May 2018 No.81
Japanese Infrastructure Newsletter

IDI QUARTERLY

Infrastructure Development Institute—JAPAN

The cover picture is a reinforcement work of the Kochi coastal levee utilizing the implant structure methodology, the GRB system and the Gyropress method.

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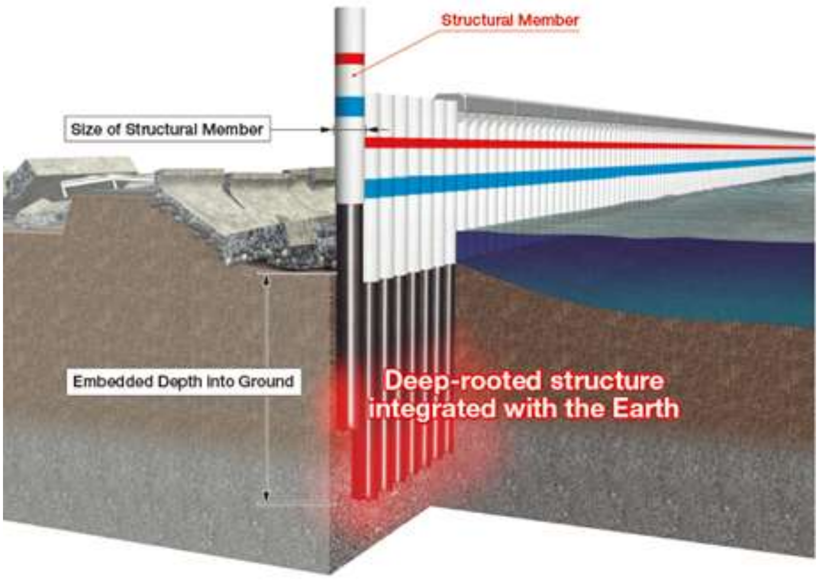
Infrastructure Development Institute – Japan (IDI)
Suido-cho Bldg, 3-1, Suido-cho, Shinjuku-ku, Tokyo, 162-0811, JAPAN
Tel: +81-3-5227-4107 Fax: +81-3-5227-4109 E-Mail: idi17@idi.or.jp Website: http://www.idi.or.jp/english/00index.htm

Implant Levee Embedded Resilient Structure

Embedded resilient piled foundations installed into the ground by the Press-in Method

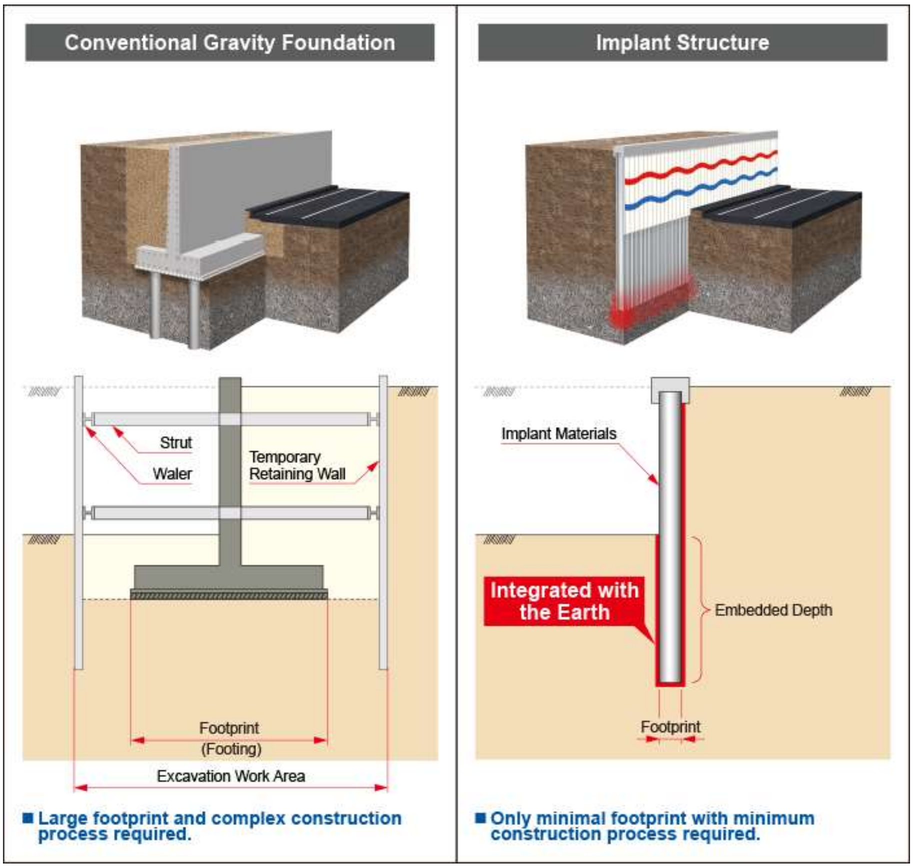
1. Deep-rooted Resilient Structures

The Implant Structure consists of robust and durable structural members which are firmly embedded into the ground by the Press-in Method. The structural members are selected from a wide variety of piling materials in accordance with design requirement, thus, the Implant Structure can cover a wide range of foundation designs required in today's construction industry. Also, being embedded into the ground, the Implant Structure is extremely resilient and maintains its serviceability even in extreme events, such as natural disasters.



2.Rapid Construction with Minimal Footprint

Traditional gravity structures are commonly used worldwide as they are simply constructed by "seating" on firm ground. However, they are quite vulnerable to dynamic loads caused by floods, wave actions, earthquakes and tsunamis. Furthermore, gravity foundations require a large footprint. This leads to complex construction processes i.e. temporary retaining walls, bulk excavation, shoring and backfilling etc. On the other hand, the Implant Structure is directly installed into the ground forming an extremely resilient structure with a minimal footprint and construction process.

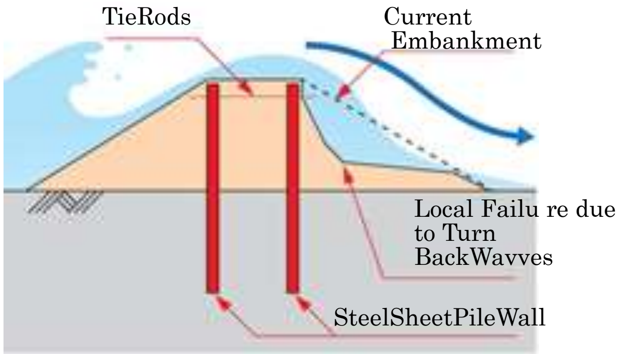


3.Twin Steel Sheet Pile Wall System

Steel sheet piles are installed into the embankment to a depth determined for proper stability and/or cut-off of flow.

Also, liquefaction of the levee can be prevented by enclosing it with twin sheet pile walls.

Thus, the levee can withstand large external loading and the levee crest can remain in place, even in cata- strophic events.



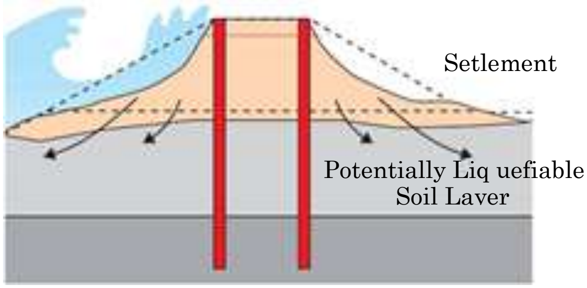
■Advantages of Implant Levee

Flood, Storm Surge and Tsunami Protection

Functions of the levee can be maintained by increasing its stability.

Liquefaction Protection

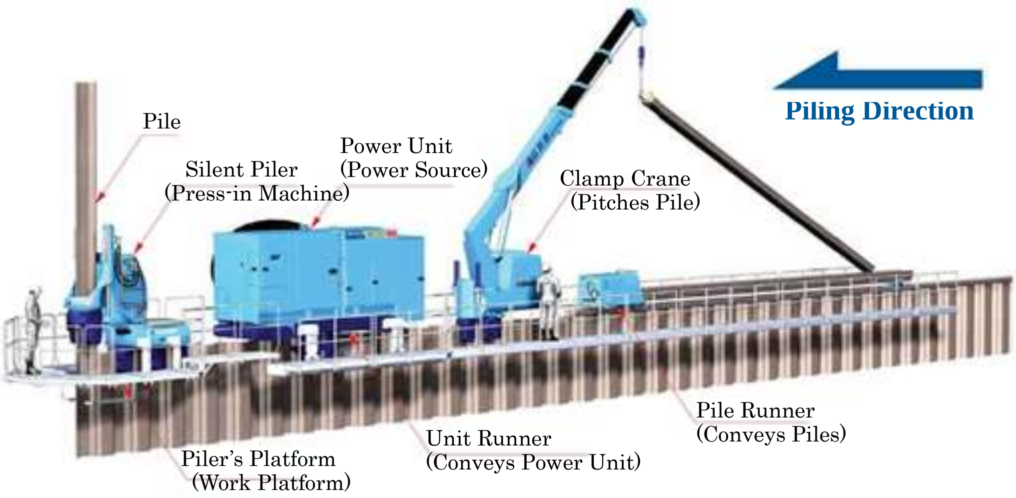
Functions of the levee can be maintained by the ground enclosure effect.



4. Giken Reaction Base(GRB)System

The press-in machine utilises reaction force from previously installed piles and performs piling work on top of the piles. With further development based on the principle of "reaction based mechanism", "the GRB System" was developed as a press-in system which performs all piling procedures such as; pile transportation, pile pitching and press-in work, on top of installed piles.

The GRB System consists of a Silent Piler in the front, a Power Unit as a power source, a Clamp Crane to pitch piles and a Pile Runner to convey piles from storage site.



5. Contiguous Tubular Pile Wall

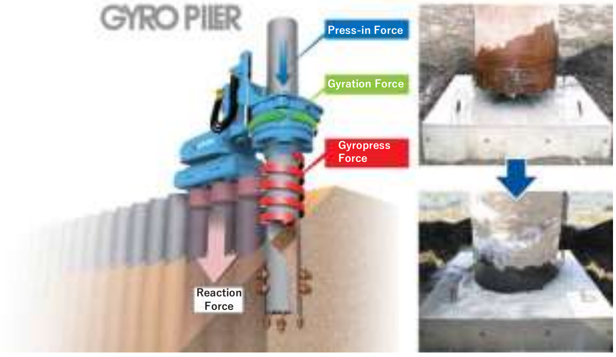
Steel tubular pile wall is a vertical barrier and can be installed in locations where space is scarce, such as urban environments or where the construction of a wide levee is not feasible.

The piles are installed into the embankment to a depth determined for proper stability to withstand large dynamic and hydraulic loading.

6. Gyropress Method

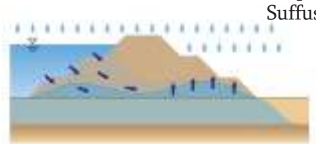
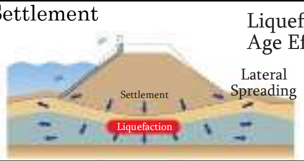
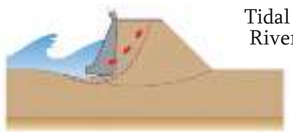
Gyropress Method installs tubular piles with cutting bits attached on pile toe by rotary jack-in system, and travels on top of piles which are completely installed (completed piles).

Gyropress Method allows the installation of tubular piles without prior removal of existing structures and/or obstacles.



7. Comparison of Implant Levee to conventional levees (Risk Analysis)

Failure of levees potentially results in devastating consequences, in both life and economic losses, around the failure. Therefore, risk analysis and evaluation is a key issue for levee operation and management.

Failure/ Deterioration Mode/ Risk Elements	Process	Risk Evaluation: Implant Levee	Risk Evaluation: Conventional Levee
Instability Animal Burrowing Shrinkage Cracks (Desiccation Cracks) 	Water entering the embankment through surface cracks or animal burrows could reduce the soil strength of the levee.This may compromise the stability of the embankment and, in turn, reduce the ability of the levee to perform as designed during high water events.	Negligible	Moderate - High
Internal Erosion Seepage Suffusion 	The hydrostatic pressure against a levee slope increases significantly and can force water into the levee embankment and its foundation. This seepage will generally follow paths of least resistance. Depending on the geotechnical properties of the soil, internal erosion may then happen.	Negligible	Moderate - High
Settlement Liquefaction Age Effect 	Large seismic accelerations cause settlement and loss of effective shear strength in water-saturated, unconsolidated sediment, leading to loss of bearing pressures and lateral spreading of levee.	Negligible - Low	High
Breach Flood Tidal Action River Flows 	Levees can breach before overflow/ overtopping if there are structural issues with the levee making it unstable under a hydraulic load.	Negligible	Moderate - High
Collapse (Widespread Devastation) 	Large external cyclic loading due to these catastrophic events may lead to large parts of the levee collapsing or significant deformations. The levee failure occurs when the weakness of the levee reaches an unsustainable ultimate state.	Negligible - Low	High

Technology Developer：GIKEN LTD.
Contact: Head Office International Business Department
E-mail: international@giken.com FAX: +81-(0)88-800-1227

1. Introduction

IDI-Japan had been operating "Global Flood Alert System (GFAS)" on the website since April 2006 and started operations of GFAS II (ver.2.0) in June 2015 which additionally utilized GSMaP_NRT*1, the precipitation obtained by analysis of observation data from multiple satellites.

GSMaP_NRT

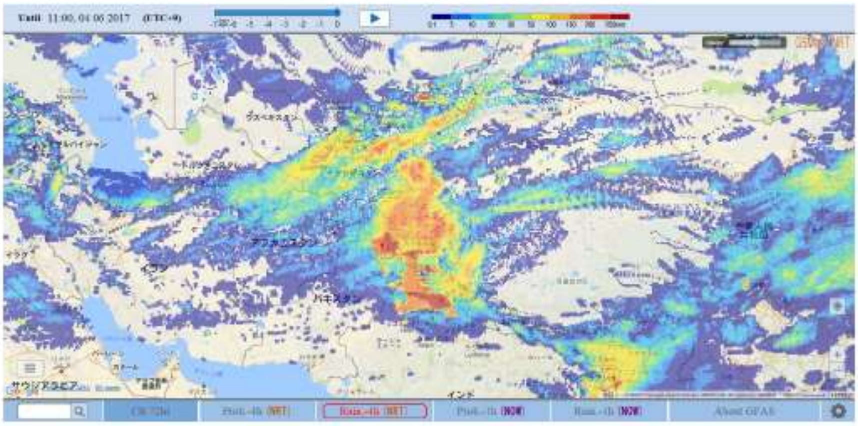
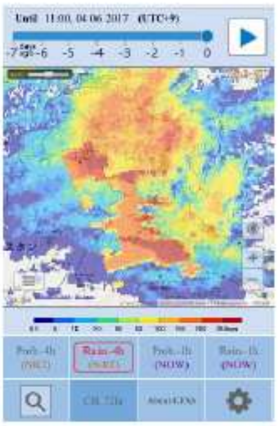
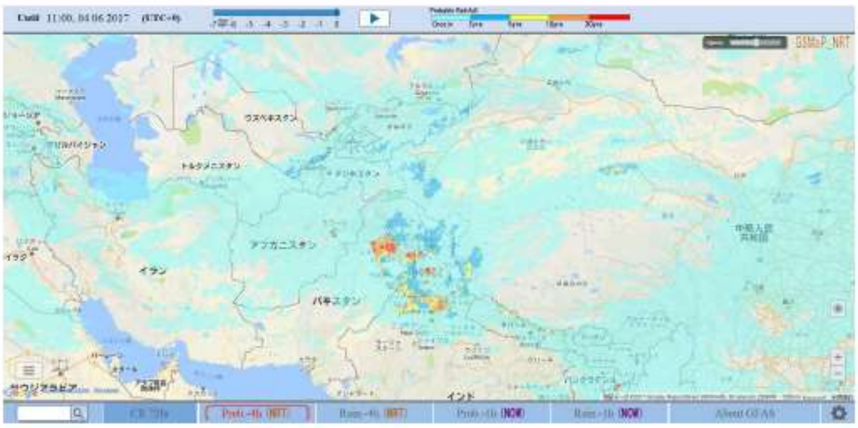
GFAS II provides precipitation data observed by satellites using Global Grid (with latitude and longitude of 0.1 degree width, which is approximately 11 km in equatorial regions), conducts risk assessment by occurrence probability (return period) in each grid, and updates the data hourly in the map.

Japan Aerospace Exploration Agency (JAXA) started delivering GSMaP_NOW in 2015 which provides precipitation in almost real time. The new version of GFAS II (ver.2.1) utilizes the data of GSMaP_NOW and can show a global risk map of possible rain related disasters about 1 hour late.

The revised GFAS II (ver.2.1) is available in the following web sites since June 2017.

2. How to use, environment

Please use a personal computer (recommended browser is IE) and can be used on smartphone.

	Personal Computer	Smartphone
amount of rainfall		
Probability rainfall		

The revised GFAS Ⅱ (ver.2.1) is available in the following web sites since June 2017.

[for PCs] http://gfas.internationalfloodnetwork.org/n-gfas-web/pc/frmMain.aspx
[for Smartphones] http://gfas.internationalfloodnetwork.org/n-gfas-web/sp/frmMain.aspx y

Smartphones

3. Major Improvements of GFAS Ⅱ (ver.2.1)

✓Utilization of GSMaP_NOW

✓Updating probability of precipitation occurrence (probability distribution form):
For the precipitation in the past, data by the latest JAXA products, RNLver6 and MVKver6 are used as well as precipitation data of the recent 2 years and data of the past 16 years.

✓Extension of movie display time

✓Burmese now available:
You can choose from six languages; English, Spanish, German, Vietnamese, Burmese and Japanese.

GSMaP_NRT is the near real time version which provides global precipitation data about 4 hours late with high resolution (with temporal resolution; 1.hour and special resolution; latitude and longitude grid of 0.1 degree width)

GSMaP_NOW is the quasi-real time version of GSMaP_NRT which provides precipitation data within the observation range of Stationary Satellite HIMAWARI by predicting precipitation of 30 minutes later using cloud motion vector observed by HIMAWARI.

NOTE: In GFAS Ⅱ, GSMaP_NRT shows data about 4 hours late, and GSMaP NOW shows about 1 hour late. GSMaP_NOW is higher in immediacy than GSMaP_NRT, however, tends to be lower in qualitative accuracy.

If you have any questions, please send an e-mail to the following e-mail address:
Infrastructure Development Institute (IDI-Japan)
e-mail;info@internationalfloodnetwork.org

[Reference]
*[1]GSMaP: http://sharaku.eorc.jaxa.jp/GSMaP/guide.html

About IDI and IDI-quarterly

Infrastructure Development Institute (IDI)-Japan is a general incorporated association operating under the guidance of Ministry of Land, Infrastructure, Transport and Tourism of Japanese Government.
IDI provides consulting services for mobilizing International Assistance to developing countries, promoting international exchange of information and human resources, and supporting globalization of project implementation systems targeting both developed and developing countries in the field of infrastructure.

IDI has been publishing the free quarterly journal "IDI Quarterly" since1996 for the purpose of introducing information relating to public works and construction technologies developed in Japan to foreign countries. We have distributed the journal to administration officials in more than 90 countries around the world by e-mail.

It is highly appreciated if you would send us your opinions, impressions etc on the articles.
We are also welcoming your specific requests on articles to pickup for the following Quarterly issues.