

**ACCELEROMETERS** – An electronic measuring device that is attached to a structural member to measure and record accelerations, typically used with Pile Driving Analyzer to measure the stress wave induced by pile driving equipment.

**ALLUVIUM** – Unconsolidated and poorly sorted sediments deposited by a river or stream. The deposited sediments typically range from silt to gravel-size but can include boulders. The size of the material deposited is dependent on the speed at which the water is flowing. The more rapidly the water is flowing the larger the material transported.

**ASSIGNED SHIFT**– The hours and times the employee is regularly scheduled to work.

**AUGER** – A screw-like boring tool used to explore relatively unconsolidated near-surface materials.

**BECKER PENETRATION TEST (BPT)** – A test used to investigate coarse-grained materials (gravel, cobbles) using an instrumented steel pipe pile.

**BEDDING** – Distinct layers of sediment or rock that may differ in a variety of ways from adjacent layers. Bedding typically applies to sedimentary and pyroclastic rocks.

**BORROS ANCHOR**– A three-pronged mechanical anchor lowered into a borehole used to secure the base of a settlement or heave monitoring instrument in soft soils.

**BORROW** – Material that is excavated on the project site or supplied by a Contractor for earthwork or other construction applications.

**CDL** – Commercial Driver's License

**CABLE LASHING** – The use of anchored and tensioned cables to provide support for an isolated potentially unstable rock.

**CALIFORNIA BEARING RATIO (CBR)** – A simple penetration test developed to evaluate the strength of road subgrades. In this test a plunger of standard area penetrates a soil sample. The force required to cause the penetration is plotted against measured penetration to determine the CBR value.

**CANTILEVERED WALL** – The most common type of conventional reinforced concrete wall, where the wall stem is attached to a spread footing (or pile cap).

**CEMENTATION** – Bonding of grains by secondary minerals (e.g., calcite or iron oxide) or degradation products (e.g., clay). Typically causes an increase in dry strength.

**COLLUVIUM**– Soil transported and deposited downslope by gravity, typically by landslides, soil slumps, debris flows, downhill creep, etc. The material is generally poorly sorted and tends to form hummocky terrain.

**COLORADO ROCKFALL SIMULATION PROGRAM (CRSP)** – A computer program used to simulate rockfall events and provide information on rockfall trajectories and energies.

**CONE PENETROMETER TEST (CPT)** – An in situ test that produces a plot of resistance with depth used to interpret the profile of subsurface materials.

**CONSULTANT** – A firm, or professional, that has an expertise in specific disciplines that can contract with the Department to perform services on behalf of the State.

**CONTROLLED BLASTING** – The use of closely spaced and lightly loaded blast holes to produce a relatively undamaged, stable cut slope.

**CORE RECOVERY** – An index of rock quality calculated by the ratio of the length of core recovered (rock/soil extracted in the core barrel) to the total core run length reported as a percentage. Core recovery depends on drilling technique and speed, and equipment quality, as well as rock characteristics and condition.

**COUNTERBERM** – A fill embankment placed at the toe of a marginally stable slope to improve overall stability.

**CONSOLIDATED-UNDRAINED (CU) TEST** – A flexible triaxial shear strength test used to determine total or effective stress strength parameters. The specimen is consolidated before shearing and is not allowed to drain during the test.

**CREEP TESTS (SOIL NAILS AND ANCHORS)** – Determines the long-term performance characteristics of either soil nails or ground anchors, usually requires 1-8 hours to perform.

**CROSSHOLE SONIC LOGGING** – Method used to determine the integrity of drilled shafts and slurry walls by use of down-hole measurements.

**DEGREE OF INDURATION** – A qualitative measurement of the hardening of a rock or rock material by heat, pressure, or the introduction of cementing material, esp. the process by which relatively consolidated rock is made harder or more compact. It can also indicate the formation of hardpan by chemical action on a soil horizon.

**DEGREE OF WEATHERING** – A measurement of rock weathering based on an established scale (see Table 9-18) used as a descriptor of rock and an indicator of rock quality and strength. Weathering is the destructive process by which earthy and rocky materials are changed in color, texture, composition, firmness or form by exposure to atmospheric agents near the Earth's surface. It can lead to the complete disintegration and chemical decomposition of rock.

**DEWATERING** – The art of drawing down groundwater levels to enable construction and improve slope stability.

**DILATANCY** – A qualitative descriptor of the movement of water in soil voids caused by shearing or shaking; used as a soil characteristic in visual classification.

**DISPERSION** – The characteristic occurrence and amount of settlement or suspension of a soil in water that can be used for visual classification. For example, clay remain suspended in the water longer than silt or sand, which tends to settle faster leaving the water less opaque or clear.

**DRILLED SHAFTS** – Deep reinforced concrete foundations constructed in a drilled hole to a desired bearing level. The shaft borings are typically cased.

**DRY STRENGTH** – A soil characteristic quantified by the pressure required to crush a dried lump of soil. This characteristic may be used as part of a visual soil description.

**DUTY STATION** – The employee's assigned work location.

**DYNAMIC COMPACTION** – A method of ground improvement that densifies subsurface soils by dropping a heavy mass on the ground surface in a grid pattern.

**DYNAMIC DRIVING ANALYSIS (WEAP)** – Pile analysis performed before pile driving to determine a suitable pile type, such as steel or concrete, and to evaluate the proposed driving system.

**DYNAMIC PILE TEST** – Test performed while driving piles to evaluate the performance of the pile driving system, calculate pile installation stresses, determine pile integrity, and estimate static pile capacity.

**EA** – Engineering Authorization

**EEO** – Equal Employment Opportunity

**EMBANKMENT EARTH PRESSURE CELLS** – Devices installed within embankments to determine the magnitude and direction of total stress.

**ENTRY PERMITS** – Formal permission documents to access private property.

**EXTENSOMETER** – Small diameter steel rods used to measure relative displacements/deformations within a soil or rock mass. A typical extensometer consists of a reference head at the collar of a drill hole, and one or more in-hole steel rods attached to anchors at known depths within the ground.

**EXTRUDED POLYSTYRENE (EPS)** – A very low density (2 lbs/cu. ft.) material, used in lightweight fill applications.

**FACTOR OF SAFETY (FS)** – The ratio of resisting to driving forces used to quantify the margin of stability for various design applications, such as foundations, slope stability, retaining walls, etc.

**FAULTS** – A break in the continuity of materials, where displacement has occurred. The presence of gouge (pulverized rock), bedding offset, and/or slickensided surfaces (commonly with mineral or clay coating) may be indicators of fault movement.

**FILL** – Soil or rock that has been added or placed at a location by human activity.

**FMLA** – Family Medical Leave Act

**FOLIATION** – A descriptive term common to metamorphic rocks for the structural or textural appearance of the rock due to flattening or aligning of the constituent minerals.

**GEOTECHNICAL PROJECT FILE** – File containing the complete Geotechnical history of a project

**SPECIFIC GRAVITY OF SOILS (GS)** – The ratio of a material's density to the density of water.

**GRAVITY WALL** – A wall that relies on mass for stability such as a bin, crib, or mass concrete wall.

**GROUND ACCELERATION** – A material property used for seismic analysis that is dependent on the earthquake recurrence interval and site conditions.

**GROUND ANCHORS** – Retaining wall support system consisting of anchors (steel tendons, rods, etc.) placed in holes that penetrate competent geologic strata. The anchors are grouted in place and then tensioned to the prescribed design load.

**HORIZONTAL DRAINS** – Drilled holes used to reduce groundwater pressures in soil or rock slopes, or landslides.

**HYDRAULIC FRACTURING TEST (HF)** – A test used to directly measure the in situ lateral stress state ( $K_0$ ) in rock formations.

**IGNEOUS ROCKS** – Intrusive or extrusive rocks formed from cooled and solidified magma or lava. Common igneous rock types include: granite, basalt, diorite, andesite, rhyolite, and gabbro.

**INCLINOMETER** – Instruments used to monitor lateral movements below ground. This instrument consists of four elements: 1) casing with internal guide grooves, 2) sensor (a probe with wheels that fit the grooves in the casing), 3) control cable (signal wire and depth measurement), and 4) a readout device (indicator). The change in casing profile over time is used to determine the depth and rate of movement at the failure surface in a landslide.

**INFILLING** – The material separating the adjacent sides of a discontinuity in rock.

**INTERCEPTOR DRAINS** – Ditches or trench drains installed to collect surface water/runoff, shallow groundwater, and/or springs in order to reduce infiltration into cut slopes or other marginally stable areas.

**IOWA STEPPED BLADE TEST (ISB)** – A direct measure of the in situ lateral stress state ( $K_0$ ) in soils.

**JACK/LOAD CELL SYSTEM** – Static pile load testing equipment used to apply compressive load to the pile and measure movements.

**JET GROUTING** – Method of ground stabilization that injects cement and water and mixes them with in situ soil to create a network of strengthened “soil-cement columns.”

**JOINT ROUGHNESS COEFFICIENT (JRC)** – The surface shape along a rock discontinuity. The JRC can be visually approximated by comparing joint surfaces with reference charts.

**JOINT** – A rock discontinuity where no displacement has occurred, often caused by tensile stresses associated with rock cooling, removal of adjacent rock, or tectonic movements. A repetitive pattern of more or less parallel joints is called a joint set.

**KINEMATIC ANALYSIS** – Evaluation of the capability of a rock block bounded by discontinuities and a slope face to fail out of the slope without reference to forces involved.

**LARGE PENETRATION TEST (LPT)** – A modification of the Standard Penetration Test, which uses a larger diameter sampler for use in gravelly soils.

**LIQUID LIMIT (LL)** – The moisture content of a soil at the boundary between the liquid and plastic states. Used in the classification of soils and the determination of the plasticity index.

**LIQUEFACTION** – A problem condition that develops when pore water pressures are suddenly increased to the extent that the effective shear strength approaches 0 and the soil turns fluid.

**LOAD AND RESISTANCE FACTOR DESIGN (LRFD)** – A design approach for structures in which failure and serviceability conditions can be evaluated, considering the uncertainties associated with loads and material resistances.

**LOAD CELL** – A transducer that converts force into a measurable electrical output. Although there are many varieties of load cells, strain gage based load cells are the most commonly used type.

**MECHANICALLY STABILIZED EARTH WALL (MSE WALL)** – Gravity fill wall reinforced with horizontal steel strips, geogrids, wire mesh, geosynthetic fabric or other material. Many patented systems and a variety of facing options are available.

**METAMORPHIC ROCK** – A rock formed from igneous, sedimentary or other metamorphic rocks by intense heat and pressure. Common metamorphic rock types include: slate, schist, gneiss, quartzite, and marble.

**MODULAR GRAVITY WALLS** – Interlocking concrete, steel, or wood modules such as gabions, bin walls, crib walls, concrete blocks, etc.

**MSDS** – Material Safety Data Sheets

**NDOT** – Nevada Department of Transportation

**NON DESTRUCTIVE TECHNIQUES (NDT)** – Measurement of in-place pile properties or drilled shaft condition without damaging the member. NDT methods include geophysical surveys, transient shock excitation, ground penetrating radar and cross-hole sonic logging.

**NRS** – Nevada Revised Statute

**OBSERVATION WELL** – A casing (commonly PVC) installed in borehole, which is slotted or perforated in the depth range desired for groundwater measurement. Ideally, the water level in the casing represents the average head of water acting on the perforated zone.

**OBSERVATIONAL METHOD** – The use of geotechnical observations and instrumentation during construction to adjust designs to fit field conditions.

**ON-CALL AGREEMENT** – A general agreement between the Department and a Consultant that is executed periodically, normally every two years, for a specific discipline of work. It does not contain any details about particular project work assignments, but does include all necessary terms and conditions to bind the parties into a contractual relationship. The agreement can be utilized by issuing a Task Order when the service of a Consultant is needed.

**ON-CALL CONSULTANT** – A Consultant under contract to NDOT that can be issued Task Orders to provide specific work.

**OPEN WORK GRAVEL** – A processed, poorly-graded, coarse gravel used for drainage applications.

**OSHA** – Occupational Health and Safety Act.

**OSTERBERG LOAD TEST** – Jacking unit attached to the bottom of a pile or placed at the base of a drilled shaft that applies pressure to measure foundation resistance.

**PEAK GROUND ANCHOR** – Method to develop forces necessary to stabilize structures and landslides. Anchors can include helix, bar or strand types.

**PERS** – Public Employee's Retirement System.

**PIEZOCONE PENETROMETER TEST (PQS)** – The use of a Cone Penetrometer with a piezometer at the tip to measure pore pressures generated during the test and to determine the rate of pore pressure dissipation during consolidation.

**PIEZOMETER** – Instrument used to measure groundwater pressure (pore pressure) at the elevation of the sensor.

**PILE DRIVING ANALYZER (PDA)** – System used to perform computations to analyze the response of a pile to driving equipment, driving stresses, pile integrity and the pile capacity.

**PILE INTEGRITY TESTER (PIT)** – An NDT test that uses a hammer and recording instrument to measure signal response of the pile to a low energy source (hammer).

**PILE LOAD TEST** – Tests in which either a tensile or compressive load is applied to determine load/deflection relationships and to evaluate pile capacity.

**PILES** – Deep foundations that are either drilled or driven into place. Many types of displacement and non-displacement piles exist, typically made of steel or concrete.

**PLASTICITY INDEX (PI)** – A quantitative or qualitative property of a soil that describes its response to changes in moisture content to create a soft and pliable consistency. Used for identification and classification of soil.

**PLASTIC LIMIT (PL)** – The moisture content at the boundary between the plastic and semi-solid states. Used in the classification of soils and the determination of the plasticity index.

**POOR MAN'S INCLINOMETER** – A means of determining the approximate depth to the slide failure surface by lowering a length of steel rod on a cable into a simple small diameter plastic pipe (similar to an observation well). Distortion and bending of the pipe caused by ground movements prevents the steel rod from passing.

**PRECOMPRESSION** – A ground improvement method used to compress the foundation soil before constructing sensitive structures and pavements on soft ground. Pre-compression in fine-grained soils can be accelerated by using vertical drainage systems, such as sand or wick drains.

**PRELOADING** – See Surcharging.

**PRESSUREMETER (PMT)** – An in situ test used to measure the stress/strain properties of soils by inflating a probe lowered into a borehole. The PMT provides a much more direct measurements of soil compressibility and lateral stresses than other test methods such as SPT or CPT.

**PROOF TESTS (SOIL NAILS AND ANCHORS)** – Test of soil nail or ground anchor capacity by incrementally loading to 125% - 150% of the design load.

**PUSHED-IN SPADE CELLS** – A device used to directly measure the in situ lateral stress state ( $K_o$ ) in soils.

**QTEST (UNCONSOLIDATED-UNDRAINED, UU)** – Triaxial shear strength test used primarily in the calculation of immediate embankment stability during short-term (quick-loading) conditions. During the test, the specimen is not permitted to change its initial water content before or during shear. The results are total stress strength parameters.

**RTEST (CONSOLIDATED-UNDRAINED, CU)** – A flexible triaxial shear strength test used to determine either total or effective stress strength parameters. In this test, the specimen is allowed to consolidate before shearing, but during shear the sample is not allowed to drain, maintaining the consolidated water content.

**R-VALUE** – A test used to determine subgrade strength and the ability of the soil to resist lateral deformations when a vertical load is acted upon it.

**REINFORCED SOIL SLOPES (RSS)** – Embankments constructed with metal or geosynthetic reinforcements to allow construction of steeper side slopes or to improve slope stability.

**RELICT ROCK STRUCTURE** – Describes decomposed rock or residual soil that still reveals the original texture of the crystals of the parent rock.

**RESILIENT MODULUS (MR)** – A test used to measure stress-deformation relationships of subgrade materials.

**RIGHT OF ENTRY** – Permission to enter privately owned property.

**ROCK BOLTS** – Tensioned steel bars installed in drilled holes to support isolated rock blocks on a slope. Anchorage can be achieved by either mechanical or grouting methods.

**ROCK BUTTRESS** – The placement of a rock fill at the toe of a soil or rock slope to improve stability. It is a measure commonly used to mitigate an existing landslide.

**ROCK DOWELS** – Untensioned steel bars used to add support to isolated rock blocks on a slope. The term also refers to short steel shear pins grouted into drilled holes at the leading edge of a rock slab to prevent sliding.

**ROCKFALL HAZARD RATING SYSTEM (RHRS)** – A technique for managing rock slopes and quantifying the rockfall hazard adjacent to highways. The system provides a proactive, rational way to prioritize spending of construction funds to mitigate rockfall hazards.

**ROCK INLAY** – Slope protection blanket, usually 2 to 10 feet thick, placed against an over-excavated portion of a slope to replace weak surface soil.

**ROCK QUALITY DESIGNATION (RQD)** – An index of rock fracturing based on the number and frequency of fractures in core samples recovered while drilling. The RQD is used for rock classification and characterization.

**ROCK SLOPE FALLOUT/CATCHMENT AREA** – An area located at the base of a rock slope designed to capture and restrict rockfalls from reaching the roadway or other facility.

**ROTARY DRILLING** – The chief method of drilling deep wells. A drill bit grinds a hole in the rock. Lubrication and cooling are provided by continuously circulating water or drilling mud, which brings the well cuttings to the surface.

**SAND DRAINS** – A method to accelerate settlement by increasing the rate of drainage in fine-grained, compressible strata by shortening the drainage path to a much more permeable, small diameter column of sand.

**SCALING** – Removal of loose rock from slopes using either manual or mechanical methods.

**SCOUR** – Erosion of river or stream bed or bank sediments that could undermine nearby foundations. A significant concern for bridge applications.

**SEDIMENTARY ROCKS** – Rock formed by cementation or by pressure from overlying sediments. Common sedimentary rock types include: conglomerate, breccia, sandstone, siltstone, claystone, shale, limestone, chalk, and dolomite.

**SEISMIC REFRACTION** – A noninvasive subsurface exploration technique used to interpret the layering of subsurface materials, which relies on the travel times of the seismic waves as they pass through materials of increasing seismic velocity with depth.

**SENSITIVITY** – Sensitivity refers to the significant loss of strength when a fine-grained soil is remolded.

**SERVICE LOAD DESIGN (SLD)** – Foundation design that uses factor of safety methodology applied to ultimate bearing capacities to determine “allowable bearing pressures.” Also referred to as the Allowable Stress Design method (ASD).

**SETTLEMENT PLATE** – A simple platform and riser pipe that is placed within the embankment. The top of the pipe is surveyed at various times during embankment construction to determine the magnitude and time-rate of settlement.

**SHAFT INSPECTION DEVICE (SID)** – Sampling method (with camera) used to inspect the bottom and side-walls of drilled shafts to evaluate the base and sidewall condition.

**SHEAR KEY** – A mitigation method for improving the shear resistance in landslides, retaining walls and embankments.

**SHEAR PLANE INDICATOR** – A shear plane indicator consists of a plastic pipe installed in a borehole, similar to an observation well. Also See “Poor Man’s” Inclinometer.

**SHEET PILE WALL** – A wall formed with a continuous and interlocked line of steel sheet piles that behave in a cantilevered manner. Tie-back anchors are sometimes added if the wall height creates high structural moments in the sheets.

**SHELBY TUBE** – A thin-walled, push-tube sampler used to obtain undisturbed samples of cohesive soils.

**SHOTCRETE** – The high-pressure application of concrete onto a soil or rock surface to prevent erosion, sloughing, and raveling.

**SHRINK/SWELL** – The change (percent decrease or increase) in volume that occurs when excavated earth materials are placed in a compacted or uncompacted embankment. Rock materials tend to swell; soil materials tend to shrink.

**SHRINKAGE LIMIT (SL)** – A test performed on clay soils suspected of having swell potential. The test determines the limits of a soil’s tendency to lose volume during decreases in moisture content.

**SLICKENSIDES** – A discontinuity between adjacent rock blocks that appears polished or glossy, sometimes with linear markings showing evidence of the orientation of past movement. Not all slickensides are caused by faulting. Slickensides can be caused by deformation (i.e., folds, flows) or landsliding.

**SLOPE MESH** – Steel mesh (gabion or chain link) anchored at the crest of a slope that drapes down the face of the slope to control the descent of rockfall.

**SOIL NAIL WALL** – Soil cut slope retaining system consisting of steel bars/tendons installed in drilled holes and grouted in-place. Earth pressure near the face is transferred to soil nails by a reinforced shotcrete facing. The final wall facing may consist of shotcrete or concrete panels (precast or cast-in-place).

**SPACING** – The distance between individual joints or beds. Care must be taken to distinguish between joints and mechanical breaks that are caused by handling or drilling.

**SPLIT-SPOON SAMPLER** – A thick-walled, divided tube sampler used to obtain disturbed soil samples and penetration rates during the Standard Penetration Test (SPT).

**STANDARD PENETRATION TEST (SPT)** – A standardized soil sampling procedure in which a 140-pound hammer is dropped 30 inches to drive a two-inch split-spoon sampler 18 inches. The number of blows (blow count) required to drive the sampler through the last 12 inches is correlated with the soil conditions.

**STATNOMIC LOAD TEST** – A test that uses pressure created by burned fuel to apply either horizontal or vertical load to a pile or drilled shaft.

**STONE COLUMNS** – A ground improvement method that displaces and densifies subsurface soil through vibration and replacement of displaced soil with free-draining crushed stone. Installation increases overall shear strength and accelerates consolidation.

**STRAIN GAUGES** – Electronic measuring device attached to a structural element to measure small compressive or tensile deformations over a set distance. Results are used to calculate percent strain.

**STRATIFICATION** – The layering of rock units evidenced by changes in texture, composition, age, fossil content or unique forms.

**STRUCTURAL DISCONTINUITIES** – Natural breaks within a rock mass such as joints, bedding, faults, fractures or foliations.

**SUBDRAINAGE** – A technique used below pavements or embankments to remove groundwater.

**SURCHARGING** – Placement of a temporary fill or other weight to accelerate settlement prior to constructing a permanent facility, such as pavements or bridge abutments.

**SURVEY HUBS** – Stakes that are positioned in critical areas to monitor relative ground surface movements using standard survey techniques.

**T.P.** – Transportation Policy.

**TASK ORDERS** – A document used to specifically describe all items of work agreed upon between the Department and a Consultant for a particular project. Task Orders are numbered and are sub parts of an On-Call agreement. An example would be “Task Order Number 5 of On-Call Agreement Number P063-07-089.”

**TELLTALE STAKES** – Stakes installed along a “line-of-sight” used to make visual evaluations of ground surface movements.

**TEMPORARY DUTY STATION** – A work location to which an employee is formally transferred, in writing, for a period of time in excess of two weeks.

**TERRACE DEPOSIT** – Alluvial deposits found along the margin or above the level of a stream channel marking a former water level. They are commonly composed of higher energy deposits such as sand and gravel.

**TEST PITS** – A pit dug with a shovel or backhoe to obtain bulk samples and to identify the types and sequence of near surface materials.

**THERMISTOR** – Measures ambient or ground temperature using a calibrated gauge consisting of two wires made of different materials that exhibit a predictable contraction or expansion in response to a change in temperature.

**TILTMETER** – Tiltmeters use a server-accelerometer to measure the rotation of a surface point on a critical slope or structure. The data is transferred to a readout device via a control cable.

**TIME DOMAIN REFLECTOMETRY (TDR)** – A device used to determine the depth of a landslide that relies on changes in electrical properties of a coaxial cable caused by thinning/stretching at the failure surface as landslide movements proceed.

**TOTAL STRESS CELLS (TSC)** – A device used to directly measure the in situ lateral stress state ( $K_0$ ) in soils.

**TOUGHNESS** – A qualitative measurement used as a descriptor of a soil based on the way a soil lump or ball breaks when in a moist state.

**TRAVEL STATUS** – Temporary assignment away from the employee's duty station, which does not require written transfer.

**TREMIE TUBE** – During the backfilling process, grout can be delivered to the bottom of a borehole through a tube to prevent contamination, caving or bridging.

**TRENCH DRAINS** – A method of subdrainage to intercept, collect and remove shallow groundwater.

**UNCONSOLIDATED-UNDRAINED (UU)** – Triaxial shear strength test result used primarily in the calculation of immediate embankment stability during short-term (quick-loading) conditions. In this test, the specimen is not permitted to change its initial water content before or during shear.

**UNDERDRAIN BLANKET** – A method to reduce the potential for groundwater to affect an embankment by placing a free-draining rock layer on the foundation soil prior to placing fill.

**VALUE ENGINEERING (VE)** – An engineering process to re-examine project development and decisions to evaluate if more efficient or less costly solutions could be incorporated.

**VECTOR SUMS** – Used to determine the overall direction of movement.

**VERIFICATION TESTS** – Performance test used to verify that constructed elements (such as soil nails) meet design specifications. Generally sacrificial elements are loaded to 200% of the design load.

**VIBRATING-WIRE PIEZOMETER OR STRAIN GAUGE** – Electronic gauges that utilize the frequency of a wire connected to a flexible diaphragm to measure strain or pressure. The key principle is that the natural frequency of a vibrating wire constrained at both ends varies with the square root of the tension in the wire. Changes in the tension of the wire indicate corresponding changes in strain or pressure of the attached structural member.

**VIBRATION MONITORING** – Ground vibrations are monitored with an instrument containing an oscillographic recording system, capable of measuring vertical, longitudinal and transverse components of motion with respect to the source of vibration motion. Commonly used in blasting or pile driving operations.

**VIBROFLOATATION** – A method of ground improvement that creates a vertical hole for incorporating sand backfill (using a vibrating probe) to create denser conditions.

**WEEP HOLES** – Drain holes formed in cut slopes, walls or shotcreted surfaces to relieve the buildup of groundwater pressure.

**WICK DRAINS** – Geosynthetic fabric and plastic core drains inserted into the soil to increase subsurface soil drainage. Used to accelerate settlement to shorten construction time. They are an alternative to sand drains.