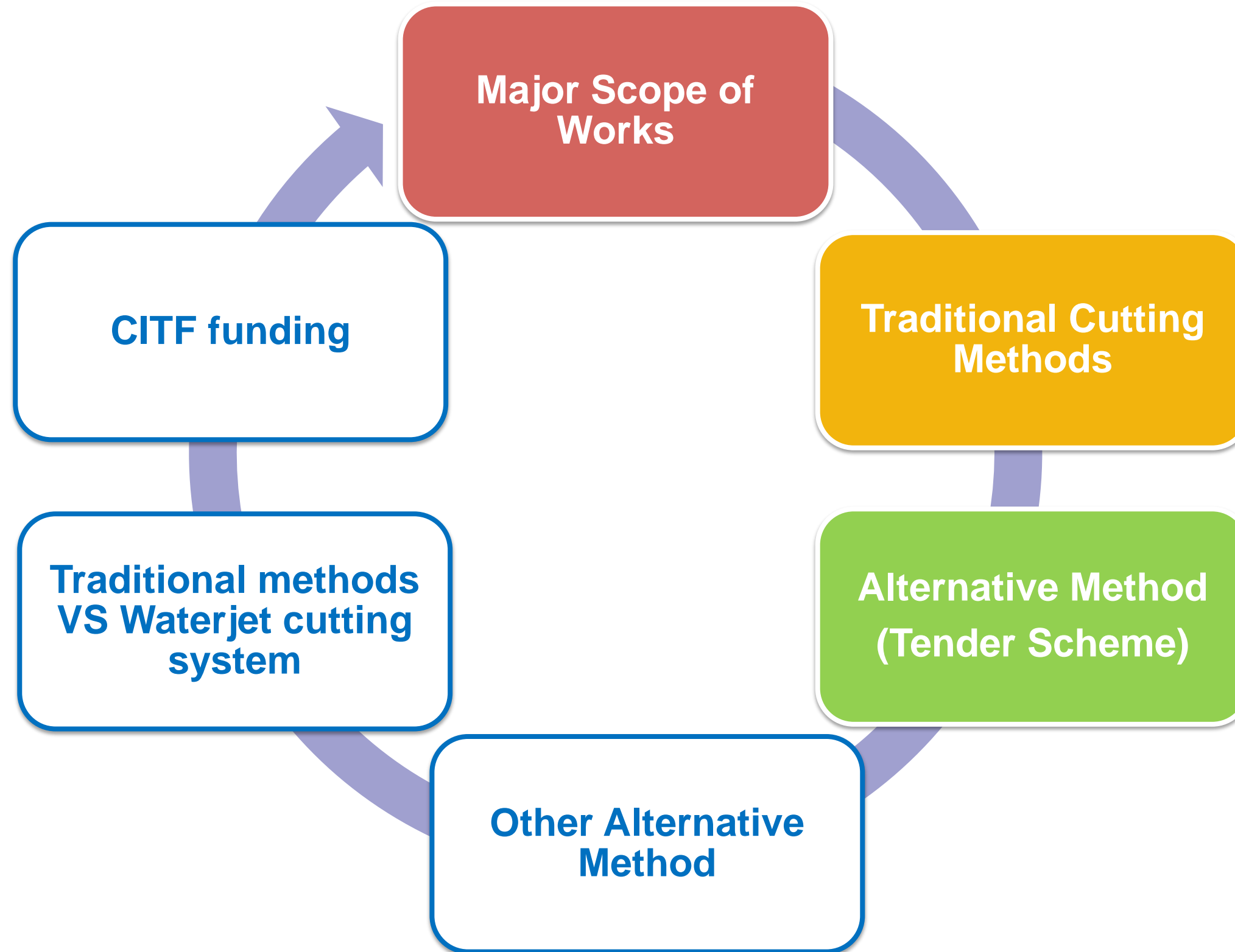


# Traditional cutting methods



- Underwater flame cutting by commercial diving
  1. Locally excavate 2m below seabed
  2. Diver trims the pipe pile by underwater flame cutting
  
- Drawbacks:
  - ✗ Commercial diving is high risk;
  - ✗ Lack of specialist divers
  - ✗ Low production rates (1 no/day/gang)
  - ✗ No other marine work is allowed nearby

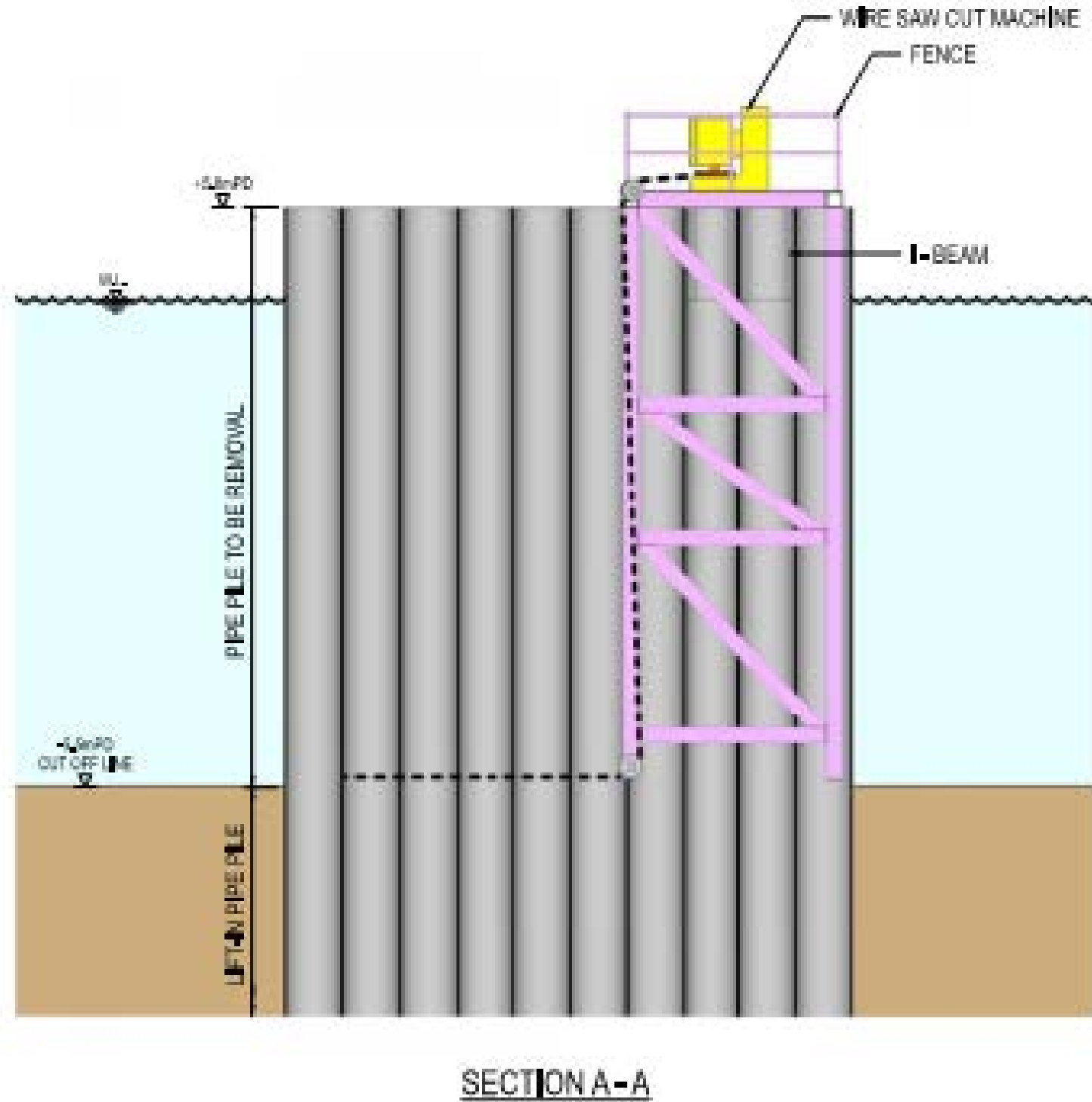
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# Alternative Method (Tender Scheme)

Wire cutting method



**WIRE SAWING MACHINE**

INSTALLED ON TOP OF WIRE SAW CUT PLATFORM FOR CUTTING CLUTCHED PIPE PILE

# Alternative Method (Tender Scheme)

## Wire cutting method

**Excavate seabed for trimming**

- Marine mud collapse
- Safety risk to diver

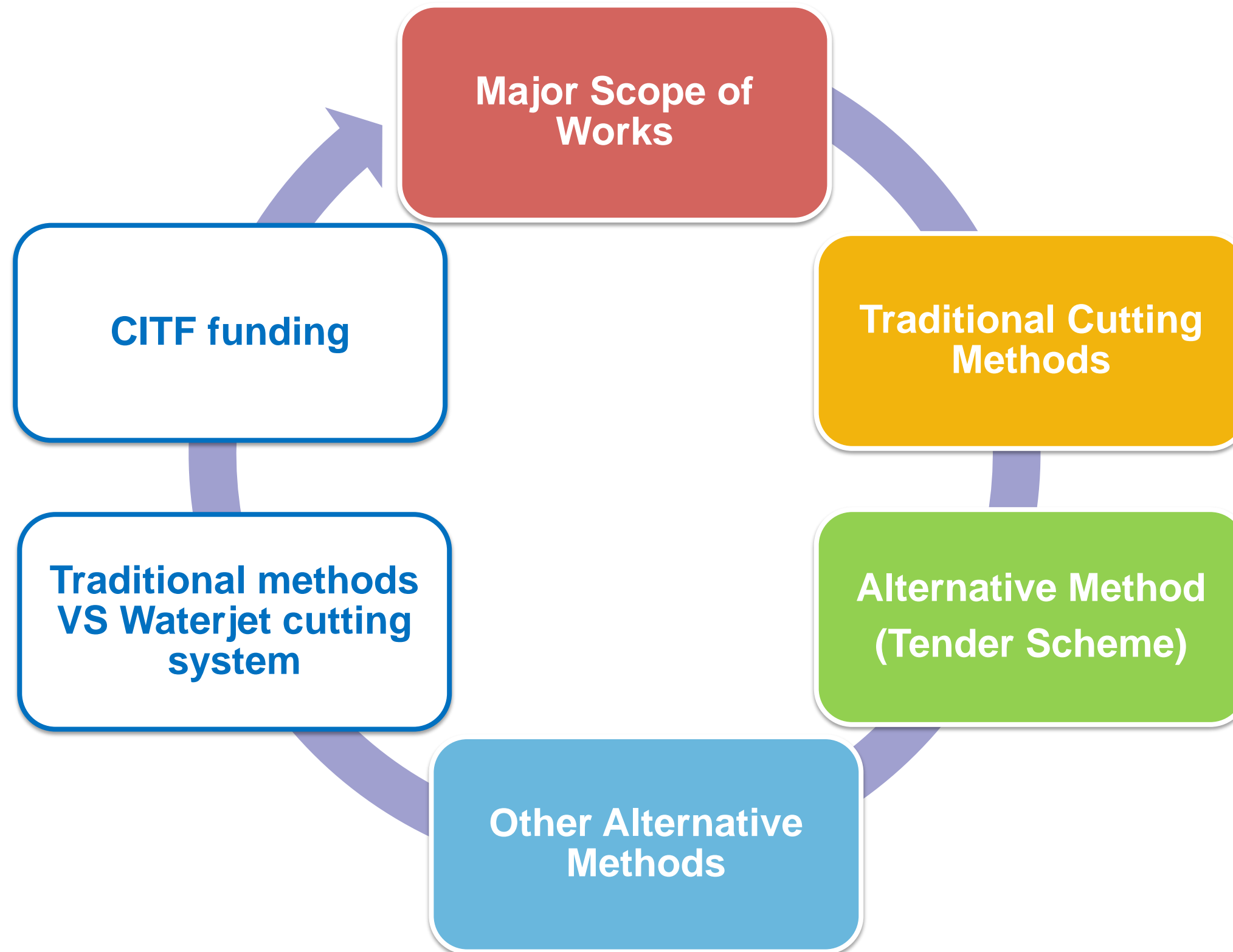
**Create opening for trimming**

- Reduced diving time for underwater hotworks
- Diver still needs to standby

**Trim pipe piles by wire**

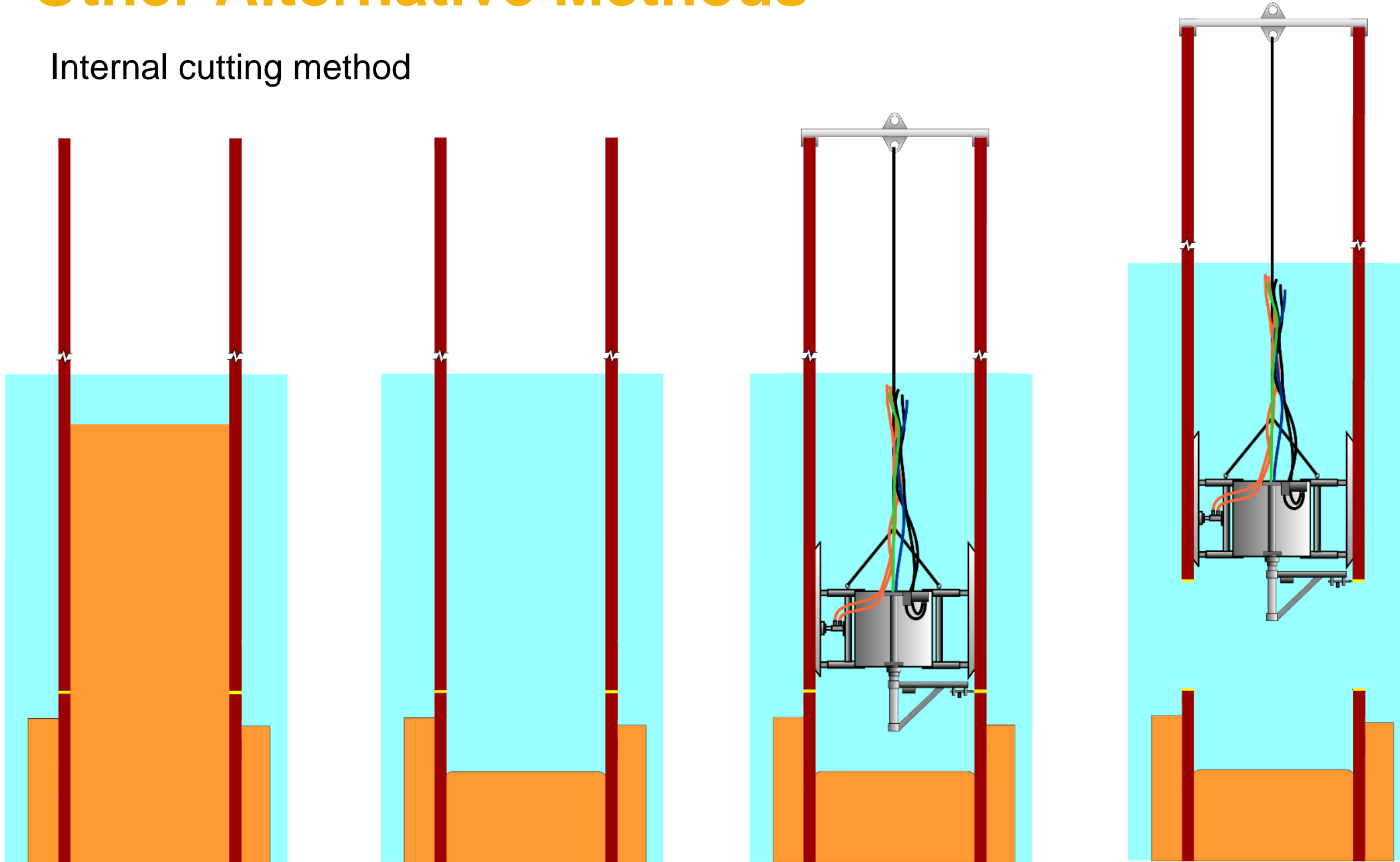
- Difficulty of cutting through the pipe
- Wire breaks and/or jams in the pipe
- Risk of pipe movement whilst the diver(s) are trying to free the jammed wire pipe

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# Other Alternative Methods

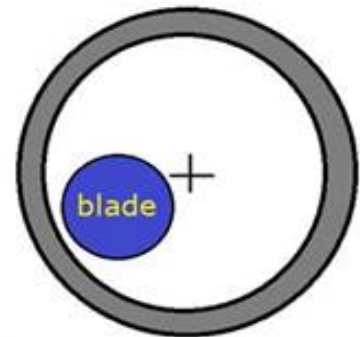
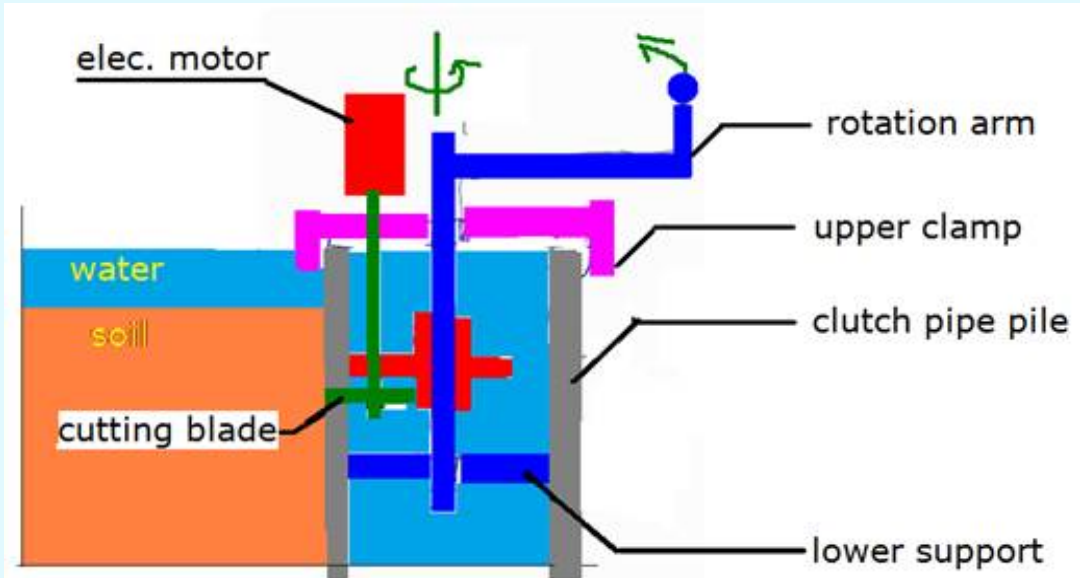
Internal cutting method



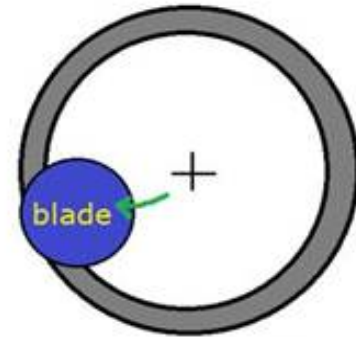
# Other Alternative Methods

Stage 1: Feasibility study and development  
Hydraulic Driven Disc Cutting (HDDC)

## Mockup of HDDC



Initial position of cutting blade



Position of cutting blade after level arm actuated

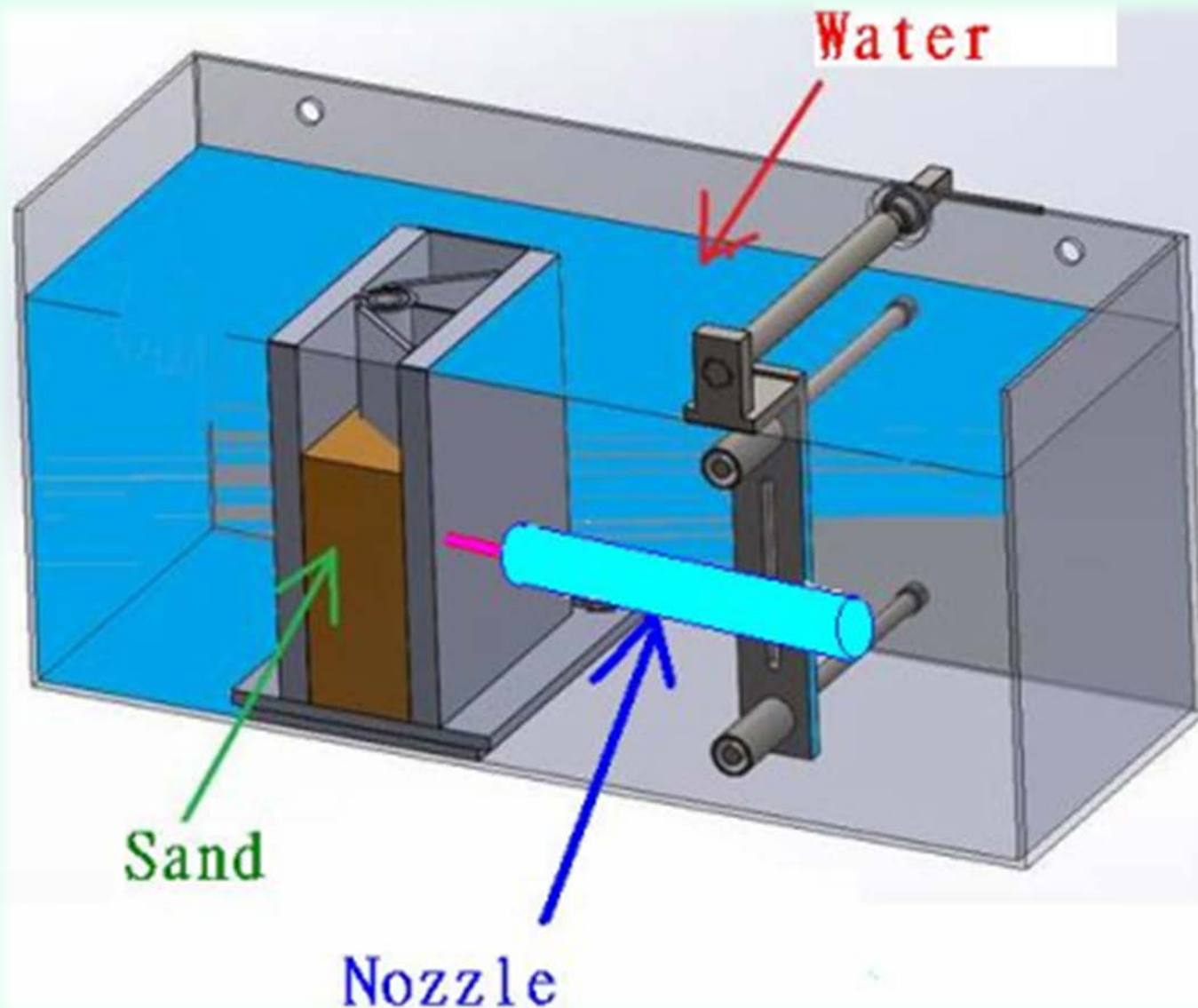
## Trail of HDDC



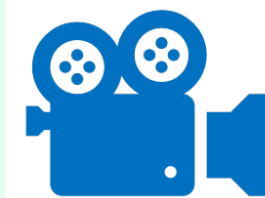
# Other Alternative Methods

Stage 1: Feasibility study and development  
High Pressure Water Jet Cutting (HPWJC)

## Trail by (HPWJC)



(Template after cutting)



## Other Alternative Methods

### Hydraulic Driven Disc Cutting

- ✓ Low investment cost
- ✓ Low machinery cost
- ✗ Risk of jamming
- ✗ Production rate not guarantee
- ✗ Large disc consumption

### High Pressure Water Jet Cutting

- ✓ No jamming risk
- ✓ Production rate is guarantee
- ✓ Low material consumption
- ✗ High investment cost
- ✗ Comparatively high machinery cost

## Other Alternative Methods

Stage 2: Full scale prototype trial at yard  
High Pressure Water Jet Cutting (HPWJC)  
Set up similar to site condition





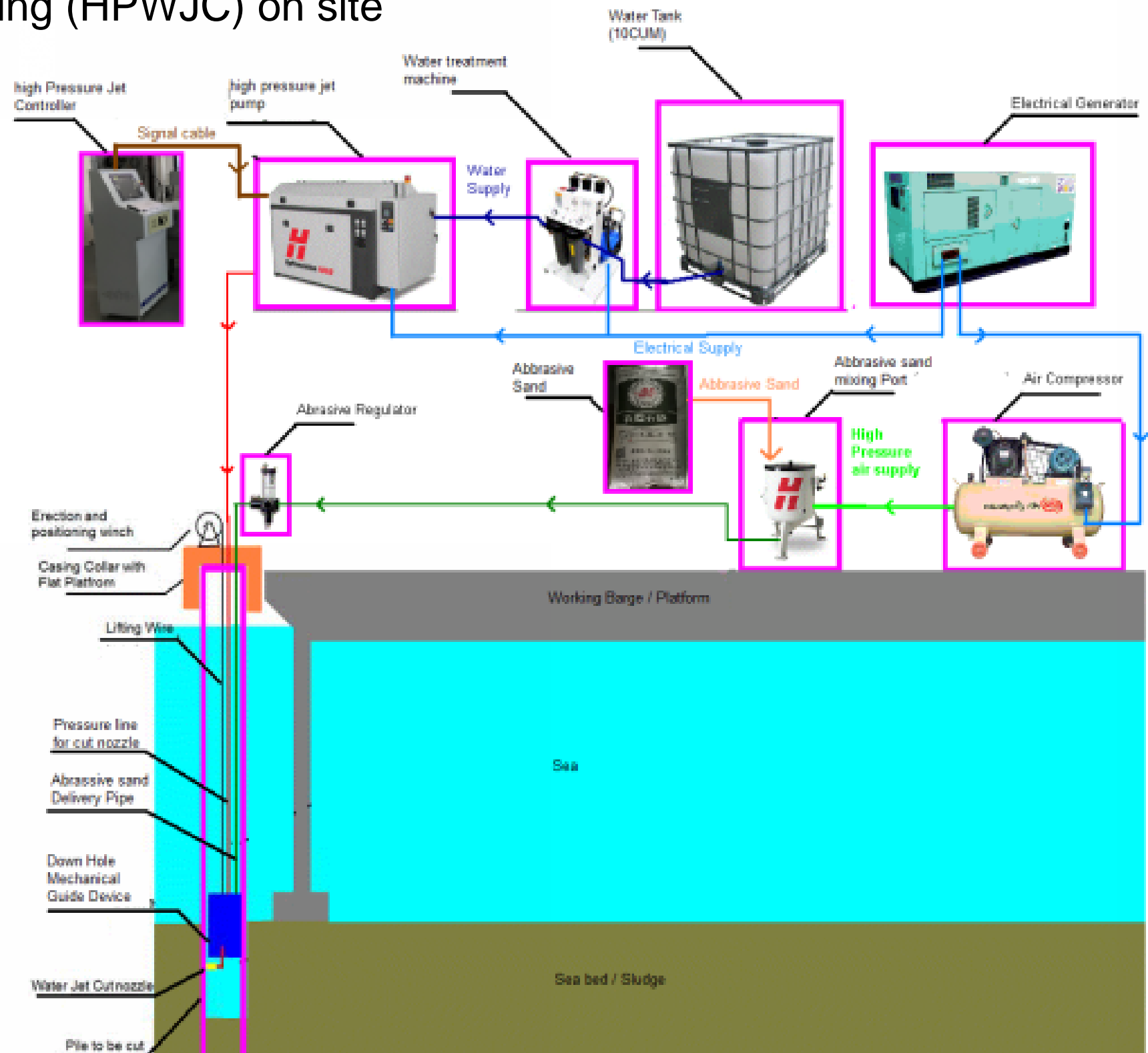
# Other Alternative Methods

Stage 2: Full scale prototype trial at yard  
High Pressure Water Jet Cutting (HPWJC)



# Other Alternative Methods

## Stage 3: High Pressure Water Jet Cutting (HPWJC) on site

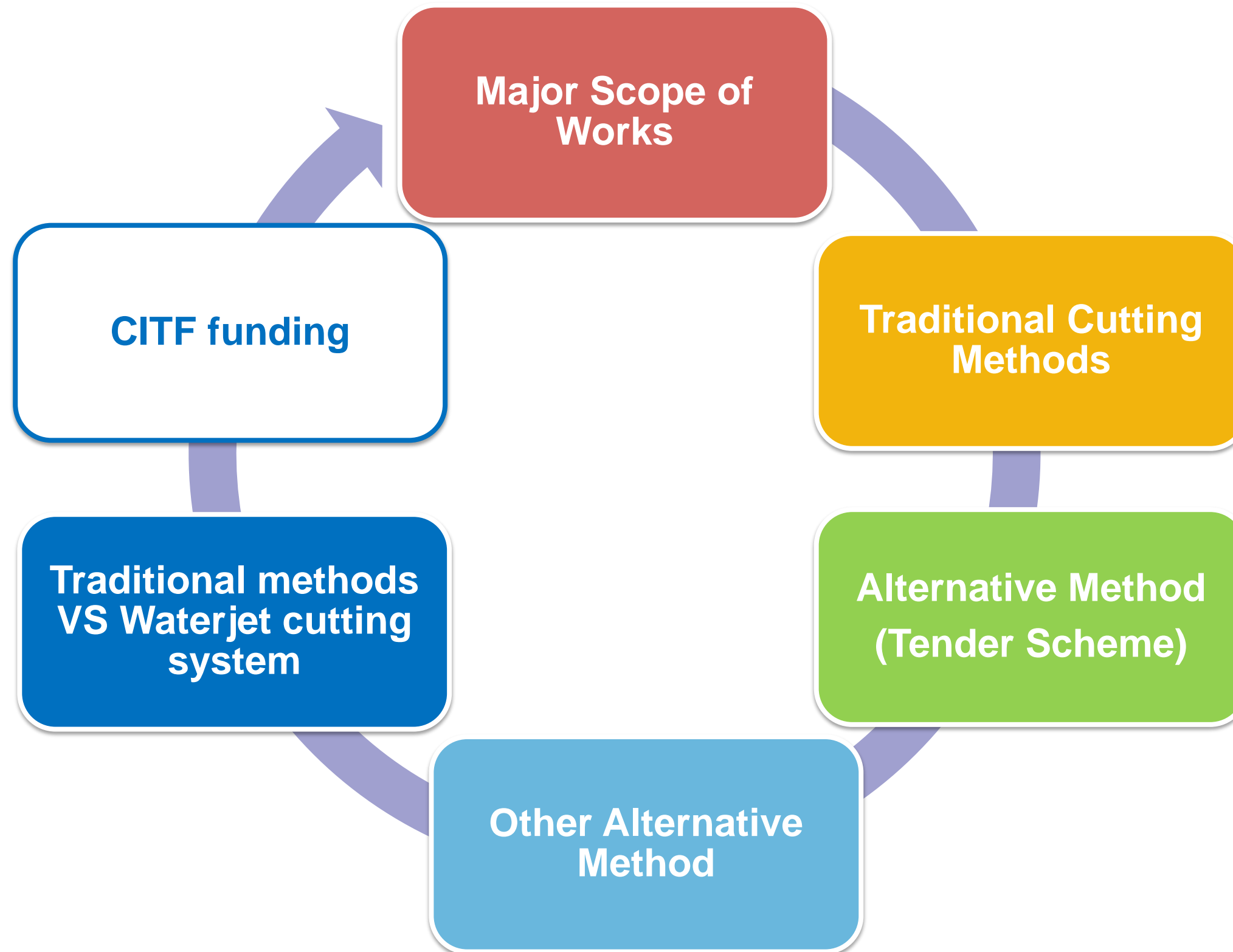


# Other Alternative Methods

Stage 3: High Pressure Water Jet Cutting (HPWJC) on site



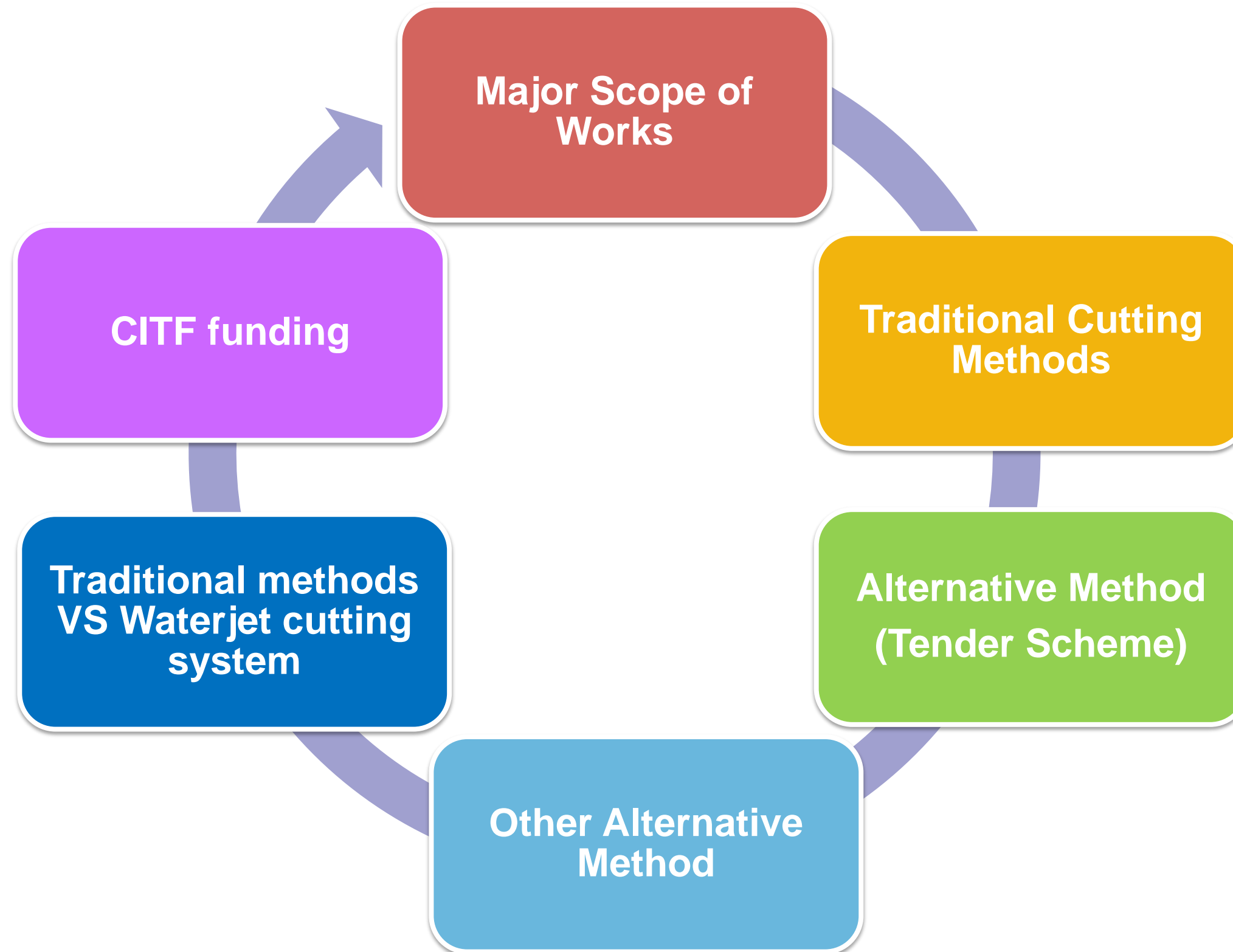
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# Traditional methods VS Waterjet cutting system

	Conventional diving & hot work	HPWJC (self-developed)
<b>Manufacturing</b>	Low-price	Expensive
<b>Anticipated Production Rate</b>	1 pipe/day	3 pipes/day (inc. setup)
<b>Total Duration (958 pipes total)</b>	958 days	320 days
<b>Labour Requirement</b>	Divers ~2880 man-days (team of 3 divers)	Operators ~640 man-days (team of 2)
<b>Safety risk</b>	High risk (Diving works and underwater flame cutting)	Low risk (Remote at control room)
<b>Cost to Implement</b>	\$\$\$\$	\$

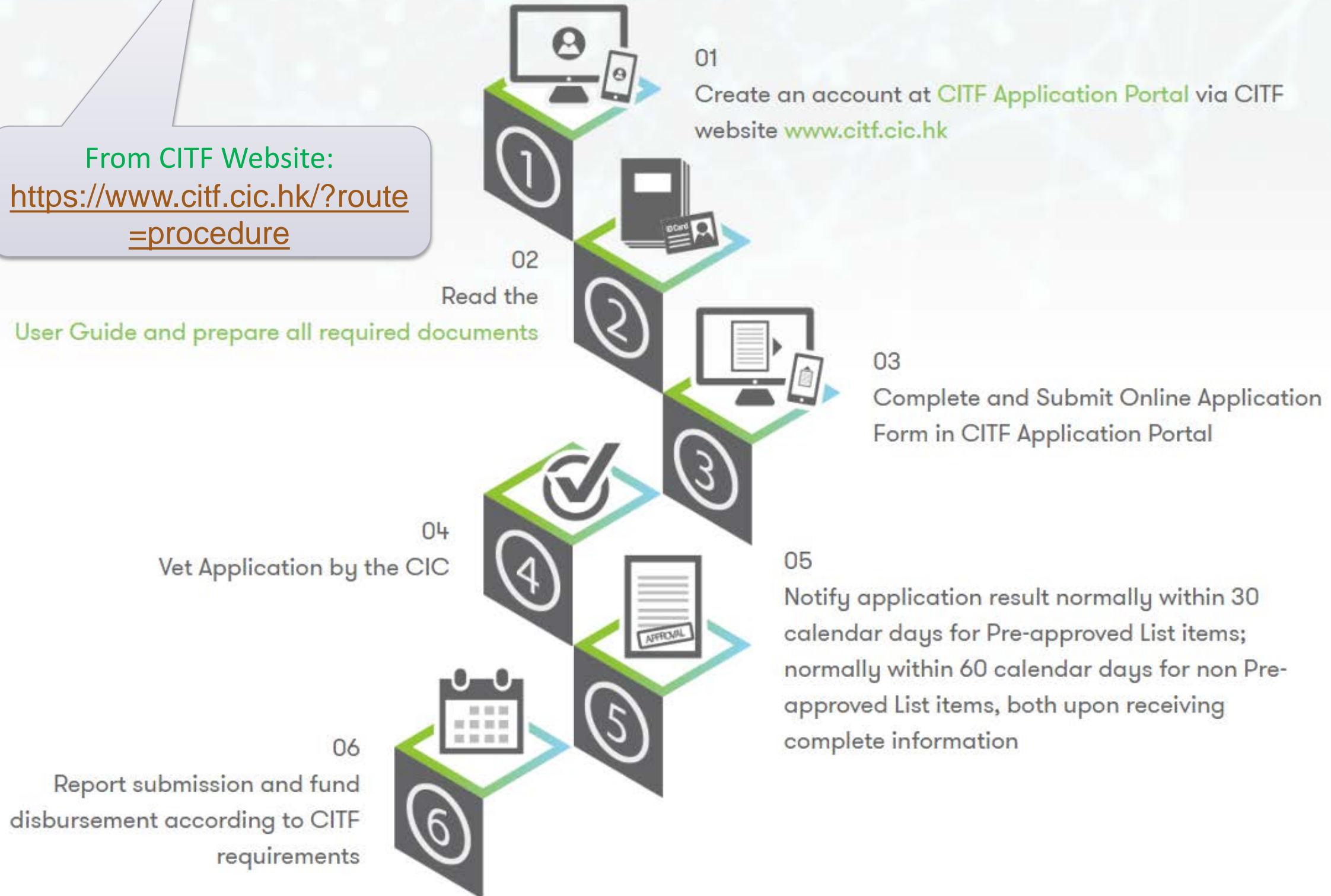
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# Application Procedures

FAQ

From CITF Website:  
<https://www.citf.cic.hk/?route=procedure>





Building Information Modelling (BIM)



Advanced Construction Technologies (ACT)



Modular Integrated Construction (MiC)



Prefabricated Steel Rebar (STB)

**Building Information Modelling (BIM)**

Granted for KTW Project

BIM digitalises the construction process. It can minimise clashes and abortive work and reduce the risks of project delivery failure through better co-ordination, hence achieving clearer programme and costs at all project stages.

**Advanced Construction Technologies (ACT)**

Granted for KTW Project

With the advance in technology, many manual construction operations can be performed by machines and robots under the supervision of skilled and knowledgeable construction personnel.

**Modular Integrated Construction (MiC)**

Entry for KTW Project submitted

MiC transfers labour-intensive processes and site-bound wet works (such as concreting, screeding, plastering and most building services installations) to off-site manufacturing yards through standardization, thus enhancing productivity, site safety, environmental performance and cost-effectiveness. The use of MiC will shorten construction time, in particular for interior finishes, fixtures and fittings on-site, and allow better quality control.

**Prefabricated Steel Rebar (STB)**

The use of prefabricated steel rebar can reduce laborious bar-bending work in construction sites, improve productivity and reduce material wastage.



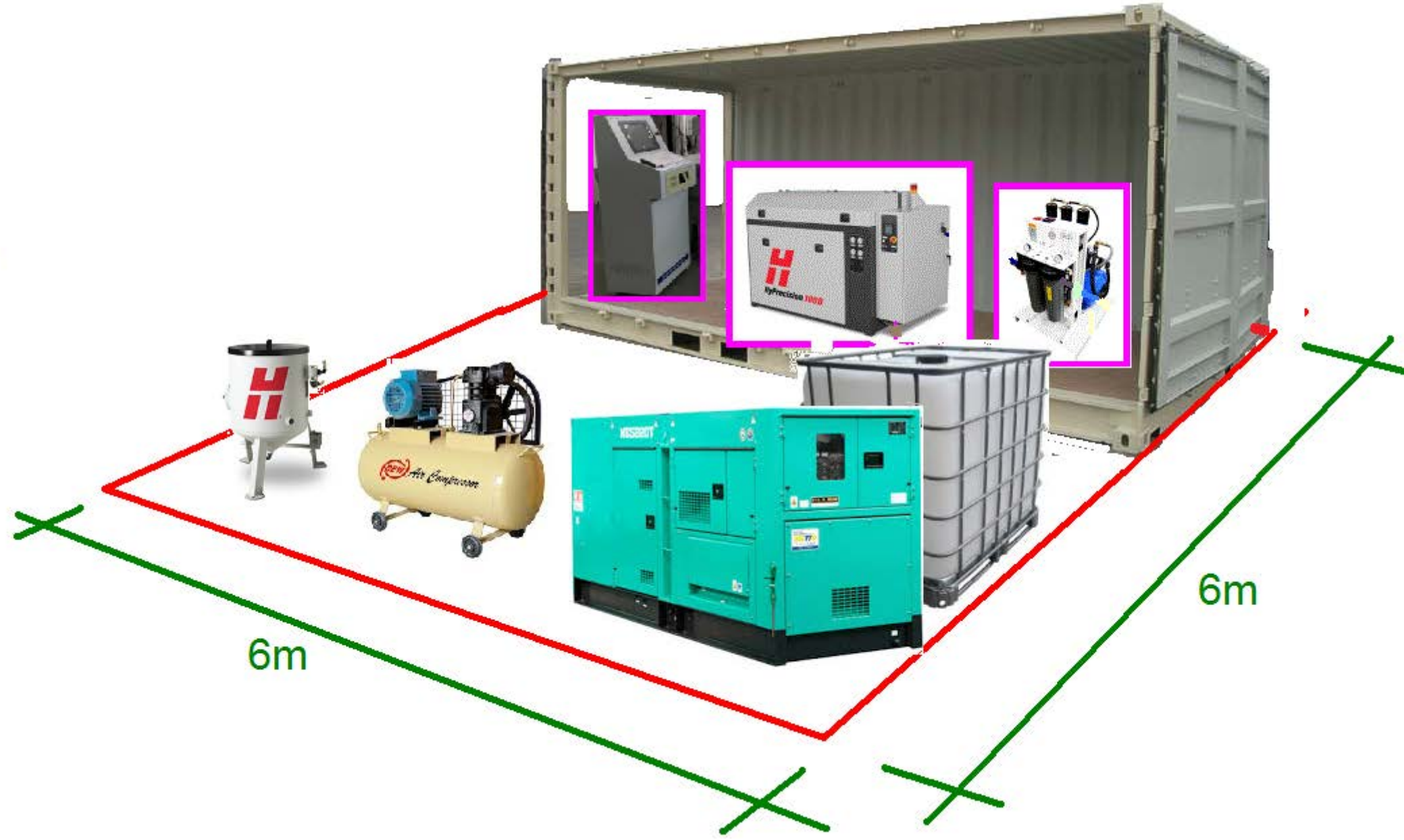
	CITF (jointly implemented by DEVB/CIC)	Examples from other funding/grant
Objectives	Encourage wider adoption of innovative methods and new technologies in the construction industry - to promote productivity, uplifting built quality, improving site safety and enhancing environmental performance	Enhance site safety - to promote the development and implementation of measures to prevent serious accidents on construction sites
Initial seed funding	HK\$1 Billion	~HK\$10 Million
Scope	BIM, ACT, MiC, Prefab Steel Rebar, Manpower Development	Project based
Max. amount for each entry	Matching up to max. 75% of the total cost of approved project sum (e.g. \$2.5M max. for ACT entries)	~HK\$250K average for each successful entry
Quick approval	Quick approval (30 days) if tool/technology is on pre-approved list, non pre-approval items typical approval within 60 days	~ 60 working days to complete approval
Disbursement mode	By way of reimbursement (paid afterwards), in instalments. 1 <sup>st</sup> request can obtain up to 80% of fund amount	Grant to be disbursed after signing of agreement following fund approval (paid before the expense)

**Other observation/sharing from our experience with CITF:**

- Very effective process due to use of online portal
- During application and vetting, CITF Secretariat is very helpful for assistance, especially for preparation before meeting of the Vetting Sub-Committee
- Corporate fund ceiling imposed and no further approval for new entries
- Temporary works not applicable for MiC however it is a key element of works for delivery of Civil and Geotechnical projects

# Thank You Q&A

# High Pressure Water Jet Cutting (HPWJC) Set up



# The Prototype waterjet cutting on site

Operation Procedure is proof workable and the work duration is approx. 3hrs 30mins / CPP.

Work Sequence	Duration
1. Pre work check of WCD function	approx. 30mins
2. Installation of WCD to CPP	approx. 30mins
3. Operate WCD for CPP cutting	approx. 2hrs 15mins
4. Dismantle of WCD from CPP	approx. 15mins
Total	3hrs 30mins