

Procedure Title:	Civil Work	SOP Number:	SOP-100-03-PR-035
Procedure Owner:	Corporate HSE	Issuing Authority:	Chief Safety Officer

Civil Work

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1.0 PURPOSE

The purpose of this procedure is to establish the minimum requirements for Civil Work for STIS DBA Southeast Texas Industrial Services.

2.0 SCOPE

This procedure applies to all HenSu Holdings employees, contractors, subcontractors and visitors associated with an HenSu Holdings site.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- HenSu Holdings Managers
- HenSu Holdings Supervisors
- HenSu Holdings Employees
- HenSu Holdings Contractors
- HenSu Holdings Subcontractors
- HenSu Holdings Visitors

4.0 PROCEDURE

Each site shall make every attempt to prevent the possibility of incidents and accidents to employees while performing work activities through compliance with safety regulations, training of employees to properly perform their job activities and through employee involvement in safe work activities.

4.1 General

- 4.1.1 All operators shall be assessed for competency before the operation of any piece of machinery or equipment.
- 4.1.2 Any task not covered in this procedure and not found in a separate procedure shall be considered a critical task.
 - 4.1.2.1 A detailed plan of action shall be developed and approved by both operation and HSE management prior to commencing work.

4.2 Earthworks/Civil Machinery

- 4.2.1 For the purposes of this section mobile equipment includes but is not limited to excavators, front-end loaders, integrated tool carriers, scrapers, dump trucks, service/refueling trucks, water carts, graders, vibrating compactors, rollers and bulldozers.
- 4.2.2 Earthworks machinery will be operated and inspected in accordance with SOP-100-03-PR-031 - Mechanized & Marine Equipment.
- 4.2.3 The Supervisor will verify that the construction (including the width, gradient, camber and radius of curvature of bends) of each road and/or area at the site is set up or arranged to enable the safe operation of all mobile equipment authorized to travel on the road and/or in the area. The construction shall also take into account the size, speed, loads, and operating characteristics of the equipment to be used and site conditions, including the effects of weather.
- 4.2.4 Haul roads must be at least 3 times the width of the largest vehicle running on it where practical.
- 4.2.5 Walk behind compactors (or similar) shall be equipped with a continuous pressure (dead man type) control to stop the equipment if released.
- 4.2.6 Ensure a minimum 32 feet exclusion zone exists around any overhead power line. In all cases where equipment must operate within this exclusion zone a task specific Risk

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Assessment shall be completed by the Supervisor and submitted to the site HSE Manager for approval.

- 4.2.7 The use of a spotter is mandatory when operating within 32-foot exclusion zone.
- 4.2.8 All personnel who are required to work around heavy earth working equipment shall wear a high visibility vest or clothing.
- 4.2.9 Access ways, direction and speed of travel of all site roads should be arranged before work commences and a physical plan or drawing made available before work commences.
- 4.2.10 Excavation material should be removed if practical and stored at an agreed location until backfilling is required.
- 4.2.11 Overburden material shall be stored at an agreed location until remediation operations commence.
- 4.2.12 Excess diggings and redundant civil materials such as concrete and reinforcing steel shall be stored or disposed of as per the project Environmental Control Plan.
- 4.2.13 The driver of a haul or dump truck shall not enter or leave the cab while the truck is being loaded.
- 4.2.14 The operator of the loading equipment shall not cause the bucket to be traversed over the driver's cab during loading operations.
- 4.2.15 The supervisor shall confirm that the design, layout, construction and maintenance of any dumping or stockpiling operations take the following into account:
 - The nature of the material being dumped;
 - The size and weight of the equipment being used;
 - The site conditions, including stability of the area on which the dump is built; and
 - The weather conditions.
- 4.2.16 The operator shall not dump rock or other material from a haul or dump truck over a bank or into a bin unless there is an effective backstop provided or a person (spotter) suitably stationed to guide and direct the driver to a safe dumping position, via radio communications or hand signals.
- 4.2.17 Marker guides, lighting or other effective signs shall be placed to indicate to the driver the limit of safe approach to the tipping area when dumping operations are being carried out (whether by day or night).
- 4.2.18 Drivers of trucks delivering materials to site in multi-stage tippers or side un-loaders shall take into account the gradient of the ground on which they are tipping, the nature of the material being discharged and to watch out for "hang up" of material during discharge. If necessary, a spotter shall be used to direct discharge via radio communication or hand signals.
- 4.2.19 The site supervision in coordination with HSE shall decide to suspend earth moving activity or relocate to other areas in the event of inclement weather.
- 4.2.20 Roadways shall be regularly maintained, swept clean of rubble, holes filled and watered to suppress dust.
- 4.2.21 When it is necessary to approach closer than 65 feet to a heavy vehicle, this shall only be done with the verbal permission of the driver/operator of the heavy vehicle. The following rules shall apply to parking of heavy equipment:
 - Only park in designated areas;
 - Lower all attachments on equipment fitted with moveable attachments (i.e., forks, buckets, blades, ripper's etc.) when parking;
 - If on an incline chock the wheels;

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- Turn wheels into the side of the bank or road; and
- Apply the park brake and slew brake where applicable.

4.3 CONCRETE

4.3.1 General Requirements

- 4.3.1.1 Concrete work often requires the use of chemical applications; the use of such products shall be performed under the guidance of manufacturer's instructions and the Safety Data Sheet (SDS) for that product.
- 4.3.1.2 No construction loads shall be placed on a concrete structure or portion of a concrete structure unless, based on information received from a qualified person, the structure or portion of the structure is capable of supporting the loads
- 4.3.1.3 All protruding reinforcing steel onto and into which employees could fall, shall be guarded to eliminate the possibility of impalement. Refer to paragraph 4.3.17.10 for more details
- 4.3.1.4 No employee shall be permitted to ride in or on concrete buckets
- 4.3.1.5 Employees shall be required to wear proper clothing (i.e., boots, gloves, hard hats and safety glasses) to prevent cement burns.
- 4.3.1.6 Employees applying cement, sand, and water mixtures through a pneumatic hose shall wear face protection in addition to safety glasses.
- 4.3.1.7 Clothing that becomes saturated with concrete should be removed and exposed skin thoroughly flushed with fresh water.
- 4.3.1.8 The tops of boots shall be taped to prevent concrete from falling into boots.
- 4.3.1.9 Skin that is exposed to concrete should be flushed with fresh water as soon as possible and concrete should not be allowed to dry on the skin.
- 4.3.1.10 Eyes that are exposed to concrete or cement dust shall immediately be flushed with large amounts of clean, fresh water.
- 4.3.1.11 Any noticeable adverse skin reaction shall be reported to the employee's supervisor and/or HSE.
- 4.3.1.12 No employee shall be permitted to place or tie reinforcing steel more than six (6) feet above any adjacent working surface unless the employee is protected by the use of a personal fall arrest system or other approved means of fall protection.
- 4.3.1.13 Where there is a possibility of contact with energized electrical conductors, handles on bull floats shall be constructed of non-conductive materials or insulated with a non-conductive sheath.

4.3.2 Mixers

- 4.3.2.1 Storage bins, silos and containers shall be equipped with conical or tapered bottoms, and have mechanical or pneumatic control to pour the material.
 - Entry into storage facilities shall only be permitted in accordance with SOP-100-03-PR-002 - Confined Space.
- 4.3.2.2 Mixers with one (1) cubic yard or larger loading skips shall be equipped with a mechanical device to clear the skip of materials, with guardrails installed on each side of the skip.
 - All potentially hazardous energy sources shall be locked out and tagged before performing maintenance or repair on the equipment. See SOP-100-03-PR-004 - Control of Hazardous Energy

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- 4.3.3 Concrete Placement Using Chutes
 - 4.3.3.1 Position truck to minimize movement during concrete placement
 - 4.3.3.2 Review established hand signals and other means of communication with driver
 - 4.3.3.3 Establish who will be the signal person for the truck driver and who is responsible for operating the chute.
 - 4.3.3.4 Control the speed of the discharge drum to maintain control of the situation.
 - 4.3.3.5 Place concrete in a steady and controlled manner.
 - 4.3.3.6 Identify all pinch point and line of fire hazards prior to commencement of work
- 4.3.4 Concrete Placement with A Bucket
 - 4.3.4.1 Positive safety latches or similar devices shall be installed on all hydraulic or pneumatic gates of concrete buckets to prevent premature or accidental dumping.
 - 4.3.4.2 Buckets will be suspended from shackles or hooks equipped with a safety latch.
 - 4.3.4.3 Personnel shall not be permitted to work under concrete buckets while the buckets are being elevated or lowered into position.
 - 4.3.4.4 To the extent practicable, elevated concrete buckets shall be routed so that no employee or the fewest employees possible are exposed to the hazards associated with overhead loads.
 - 4.3.4.5 Attach tag line to bucket for safe operation
 - 4.3.4.6 Designate signal person and bucket operators prior to commencement of work
 - 4.3.4.7 Identify pinch point and line of fire hazards prior to commencement of work
- 4.3.5 Concrete Placement Using Pump Trucks
 - 4.3.5.1 Locate pump truck on stable ground or matting and away from overhead power lines.
 - 4.3.5.2 Place pump in a location that provides safe and productive access to the hopper by delivery trucks
 - 4.3.5.3 Review established hand signals and other means of communication with operator of pump
 - 4.3.5.4 Establish who is the signal person for the pump hose and/or pump hose operator and who is responsible for flagging the concrete trucks
 - 4.3.5.5 Never fly opened ended hose over employees
 - 4.3.5.6 All pipe supports of concrete pumping system shall be designed to one hundred percent (100%) overload.
 - 4.3.5.7 Compressed air hoses shall utilize only fail-safe joint connectors to prevent separation of sections when pressurized.
 - 4.3.5.8 Tremies, elephant trunks, etc., sections shall be secured with fail-safe chain or wire rope in addition to regular couplings or connections.
 - 4.3.5.9 Concrete buggy (Georgia buggy) handles shall not extend beyond the wheels on either side of the buggy.
- 4.3.6 Concrete Trilling

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4.3.6.1 Power and rotating type concrete trilling machines that are manually guided shall be equipped with a control switch that will automatically shut off the power whenever the hands of the operator are removed from the equipment handles.

4.3.7 Concrete Cutting

4.3.7.1 Blades of masonry saws shall be covered with a semi-circular enclosure to retain blade fragments.

4.3.7.2 A method for retaining blade fragments shall be incorporated in the design of the semi-circular enclosure.

4.4 FORMWORK AND SHORING

4.4.1 Formwork and shoring shall be designed, erected, supported, braced and maintained so as to safely support any and all vertical and lateral loads that may be imposed upon it during placement of concrete.

4.4.2 Drawings of plans showing the jack layout, formwork, shoring, working decks and scaffolding shall be available at the site.

4.4.3 Careful consideration of environment and access shall be taken when determining a forming system and method.

4.4.4 When manually handling forms constantly be aware of hand placement and pinch points

4.4.5 When manually lifting and carrying forms use proper lifting techniques and plan your path to assure a clean walkway free of tripping hazards. Get assistance for awkward or heavy loads

4.4.6 Removal of forming materials shall be done in an orderly fashion. Maintaining neat and organized work areas.

4.4.7 Remove all fasteners and dispose of materials immediately that are not for reuse.

4.4.8 Use proper rigging practices when lifting equipment is required

4.4.9 Inspection

4.4.9.1 All shoring equipment shall be inspected prior to erection to determine that it is specified in the shoring layout and that it is not defective.

4.4.9.2 Defective or damaged shoring equipment shall not be used for shoring under any circumstances.

4.4.9.3 Erected shoring equipment shall be inspected during and immediately before and after the placement of concrete.

4.4.9.4 Damaged or weakened shoring equipment shall be immediately reinforced or replaced.

4.4.10 Permissible Loads

4.4.10.1 All sills for shoring shall be sound, rigid and capable of safely carrying all vertical and lateral loads that may be imposed upon them at any time.

4.4.10.2 All base-plates, shore heads, extension devices and adjustment screws shall be in firm contact with the footing sill and the form material.

4.4.10.3 Eccentric loads on shore heads and similar members shall be designed for such loading.

4.4.10.4 Ground load compaction shall be checked to verify that the imposed load can be sustained.

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- 4.4.10.5 Shoring for tiered single post shores and erected shoring shall be designed and inspected by a qualified designer and/or by an engineer qualified in structural design.

- 4.4.11 Bracing
 - 4.4.11.1 Single post shores shall be vertically aligned, spliced to prevent misalignment, and adequately braced in two (2) mutually perpendicular directions at the splice level.
 - 4.4.11.2 Each tier shall also be diagonally braced in the same two (2) directions.
 - 4.4.11.3 Single post shores should not be adjusted after the placement of concrete.
 - 4.4.11.4 The spacing between towers and cross-brace spacing in erected shoring shall not exceed that shown on the layout, and all locking devices shall be in the closed position.
 - 4.4.11.5 All shoring shall be laterally supported by attachment to the structure.
 - 4.4.11.6 Freestanding masonry walls shall be braced and supported to provide lateral stability against wind or other forces.
 - 4.4.11.7 Reshoring shall be erected, as original forms and shores are removed, whenever the concrete is required to support loads in excess of its capacity.

- 4.4.12 Stripping
 - 4.4.12.1 Forms and shores (except those used for slabs on grade and slip forms) shall not be removed until the concrete gains sufficient strength to support its weight and superimposed loads.
 - 4.4.12.2 Compliance with the plans and specifications for removal of forms and shores, and proper testing with an appropriate American Society of Testing Material (ASTM) standard test method can help determine if the concrete has gained sufficient strength.
 - 4.4.12.3 Reshoring shall not be removed until the concrete being supported has gained adequate strength to support its weight and all loads upon it.
 - 4.4.12.4 Employees removing formwork or shoring at elevations of six (6) feet or more shall wear and use safety harnesses with lanyards being attached to a lifeline or the structure, or work from a suitably guarded platform.

- 4.4.13 Climbing Formwork
 - 4.4.13.1 Steel rods or pipes of vertical slip forms on which jacks climb or by which forms are lifted shall be specifically designed and adequately braced when not encased in concrete.
 - 4.4.13.2 Forms shall be designed to prevent excessive distortion of the structure during the jacking operation.
 - 4.4.13.3 All vertical slip forms shall be provided with scaffolds or work platforms where employees are required to work or pass.
 - 4.4.13.4 Jacks and vertical supports shall be positioned so loads do not exceed the rated capacity.
 - 4.4.13.5 Jacks or other lifting devices shall be provided with mechanical dogs or other automatic holding devices to support the slip forms in case of power supply or lifting mechanism failure.
 - 4.4.13.6 The form structure shall be maintained within all design tolerances during jacking operations and must not exceed the safe rate of lift.

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- 4.5 PRECAST OPERATION
- 4.5.1 A limited access area shall be established and barricaded before precast concrete work begins.
 - 4.5.2 Only employees actively engaged in erecting the precast shall be permitted to enter this area.
 - 4.5.3 Employees shall not be permitted under precast concrete members when they are being tilted or lifted
 - 4.5.4 Precast wall units, structural framing, and tilt-up wall panels shall be adequately supported to prevent overturning and to prevent collapse until permanent connections are completed.
 - 4.5.5 Lifting inserts that are embedded or otherwise attached to tilt-up precast concrete member shall be capable of supporting at least two (2) times the maximum intended load applied or transmitted to them.
 - 4.5.6 Other lifting inserts shall be capable of supporting at least four (4) times the maximum intended load.
 - 4.5.7 Lifting hardware shall also be capable of supporting at least five (5) times the maximum intended load.
- 4.6 MASONRY CONSTRUCTION
- 4.6.1 A limited access zone shall be established and barricaded whenever a masonry wall is being constructed.
 - 4.6.2 The limited access zone shall be established, prior to beginning construction of the wall, and shall:
 - 4.6.2.1 Be equal to the height of the wall to be constructed plus four (4) feet;
 - 4.6.2.2 Run the entire length of the wall; and
 - 4.6.2.3 Be established on the side of the wall where scaffolding will not be placed.
 - 4.6.3 Only employees actively engaged in construction of the wall shall be permitted to enter the barricaded limited access zone.
 - 4.6.4 The barricade shall remain in place until the wall is adequately supported.
 - 4.6.5 Masonry walls of over eight (8) feet shall be adequately braced to prevent overturning and to prevent collapse.
 - 4.6.6 The bracing shall remain in place until permanent supports are installed.
- 4.7 REINFORCING STEEL (WIRE MESH AND REBAR)
- 4.7.1 Employees shall wear gloves when placing or tying reinforcing steel.
 - 4.7.2 Ends of tie-wire should be bent over to reduce the possibility of impalement
 - 4.7.3 Wire mesh rolls shall be secured at each end to prevent a recoiling action.
 - 4.7.3.1 Measures may include, but are not limited to, securing each end of the roll or turning over the roll.
 - 4.7.3.2 The use of welded wire sheets or panels should be used when available.
 - 4.7.4 A two (2)-part bridle sling configuration shall be used when moving bundles of rebar by crane over twenty (20) feet in length.
 - 4.7.5 Reinforcing steel for walls, piers, columns, and similar vertical structures shall be adequately supported to prevent overturning and collapse

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- 4.7.6 Loose rebar rods and wire mesh should be removed from the work area or placed in a manner to reduce the tripping hazard to foot traffic
- 4.7.7 Rebar should be secured to prevent movement during placement of concrete.
- 4.7.8 Reinforcing mats (used as a walkway) shall be provided with planking to provide safe footing.
- 4.7.9 Employees shall not be permitted to work above vertically protruding reinforcing steel (rebar) unless it has been protected to eliminate the hazard of impalement.
- 4.7.10 Workers shall be protected from vertical and horizontal impalement hazards through one (or a combination) of the following means:
 - 4.7.10.1 Installation of hard barricades with appropriate signage in areas with recognized impalement hazards forbidding workers to enter until the work area is determined by site HSE personnel to be free of recognized impalement hazards.
 - 4.7.10.2 Installation of suitably sturdy wood covers, such as those made of 2 x 4s, over the rebar (see example at right) .
 - 4.7.10.3 Ensure that work areas above recognized impalement hazards are equipped with guard rails and other suitable devices to prevent falls.
 - 4.7.10.4 Ensure workers working above recognized impalement hazards use approved personal fall protection/arrest system. (This does not eliminate the need to cap/protect the ends of recognized vertical or horizontal impalement hazards.)
 - 4.7.10.5 Capping the ends of protruding rebar to eliminate the danger of impalement. Only rebar caps designed to provide vertical or horizontal impalement protection, such as those containing steel reinforcement, should be used. Standard plastic “mushroom” type caps are designed to provide scratch protection only.
 - 4.7.10.6 Bending the ends of the protruding steel rebar or other impalement hazards.
 - 4.7.10.7 Training shall be provided to supervisors and workers during HSE orientation to follow safe work procedures when working with protruding rebar and other horizontal and vertical impalement hazards.



4.8 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

- 4.8.1 The minimum PPE for working with concrete shall be:
 - 4.8.1.1 hard hat
 - 4.8.1.2 safety glasses
 - 4.8.1.3 chemical resistant gloves
 - 4.8.1.4 chemical resistant boots
 - 4.8.1.5 Tyvek suit and face shield on chute, hose or bucket operator
- 4.8.2 A dust mask shall be used when working with powdered cement or while operating or near a dry concrete cutting saw or grinder.
- 4.8.3 Personnel shall not be permitted to apply cement, sand and water mixture through a pneumatic hose unless they are wearing protective head and face equipment.
- 4.8.4 When personnel are working in an area that is elevated six (6) feet above any adjacent working surface, they shall not be permitted to place or tie reinforcing steel unless they

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are protected by the use of a safety positioning belt and proper fall protection meeting the criteria in OSHA standards on "Personal Protective and Life Saving Equipment" - 29 CFR 1926 Subpart E.

5.0 REFERENCES

SOP-100-03-PR-002	Confined Space
SOP-100-03-PR-004	Control of Hazardous Energy
SOP-100-03-PR-031	Mechanized & Marine Equipment

6.0 TERMINOLOGY

Incident	An unintended event that has the potential to cause damage to property, injury, illness or death.
Hazard	An unassessed risk or a potential threat for a loss. An unsafe condition or an unsafe practice (act) that, if not corrected or controlled, has the potential to cause, contribute to or intensify an undesired or unintended event.
Site	Any location where HenSu Holdings personnel are involved in work activities.
Unsafe Condition	A physical condition within the environment with the potential to cause or contribute to an accident.

7.0 EXHIBITS

None