Section 5A: Safety Management Systems

Policy #6: **Trenching & Excavation Safety Program**
Effective Date: **October 20, 2015**

I. Purpose

The Trenching and Excavation program was developed to protect employees from a wide variety of safety hazards that may be encountered during the trenching and excavation process. This program is intended to assure that employees who perform work in trenching and excavations are aware of their responsibilities and know how to perform the work safely. Preventing future workplace injuries in the Town of Mooresville is the principle purpose of this document. This policy will provide a basis for ensuring that all procedures implemented, revised, or modified to meet the Town's requirements for safety.

II. Scope

The Trenching and Excavation Safety Program pertains to all town projects and/or contracts that require any trenches or excavations as defined in Section VI of this policy. Trenching and Excavation work can present serious hazards to all workers involved. This document provides the practices and procedures necessary to adequately control the hazards associated with this task to protect employees, citizens and contractors.

III. Definitions

Accepted engineering practices: the standards of practice required by a registered professional engineer.

Aluminum hydraulic shoring: a manufactured shoring system consisting of aluminum hydraulic cylinders (crossbraces) used with vertical rails (uprights) or horizontal rails (wales). This system is designed to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole: a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a bell shape.

Benching system: a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or more horizontal steps, usually with vertical or near-vertical surfaces between levels.

Cave-in: the movement of soil or rock into an excavation, or the loss of soil from under a trench shield or support system, in amounts large enough to trap, bury, or injure and immobilize a person.

Cohesive Soil: means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical side-slopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Competent person: a person who has been trained to identify hazards in the workplace, or working conditions that are unsafe for employees, and who has the authority to have these hazards corrected.

Cross braces: the horizontal members of a shoring system installed from side to side of the excavation. The cross braces bear against either uprights or wales.

Excavation: any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

Faces or sides: the vertical or inclined earth surfaces formed as a result of excavation work.

Failure: the movement or damage of a structural member or connection that makes it unable to support loads.

Fissured: means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular Soil: means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Hazardous atmosphere: an atmosphere that is explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, that may cause death, illness, or injury.

Kickout: the accidental movement or failure of a cross brace.

Moist Soil: means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Protective system: a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp: an inclined walking or working surface that is used to gain access to one point from another. A ramp may be constructed from earth or from structural materials such as steel or wood.

Saturated Soil: means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Sheeting: the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield system: a structure used in an excavation to withstand cave-ins and which will protect employees working within the shield system. Shields can be permanent structures or portable units moved along as work progresses. Shields used in trenches are commonly referred to as trench boxes or trench shields.

Shoring system: a structure that is built or put in place to support the sides of an excavation to prevent cave-ins.

Sides: see faces.

Soil Classification System: a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the characteristics of the deposits and the environmental conditions of exposure.

Sloping system: sloping the sides of an excavation away from the excavation to protect employees from cave-ins. The required slope will vary with soil type, weather, and surface or near surface loads that may affect the soil in the area of the trench (such as adjacent buildings, vehicles near the edge of the trench, etc.).

Stable rock: natural solid mineral material that can be excavated with vertical sides that will remain intact while exposed.

Structural ramp: a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock is not considered a structural ramp.

Support system: a structure used as underpinning, bracing or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data: tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench: a narrow excavation (in relation to its height) made below the surface of the ground.

Trench box or trench shield: see shield.

Type "A" Soil: means cohesive soils with an unconfined, compressive strength of 1.5 tons per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

The soil is fissured; or
The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
The soil has been previously disturbed; or
The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or
The material is subject to other factors that would require it to be classified as a less stable material.

NOTE: Only a Professional Engineer can determine Type 'A' Soils

Type "B" Soil: means cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

Type B Soils may also be:

Previously disturbed soils except those which would otherwise be classed as Type C soil; or
Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
Dry rock that is not stable; or
Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type "C" Soil: means cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less. This soil type includes:

Granular soils including gravel, sand, and loamy sand; or
Submerged soil or soil from which water is freely seeping; or
Submerged rock that is not stable, or Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Type "C-60" Soil: means a moist, cohesive soil or a moist dense granular soil which does not fit into Type A or Type B classifications, and is not flowing or submerged. This material can be cut with near vertical sidewalls and

will stand unsupported long enough to allow the shoring to be properly installed. In sum, Type C-60 Soil will stand, has no water, and allows the use of safe shoring.

(Ref: Speed Shore Corporation report by Robert C. Davis, Ph.d., P.E., Senior Geotechnical Engineer. Report is in accordance with OSHA Excavation regulation arid the N.B.S. study 121 and available from the Speed Shore Corporation)

Unconfined Compressive Strength: means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Uprights: the vertical members of a trench shoring system placed in contact with the earth and usually positioned so the individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called sheeting.

Wales: horizontal members of a shoring system placed in the direction of the excavation face whose sides bear against the vertical members of the shoring system or earth (the uprights or sheeting).

Wet Soil: soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

IV. Assignment of Responsibility

A. **The Public Utilities Director and the Public Works Director** are responsible for the dissemination, execution, and continued support of the Trenching and Excavation Safety Program. They have the authority to delegate any or all portions of their responsibilities to subordinates, but are ultimately responsible for its compliance. The Directors will:

1. Ensure corrective actions identified by site safety inspections or annual auditing has been met in a timely manner to mitigate hazards and risk effectively.
2. Provide adequate means to support a viable and effective Trenching and Excavation program for the Town's employees and citizens.
3. Immediately respond to government compliance inspections, as well as notify the Risk & Safety Manager of the inspection.
4. Ensure that any changes or revisions to this program, made by the Risk & Safety Manager and approved by the Town Manager, are given to the affected supervisors and employees.
5. Implement progressive disciplinary actions if and when necessary for failure to comply with this program, in accordance with the Town of Mooresville's Human Resources policies.
6. Conduct random site inspections using the *Trenching and Excavation Checklist* (Attachment A) to help ensure ongoing compliance with this program.

B. The **Risk & Safety Manager** or **Safety Coordinator** is responsible for the overall management and support of the Town of Mooresville's Trenching and Excavation safety program. The Risk & Safety Manager's responsibilities include:

1. Assist as needed with program development, policy revisions, technical issues, and general support regarding this program.
2. Review and update the policy as needed and notify affected directors/supervisors of any changes or revisions to the policy so that they can ensure training is provided to all employees.
3. Monitor the overall effectiveness of the program by means of random or scheduled task observations, feedback to supervisors, site safety inspections, and annual safety auditing of the department and this program.

4. Ensure initial investigations are conducted thoroughly for near misses and incidents, as well as conclude all investigations with findings and corrective actions.
5. Conduct random site inspections using the *Trenching and Excavation Checklist* (Attachment A) to help ensure ongoing compliance with this program.

C. **Department Supervisors** are responsible for the daily implementation of the Trenching and Excavation safety program. They work directly with the Public Utilities Director, Public Works Director, Risk & Safety Manager, other supervisors, employees, and contractors. Activities falling under the direction of Department Supervisors include:

1. Provide atmospheric equipment, testing, and selection as needed.
2. Ensure all Town of Mooresville employees are provided with adequate and readily accessible Personal Protective Equipment (PPE) as needed and that the PPE meets the standards of the Town and those listed in this policy.
3. Provide protective systems as needed and outlined within this policy.
4. Ensure training is provided to all affected employees, new hires, and Crew Leaders. Perform corrective coaching and positive reiteration of this safety program as needed.
5. Provide technical assistance as needed.
6. Preview and update the program on at least an annual basis, or as needed. Advise all affected employees of any program changes, revisions, or updates.
7. Retain records and logs in accordance with this program.
8. Carry out additional duties as noted by this program.

D. **Crew Leaders** act as the site supervisor and must be qualified to assume the role of the *Competent Person* for the Town of Mooresville in reference to this program. As site supervisors and trained *Competent Persons*, they have the authority to make necessary changes in the field to ensure a safe worksite for their crew. Crew Leaders must assure that:

1. The procedures described in this program are followed and enforced at all times.
2. Employees entering excavations or trenches are properly trained and equipped to perform their duties safely.
3. Has ensured the identification of all existing and predictable hazards at worksites they are assigned with the assistance of a *Trenching & Excavation Permit to Work* (Attachment B) document that will be posted on-site and retained in accordance with this program.
4. They are empowered and prepared to take prompt corrective actions to eliminate any unsafe acts or environments to protect themselves and employees at work sites.
5. All required inspections, tests, and recordkeeping functions have been performed at the proper stage.
6. Ensure public safety from open trench and excavation sites at all times.
7. Will notify Risk Management for Trenching & Excavation related issues or safety concerns regarding contractors.
8. Carry out additional duties as noted by this program.

E. **Employees**- Employees who are tasked with trenching and excavation work are empowered and expected to take responsibility for their own safety, as well as making efforts to ensure the safety of those they work with. All employees, including contracted personnel, who work in or around trenches and/or excavations for the Town of Mooresville must comply with all the requirements outlined in this program. Employees are responsible for:

1. Reporting hazardous practices or situations to a Crew Leader or Supervisor.
2. Stopping or refusing any job or task that is reasonably believed to be unsafe until the task can be reviewed with either a supervisor or the Safety Coordinator.
3. The prompt reporting of incident(s) that causes injury to themselves or other employees to a Crew Leader/Supervisor immediately, providing detailed and accurate information needed to help reduce similar incidents from occurring.

4. The prompt reporting of "near miss" incidents and property damages to the Crew Leader/Supervisor, again providing detailed and accurate information needed to help reduce similar incidents from occurring.
5. Active participation and input of the Trenching & Excavation Permit to Work form by the Crew Leader prior to beginning work.
6. Confirm that a Crew Leader, or acting Crew Leader, trained as a "competent person" is on site at all times.
7. Wear appropriate Personal Protective Equipment (PPE) as described by this program, NC OSHA regulations and the *Trenching & Excavation Permit to Work* (Attachment B)

V. Legislation

The Town of Mooresville complies with 29 CFR 1926.650-652, subpart P- OSHA Trenching and Excavation standard and it's Appendices and is incorporated by reference under 13 North Carolina Administrative Code (N.C.A.C.) 07F .0201 Construction Standards, relevant sections of North Carolina General statues (N.C.G.S) 87-Article 8 Underground Utility Safety and Damage Prevention Act and N.C.G.S 95-148 Safety and Health Programs of State Agencies and Local Governments.

VI. Policy and Compliance Methods

A. Training Requirements

All personnel involved in trenching or excavation work shall be trained in accordance with the requirements of this plan. Training will be performed before anyone is assigned duties in excavations. Initial training includes a complete review of this policy with a certified Competent Person and consists of classroom and/or video instruction followed by a comprehensive exam.

1. **Employee Training**

   Components of the initial training program provided to all personnel who perform work in Trenching & Excavations shall include:

   a) The work practices that must be followed during excavating or working in excavations.
   b) The use of personal protective equipment that will typically be required during work in excavations, including but not limited to safety shoes, hardhats, and fall protection devices.
   c) The requirements and proper use of Protective Systems.
   d) Procedures to be followed if a hazardous atmosphere exists or could reasonably be expected to develop during work in an excavation.
   e) Procedures to be followed if a confined space exists or develops during excavation work.
   f) A complete review of the OSHA Excavation Standard, 29 CFR 1926, Subpart P.
   g) Emergency and non-entry rescue methods, and the procedure for calling rescue services.
   h) The Town of Mooresville's policy on reporting incidents that cause injury to employees, as well as reporting "near miss" incidents and property damage.

2. **Department Supervisor and Crew Leader Training**

   Program Supervisors and Crew Leaders shall receive the training detailed in this program, as well as additional training on the requirements detailed in the OSHA Excavation Standard as a "Competent Person". Department Supervisors coordinate and document the training of all employees affected by this program. Make available a copy of this program and the OSHA Excavation Standard to any employee who requests it. Ensure, if required, that the design of a protective system has been completed and approved by a registered professional engineer before work begins in an excavation.

   a) **Department Supervisors** shall:
      i. Coordinate and document the training of all employees affected by this program.

ii. Make available a copy of this program and the OSHA Excavation Standard to any employee who requests it.
iii. Ensure, if required, that the design of a protective system has been completed and approved by any registered professional engineer before work begins in an excavation.

b) **Crew Leader**(s), acting in the assigned capacity of a qualified "Competent Person" shall:
   i. Actively participate in and present the Trenching & Excavation Safety training to all employees affected by this program
   ii. Ensure on a daily basis, or more often as detailed in this program, that worksite conditions are safe for employees to work in excavations
   iii. Provide coaching and correction as needed to ensure program compliance at work sites.
   iv. Determine the means of protection that will be used for each excavation project
   v. Ensure, if required, that the design of a protective system has been completed and approved by a registered professional engineer before work begins in an excavation.

3. **Refresher Training**
   Refresher training for Trenching & Excavation Safety must be given on an annual basis. This training may include classroom instruction or a video presentation, but must include a comprehensive exam. Refresher training for all Competent Persons must be done every 3 years.

4. **Training records**
   Documentation is required for all trenching and excavation training attended, be actively maintained by Department Supervisors, and shall include the following:
   a) name(s) of the instructor(s) who conducted the training;
   b) a copy of the training syllabus, as well as the written material presented; and
   c) Name of the employee(s) who received the training.

   Training and policy reviews shall be performed and properly documented before employees are assigned duties in excavations

5. Remedial training will be performed when work site inspections indicate that an employee does not have the necessary knowledge or skills to safely work in or around excavations. Depending on the circumstances, this can include coaching, formal classroom training, and/or a safety observation period where the employee continually demonstrates correct and safe policies and procedures.

B. **General Requirements**
Each work site is unique and presents its own challenges and circumstances, which should be recognized by the Competent Person. Prior to any trenching or excavation work, a Town of Mooresville *Trenching & Excavation Permit to Work* (Attachment B) form must be completed. This permit is intended to serve as a guide to assist in mitigating the more common hazards associated with trenching and excavation work.

1. **Pre-Work Site Inspection**
   Prior to excavation, the site shall be thoroughly inspected by a Crew Leader to determine if special safety measures must be taken. These measures should be noted in the *Trenching & Excavation Permit to Work* (Attachment B).

2. **Trenching & Excavation Permit to Work form shall:**
   a) Must be Completed by a Competent Person properly trained and experienced in trenching and excavation work and be posted at the work site for the duration of the project.

b) Be discussed in an open forum at the work site with all affected employees, who will be empowered to provide feedback, express concerns, and share expertise in regards to trenching and excavation safety specific to the project and contents of the permit.
c) Be initialed by both the Crew Leader and the affected employees before beginning work, indicating an understanding of the permit and its contents.

3. **Daily Inspections**

The Crew Leader or Program Supervisor shall conduct daily inspections of excavations, adjacent areas, and protective systems for evidence of a situation that could result in possible cave-ins, failure of protective systems, hazardous atmospheres, or other hazardous conditions. Exposed employees shall be removed from the hazardous area until precautions have been taken to assure their safety.

An inspection shall be conducted:

a) Prior to the start of work.
b) As needed throughout the shift.
c) After every rainstorm.
d) Where the Crew Leader or Department Supervisor finds evidence of a situation that could result in a possible cave-in, failure of protective systems, hazardous atmosphere, or other hazardous conditions.

It is recommended the *Trenching and Excavation Checklist* (Attachment A) be used to conduct this inspection, and that the competent person signs the checklist upon completion of the inspection. The Crew Leader shall maintain a written log of all inspections conducted. This log shall include the date, work site location, results of the inspection, and a summary of any action taken to correct existing hazards. These logs shall be maintained and readily accessible by the Department Supervisor(s) for a minimum of 5 years.

4. **Surface Encumbrances and Underground Installations**

All equipment, materials, supplies, permanent installations (i.e., buildings or roadways), trees, brush, boulders, power poles, and other objects at the surface that could present a hazard to employees working in the excavation shall be removed, mitigated, or supported as necessary to protect employees and the public.

The location of sewer, telephone, fuel, electric, water, or any other underground installations or wires that may be encountered during excavation work shall be determined and marked prior to opening an excavation. Arrangements shall be made as necessary by the Department Supervisor and/or Crew Leader with the appropriate utility entity for the protection, removal, shutdown, or relocation of underground installations. If it is not possible to establish the exact location of these installations, the work may proceed with caution if detection equipment or other safe and acceptable means are used to locate the utility and procedures are clearly outlined in the Permit to Work and reviewed by all on-site. Excavation shall be done in a manner that does not endanger the underground installations or the employees engaged in the work. Utilities left in place shall be protected by barricades, shoring, suspension, or other means as necessary to protect employees and the public.

5. **Access and Egress**

Stairs, ladders, and/or ramps shall be provided at excavation and trenching sites where employees are required to enter trench excavations over four (4) feet deep. The maximum distance of lateral travel (along the length of the trench) necessary to reach the means of egress shall not exceed 25 feet.

a. Structural Ramps
   i. Structural ramps used solely by employees as a means of access or egress from excavations shall be designed by a competent person.
   ii. Structural ramps used for access or egress of equipment shall be designed by a person qualified in structural design, and shall be constructed in accordance with the design.

iii. Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent movement or displacement.
iv. Structural members used for ramps and runways shall be of uniform thickness.
v. Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.
vi. Structural ramps used in place of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

b. Ladders
i. When portable ladders are used, the ladder side rails shall extend a minimum of three 3' feet above the upper surface of the excavation. Any extensions beyond 3' feet must not create additional hazards.
ii. Ladders shall have nonconductive side rails if work will be performed near exposed energized equipment or systems. (Fiberglass ladders with aluminum rungs (Type IA rated) are preferred).
iii. Two or more ladders, or a double-cleated ladder, will be provided where 2 or more employees will be conducting work in an excavation where ladders serve as the primary means of egress, or where ladders serve two-way traffic.
iv. Ladders will be inspected prior to use for signs of damage or defects. Damaged ladders will be removed from service and marked with "Do Not Use" until repaired.
v. Ladders shall be used only on stable and level surfaces unless secured. Ladders placed in any location where they can be displaced by workplace activities or traffic shall be secured, or barricades shall be used to keep these activities away from the ladders.
vi. Non self-supporting ladders shall be positioned so that the foot of the ladder is one-quarter of the working length away from the support.
vii. Employees are not permitted to carry any object or load while on a ladder that could cause them to lose their balance and fall.

6. **Vehicular Traffic**
Employees exposed to vehicular traffic shall be provided with, and shall wear warning vests or other suitable garments marked with or made of retro reflective or high-visibility material. Warning vests worn by flaggers must comply with NC DOT standards, and shall be made with retro reflective material if worn during night work. Emergency lighting, such as spotlights or portable lights, shall be provided as needed to perform work safely.

7. **Falling Loads**
Town of Mooresville employees are prohibited from working underneath loads being handled by lifting or digging equipment. Employees are required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles provide adequate protection for the operator during loading and unloading operations.

8. **Warning Systems**
A warning system shall be used when mobile equipment is operated adjacent to the edge of an excavation if the operator does not have a clear and direct view of the edge of the excavation. The warning system shall consist of barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

9. **Hazardous Atmospheres**
Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or forced ventilation of the workspace.

a) Atmospheric Testing - A qualified Crew Leader must test the atmosphere in excavations over four (4) feet deep if a hazardous atmosphere exists or could reasonably be expected to exist. A hazardous atmosphere could be expected, for example, in excavations in landfill areas, areas where hazardous substances are stored nearby, or near areas containing gas pipelines. Atmospheric testing will be performed using a properly calibrated direct reading gas monitor. Direct reading gas detector tubes or other acceptable means may also be used to test potentially toxic atmospheres.
b) Forced ventilation or other effective means shall be used to prevent employee exposure to an atmosphere containing a flammable gas in excess of ten (10) percent of the lower flammability limit of the gas.
c) Continuous air monitoring will be performed or supervised by a qualified Crew Leader when controls are used to reduce the level of atmospheric contaminants to acceptable levels
d) Atmospheric Monitoring Equipment shall be
    i. calibrated at least every six (6) months by a qualified Crew Leader on a schedule and in the manner recommended by the manufacturer.
    ii. Checked immediately prior to use to ensure that it is operating properly. This may include a Bump Test as recommended by the manufacturer.
    iii. Equipped with an audible and visual alarm.
    iv. Recalibrated when the device has not been used within the last 30 days.

Note: The on-site Crew Leader must determine if the space to be entered qualifies as a Permit-Required Confined Space as outlined by OSHA standards in 1910.146. Confined Space Entry Permitting must be done upon this determination and all hazards adequately mitigated in accordance with the permit.

9. Personal Protective Equipment

Trenching and excavation work often exposes employees to various types of dust, particles, or fragments produced by drilling, sanding, grinding, and similar operations. All employees working in trenches or excavations shall wear, at a minimum:

a) Approved hardhats that meet the requirements of ANSI Z89.1.
b) Safety shoes or boots that meet the requirements of ANSI Z41.
c) Approved safety glasses that meet the requirements of ANSI Z87.

There may be times when pother personal protective has been deemed necessary. It is up to the individual Crew Leader to determine the proper PPE associated for the task. Other personal protective equipment may include, but is not limited to:

a) Gloves or other suitable hand protection may be necessary to protect employees from injuries to the hands. Gloves should not be worn by employees using rotating equipment.
b) Hearing Protection - Employees using or working in the immediate vicinity of hammer drills, masonry saws, jackhammers, or similar high-noise producing equipment shall wear suitable hearing protection, as determined by the Crew Leader. The hearing protection selected (ear muffs or plugs) should offer a minimum Noise Reduction Rating (NRR) of 25 dB or more. Assistance from the Risk & Safety Department will be provided to help determine whether employees exposed to noise from these tasks qualify as participants in the Town's Hearing Conservation Program.
c) Fall Protection
    i. Employees entering bell-bottom pier holes or other similar deep and confined footing excavations shall wear a harness with a lifeline securely attached to it. The lifeline shall be separate from any line used to handle materials and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.
    ii. Each employee working at the edge of an excavation six (6) feet or more deep shall be protected from falling. Fall protection shall include guardrail systems, fences, barricades,

covers, or a tie-back system meeting OSHA requirements, as determined by the Crew Leader.

10. **Hot Work**

Employees performing welding, cutting, or brazing operations, or are exposed to the hazards produced by these tasks, Do not perform "hot work" such as welding, cutting, or burning in areas where flammable, combustible, corrosive, or toxic substances are being used, stored, or may otherwise be present.

a) Maintain a fire watch during all hot work until material has cooled.
b) Ensure fire extinguishers and extinguishing agents are available in the immediate area.
c) Provide natural, exhaust, or forced ventilation to control exposure to the metal fumes and other contaminants being generated.
d) Ensure that pipes and other vessels are purged of hazardous materials.
e) Identify building materials that will be welded, cut, or burned and that may contain lead, such as painted surfaces and pipes.

11. **Walkways and Guardrails**

Walkways shall be provided where employees or equipment are permitted to cross over excavations more than 30". Guardrails shall be provided where walkways, accessible only to on-site project personnel, are six (6) feet or more above lower levels.

12. **Protection from Water Accumulation Hazards**

Employees are not permitted to work in excavations that contain or are accumulating water unless precautions have been taken to protect them from the hazards posed by water accumulation. Precautions may include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of safety harnesses and lifelines. These precautions must be clearly outlined by the Crew Leader in the Permit to Work.

a) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operation shall be monitored by a person trained in the use of that equipment.
b) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation.
c) Precautions shall also be taken to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains shall be re-inspected by the Crew Leader after each rain incident to determine if additional precautions, such as special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of safety harnesses and lifelines, should be used.

The Crew Leader shall inform affected employees of the precautions or procedures that are to be followed if water accumulates or is accumulating in an excavation.

13. **Stability of Adjacent Structures**

The Crew Leader will determine if the excavation work could affect the stability of adjoining buildings, walls, sidewalks, or other structures. Support systems (such as shoring, bracing, or underpinning) shall be used to assure the stability of structures and the protection of employees where excavation operations could affect the stability of adjoining buildings, walls, or other structures.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted, except when:

a) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure.
b) The excavation is in stable rock.

c) Any registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity, or approved the determination that such excavation work will not pose a hazard to employees.

Sidewalks, pavements, and appurtenant structures shall not be undermined unless a support system or other method of protection is provided to protect employees from the possible collapse of such structures. Where review or approval of a support system by any registered professional engineer is required, the Crew Leader or Supervisor shall secure this review and approval in writing before the work begins.

14. **Protection from Falling Objects and Loose Rocks or Soil**
Employees shall be protected from excavated materials, equipment, or other materials that could pose a hazard by falling or rolling into excavations. Employees shall not be permitted to work where the danger of falling rock or earth exists. Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face, such protection may consist of any of the following:
    a) Storing materials or equipment at least two (2) feet from the edge of excavations.
    b) Scaling to remove loose material.
    c) Installation of protective barricades, such as wire mesh or timber, at appropriate intervals on the face of the slope to stop and contain falling material.
    d) Benching to contain falling material.
    e) The use of restraining devices to prevent materials or equipment from falling or rolling into excavations.

Materials and equipment may, as determined by the Crew Leader, need to be stored further than two (2) feet from the edge of the excavation if a hazardous loading condition is created on the face of the excavation.

15. **Protective System Requirements**
Employees in an excavation shall be protected from cave-ins by using either an adequate sloping and benching system or an adequate support or protective system. Protective systems shall be capable of resisting all loads that could reasonably be expected to be applied to the system. The only exceptions are:
    - Excavations made entirely in stable rock; or
    - Excavations less than five (5) feet in depth where examination of the ground by a qualified Crew Leader provides no indication of a potential cave-in.

16. **Design of Support, Shield, and Other Protective Systems**
The design of support systems, shield systems, and other protective systems shall be selected and constructed by a qualified Crew Leader or Department Supervisor in accordance with the following requirements:
    a) Employees in an excavation shall be protected from cave-ins by using either an adequate sloping and benching system or an adequate support or protective system. Allowable exceptions are noted above in section 15.

    b) Protective systems shall be capable of resisting all loads that could reasonably be expected to be applied to the system.

    c) Design of Sloping and Benching Systems:
    The slope and configuration of sloping and benching systems shall be selected and constructed by a qualified Crew Leader in accordance with the following options
        i. Determination of Soil Type:

Soil types shall be classified by a Crew Leader or Program Supervisor qualified as a Competent Person in accordance with the standards and definitions listed in 29 CFR 1926, Subpart P, Appendix A.

ii. Soil determination by the Competent Person must include both visual observations and at least one of the following manual tests

- Ribbon Test.
- Jar Settling Test.
- Thumb Penetration Test.

In addition to the *Competent Person's* observations and manual testing, a penetrometer must also be used to determine soil type. Soil type must be determined **prior** to entry and documented on the Permit to Work and in the inspection log.

d) Allowable Configurations and Slopes:
Excavations shall be sloped at an angle no steeper than one and one-half (1 ½) horizontal to one (1) vertical (34 degrees measured from the horizontal), unless one of the options listed below is used. Slopes shall be properly excavated depending on soil type as shown in 29 CFR 1926, Subpart P, Appendix B.

The maximum allowable slopes and allowable configurations for sloping and benching systems shall meet the requirements set forth in these appendices.

e) Designs Using Other Tabulated Data:
The design of sloping or benching systems may be selected from, and shall be constructed in accordance with, other tabulated data, such as tables and charts. The tabulated data used must be in written form and include the following:

i. Identification of the factors that affect the selection of a sloping or benching system.
ii. Identification of the limits of the use of the data, including the maximum height and angle of the slopes determined to be safe.

At least one copy of the tabulated data that identifies the registered professional engineer who approved the data shall be maintained at the jobsite during construction of the protective system. After that time, the data may be stored off the jobsite, and shall be maintained by the Program Supervisor for a minimum period of 5 years.

f) Design by a Registered Professional Engineer:
Sloping or benching systems designed in a manner other than those described in the preceding three options shall be approved by any registered professional engineer.

Designs shall be in written form and shall include at least the following information:

i. The maximum height and angle of the slopes that were determined to be safe for a particular project; and
ii. The identity of the registered professional engineers who approved the design.

At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time, the design may be stored off the jobsite, and shall be maintained by the Department Supervisor for a minimum period of 5 years.

17. **Design of Support, Shield, and Other Protective Systems**
The design of support systems, shield systems, and other protective systems shall be selected and constructed by a qualified Crew Leader or Department Supervisor in accordance with the following requirements:
    a) Designs using 29 CFR 1926, Subpart P, Appendices A, C and D.
    b) Timber shoring in trenches shall be designed in accordance with the requirements of the OSHA guidelines.
    c) Aluminum hydraulic shoring shall be designed in accordance with the manufacturer's tabulated data or the requirements of the OSHA guidelines.
    d) Designs using manufacturer's tabulated data.
    e) Support systems, shield systems, and other protective systems designed from manufacturer's tabulated data shall be constructed and used in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.
    f) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall be allowed only after the manufacturer issues specific written approval.
    g) Manufacturer's specifications, recommendations, and limitations, as well as the manufacturer's written approval to deviate from the specifications, recommendations, and limitations, shall be kept in written form at the jobsite during construction of the protective system(s). After that time, the information may be stored off the jobsite, and shall be maintained by the Department Supervisor for a minimum period of 5 years.

18. **Designs using other tabulated data**
Designs of support systems, shield systems, and other protective systems shall be selected from and constructed in accordance with tabulated data, such as tables and charts.
The tabulated data shall be in written form and shall include all of the following:
    a) Identification of the factors that affect the selection of a protective system drawn from such data;
    b) Identification of the limits of such data; and
    c) Information needed by the user to make a correct selection of a protective system from the data.

At least one written copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time, the data may be stored off the jobsite, and shall be maintained by the Department Supervisor for a minimum period of 5 years.

19. **Design by a registered Professional Engineer**
Support systems, shield systems, and other protective systems designed in a manner other than the preceding three options shall be approved by a registered professional engineer.

Designs shall be in written form and shall include:
    a) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and
    b) The identity of the registered professional engineer who approved the design.

At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, and shall be maintained by the Department Supervisor for a minimum period of 5 years.

20. **Materials and Equipment**
    a) Materials and equipment used for protective systems shall be free from damage or defects that might affect their proper function.
    b) Manufactured materials and equipment used for protective systems shall be used and maintained in accordance with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.
    c) When materials or equipment used for protective systems are damaged, these systems must be examined by a competent person to evaluate suitability for continued use. If the competent person cannot assure that the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service. The material or equipment shall then be evaluated and approved by any registered professional engineer before being returned to service.

21. **Installation and Removal of Supports**
    Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other potential hazards. Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support systems. Individual members of the support systems shall not be subjected to loads exceeding those that they were designed to support. Before temporary removal of individual support members begins, additional precautions shall be taken as directed by a Crew Leader to ensure the safety of employees (i.e., the installation of other structural members to carry the loads imposed on the support system).

    Removal of support systems shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly. If there is any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation, the work shall be halted until it can be examined by the Crew Leader or Department Supervisor. Backfilling shall progress in conjunction with the removal of support systems from excavations.

    Excavation of material to a level no greater than two (2) feet below the bottom of the members of a support system is allowed, but only if the system is designed to resist the forces calculated for the full depth of the trench. There shall be no indications of a possible loss of soil from behind or below the bottom of the support system while the trench is open. Installation of a support system shall be closely coordinated with the excavation of trenches.

22. **Sloping and Benching Systems**
    Employees are not permitted to work above other employees in the faces of sloped or benched systems, except when employees at lower levels are protected from the hazards of falling, rolling, or sliding material or equipment.

23. **Shield Systems**
    Shield systems shall not be subjected to loads that are greater than those they are designed to withstand. Shields shall be installed in a manner that will restrict lateral or other hazardous movement of the shield and could occur during cave-in or unexpected soil movement. Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields. Employees are not permitted in trenches when shields are being installed, removed, or moved vertically.

    Excavation of material to a level no greater than two (2) feet below the bottom of the shield system is allowed, but only if the system is designed to resist the forces calculated for the full depth of the trench. There shall be no indications of a possible loss of soil from behind or below the bottom of the shield system while the trench is open.

24. **Accident Investigations**

All incidents that result in injury to workers, as well as near misses, regardless of their nature, shall be reported and investigated in accordance with Town policy. Investigations shall be conducted by a Department Supervisor as soon after an incident as possible to identify the cause and means of prevention to eliminate the risk of reoccurrence. All near misses and incidents must be promptly reported by the Supervisor to the Town of Mooresville's Risk and Safety Department. The Risk & Safety Manager will conclude all investigations with findings and corrective actions.

In the event of such an incident, the Trenching & Excavation Safety Program shall be reevaluated to determine if additional practices, procedures, or training are necessary to prevent similar future incidents.

25. **Changes to Program**
Any changes to the Trenching & Excavation Safety Program shall be approved by both the Town's Risk & Safety Manager and the Town Manager, as well as reviewed by a qualified person as the job progresses to determine additional practices, procedures, or training needs necessary to prevent injuries. Affected employees shall be notified of procedure changes, and trained if necessary. A copy of this program shall be maintained at the jobsite by a Program Supervisor.

26. **Protection of the Public**
Adequate protection for pedestrian and passing vehicular traffic should be provided.
Such protection may be provided by barricades, fences, guardrails, warning signs or flags and the protection provided should be kept in place until backfilling is completed. Under conditions of heavy traffic, a watchman may be needed. Warning lights or other illumination shall be maintained as necessary for the safety of the public and employees from sunset to sunrise.

Guardrails, fences, or barricades shall be provided on excavations adjacent to walkways, driveways, and other pedestrian or vehicle thoroughfares. Walkways or bridges protected by standard guardrails shall be provided where employees and the general public are permitted to cross over excavations.

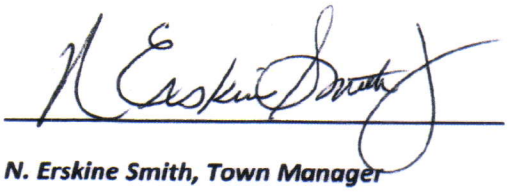
Wells, holes, pits, shafts, and all similar hazardous excavations shall be effectively barricaded or covered and posted as necessary to prevent unauthorized access. All temporary excavations of this type shall be backfilled as soon as possible.

Information on the requirements for guardrails and toeboards may be obtained by contacting the Crew Leader in charge.

27. **Program Compliance**
Any direct or intentional violation or non-compliance with this program may result in the discipline, up to and including termination of the person or persons involved in accordance with the Town of Mooresville's personnel policy.

VII. Authorization

Approved by:



N. Erskine Smith, Town Manager

October 20, 2015

Date

VIII. Attachments

A. Trenching & Excavation Safety Checklist

B. Trenching and Excavation Permit to Work

IX. Revisions

A. October 20, 2015: Original policy approval and implementation.

Attachment A

Town of Mooresville
Trenching & Excavation Safety Checklist

Site Location_____ **Date**_____ **Time**_____

General Inspection		Yes	No	N/A
1.	Has the competent Person had specific training – and is knowledgeable about-soil analysis, use of protective systems, and the requirements of 29 CFR 1926- Subpart P: Excavations and Trenching?	☐	☐	☐
2.	Does the "Competent Person" have the authority to remove workers from the excavation immediately?	☐	☐	☐
3.	Are excavations, adjacent areas, and protective systems inspected by a Competent Person: **A.** Daily prior to the start of work, **B.** As needed throughout the shift and **C.** After every rainstorm or other occurrence that could increase the hazard?	☐	☐	☐
4.	Are all surface encumbrances removed or supported?	☐	☐	☐
5.	Are all employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation?	☐	☐	☐
6.	Are hardhats worn by all employees?	☐	☐	☐
7.	Are spoils, materials, and equipment set back at least two feet from the edge of the excavation?	☐	☐	☐
8.	Are barriers provided at all remotely located excavations, wells, pits, shafts, etc.?	☐	☐	☐
9.	Are walkways and bridges over excavations 6 feet or more in depth and 30 inches or more in width equipped with standard guardrails and	☐	☐	☐
10.	Are warning systems established and used when mobile equipment is operating near the edge of an evacuation?	☐	☐	☐
11.	Are employees required to stand away from vehicles being loaded or unloaded?	☐	☐	☐
12.	Are warning systems established and used when mobile equipment is operating near the edge of an excavation?	☐	☐	☐
13.	Are employees prohibited from going under suspended loads?	☐	☐	☐
14.	Are employees prohibited from working on the faces of sloped or benched excavations above other employees?	☐	☐	☐
Utilities				
15.	Are utilities company contacted and or utilities located as required by local, state, and federal law?	☐	☐	☐
16.	Are the exact locations clearly marked?	☐	☐	☐
17.	Are underground installations protected, supported, or removed when an excavation is open?	☐	☐	☐
Access & Egress				
18.	Are ladders or other means of access and egress in all trenches 4 or more feet in depth?	☐	☐	☐
19.	Are all workers within 25 feet of a means of access and egress?	☐	☐	☐
20.	Are underground installations protected, supported, or removed when an excavation is open?	☐	☐	☐
21.	Are all structural ramps used by employees designed by a Competent Person?	☐	☐	☐
22.	Are all structural ramps used for equipment designed by a Registered Professional Engineer?	☐	☐	☐

23.	Are all structural ramps constructed of uniform thickness, cleated together, equipped with non-slip surfaces?	☐	☐	☐
24.	Are all employees protected from cave ins when entering or exiting excavation?	☐	☐	☐
Wet Conditions				
25.	Are precautions taken to protect employees from water accumulation?	☐	☐	☐
26.	Is water removal equipment monitored by the Competent Person?	☐	☐	☐
27.	Is surface water or runoff water diverted after every rainstorm or other hazard-increasing occurrence?	☐	☐	☐
Hazardous Atmospheres				
28.	Is the atmosphere within all excavations tested when there is a reasonable possibility of oxygen-deficient, oxygen enriched, combustible, toxic or other harmful contaminant?	☐	☐	☐
29.	Are adequate precautions taken to protect employees from exposure to an atmosphere containing less than 19.5% oxygen and/or other hazardous atmosphere?	☐	☐	☐
30.	Is verification provided to protect employees from an atmosphere containing flammable gas in excess of 10% of the lower explosive limit of the gas?	☐	☐	☐
31.	Is emergency equipment available when hazardous atmosphere s could or do exist?	☐	☐	☐
32.	Are employees trained to use personal protective equipment and other rescue equipment?	☐	☐	☐
Soils				
33.	Has the Competent Person classified the soil using one visual test and two manual tests?	☐	☐	☐

Support Systems

Support Systems are required for excavations deeper than 5 feet or when there is a potential for cave-ins. 3 primary options are available. Data obtained from manufacturer's recommendations must remain on site.

Sloping- available only for excavations less than 20 feet	**Shoring**- must be installed according to OSHA regulation or manufacturer's recommendations.	**Shielding**- must be installed according to manufacturer's recommendations.

34.	Are materials and/or equipment chosen based upon soil analysis, trench depth and expected loads?	☐	☐	☐
35.	Are materials and equipment that are used for protective systems inspected and in good working order?	☐	☐	☐
36.	Are damaged materials and equipment immediately removed from service?	☐	☐	☐
37.	Are damaged materials and equipment inspected by a registered Professional Engineer after repairs are made and before being placed back in service?	☐	☐	☐
38.	Are protective systems installed without exposing employees to hazards of cave-ins, collapses, or threat of being struck by materials or equipment?	☐	☐	☐
39.	Are all members of support systems securely fastened together to prevent failure?	☐	☐	☐
40.	Are support systems provided to secure stability or adjacent structures, buildings, roadways, sidewalks, etc.?	☐	☐	☐
41.	Are excavations below the level of the base or footing support, and approved by a Registered Professional Engineer?	☐	☐	☐
42.	Does back filling progress with the removal of the support system?	☐	☐	☐
43.	Is a shield system installed to prevent lateral movement?	☐	☐	☐
44.	Are employees prohibited from remaining in a shield system during vertical movement?	☐	☐	☐

Inspected by:_____ **Date:**_____

Attachment B

Trenching and Excavation Permit to Work

No excavation work may begin until permit restriction requirements are met, approval signatures are obtained and the permit is posted at the job site. Permits are returned to the Crew Leader when the job is complete.

General

Location: Date:

North Carolina 811 Notification: Date:
Time:

Ticket Number:

Excavation Hazard Analysis

Excavation requirements

	YES	N/A			
Local permits Obtained Expiration date: / /	☐	☐	Spoils kept back more than 2 feet from the edge of excavation	☐	☐
Risk of affecting nearby structures	☐	☐	Crossovers required	☐	☐
Advise workers of all underground piping and other installations	☐	☐	Covers of excavation secured against displacement	☐	☐
Fissures(side or on top- cracks or separation)	☐	☐	Potential for water accumulation	☐	☐
Vibrations (caused by excavation or other source)	☐	☐	Registered Professional Engineer Certification required(shoring only)	☐	☐
Mobile equipment must have warning system established and utilized	☐	☐	Traffic warning signs/ Traffic plan	☐	☐
Guardrails and handrails around excavation and on crossings	☐	☐	Protection from lose rock and soil	☐	☐
Sloughs (hollow, usually filled with mud or mire	☐	☐	Atmospheric monitoring, if yes refer to back	☐	☐
Caving or depressions since the last inspection	☐	☐	All employees informed of necessary PPE onsight	☐	☐
Utility Interferences	☐	☐	Other:	☐	☐

REQUIREMENTS FOR ENTRY

Daily competent Person Inspection	☐ REQUIRED	Emergency Action Plan	☐ REQUIRED
Standby required	☐ Yes ☐ No	Other:	☐ Yes ☐ No

Excavation

SOIL TEST		SOIL TYPE	PROTECTIVE SYSTEM	EXCAVATION DIMENSIONS
☐ VISUAL ☐ PENETROMETER _____TONS/FT2 BOTH REQUIRED	☐ THUMB ☐ JAR ☐ RIBBON TEST	☐ TYPE A ☐ TYPE B ☐ TYPE C-60 ☐ TYPE C-80	☐ BENCH ☐ SLOPE ☐ SHIELD ☐ ALUMINUM HYDRAULIC SHORING	LENGTH: WIDTH: DEPTH:

Inspection

ALL INSPECTIONS MUST BE COMPLETED BY A TRAINED COMPETENT PERSON

TIMES OF INSPECTION: _____ / _____ / _____

VISUAL TEST: SPOILS _____ **TRENCH SIDE** _____

Approval

Permit conditions are understood and met for this facility

Competent person:_____(Print)

Signature:_____ Date and time:_____

Crew Leader:_____(Print)

Signature:_____ Date and time:_____

All employees performing work at the trenching site must initial

Extensio

EXTENSIONS TO EXCAVATION PERMITS ARE ISSUED FOR NO LONGER THAN 48 HOURS FROM THE TIME OF OPENING AND THE SITE MUST BE SECURED IN ACCORDANCE WITH THE TOWN OF MOORESVILLE'S POLICY.

Date: Time: Approved By:_____