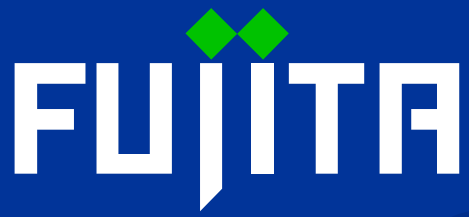
Load Test of High Capacity Micropile in Site

MASAO SAGARA

Load Test of NEW-High Capacity Micropile



MASAO SAGARA

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1. Background(Construction Example of HMP)
2. Purpose
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4. Result of the Pull Out Test with NEW-HMP
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Design & Construction Manual for Seismic Retrofit Method for the Existing Bridge Foundation

CHAPTER 3 EXECUTION METHOD

3.1 Execution process

The standard execution process of HMP consists of boring, installation of core bars, grout mixing, initial injection, pressure injection, reinsertion of HMP steel pipes, and treatment of pile head. The execution of a single HMP shall, in principle, be a continuous work from the beginning of boring to the reinsertion of HMP steel pipes.

[Explanation]

Figure-C 3.1.1 shows the standard HMP execution process, and Figure-C 3.1.2 is the outline of the execution process.

The process from the beginning of the boring until the reinsertion of HMP steel pipes must be, in principle, a continuous work, because it is difficult to insert and remove HMP steel pipes if the boring work is interrupted. In addition, because the quality of hardened grout will be poor if the ground injection work is interrupted.

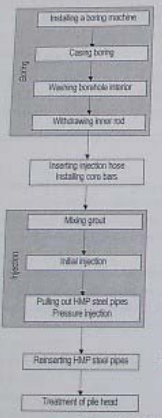

Figure-C 3.1.1 HMP Execution Process

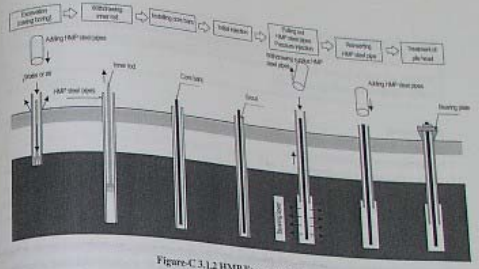

Figure-C 3.1.2 HMP Execution Process

3.2 Major machinery and equipment

The execution machinery and equipment used to execute HMP shall be selected appropriately accounting for the working environment conditions at the execution site, surrounding environment conditions, and economic factors.

[Explanation]

Table-C 3.2.1 shows the standard execution machinery and equipment used to execute HMP. The specifications in the table are standard sample. Therefore, special machinery and equipment must be selected according to the working environment and ground conditions.

Table-C 3.2.1 Sample of Standard Execution Machinery and Equipment

Work category	Name	Specifications	Quantity	Remarks
Boring	Boring machine	Motor about 110PS	1 unit	Rotary percussion double-wall pipe method
	Water feed pump	15kW	1 unit	Ejection rate 300ℓ/min
	Water tank	5, 10m³	Necessary number	For pure water, for slurry
	Sand pump	5.5kW	Necessary number	
	Pipe extractor		1 unit	Used as necessary
Injection	Grout mixer	11kW	1 unit	Vertical or two tank horizontal type
	Grout pump	15kW	1 unit	Ejection rate 300ℓ/min
	Water meter		1 unit	
	Flow meter		1 unit	Used as necessary
Common	Compressor		1 unit	
	Crane	Lifting capacity 4.9 to 25t	1 unit	
	Engine driven generator	Approx. 45, 100kVA	1 unit	Used as necessary

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Design & Construction Manual for Seismic Retrofit Method for the Existing Bridge Foundation

Lecture to engineers about Design & Construction Manual

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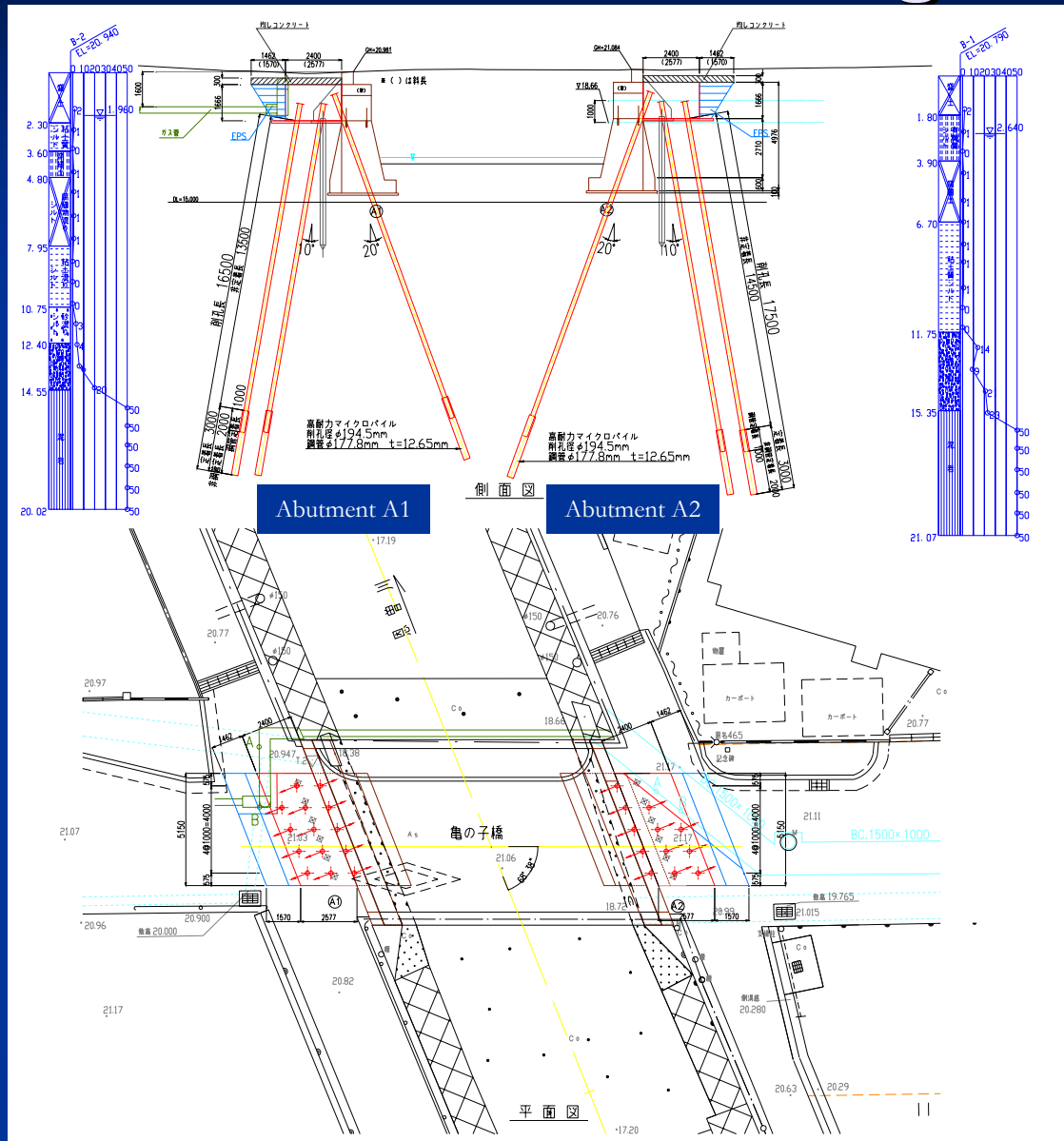
Construction Example

Seismic Retrofit of KAMENOKO Bridge

Construction Example

Seismic Retrofit of KAMENOKO Bridge

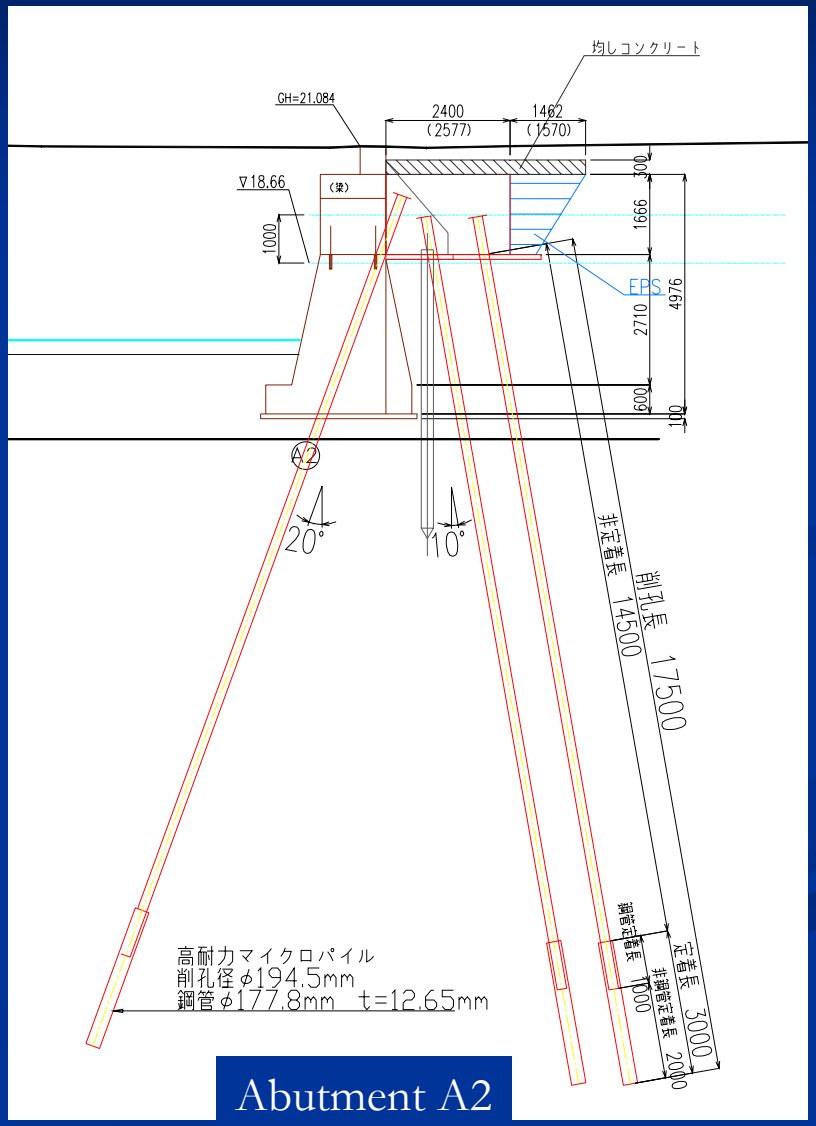
- small bridge;
  - 14m in length
  - 6m in width.
- There is a soft soil layer over 10m in depth.
- The influence on the house by the vibration of a large-scale machine was worried.
- HMP with a small machine was applied.



Construction Example

Seismic Retrofit of KAMENOKO Bridge

- HMP penetrated through the abutment.
- Amount of piles : term ;17.5m × 12piles, 16.5m × 14piles, Total 476m



Abutment A2

Construction Example

Seismic Retrofit of KAMENOKO Bridge

Construction Example

Seismic Retrofit of KAMENOKO Bridge

Construction Example

Seismic Retrofit of KAMENOKO Bridge

Construction Example

Seismic Retrofit of KAMENOKO Bridge

Construction Example

Seismic Retrofit of KAMENOKO Bridge

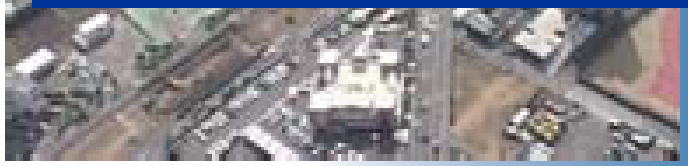
On the other hand…

Recently, the intersection in the city always gets a traffic jam.

It is necessary to overpass the intersection in Japan

When the overpass is constructed without stopping the car in the city, an enough construction place might not be able to be secured.

Then, the application of HMP is expected as a new foundation.



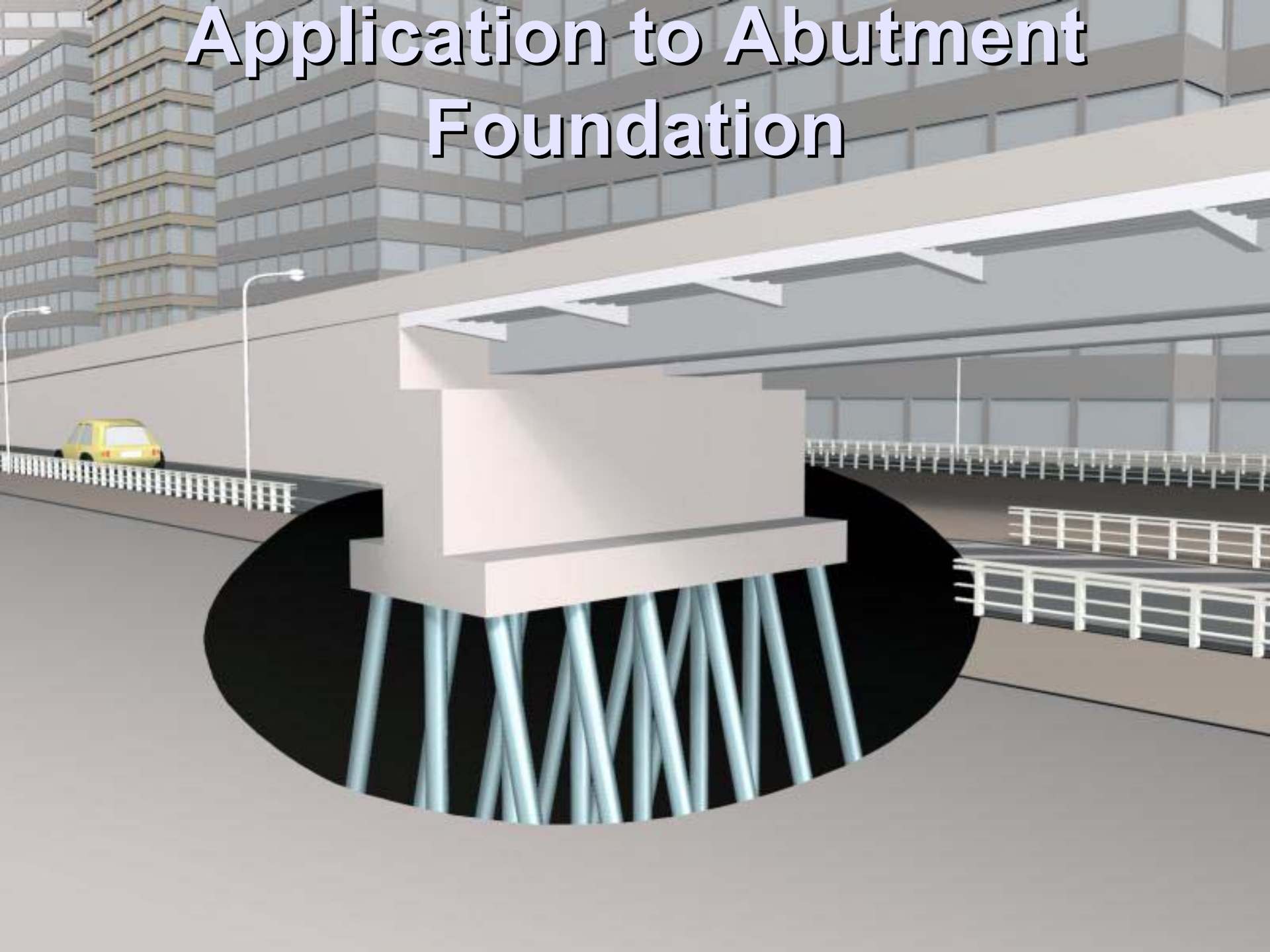
Recently, the intersection in the city always gets a traffic jam.

After

We need the overpass of the intersection to cancel the traffic jam.

Application Example to Overpass of HMP

Application to Abutment Foundation



Problem and Measure

- Problem
  - It is important that the overpass can be constructed cheaply and early.
  - But HMP is necessary to construct a lot of pile as a new foundation of the abutment or the pier.

- Measures
  - Then, HMP is improved so that the bearing capacity may increase.
  - As a result, the total number of the HMP can be decreased.
  - Moreover, the construction period can be short and the cost can be made down.

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Purpose

- Bond length of HMP is only bearing layer.
- We propose HMP of the improvement type by which the whole area of the pile is bond length to increase the bearing capacity.

This is called NEW-HMP.

- We executed the pull out load test of NEW-HMP, and confirmed the bearing capacity.
- I describe result of pull out test.

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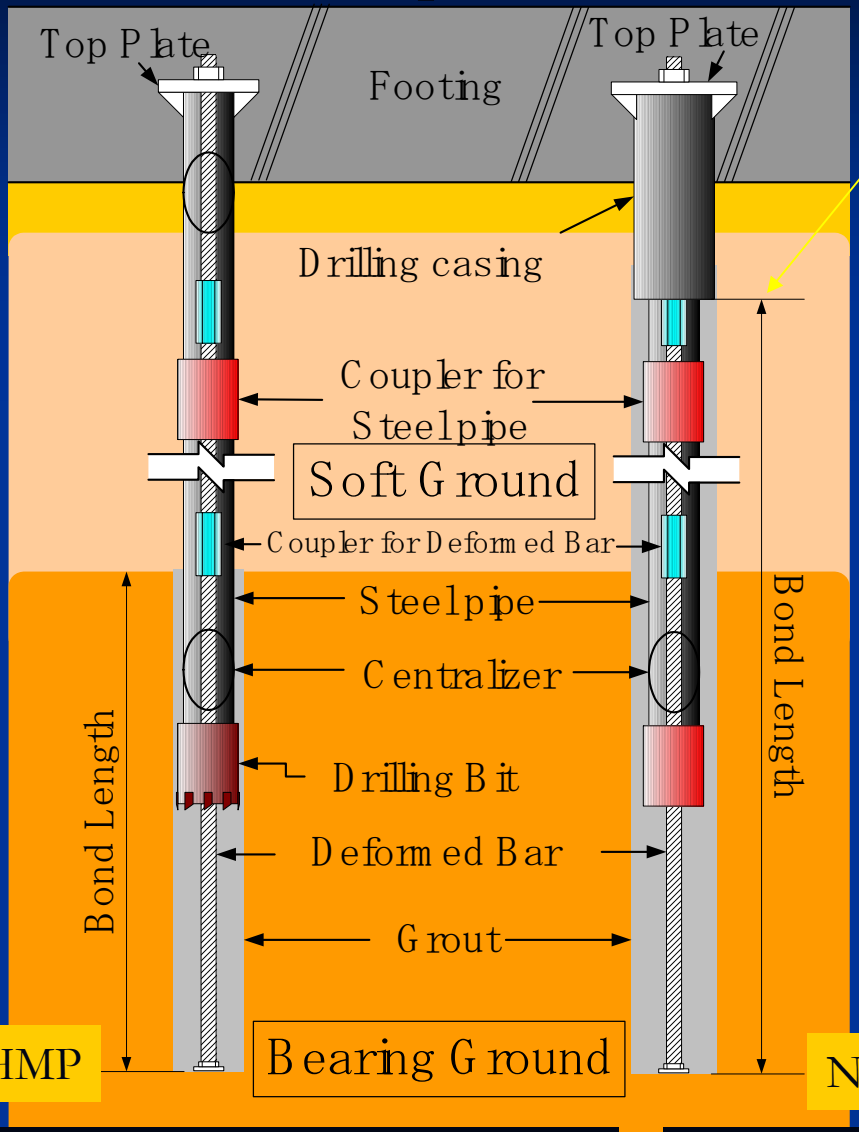
Improvement of HMP

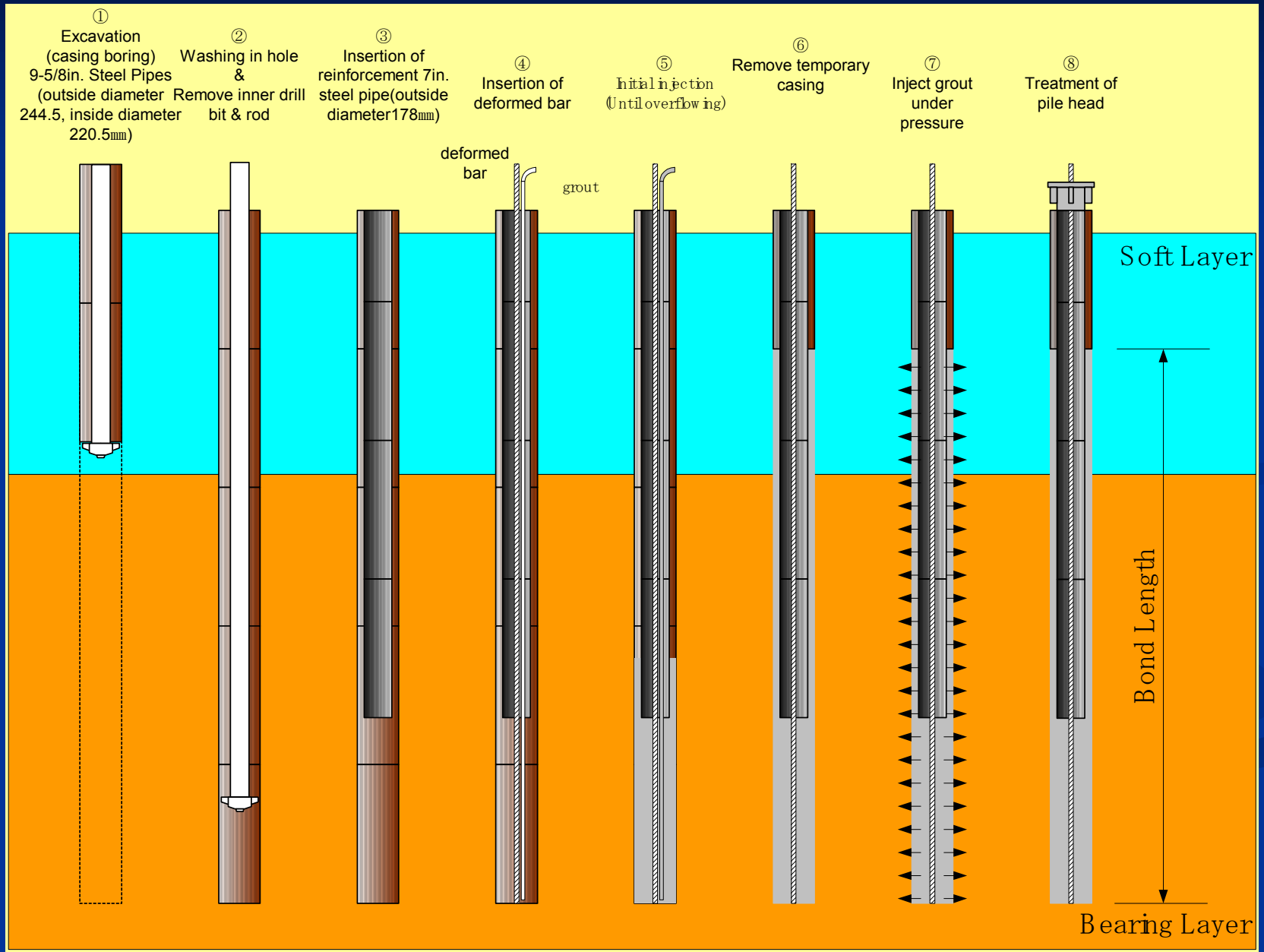


- New-HMP
  - Diameter is larger than HMP.
  - Bond length of NEW-HMP is longer than that of HMP.

Bond length of HMP is only bearing layer.

Whole area of the NEW-HMP is Bond length.

Construction Process of NEW-HMP



Construction situation

Construction situation

Construction situation

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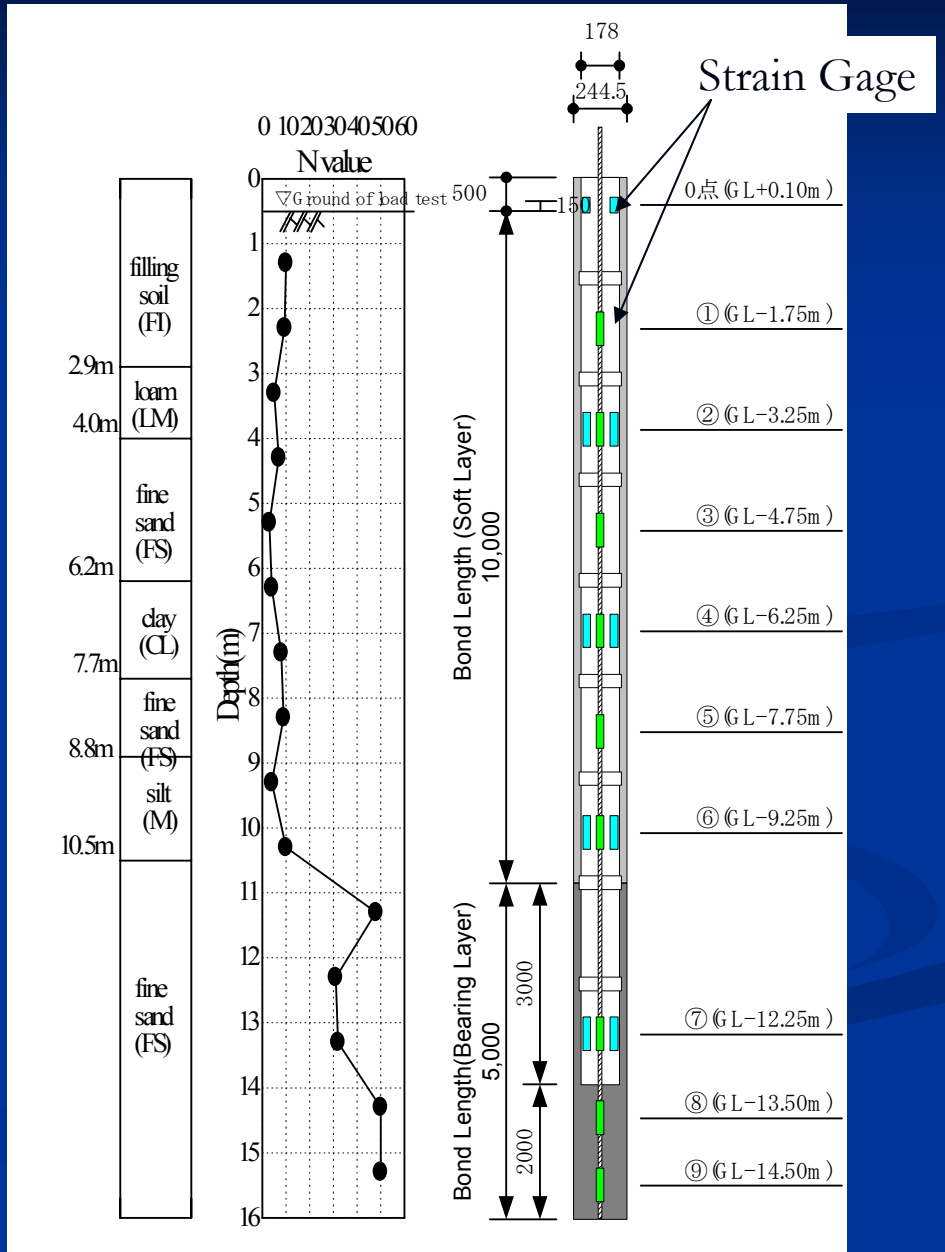
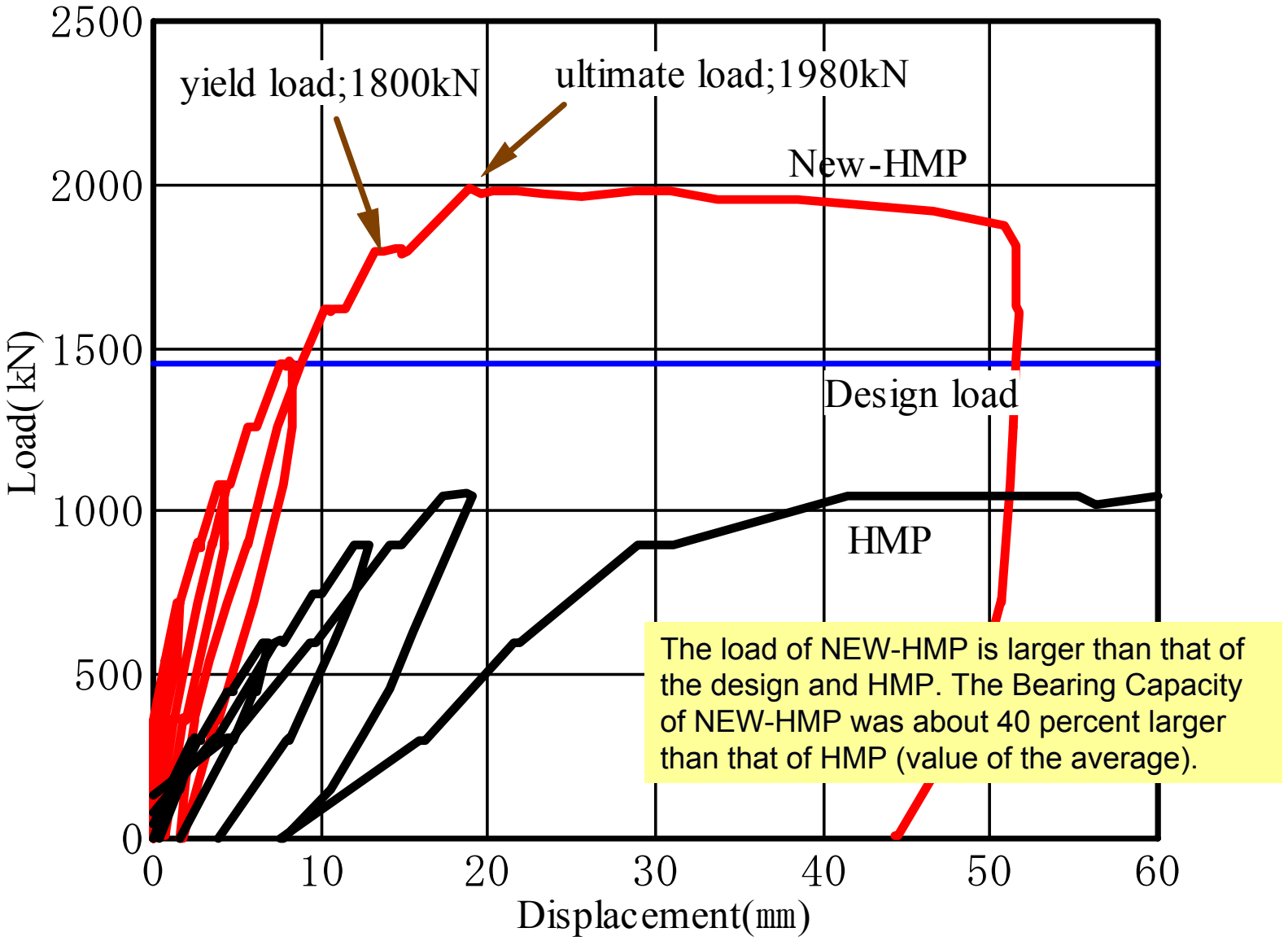
Outline of Test Pile

- The strain gages are put on the steel pipe and the deformed bar.



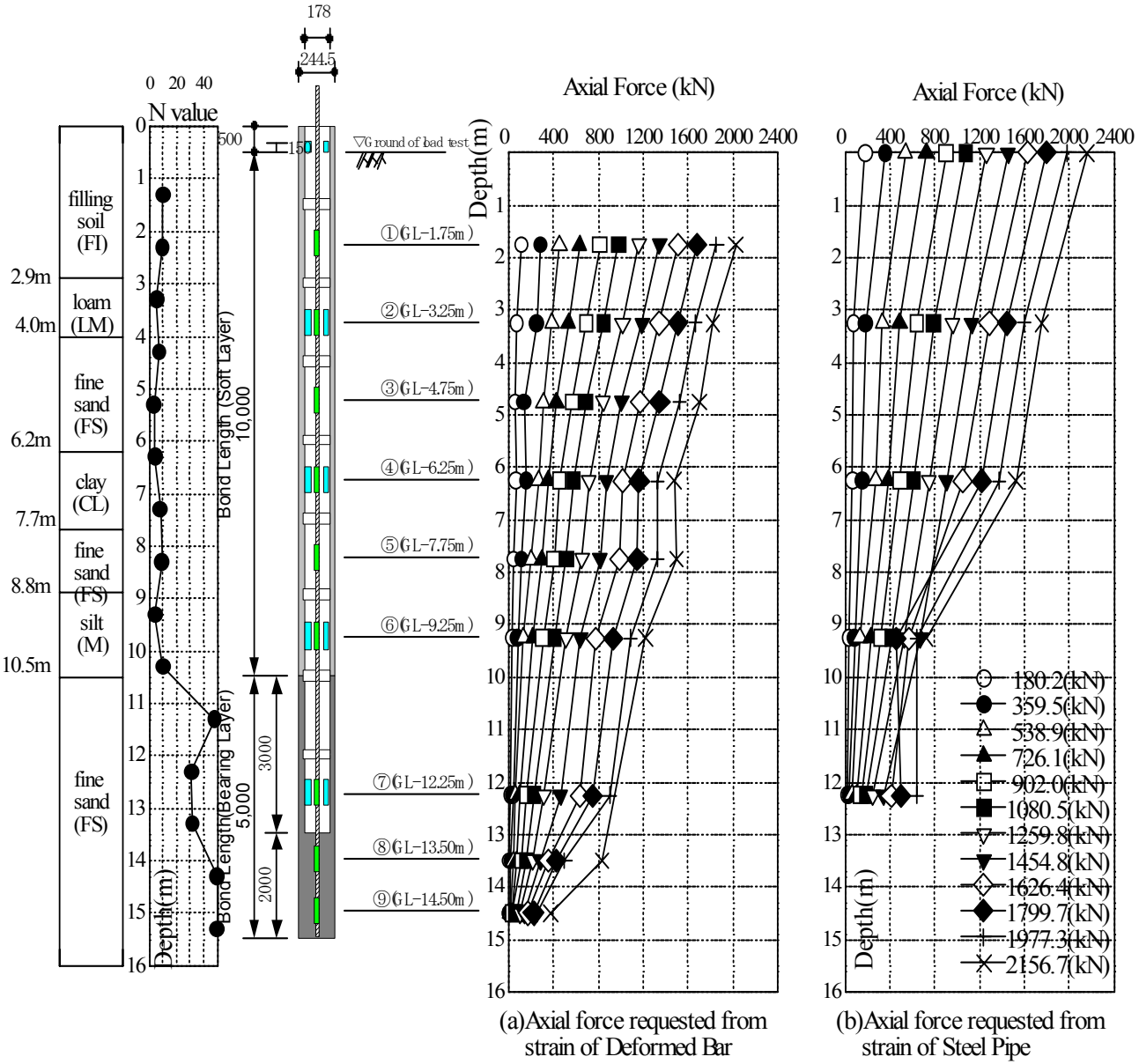
Pull out test situation

Curve of Load and Displacement



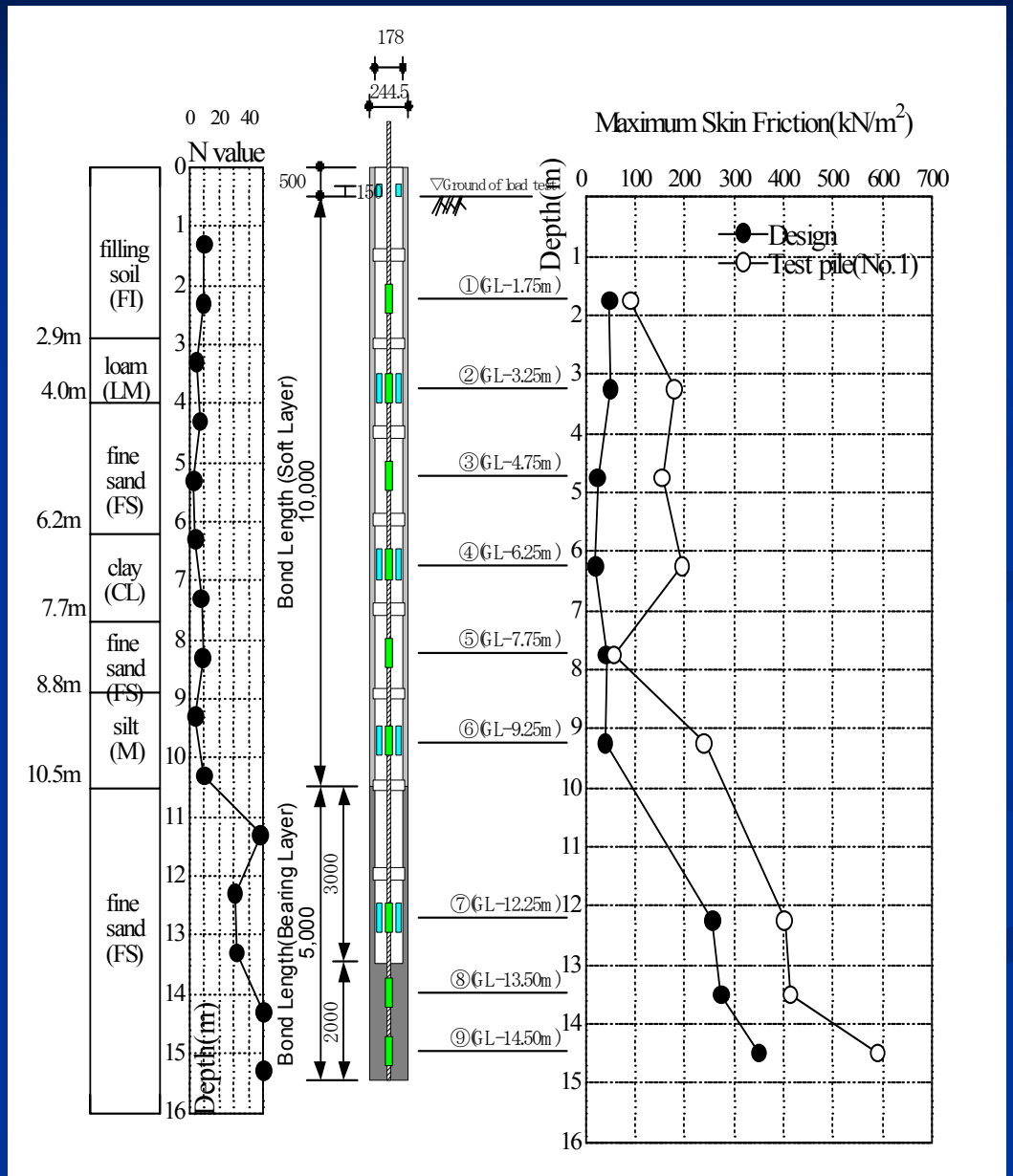
Axial force – Depth

The axial force has also decreased.
It is understood that the whole area of the pile is bond length.



Maximum Skin Friction-Depth

Maximum Skin Friction was also larger than the design.



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Conclusion

- The Bearing Capacity of NEW-HMP was about 40 percent larger than that of HMP.
- NEW-HMP is a calculation, which can reduce the number of the pile by about 20% compared with HMP.
- The problem of NEW-HMP is negative friction though it did not become a problem in the design in HMP. It is necessary to examine the method of designing the skin friction in the soft layer.
- We want to make the cost down adding the improvement further in the future.

THE END

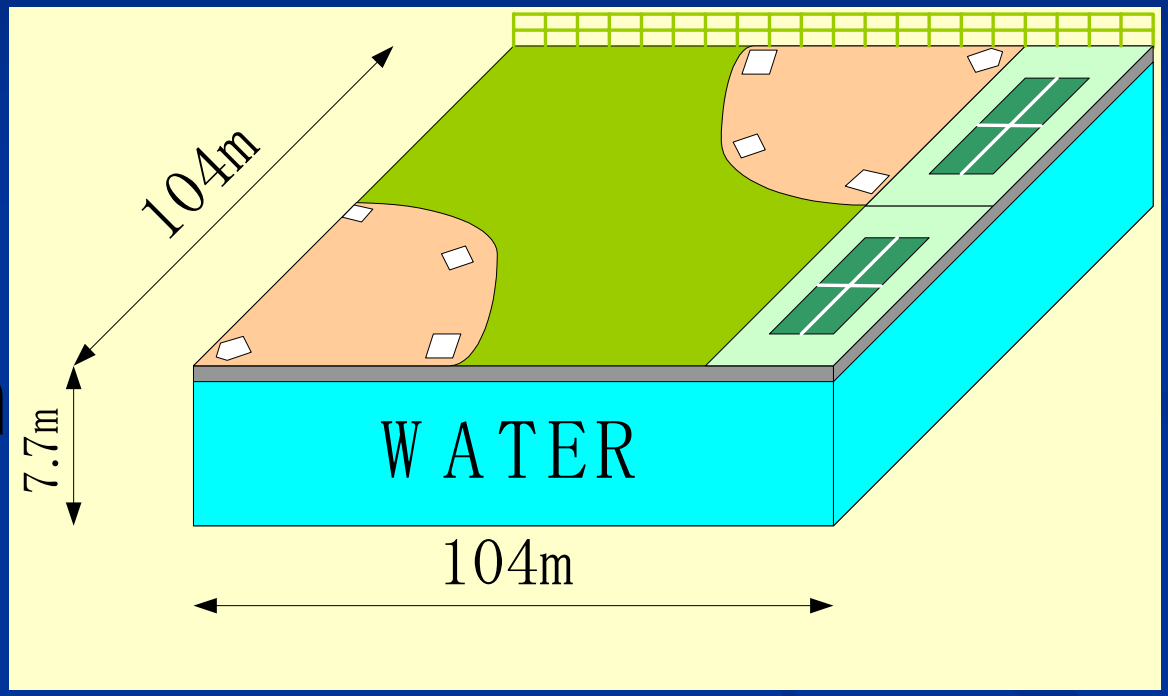
Thank you for your attention!!

Construction Example(2)
Seismic Retrofit of KAMEIDO water service station

- In the upper part, there are a baseball ground and tennis courts.

Construction Example(2)
Seismic Retrofit of KAMEIDO water service station

- Built in 1970
- height ; 7.7m
- Width; 104m × 104m
- Volume of water kept in store; 60,000m^3



Construction Example(2)
Seismic Retrofit of KAMEIDO water service station

- Built in 1970
- height ; 7.7m
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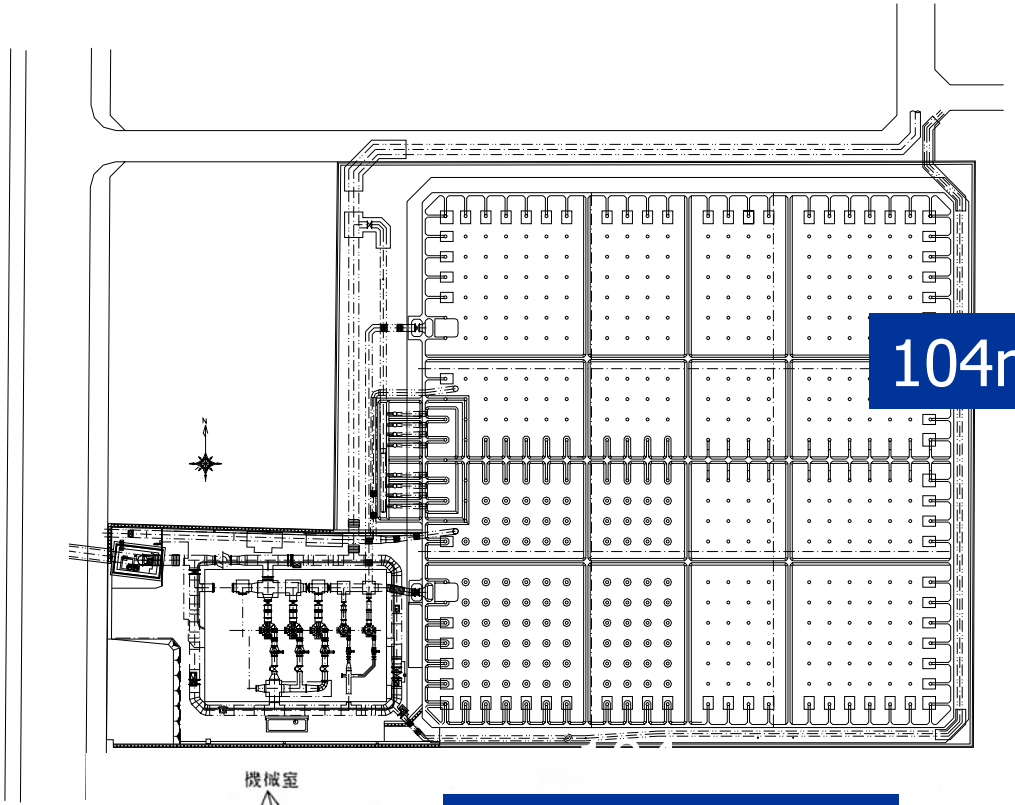
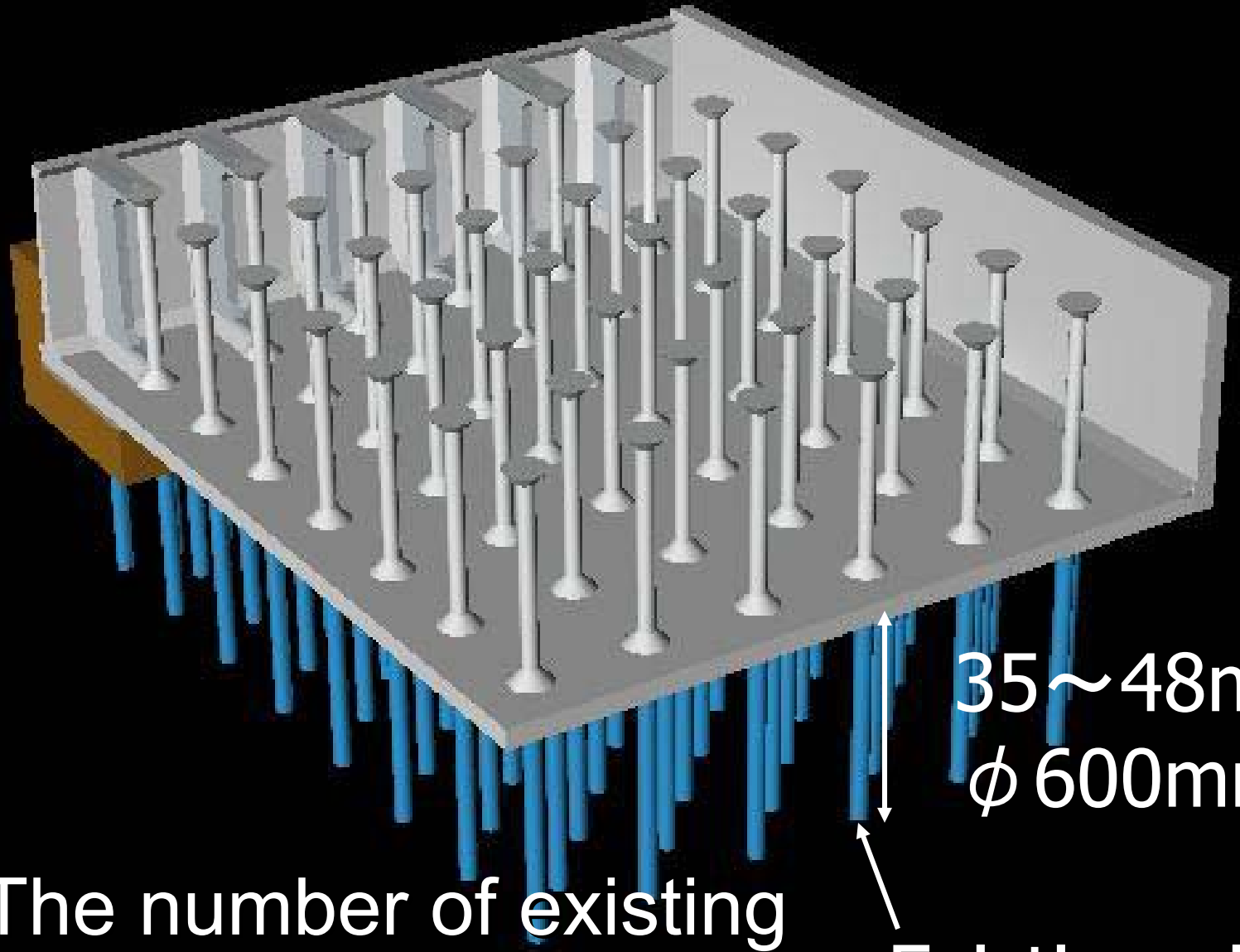
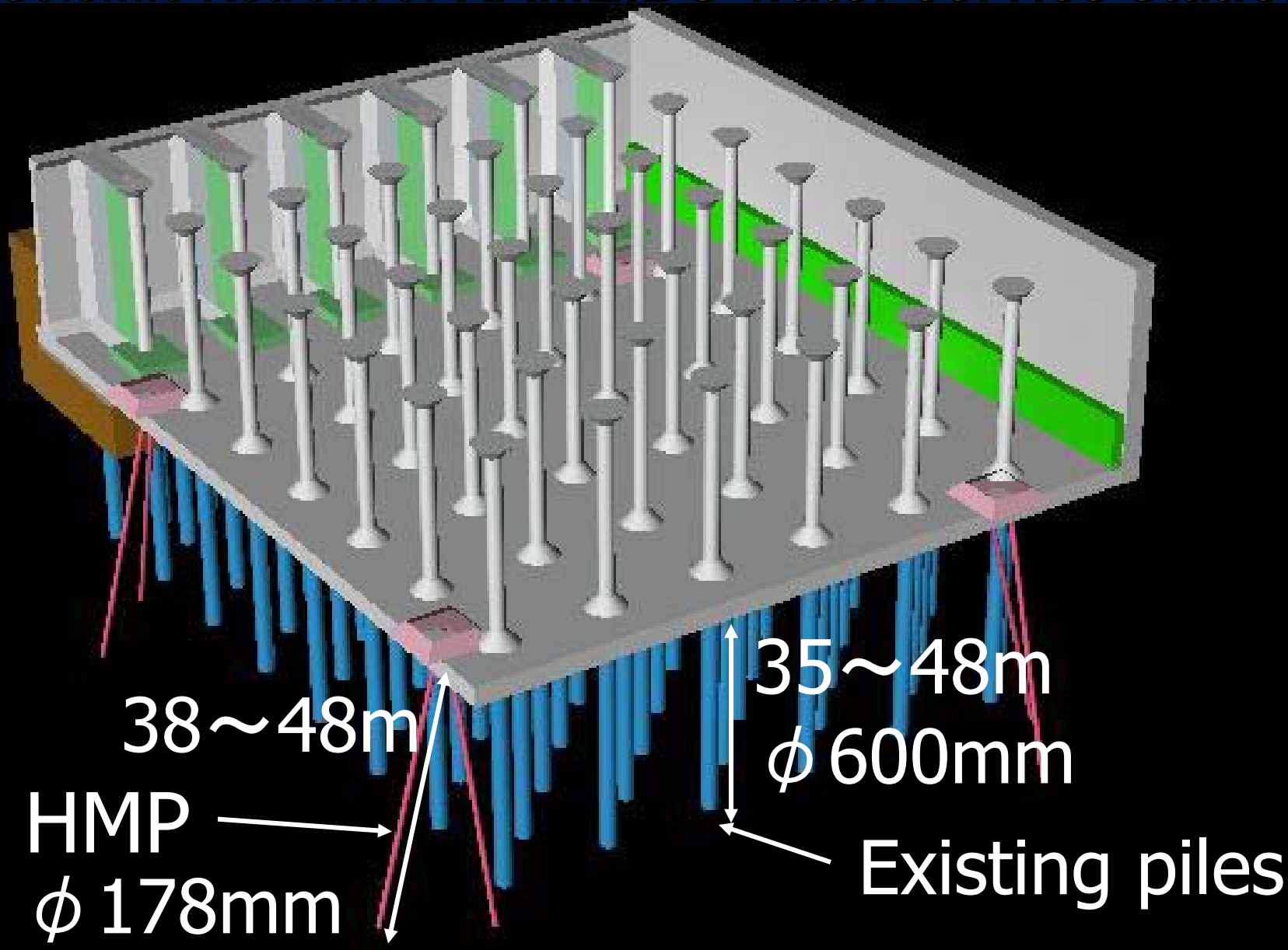


Construction Example(2)
Seismic Retrofit of KAMEIDO water service station



- The number of existing piles are 1696.

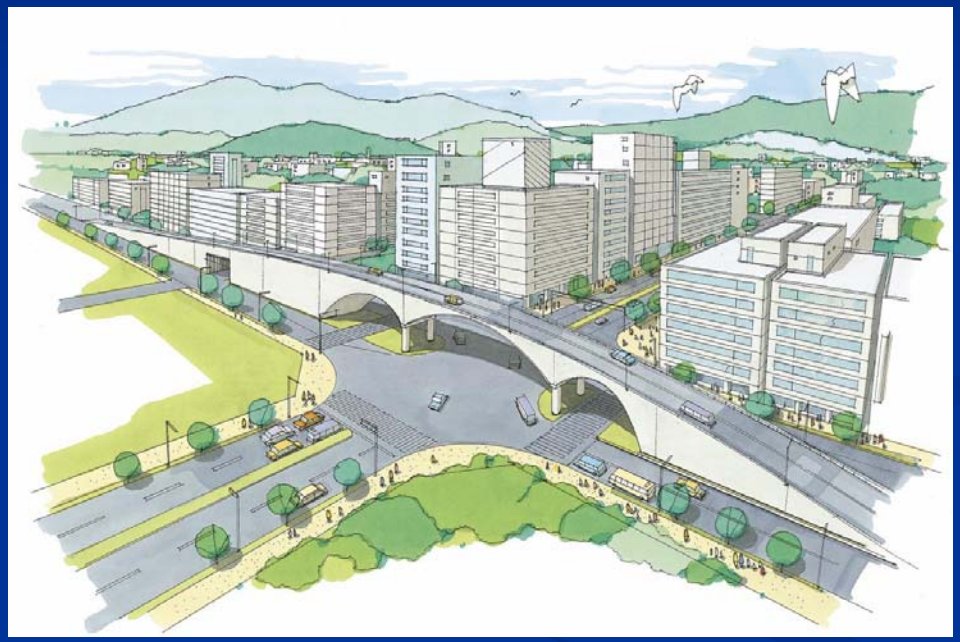
Construction Example(2)
Seismic Retrofit of KAMEIDO water service station



Construction Example(2)
Seismic Retrofit of KAMEIDO water service station

PWRI Collaboration Project with Private Companies

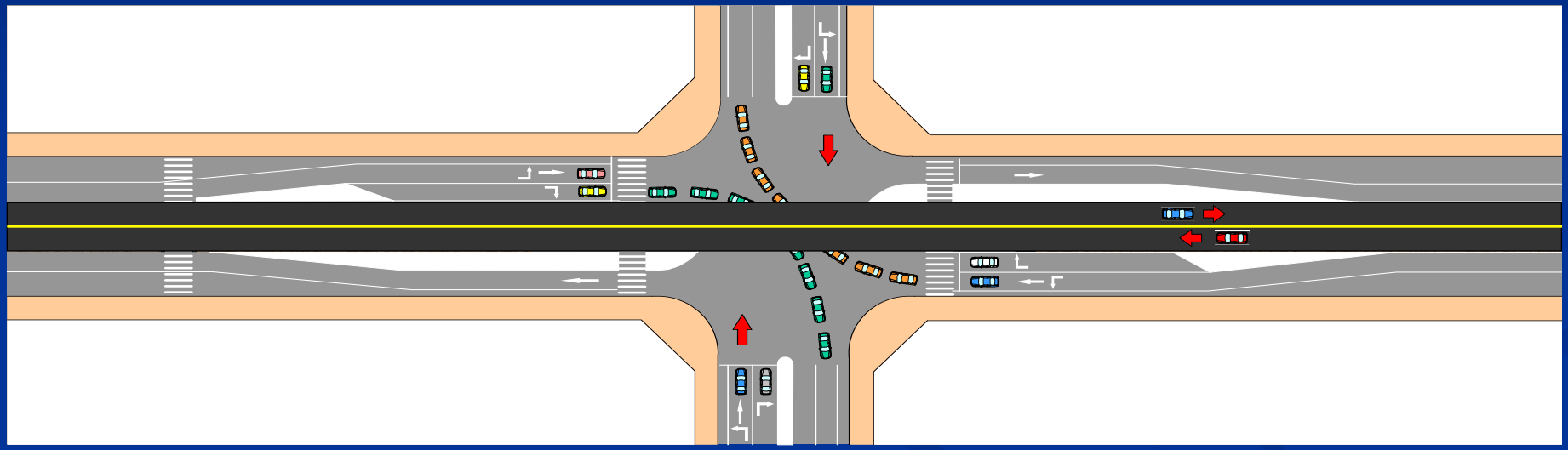
- Development of Rapid Overpass Method
  - The application of micropiles is researched as a new foundation.

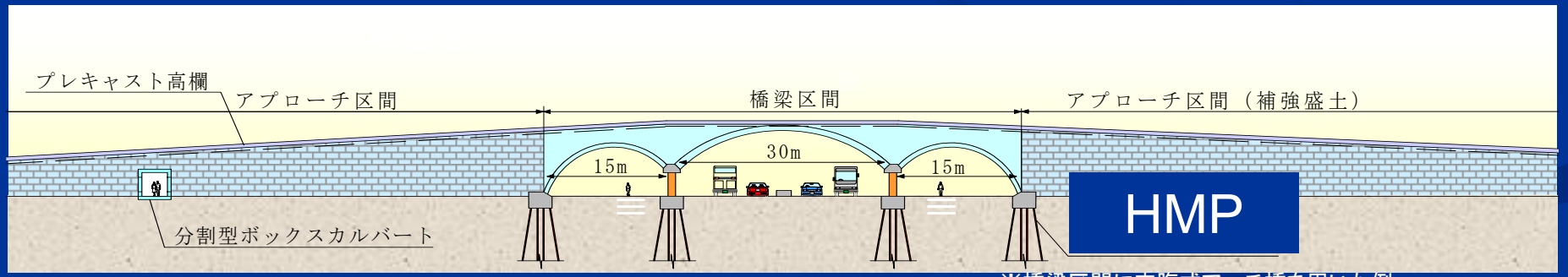


Design and construction manual

PWRI Collaboration Project with Private Companies

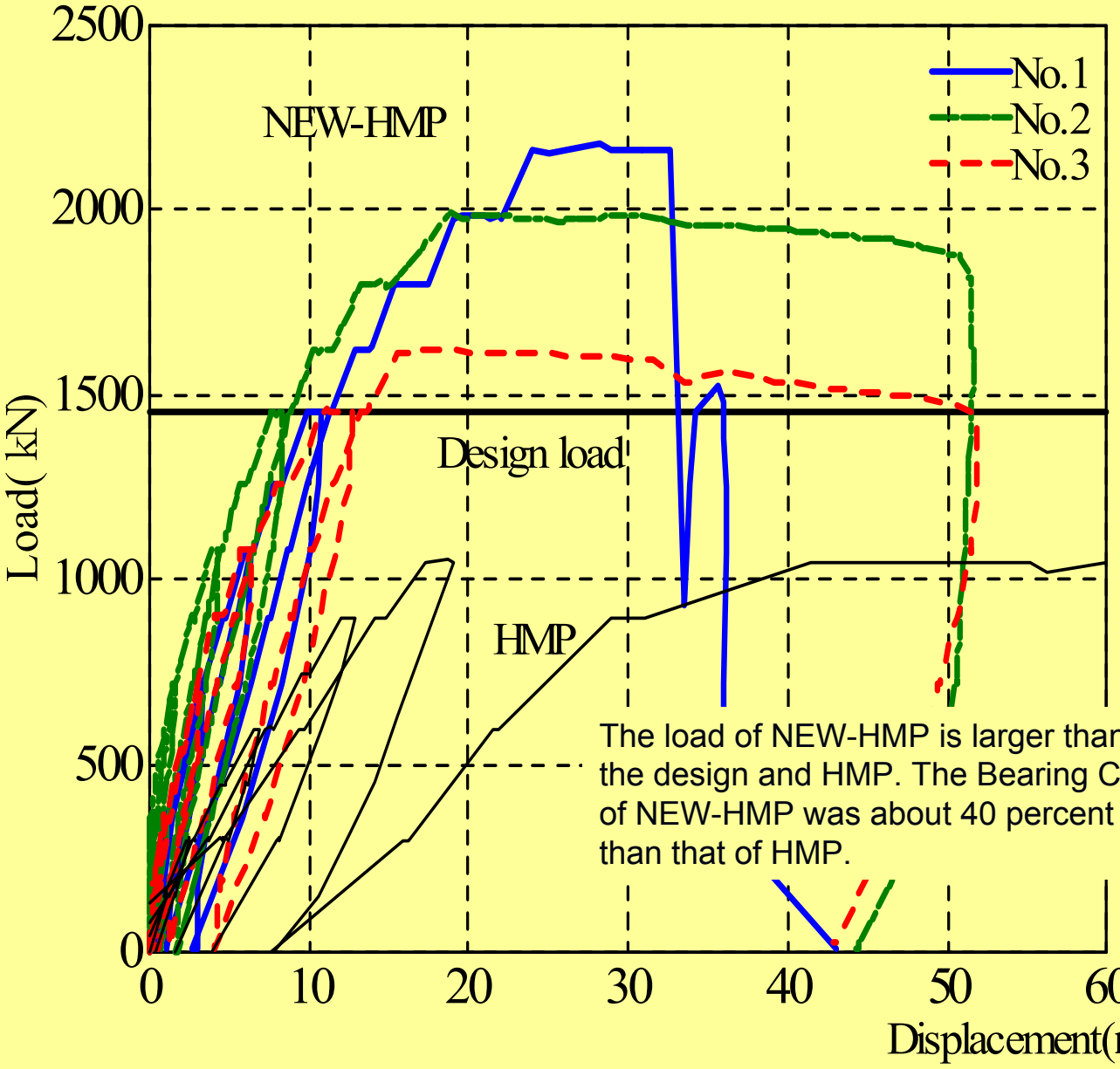
(Development of Rapid Overpass Method)





※橋梁区間に充腹式アーチ橋を用いた例

Curve of Load and Displacement



The load of NEW-HMP is larger than that of the design and HMP. The Bearing Capacity of NEW-HMP was about 40 percent larger than that of HMP.

Maximum Skin Friction-Depth