### Integrated Geotechnology Institute Limited Corporate Profile

### "Pioneer Think Tank" in the field of reinforced soil stru

What we have been aiming for since our company was established :

To become a "Pioneer Think Tank" consultant at the forefront in the field of reinforced soil structures and ground improvement.

Due to the increasingly severe changes in the environment, society demands are becoming more sophisticated, complex and varied.

Our company has been established as a strong organization that can adapt to these demands, keeping our originality in mind and not being afraid of change.

By developing four complementary axes related to Experiments, Analysis, Design and Overseas Projects, we can actively and continuously strive for innovation and change.

We provide high-quality services as a pionneer civil engineering consultant with advanced technical capabilities.

### ctures and ground improvement

Civil engineering consultant Integrated Geotechnology Institute Limited (IGI)



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## **Experiments**

Total support for experiments and tests with a valuable link to design and numerical analysis

#### **Model experiments**

We conduct dynamic and static loading experiments on earth, foundation and track structures at Railway Technical Research Institute or public research institutions.

We conduct model experiments while considering performance-based design, and contribute to the improvement of railway technology by reflecting the gained knowledge on railway design standards.

#### Laboratory tests

In addition to ordinary soil testing, we conduct various laboratory tests such as advanced triaxial tests (static or dynamic loading) using LDT, unsaturated triaxial tests, liquefaction tests, hollow cylindrical torsional shear tests, and elastic wave velocity measurements etc.

We conduct compressive strength tests using small or large triaxial testing equipment while covering a wide range from cohesive soil to ballasts with large particle size.

The strength constants (c,  $\varphi$ ) and dynamic deformation coefficients (G,  $\gamma$ , h) obtained by tests are used as parameters for preliminary design and numerical analysis.

#### **Field experiments**

We conduct full-scale tests and long-term dynamic measurements for civil engineering structures.



Experimental facilities at RTRI



Case① Shaking tablet test of abutment model



Case<sup>2</sup> Shaking table test of embankment model



Hollow cylindrical torsional shear test





Elastic wave measurement

## Analysis

#### **Development of Analysis**

- We developed a slip calculation system using Newmark-D method under the supervision of Professor Tatsuoka from Tokyo University of Science.
- This system has become a standard seismic diagnosis method for strong earthquakes on dams and ponds.
- Seismic-induced settlement can be computed taking into account the reduction in soil strength and rigidity caused by undrained cyclic loading (liquefaction) based on the cumulative damage theory (softwares "SERID" and "SENPS" ).

#### **Design support by Analysis**

- Case ① is an example of FEM analysis that took into account the dissipation of excess pore water pressure after liquefaction in order to examine countermeasures against settlement of supporting ground due to strong earthquakes. It was confirmed that subsidence could be reduced to more than half by ground improvement.
- Case ② is a example of consolidation settlement analysis to evaluate the effects of the newly laid embankment. It was confirmed that the settlement of the existing embankment can be reduced to 1/5 or less by adopting relevant countermeasures.





Case① Study of liquefaction counter measures for L2 earthquake (SENPS)



Case<sup>(2)</sup> Consolidation settlement analysis

#### Other

- Reproduction analysis of shaking table experiment (dynamic FEM analysis etc.)
- Seismic response analysis of ground and structures (ALID, Flush, Soil Plus)

# Design

#### **Design of Reinforced soil**

As a pioneer of the Reinforced Earth Technology in Japan (RRR Construction System), we provide high-quality designs with valuable experience.

In addition to the design of reinforced soil structures, we also design other conventional soil structures (embankment, cutting, temporary earth retaining structures etc.).

We also contribute to society by implementing disaster recovery-related designs in areas damaged by earthquakes and heavy rains.

#### **New Design method**

We can offer total technical proposals from the planning to the design and construction, in collaboration with the engineering department that conducts various research tasks (experiments and testing) and the analysis department that specializes in numerical analysis.

#### Design

- Reinforced soil structures (RRR-A, RRR-B, RRR-C, RRR-D etc.)
- Disaster prevention and recovery (Reinforcement of existing retaining walls etc.)
- Earth retaining structures (Temporary earth retaining walls etc.)

※ In addition to the above, we also design other conventional soil structures.



Construction example (RRR-A,B)



Construction example (RRR-C)





Construction example (RRR-D)

## **Overseas Projects**

#### **Overseas Expansion**

In recent years, the development of railway network development plans has become more active with the aim of further economic growth, particualy in developing countries in Asia.

In the earthquake-prone Philippines, construction of the North-South Commuter Railway Line has recently started. Our Overseas Project team was in charge of the design of reinforced earth retaining walls & e m b a n k m e n t s (R R R - A), and of soil-reinforced integral bridge (RRR-A) that will be constructed along this line.

#### **Design Support**

We offer a large range of support, from field surveys to design calculations, drawings and numerical analysis for structures that are the most suitable to local conditions.

Based on the many achievements and experience obtained so far in Japan, we aim to propose an optimal design of railway structures in accordance with international design standards and local construction conditions.

#### **Promotional Activities**

We participate in a number of technical seminars overseas, such as the Seminar in Japanese Infrastructures Technologies in Manila (Philippines) in November 2018 organized by the Japanese Ministry MILT.

The Japanese reinforced earth structures technology (RRR) was introduced focusing on the many achievements obtained in Japan and gathered very positive reviews from the Philippines government agencies.



Overview of Philippines North-South Commuter Railway Plan (JICA)



Overseas Seminar in Philippines



Overseas seminar in Philippines



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> > Fisical year 2019