Our Three Promises for the Future

“Sustain the Land” “Protect from Natural Disaster” “Mediate with the Next Generation”

Reliable Technology and Force of Continuity
We, Sanshin Corporation, will keep the mission of transferring safe and comfortable land to the next generation in our minds and strive to create safe society in the future.

TECHNOLOGY

Ground Improvement ......................... 4
  Soil Mixing .................................. 4
  Jet Grouting .................................. 5
  Permeation Grouting ....................... 6
  Compaction .................................. 7

Anchor ............................................. 8
Earth Reinforcement and Slope Protection ................. 9
Pile and Foundation ................................ 10
Consolidation and Drainage ....................... 11
Repair and Reinforcement of Structures ............... 12
Remediation of Contaminated Soil and Water ............ 13
WILL method
(Widely Applied to Recover from Earthquake Disaster)
NETIS Registration Number: QS-090004-V

CPG method
(Compaction Grouting method)
Seismic Reinforcement of Operating Airport Runways
NETIS Registration Number: KTK-140005-A

V-JET method
(Rapid Performance of Large Diameter Ground Improvement)
NETIS Registration Number: KT-120047-A (Publication Period is end)

Soil Nailing method
(Efficient Excavation Support and Ground Stabilization)

Backfill Grouting for Tunnels
(Long-Term Conservation of Existing Tunnels)
These are the ground improvement methods that rotating mixing blades will mix in-situ soft soils with binders such as cement and create hard soil mass. Depending on our huge experiences, we, the leading company of DJM method, can satisfy our clients' various requirements from shallow to deep soils.

Deep Mixing method by Using Powderly Binders
Mixing blades are rotated and penetrated into ground, then powderly binders are pneumatically ejected from tip of mixing blades and mixed with in-situ soils. Chemical reaction between the binders and the in-situ soils stabilizes the mixed mass and increases its strength. By positioning the improved elements properly, we can create the purpose-fitting improved ground. DJM is the representative deep soil mixing method that doesn't need mixing water. In comparison with European methods with similar concepts, it has higher quality and reliability. The following related methods are also available: EX-DJM that has larger diameter of improvement body. HL-DJM that has higher strength and applicability of lower improvement ratio, and R-DJM that has lower displacement of surrounding ground during operation.

Innovative Mid-Depth Mixing
Special shaped mixing blades that move mixing soils from inside to outside than from outside to inside during their rotation are attached to the arm of an excavator. Binder slurry is ejected from the blades and mixed with in-situ soils. Binders and in-situ soils are mixed together in both up-and-down and left-and-right directions thus homogenized rectangular improved body is created.

The De Facto Standard of Slurry-Phase Deep Mixing
Binder slurry that is prepared in the slurry mixing plant is mixed with in-situ soils. The following related methods are also available: CDM - MIGA method, CDM - LLODIC method, CDM - Lenn2/3 method and CDM - FLOWAT method.

Applicable to the hard soil layer
This method can effectively improve the lost motion in the ground, and the unique blade can achieve the improved area of more than twice the traditional slurry mixing method (double blade to reach 1m diameter).

Jet Grouting is the ground improvement method that cut and break the ground by the energy of high pressure jet fluid (water and/or binder slurry) and mix the broken soils with binder slurry. We are the leader of Jet Grouting through huge experience of JSG method, and keep licenses of various Jet Grouting methods. Based on these experiences, we are developing more advanced methods from viewpoints of environment friendliness and sustainably.

New technology to achieve the fan shape jet grouted
The concept of MultiFan was used of jet grout to form the fan shape improvement. The MultiFan can reduce the ineffective arrangement of jet grouted improved and practice the improvement configuration and layout with high eco-nomic efficiency.

MultiFan method

JSG method

Historic Double Tube method
By ejecting ultrahigh pressure cementitious slurry with the surrounding compressed air, the ground is cut and broken, and column shaped improved body from 2.0m to 5.5m in diameter is rapidly created. A special monitor consists of two nozzles with difference in level and opposite direction each other achieves very high efficiency of cutting. This monitor realizes faster construction and larger diameter of improved body than the conventional methods.

Cementitious slurry.

Jet Grouting (Overseas)
Jet Grouting (Overseas)

Advantages
1. We can select the most suitable process from three types to design wide range of improved diameter combined with the specifications.
2. Since mixing efficiency is overwhelming, we can reduce the quantity of required binder and spoils that are produced due to ejection.
Ground Improvement - Permeation Grouting

The grouting method that stabilizes ground by reducing permeability or increasing strength is the indispensable auxiliary method for tunnel and underground excavations. In recent years, it is used as countermeasure against liquefaction of ground beneath existing structures. We are proposing the suitable method to the particular soil and environmental conditions, performing reliable construction, and developing new technologies, depending on our vast experiences.

Multi-Strainer method

Rapid Construction by Means of Large-Flow Column-Shaped Permeation

Specially developed outer injection pipe (multi-strainer pipe) maintains the injection core. By using this system, we obtain reliable permeation grouting at higher injection speed. Moreover, the availability of “first injection” and subsequent “second injection” realizes more precise grouting.

Advantages

1. Larger spacing between adjacent injection location and higher injection speed make fewer number of injection locations and reduce total injection time.
2. Smaller upheaval of surrounding ground makes the work adjacent to existing structures possible.
3. By the combination with 3D injection system, more precise construction is achievable.

Ultrasonic Vibration Grouting method

Ultrasonic wave to enhance the grouting permeation

The UVG is a newly generated grouting method that combined with the Tube-A-Manchette (TAM) grouting features and the propagation characteristic of ultrasonic wave. It can use the ultrasonic wave to drive the tube vibrated and enhance the permeation of grout through grouting. Meanwhile, it can form high quality and uniform grouted mass. It comes available.

Advantages

1. Ultrasonic wave diving the vibration of grouting tube and reducing the blockage of soil particles.
2. It can increase the permeability of the grout and form a wide range of grout with high quality.
3. The ground heavy and deformation can reduce after the grout permeability was improving. The grouting workfoward or under the structures would be more workable.
4. It is improving the ground permeability that can reduce the amount of waste slurry and lowered the grout overflow to the ground surface.

Ground Flex Mole method

Popoint Treatment by Using Horizontal Directional Drilling

This is a new grouting technique that combines directional boring and double packer injection. Location and direction of the drilling bit are measured and controlled by a special device. Percussion device is available to drill harder soils. This method is suitable for liquefaction prevention yet applicable to soil remediation and filling of voids.

Advantages

1. We can treat the soils beneath the existing structures without interrupting the operation of the structure.
2. Since there is no process of withdrawal of tools, one-way operation is possible.
3. Construction of shaft is unnecessary, so schedule shortening and cost reduction are achievable.
Anchor method has more than 50 years of history in our country and has been used for various fields including slope stabilization and earth-retaining support. We have worked on the anchor method from its early phase as the leading company. Therefore, based on our vast experiences, we perform reliable work even under very strict conditions.

**Permanent Anchor method**

Representative Slope Stabilization Method with Rich Performance Records

This method is to prevent collapse of slope by the pulling resistance of tensile material that is fixed to the solid soils. It is also used for stabilization of slope and structures, and landslide prevention. The anchoring material has enough corrosion-proofing and rust-proofing thereby obtaining long-lasting function. Since its maintenance methods are established, the maintenance and renovation of its durability is easily planned. We have the performance license of many permanent anchor methods such as VSL, KTL, Super Fishtok, EHD and SEEE, together with many of their performance records.

There is a Case that the Bracing is Not Preferable

Anchor is used instead of bracing for excavation support at urban area. Its pulling resistance will undertake the reaction by the bracing. Anchor is advantageous if alignment of retaining walls is complicated or ground surface is inclined. There are two types of temporary anchors, removal type that removes tensile materials after excavation and construction of structure, and left-in-place type that leaves the tensile material as is. At removal type anchor, a loop-shaped bent un-bonded PC stranded wire combined with anchor body is mostly used. After completion of the utilization, the PC strand wire is easily removed.

**Temporary Anchor methods (removal type and left-in-place type)**

Secure Bracing Anchors under High Water Pressure Environment

This is the technique to securely install the anchors under high water pressure environment by preventing effluence of groundwater and soils, and backflow of gROUT. This method is equipped with special devices such as water-cut-off entrance device and water-cut-off packers.

Close Adhesion to the Ground

This is the cast-in-place concrete frame consists of a special frame and reinforcing bars, and works as a pressure reception plate from an anchor. During the placement of concrete, a fitting sheet will expand and adhere closely to the ground, thus this frame exhibits uniform reactions.

**High Water Pressure Resistant Anchor method**

**Fit Frame method**

**Free Frame method**

**PAN WALL method**

Earth Reinforcement and Slope Protection

In our country, having narrow land and many mountains, huge volume of land cutting is performed to construct social infrastructures thus the slope stabilization are required. We have an organization to satisfy the requirements of design, performance and maintenance of the slope stabilization methods including Soil Nailing method that is original with us.

**Soil Nailing method**

Having Original Theory and Largest Performance Records in Japan

This is the method to construct composite earth reinforcing mass by placing reinforcing nails into ground at certain spacing then spraying shotcrete for the protection of excavation surface. Earth retaining wall is constructed in parallel with excavation thus soldier pile is not necessary. Moreover, the mass has flexibility against deformation and high earthquake resistance. Accordingly, together with corrosion-proof, this method is applicable to repair and reinforcement of deformed retaining wall or stone masonry.

Advantages

1. Since small equipment is available, this method is applicable to narrow area or steep slopes.
2. If soil condition has changed during excavation, we can handle it by changing the specifications of reinforcement material.

**High Spec Nailing method**

The Packer-Equipped Reinforcement Material Grabs Firmly

This is the earth reinforcement method by inserting many short reinforcements equipped with bag-shaped packers into ground. Large pulling resistance is produced by injecting gROUT into the packers. And secure anchorage even at ground where ground easily runs off, such as gravel or talus cone, is possible. This method has higher reinforcing effect comparing with the conventional methods and needs fewer reinforcing materials for stabilizing excavation surface or slope. By evaluating the advantages and scopes of this method, we can use this method to more important slopes or structures.

**Free Frame method**

Representative Grating Grip method by Shotcrete Spray

This is the grating grip method by placing flexible wire net form that fits uneven ground surface and subsequent shotcrete spray. Stabilization or protection of extensive slopes is achievable by either placing the frame only or combining with reinforcement materials or anchors.

**PAN WALL method**

A practical method for preserve the working face of Top-down slope

The PAN WALL method used precast concrete slab to stabilization the excavation slope. This method is covered at slope surface and suitable for high degree excavated slope. Meanwhile, it can preserve the working face of Top-down excavated and maintain the slope stabilization.
Pile and Foundation

We are developing the pile and foundation methods by utilizing small equipment. CPG Lift method that is for adjustment of building settlement and applicable to narrow space or low height, and permanent ground anchor method that sustain the building by its tensile strength are representative.

- CPG Lift method
- BHP method
- TBH method
- High Spec Micro Pile method
- High Load-Bearing Micro-pile method
- VSL-J1 Permanent Anchor method

**CPG Lift method**

**Settlement Adjustment and Ground Reinforcement to Prepare for Next Earthquake**
This is the adjustment of existing building's settlement. We utilize the CPG's nature that cause upheaval during its operation near ground surface. The grout with low fluidity creates a consolidated lump near the injection point thus limited lift-up of superstructure is controllable. Since compaction of ground is intense, the ground is reinforced during the adjustment of its settlement.

Introduction of pre-mixed exclusive binders and small equipment makes application of this method to single family homes easier.

- **Advantages**
  1. Excavation beneath the foundation is not needed and execution at narrow space such as perimeter of existing structure or interior of a room is possible.
  2. We can expect the ground improvement effect by compressing the ground.

**BHP method**

**Foundation Pile that Conquers Height Restriction and Narrow Space**
Drilling is done by forward circulation of slurry. After drilled debris are treated, reinforcement cage or H-shaped beam is inserted, then concrete is placed to construct a cast-in-place pile. This method is also called Borehole Pile method, using lightweight boring machine.

**TBH method**

**Large Diameter Cast-In-Place Pile Can Be Constructed by Using Small Equipment**
This is the Borehole Pile method by using a top-drive type boring machine. By adopting reverse circulation drilling system, drilled face is further stabilized and faster construction of larger diameter drilling is achievable.

**High Spec Micro Pile method**

Seismic rehabilitation method in the limit working space
The High Spec Micro Pile method used a small and flexible machine and small-diameter steel pipe pile to reinforce the foundation of existing structures. It can be constructed in a limited height and narrow working space. Moreover, this method compared to the traditional method has cost-effectively and material saving benefit.

**VSL-J1 Permanent Anchor method**

Representative Permanent Anchor method
This method utilizes the anchoring technique to stabilize a structure and its foundation. It has received the technical evaluation by the Building Center of Japan as the permanent anchor by utilizing VSL method. This anchor has high reliability as a permanent structure.

Consolidation and Drainage

Consolidation and drainage methods that increase strength of ground by draining pour water have long histories as the ground improvement methods. Plentiful Experiences and Achievements Satisfy Various Requirements

- Well Point method
- Deep Well method
- Plastic Board Drain method
- Vacuum Deep method

**Well Point method**

The Basic Dewatering Method
Many well points that consist of a riser pipe and a cylinder-shaped filter at end of the pipe are installed throughout the excavation area. Each well point is connected to the header pipe on the ground surface. Vacuum pump sucks water through well points thus the ground-water level is lowered easily.

**Deep Well method**

Deep Well Method Suits Dewatering for Deep Excavation
A deep well which diameter is between 20 and 100 centimeters is drilled and the casing pipe with strainer pipe is installed. A high lift pump that is inserted into the strainer pipe pumps the water and lower the ground-water level.

**Plastic Board Drain method**

Economical Acceleration of Consolidation Shortens Construction Period
A band-shaped drainage material which is made of either resin or natural material is pressed into ground by a mandrel. It shortens the drainage passage of pour water and accelerate the consolidation of clay thereby increasing the strength.

**Vacuum Deep method**

Provides More Efficient Deep Well
This is the special Deep Well. The strainer pipe consists of solid inner pipe and strainer pipe. The water that flowed from bottom of the strainer pipe doesn't mix with air by means of the negative pressure inside the inner pipe.

**Well-In-Wall (WIW) method**

Groundwater Control Unit within Earth Retaining Walls
At this method, a pre-fabricated special well unit is placed inside the earth retaining walls. This method can control the groundwater during excavation more efficiently than Deep Well or Recharge Well being installed inside or outside the excavation area.

**Abrasive Wall Cut (AWC) method**

Permeable Silt Recovers Groundwater Flow
High pressure slurry containing abrasives is jetted towards the earth retaining wall that mainly consists of soil cement thereby permeable silt is bored. By preparing the permeable slits within the existing retaining wall, the groundwater flow that is interrupted by the wall is normalized.
Repair and Reinforcement of Structures

- Space Pack method
- Aqua Grout method
- Aqua Mate Plus method
- Pinup method
- TACOSIS method
- Hyper CF method
- ADOX method
- Blind Cylinder method
- Visible Net method
- Jet Powder Grout method
- JOT’S-Crete method
- Carbon Fiber Sheet Adhesion method
- Adhesion method
- Aqua Mate Plus method
- Space Pack method
- Carbon Fiber Sheet Adhesion method
- Pinup method
- JOT’S-Crete method
- Carbon Fiber Sheet Adhesion method
- Seismic rehabilitation of stone wall
  - The Pinup method can locally solidify the backfill gravel material in the back of the stone wall. Meanwhile, the shorter anchor is used to fix the ground and increasing the seismic resistance of the stone wall.
- Rehabilitation by Just Pasting
  - This is the method to reinforce and raise anti-earthquake capability and durability of structures by adhering high-strength carbon fiber sheets with impregnating epoxy resin. Carbon fiber has 10 times larger strength than steel, with increase of weight and transformation after the reinforcement.
- Highly Efficient Section Repair
  - This is the method to repair and reinforce concrete structures by sprayingurry-phased fiber-reinforced polymer cement mortar. A wide range of section repair with thickness of up to 100 millimeters is achievable. In addition, the mixed fiber prevents peeling off.

To maintain our safe and comfortable social-and-economic activities, long-term utilization of the accumulated social infrastructures is important. In recent years, the extension of structures’ life by their maintenance and repair is required to reduce life cycle costs. We have abundant experience in repair of cracks on concrete structures and are aggressively working on repair and reinforcement of structures to respond to the needs of society.

Space Pack method

Simply Mixed Backfilling Material for Tunnel
- This is the filling method for voids at back of tunnel lining or voids with spring water by using plastic filler. This filler fluidizes only under pressure thus injection of it to the definite area is achievable without running off.

Aqua Grout method

High Capability of Non-Segregation and Pumping
- This is the filling method for voids at back of existing tunnel lining by using plastic filler that contains polymer. Since this filler has very high in non-segregation in the water, it is suitable for the area with much spring water or injection to the definite area.

Aqua-Mate Plus method

Superior Long-Distance Pumping
- This is the filling method for voids at back of tunnel lining by using plastic filler. Separately blended two liquid materials are mixed by a blender near the injection point, then becomes plastic. Therefore, long-distance pumping is achievable.

Pinup method

Seismic rehabilitation of stone wall
- The Pinup method can locally solidify the backfill gravel material in the back of the stone wall. Meanwhile, the shorter anchor is used to fix the ground and increasing the seismic resistance of the stone wall.

JOT’S-Crete method

Highly Efficient Section Repair
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Remediation of Contaminated Soil and Water

- Replacement
- Volatile extraction
- Bioremediation
- Chemical Decomposition
- Insolubilization
- Groundwater Pumping
- Rotary Crushing and Mixing method

In recent years, the necessity is increasing to preserve living environment by remediating soils and groundwater that have been contaminated through past economic development. We are realizing secure and reliable in-situ (non-excavation) remediation of contamination depending on our huge experiences and accumulated technical know-how on ground treatment.

Replacement

Remediation of Contamination by Removing the Diseased Part
- The clayey soils contaminat-ed by VOC’s are cut and discharged toward ground surface by high-pressure jetting and replaced with sandy materials. The treated soil is highly permeable thus subsequent pumping aeration and bioremediation are achievable.

Bioremediation

Remediation of Contamination by the Natural Recovery of In-Situ Soils
- Some contaminants become harmless by their decomposition caused by microbes. Usually, the decomposition takes long time; therefore, the acceleration by activat-ing the in-situ microbes by injecting nutrients into the contaminated soils is performed.

Chemical Decomposition

Remediation of Contamination by Decomposition to Harmless State
- This is the injection of chemicals into contaminated soils by employing mechanical mixing or grouting techniques. Iron powders and/or oxidizing agents are injected and mixed with in-situ soils to decompose the contaminants by either oxidation or deoxidization.

Insolubilization

Remediation of Contamination by Changing to Insoluble State
- This is the method to change the contaminants within in-situ soils to insoluble state. Contaminated soils will be mechanically mixed with binders like cement or chemicals like sulfate and stabilized against dissolution.

Groundwater Pumping

Many A Little Makes A Mickle
- The groundwater within the contaminated soils is pumped up and transported to treatment plant to separate and collect the contaminants. Long-term operation of the plant is necessary, but we can certainly collect the contaminants. The water after removal of contaminants can be recharged into the original ground.