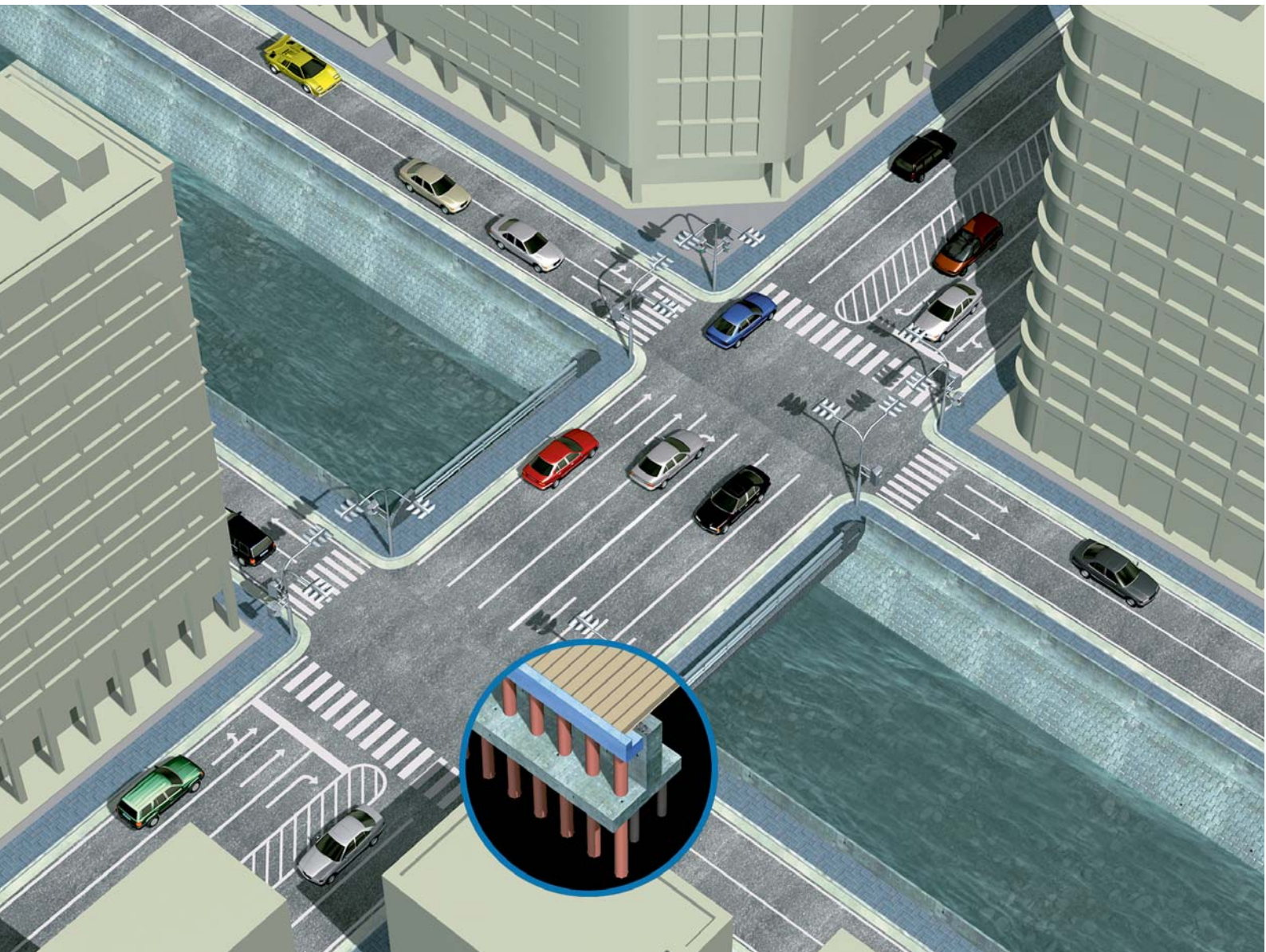


Implant Bridge



Solution for Bridge Reconstruction in Urban Area



Introduction

In the early 20th century, the first automobile was introduced in Japan. Since then, the number of automobile has grown drastically throughout the world. Automobile has become substantial and compulsory in our life. Popularisation of automobile plays a substantial role in economical and cultural developments, and it has affected various associated industries. More road networks are required to cope with the rapid increase of vehicles on road. Unfortunately, the road networks are inadequate and its function is limited. For example, bridges which were built earlier are too old to serve its function effectively causes massive traffic jams at the junction. Thus, it is critical for the society to respond to the current traffic problems and new construction approach shall be implemented as soon as possible in urban city.

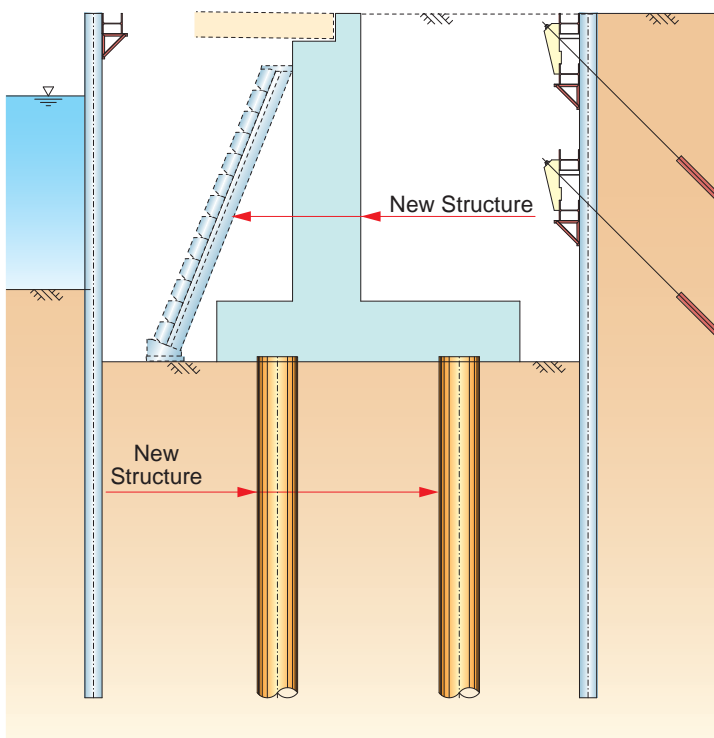
Outline of Implant Bridge

Giken's Proposal to Bridge Reconstruction

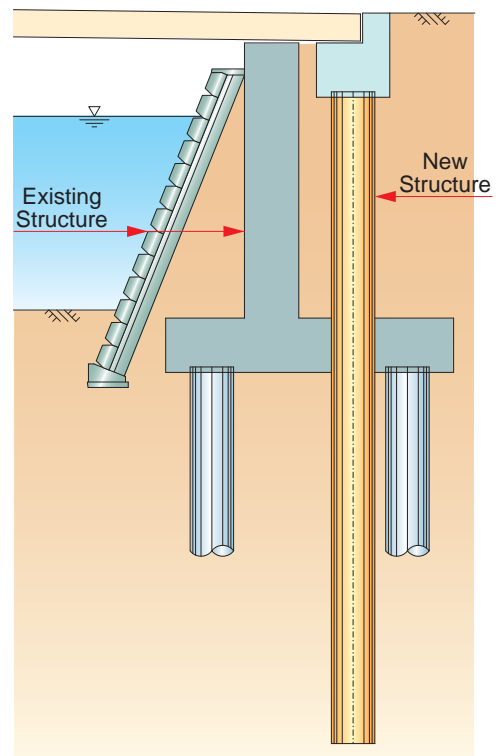
"Implant Bridge" is another form of "Implant Structure". Implant Structure is made of modular prefabricated structural elements and installed into the ground using the Press-in Method. It functions both as a foundation pile and act ultimately as the body of a structure. During the construction, no extensive temporary work is necessary. It is a structural revolution which changes the current footing type of structures into the concept of "Implant Structures". Giken has successfully established a new construction method to eliminate all negative aspects of conventional construction works.

This new concept of construction method further adds engineering value to the overall construction. It reinforces the existing structures with minimum rectification works required. The procedure of works is systematic which imposes less environmental problem to the surrounding (e.g. minimum disturbance to the existing traffics and pedestrians). Even if any existing structures obstruct the construction of a new structure, it can still be solved by demolishing only a small affected part of the existing structure. With such, the "Implant Structure" will extend the life of the existing structure by re-creating a new function to it. This concept fits well on the idea of re-cycling for a sustainable society.

[Footing Structure]



[Implant Structure]



Features of Structure

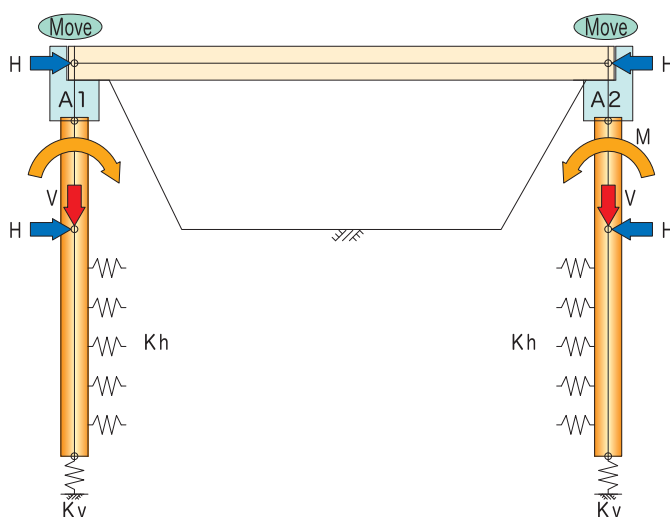
Substructure

- ◆ Modular structural elements (made of prefabricated piles) are continuously being pressed-in to the required depth without removing the existing abutment and embankment. These piles will function as the bridge abutment, so called the “Implant Abutment”.
- ◆ Construction activities are neither affected by the variations in water level nor any seasonal restrictions. Hence, the total construction period and cost can be remarkably reduced.
- ◆ Foundation and structural parts can be completed in one-step by penetrating through the existing structures even at hard ground condition.
- ◆ By selecting the most appropriate pile materials, structure which shows high resistance against earthquake can be constructed economically.

Superstructure

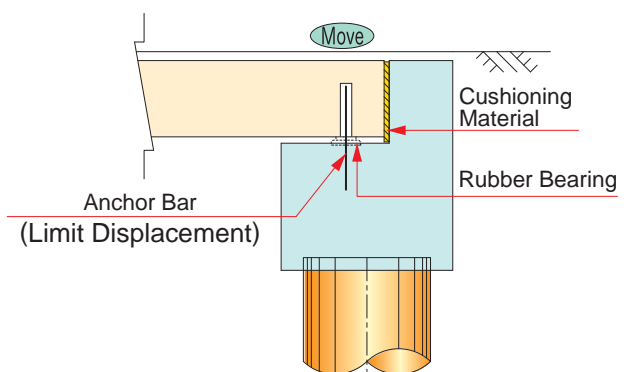
- ◆ The concept of this design is to transfer the horizontal force to superstructures through the pre-tensioned girders. Cushioning materials are inserted between the parapets of abutments and at both ends of the girders, allowing the transfer of horizontal force instead of bending moment. In the design, simple beam concept is applied since the fulcrums are at the pile tops. As the result, stresses and deformations are smaller than those induced in the cantilever beam action, which eliminate the need for a massive substructure to be constructed.
- ◆ Reduction of construction period can be achieved by employing pre-tensioned pre-cast simple slab or T shape pre-cast girder.

[Prop Structure Sample Illustration]



H : Horizontal Force
V : Vertical Force
M : Bending Moment
Kv : Axial Spring
Kh : Lateral Spring

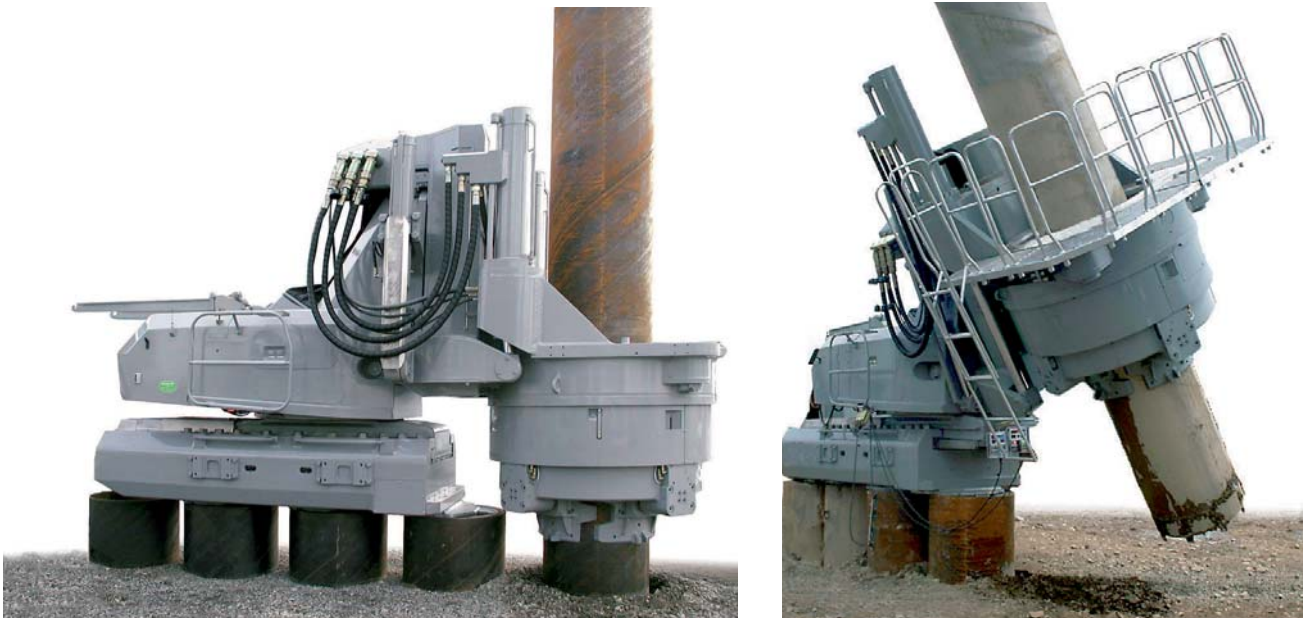
[Detail Bearing A1 & A2]



Features of Gyropress Method

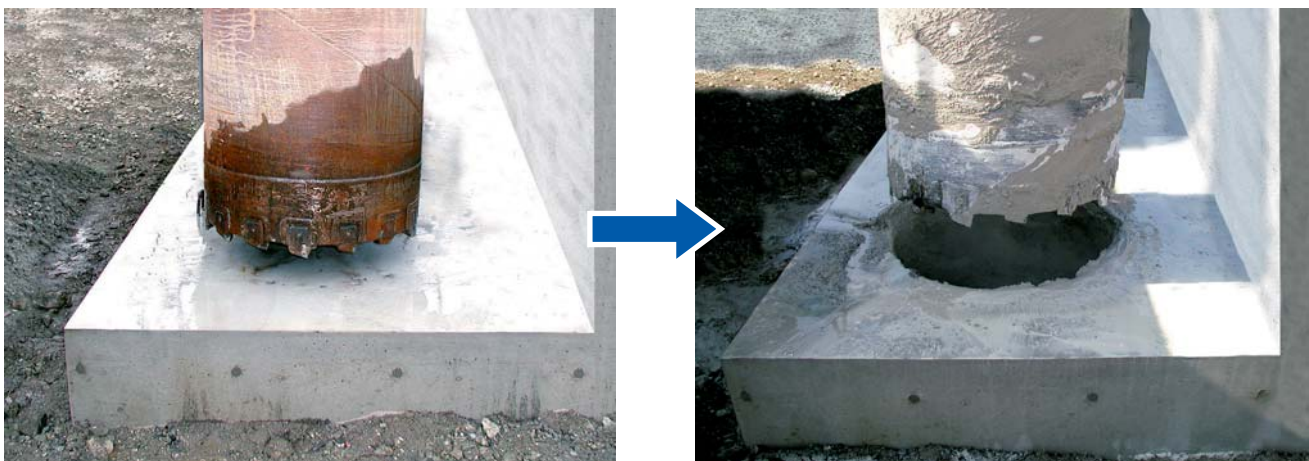
- ◆ Press-in operation is carried out on completed piles and repeated based on a simple standard procedure. Therefore, construction can be carried out under any site restrictions with minimum space and no temporary work is necessary.
- ◆ Pile material with the required strength and dimension will be selected to satisfy with the design requirement. The construction can be achieved with good accuracy by the superiority of press-in principle.
- ◆ Machines used for the construction of functional structure are free from noise and vibration with minimum emission of exhaust gas. The use of bio-degradable oil further adds to the environmental friendliness of the system.
- ◆ Systemized machines are self-standing by gripping the pre-installed piles. Thus, the machines are safe against the toppling possibility. The small and compact machine further eliminates the negative impact to the surrounding environment.
- ◆ Highly advanced IT technologies are equipped with systemized machines which enable the work to be carried out safely and efficiently at a longer time.

Gyro Piler



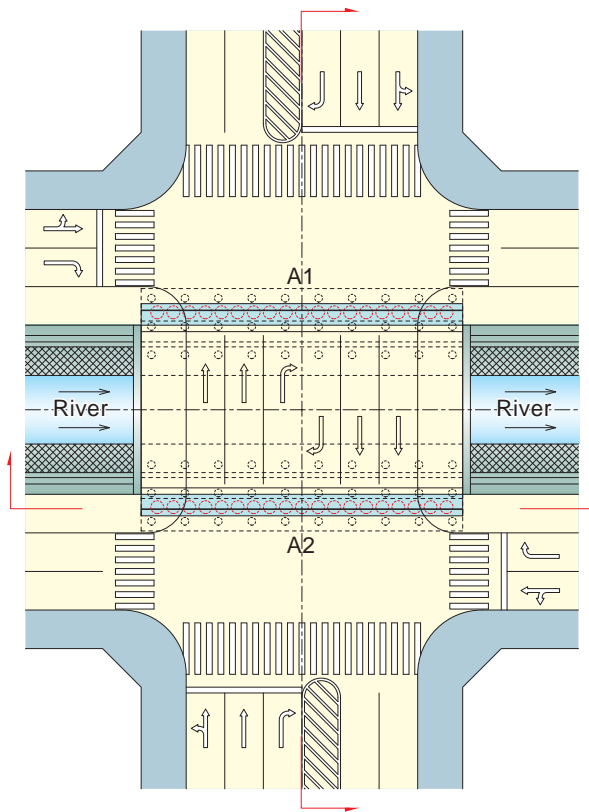
Penetration into a Reinforced Concrete Structure

Penetration through reinforced concrete by Gyropress method; Thickness 80 cm, D16@250 x 3 layers.



General Application

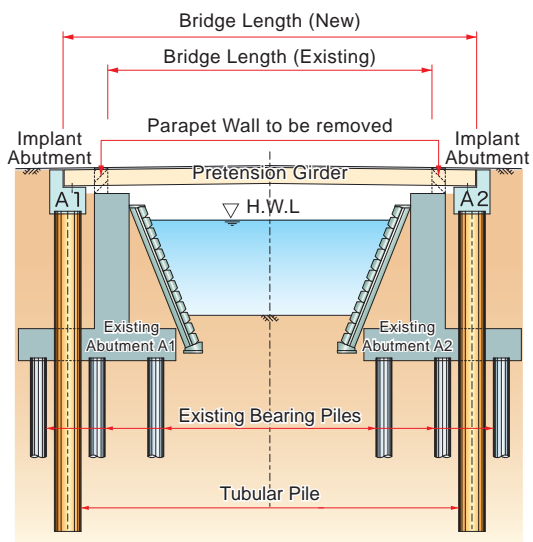
[Plan]



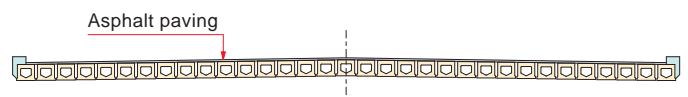
Design Outline

- 1) Superstructure
Pre-tensioned System PC Simple Deck Bridge
- 2) Substructure
Implant Abutment
- 3) Foundation
Tubular Piles (Baring Piles)
- 4) Pile Length
Semi-infinite ($\beta L_e \geq 3$)
- 5) Earthquake Resistant Design Standard
The Traditional Elastic Static Seismic Method

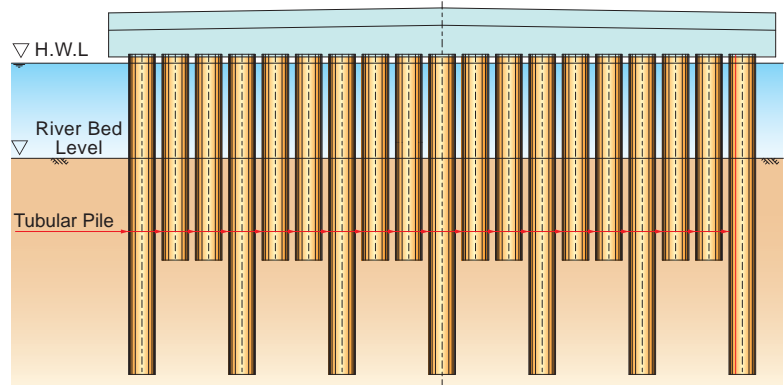
[Cross Section]



[Superstructure Elevation]



[Substructure Elevation]

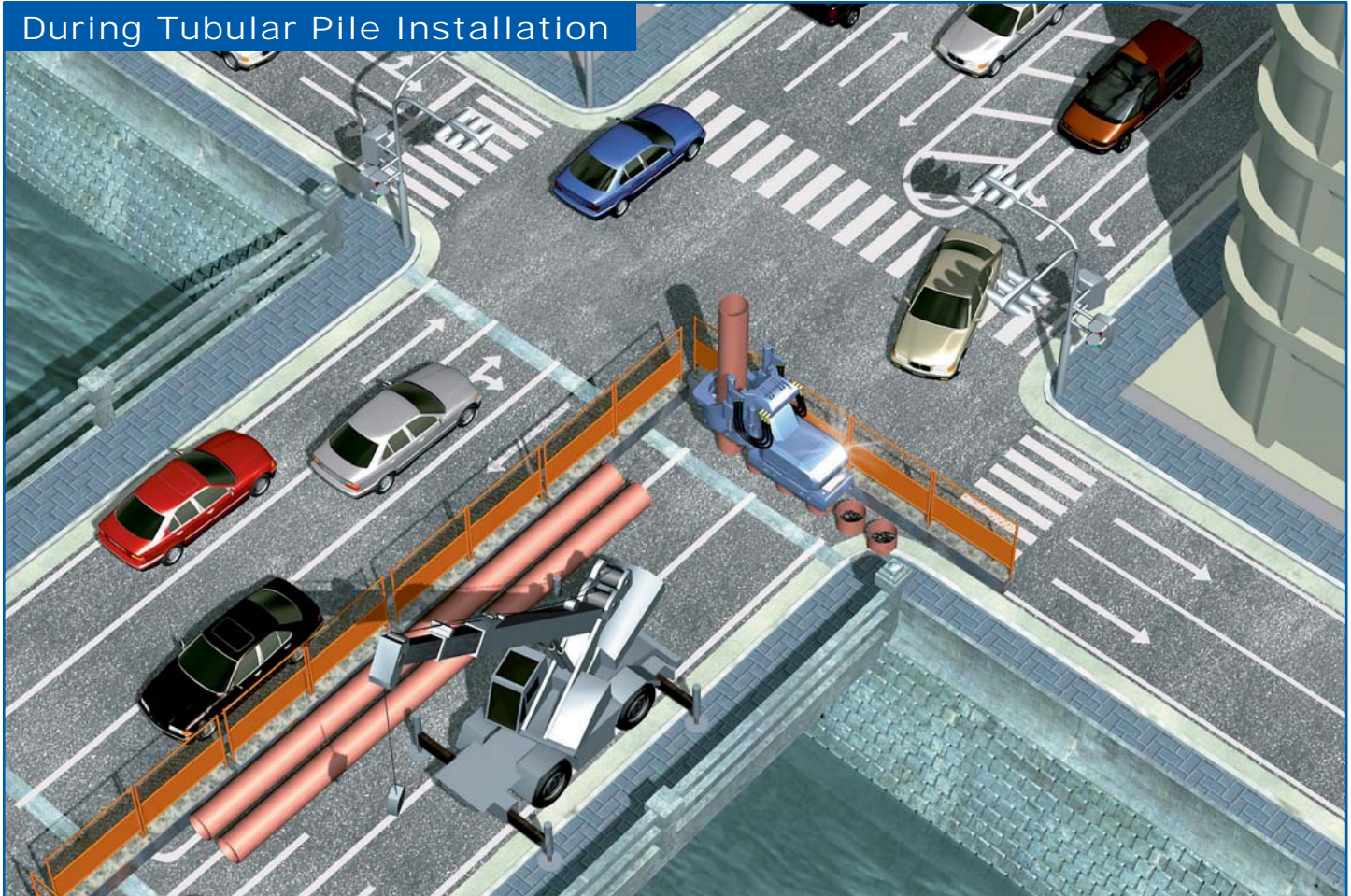


Construction Method Comparison

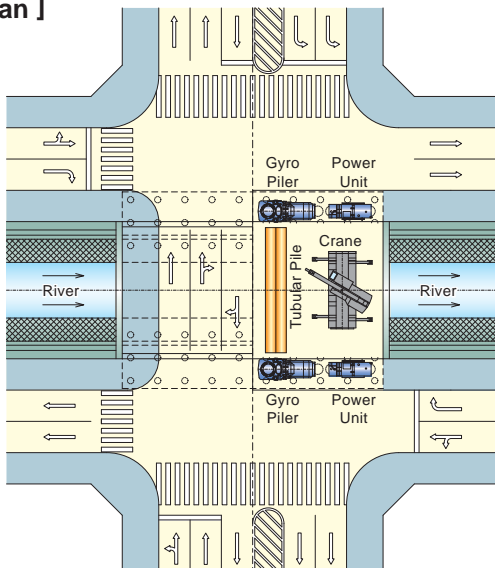
Bridge Reconstruction by Implant Bridge

The "Implant Bridge" is a method to construct the "Functional Structure" without the demolition of existing abutment. Construction can be carried out without disrupting the existing traffic and affecting the comfort of pedestrians. It maximises the use of existing structures as the working area and eliminates the massive temporary works which are required based on the conventional methods. This method can also prevent from secondary disaster during flood seasons considering that there is no obstruction to the river flow during construction. With the effective use of the superiority of press-in principle, construction will be carried out with minimum temporary works and complied with the Five Construction Principles.

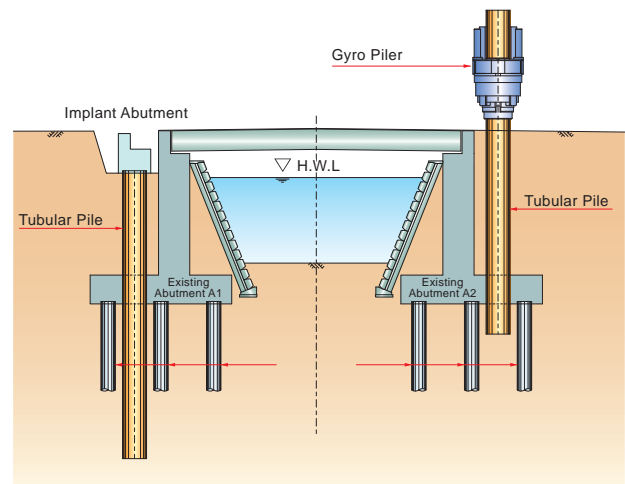
During Tubular Pile Installation



[Plan]



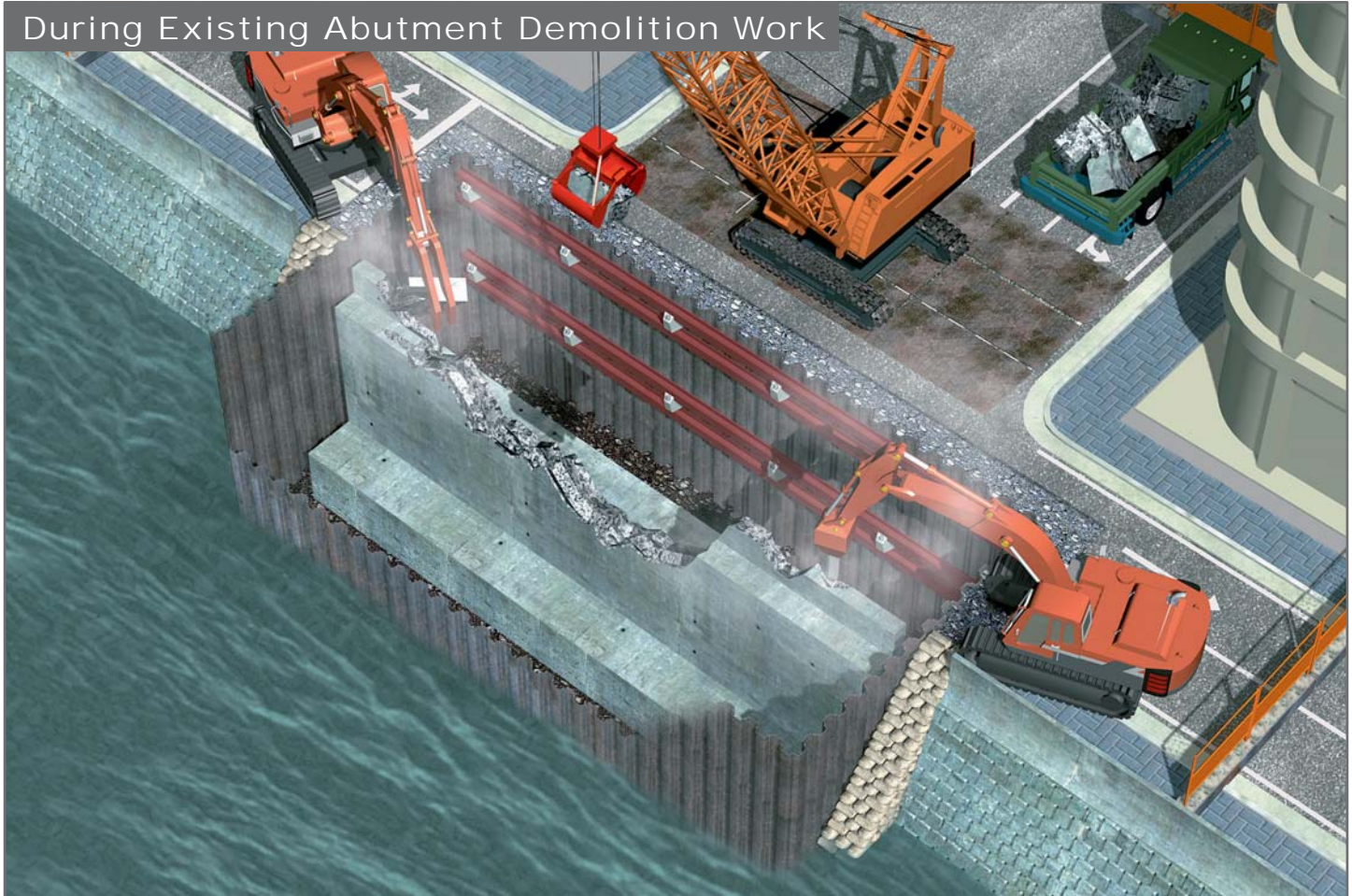
[Cross Section]



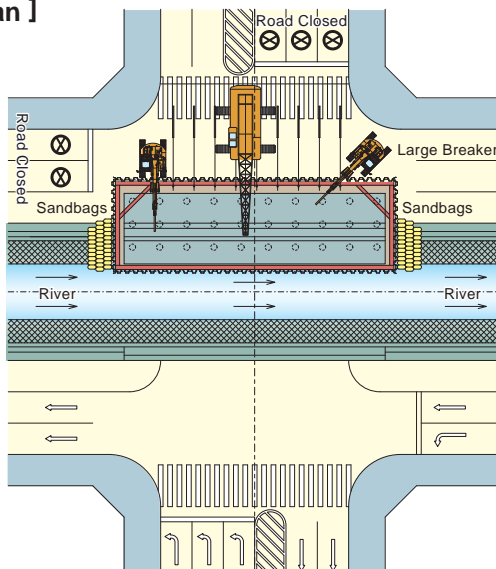
Conventional Bridge Reconstruction

The construction starts from the removal of massive existing structures. In order to remove the existing structures, massive temporary works are carried out (e.g. temporary enclosure by sheet piles, excavation, dewatering, strutting and waling, demolition of existing abutment and foundation including disposal of excavated materials and demolished concrete etc). Majority of the works involves huge temporary works, causing traffic obstruction and discomfort to pedestrians during construction. Furthermore, extensive temporary enclosure and working platform will be required in the river which affects the smooth river flow and draws the risk of the occurrence of secondary disaster during heavy rain and flood seasons. Footing type structure is common for this conventional structure and the construction works are difficult to comply with the Five Construction Principles. Consequently, it prolongs the construction period and causes detrimental effects to the surrounding environment.

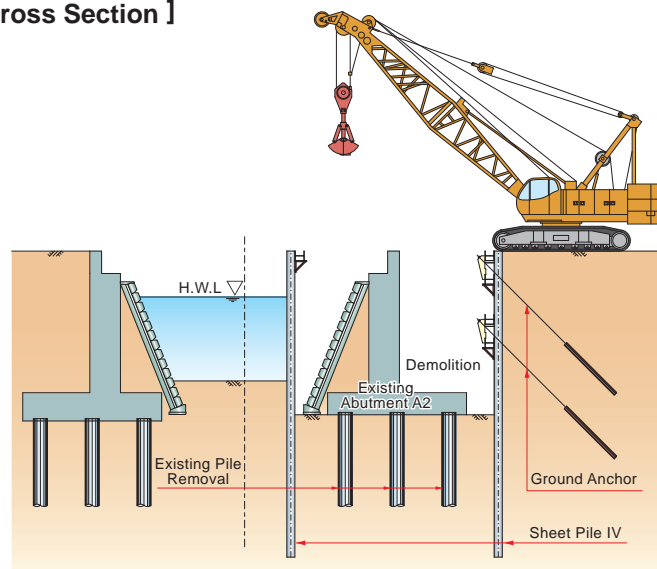
During Existing Abutment Demolition Work

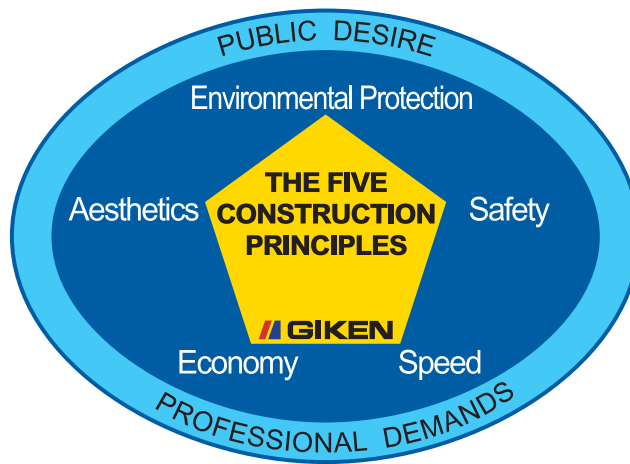


[Plan]



[Cross Section]





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