

<b>Garmong Construction Services</b>					
<i>EMPLOYEE SAFETY POLICY HANDBOOK – Excavation and Trenching</i>					
<b>Last Revised:</b>	<b>January 25, 2012</b>	<b>By</b>	<b>Douglas Mahurin, MS, CSP</b>	<b>This Copy Printed:</b>	<b>1/25/2012 2:24:00 PM</b>

## **EXCAVATION/TRENCHING SAFETY**

### **PURPOSE**

Excavation and trenching cave-ins result in more than one hundred fatalities and an estimated fifty serious injuries for each fatality annually in the United States. With little or no warning, an unsupported, improperly-shored or sloped trench or excavation wall can collapse, trapping workers below in seconds. For this reason, an Excavation and Trenching Program for the protection of our employees engaged in trenching/excavation operations has been established. This program will comply and or exceed the OSHA Excavation, Trenching, and Shoring 29 CFR 1926.650 Subpart P.

### **RESPONSIBILITY**

It is the responsibility of the Company to establish an effective Excavation/Trenching Safety Program. As an employer, our Company has the duty to assess the potential hazards associated with each particular excavation. These hazards must either be eliminated or controlled by implementation of protective measures and safe work practices.

Company Project Managers have the responsibility to plan the work in coordination with the Safety Director and other involved parties to ensure the safety of our employees. The Project Manger is responsible to initiate the one call system and obtain all available information from other sources (municipalities, plan/property owner) about the location of underground utilities.

The Safety Director has the responsibility to coordinate the program. This includes training, inspections, and program evaluation.

Superintendents have the responsibility to monitor work activities involving excavations. A competent person will be assigned to each project (generally the Superintendent, but not always). This person will have the authority to make any corrections with the excavation that are necessary for the protection of our employees.

### **TRAINING**

The Company shall provide training for employees who are asked to work inside of an excavation. The training program will enable employees to recognize excavation hazards and to implement appropriate protective measures.

The training program will include the following:

1. Recognizing Hazards of Excavations
2. Soil Classifications
3. Protective Measures/Systems
4. Safe Work Practices
5. Inspections
6. Emergency Evacuation

<b>Garmong Construction Services</b>					
<i>EMPLOYEE SAFETY POLICY HANDBOOK – Excavation and Trenching</i>					
<b>Last Revised:</b>	<b>January 25, 2012</b>	<b>By</b>	<b>Douglas Mahurin, MS, CSP</b>	<b>This Copy Printed:</b>	<b>1/25/2012 2:24:00 PM</b>

**PRE-JOB PLANNING**

During the pre-job planning, the following will be determined: trench or excavation (according to the definitions below), the depth of the excavation (is it more than 5 feet in depth), the site conditions (discussed below), the competent person designation, protection methods, and site conditions.

**Definitions (from 1926.653)**

1. Trench – a narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.
2. Excavation – any manmade cavity or depression in the earth’s surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation.

**Evaluate Site Conditions**

1. **Traffic**  
Traffic can cause several hazards to employees working inside of an excavation. The nearby traffic may cause vibration hazards, atmospheric hazards (Carbon monoxide from exhaust), and struck-by-hazards (vehicles driven into the work area or opening). Appropriate measures such as shoring or bracing, atmospheric testing or ventilation, and barricades may have to be employed if any of these hazards are present.
2. **Nearness of Structures and their Conditions or Operations**  
The weight from the buildings, curbs, trees, utility poles, and other structures adjoining the excavation area may also place more stress on the trench side. In these instances, shoring, bracing, or underpinning will be utilized to protect workers and prevent the dislocation of the soil.
3. **Soil Classification**  
The type(s) of soil must be identified to determine proper protective measures. All of the soil in an area may not be the same. It may have been previously disturbed and backfilled or may vary from a sandy loam to rock or clay or silt. For this reason soils are classified by type. Soil types are discussed in a following section.
4. **Surface and Ground Water**  
The presence of water, especially running water can erode away soil or loosen the protective supporting systems that have been put in place.
5. **Water Table**  
A high water table in an excavation area could contribute to the sides of the opening being undermined and leading to a cave-in.
6. **Overhead and Underground Utilities**  
Before the work begins, an evaluation of the surrounding utilities must be conducted. An estimated location of the underground utilities – sewer, telephone, fuel, electric, water, or any other underground installations – must be determined prior to the start of the digging. This may require coordination with local utilities, one call, and plant/property owner drawings. It is the project manager’s responsibility to initiate this process.

A survey of the overhead utilities must also be conducted prior to the start of the digging. A minimum distance of 20 feet must be maintained from any equipment or personnel from electrical lines.

<b>Garmong Construction Services</b>					
<i>EMPLOYEE SAFETY POLICY HANDBOOK – Excavation and Trenching</i>					
<b>Last Revised:</b>	<b>January 25, 2012</b>	<b>By</b>	<b>Douglas Mahurin, MS, CSP</b>	<b>This Copy Printed:</b>	<b>1/25/2012 2:24:00 PM</b>

**7. Vibrations**

Vibration or sudden shock from passing vehicles or railways, blasting, heavy equipment can contribute to cave-ins by loosening the soil. If these conditions exist near an excavation, stronger support may be required.

**8. Superimposed Loads**

Superimposed loads in the vicinity of a trench or excavation increase pressure on the excavation faces. Heavy equipment and materials should be kept as far back from the excavation as possible. If heavy loads are to be placed near an excavation, additional measures, such as bracing or shoring may have to be utilized to support the extra weight.

**9. Spoil Pile**

The spoil pile must be stored at least 2 feet from the edge of the opening. This is to prevent additional stress on the wall of the opening. This distance may have to be greater (3 feet or more) if a facility/property owner requires it.

**10. Weather**

Changing weather conditions and climate can greatly affect the stability of the excavation and may determine how strong the shoring system must be. Excess water from rain or melting snow loosens the soil. Special care should be taken during the daily inspections to note any changes in conditions of the opening caused by the weather.

**11. Depth of Cut**

Any trench/opening 5 feet or more in depth must have some measures put in place to protect the workers entering the opening. Any opening over 20 feet in depth must have a protective system designed by a registered professional engineer before workers enter the opening.

**12. Employee Fall Hazards**

Employees must be protected against falls into the opening. Protective measures must be used near an opening that is 6 feet or more in-depth. Barricades, handrails, flagging, hard fencing, or personal fall arrest equipment are some of the options.

**13. Hazardous Atmospheres**

An excavation may require atmospheric testing if a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or areas where chemicals are stored or have leaked into the soil. The depth at which the testing, under the previous conditions, is mandatory is 4 feet. The testing will depend upon the depth, location, and work operations conducted in the excavation.

If work is required to be conducted in a hazardous atmosphere and engineering controls, such as ventilation, do not control the hazard, then personal protective equipment must be worn. This may include respiratory protection, clothing, goggles, etc. A competent person will make this determination based on the testing data.

**14. Access/Egress**

A safe means of access/egress must be provided in all excavations. When working in an excavation 4-deep or more, adequate means of access/egress, such as ladders, steps, or ramps, must be provided and be within 25 feet of lateral travel.

Means of safe and quick egress is vital in the event of an emergency evacuation of an excavation. Various circumstances, such as fire, gas leak, water leak, or cave-in, could warrant such an evacuation.

<b>Garmong Construction Services</b>					
<i>EMPLOYEE SAFETY POLICY HANDBOOK – Excavation and Trenching</i>					
<b>Last Revised:</b>	<b>January 25, 2012</b>	<b>By</b>	<b>Douglas Mahurin, MS, CSP</b>	<b>This Copy Printed:</b>	<b>1/25/2012 2:24:00 PM</b>

### **Verifying Underground Obstructions**

- J.U.L.I.E System (in Illinois)** – Required by Illinois law to use this system anytime we have an excavation to dig. Call two working days ahead of time (1-800-892-0123), This system does not cover all underground utilities.
- Owner Facility Prints** – coordinate digging operations with property owner to determine if there are any of their underground lines in the area of the excavation.

### **SOIL TYPES**

It will be Company policy that all soil is considered Type C, unless the Company Safety Manager or other appointed person determines (through testing) that the soil is of a different type. The majority of excavations our company conducts is in previously disturbed soils which are Type C. It will have to be proven conclusively by testing that the soil is of another Type other than Type C. The Safety Manager will also have to give approval of the reclassification before employees are allowed in the excavation.

For reference, the following are the soil types:

- Type A** – Most Stable: clay, silty clay, and hardpan (resist penetration).
- Type B** – Medium Stability: silt, sandy loam, medium clay and unstable dry rock.
- Type C** – Least stable: gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rack.
- Stable Rock** – Excavating makes this soil unstable (In practice, we never work in this kind of rock).

### **SAFE PRACTICES**

Once it is determined the Soil Type (always Type C unless specified by an appointed individual), one of the following protection methods will be implemented.

#### **1. Sloping**

**Type A** – ½:1 ratio or approximately a 63 degree angle.

**Type B** – 1:1 ratio or approximately a 45 degree angle.

**Type C** – 1 ½:1 ratio or approximately a 33 degree angle.

**Solid Rock** – a 90 degree angle.

The backhoe operator will be instructed to slope at the required angle and to place the spoil a minimum of two feet away from the opening. The opening is to be inspected before any workers enter to begin work.

- Shoring** – approved system with engineering data.
- Benching** – must follow guidelines in the Excavation Stand OSHA 1926.650.
- Trench Boxes** – must have engineering data accompanying the box.

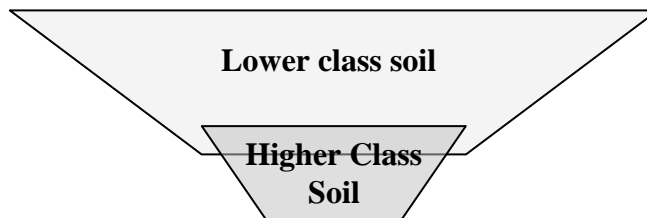
## INSPECTIONS

The inspections are to be conducted daily before anyone enters the excavation opening. The inspections are to be completed by a competent person designated on the project site. The inspection is to include the hazards already discussed. An excavation checklist is attached. This is to be used as a guide when conducting the visual/physical inspection of any excavation. The inspections are to be conducted on any trench 5 feet or more in-depth. They do not necessarily have to be written.

### Cave-in protection by Sloping:

If sloping is chosen as the preferred method for protection, the following applies:

- **Note:** If the soil is **not** analyzed and typed by a competent person as A, B or C soil as described in OSHA 29 CFR 1926 Subpart P, Excavations, 1926.652 Appendix A & B, then the soil type will be deemed as Type C soil and the *maximum* slope from the horizontal shall be 1 ½ to 1 (H:V). The slope will be from the toe of the trench and will be consistent throughout the trench wall.
- If the soil **is** analyzed and typed by a competent person as A, B or C soil as described in OSHA 29 CFR 1926 Subpart P, Excavations, 1926.652 Appendix A & B, the *maximum* slope shall be as follows:
  - Type A – ¾ to 1 slope (Horizontal to Vertical) [53°]
  - Type B – 1/1 slope (H:V) [45°]
  - Type C – 1 ½ to 1 (H:V) [34°]
- If there are two or more soil types in an excavation; default to the lowest soil classification and increase slope appropriately
- If more than 1 soil type is layered in an excavation the following applies:
  - If the lower class soil type is in the top layer, slope for the higher class soil, and increase the slope to the lower class soil at the soil transition point. See figure below:



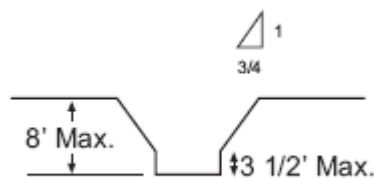
- If the lower class soil is in the lower layer, default to the appropriate slope for the lower class soil for the entire slope
- If there are multiple layers, sloping will be based on the most stringent sloping requirements of the varying types.

### Simple Slopes, Single & Multiple Benches

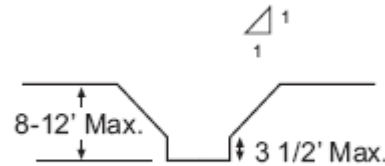
Simple slopes and single or multiple benches are allowed only as listed below:

#### Type A Soil

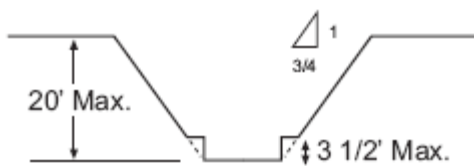
- **Note – Type A soil is uncommon and will be seldom encountered. Unless it has been accurately classified by a competent person as Class A (only), default to a lower Classification (B or C).**
- Unsupported excavations with a vertical sided lower portion (max 3 ½ ft.) where the total depth of the excavation is a maximum of 8 feet, require a ¾ to 1 slope above the (first) vertical cut (Figure 9).
- Unsupported excavations with a vertical sided lower portion (max 3 ½ ft.), where the total depth of the excavation is between 8 and 12 feet deep require a 1 to 1 slope above the (first) vertical cut (Figure 10)
- Single or Multiple Bench excavations with a vertical sided lower portion (max 3 ½ ft.), where the total depth of the excavation is a maximum of 20 feet require a ¾ to 1 slope above the (first) vertical cut. See Figure 11 and Figure 12.
- Simple slope excavations where the total depth of the excavation is a maximum of 20 feet require a ¾ to 1 slope from the toe of the ditch (Figure 13).



**Figure 9**

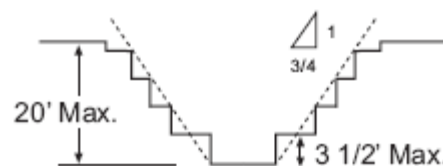


**Figure 10**



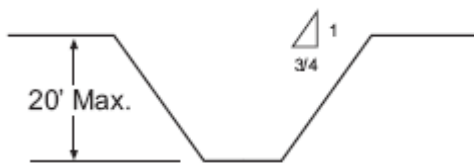
Single Bench

**Figure 11**



Multiple Bench

**Figure 12**

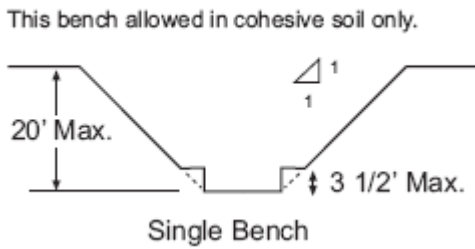


Simple Slope - General

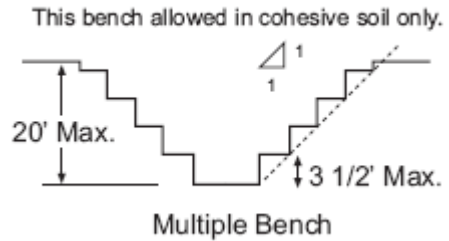
**Figure 13**

**Type B Soil**

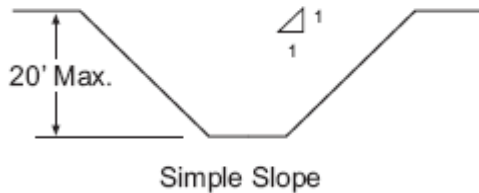
- Single or Multiple Bench vertical walls allowed only in **cohesive** soil. In non cohesive soil slope from the toe of the trench. (Figure 16)
- Single Bench or Multiple Bench excavations with a vertical sided lower portion (max 3 ½ ft.), where the total depth of the excavation is a maximum of 20 feet require a 1 to 1 slope above the (first) vertical cut. (See Figures 14 & 15)
- Simple slope excavations where the total depth of the excavation is a maximum of 20 feet require a 1 to 1 slope from the toe of the ditch. (Figure 16)



**Figure 14**



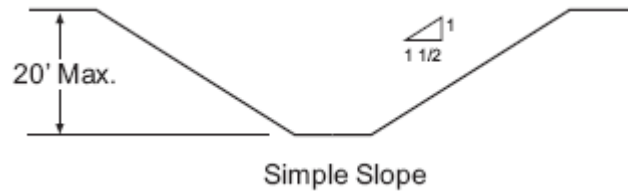
**Figure 15**



**Figure 16**

**Type C Soil**

Vertical wall is not allowed. Slope to the toe. The maximum slope should be 1 ½ to 1.



**Figure 17**



## SOME EXCAVATION CHECKLIST ITEMS

1. Protective System: Proper design/installation of Sloping (most common that we use), Shoring, Benching, or Trench Box.
2. Depth of Cut: Depth of 5 feet or more (per OSHA) must have protective measures/system (plant/owners may impose 4-foot rule), any excavation over 20 feet must be designed by a registered professional engineer.
3. Spoil Pile: Must be minimum of 2 feet from opening (per OSHA), other plant/owners may impose 3-foot rule.
4. Hazardous Atmosphere: Opening may be classified as a Confined Space if hazardous atmosphere exists from traffic or equipment exhaust, welding operations, presence of chemicals in operation or soil. Must test at 4-foot level if suspect hazardous material is in soil to be excavated. Ventilation or respiratory protection may be required.
5. Soil Classification: Always Type C unless the Company Safety Manager or other qualified person tests the soil and determines other classification. Type C = least stable (gravel, sand soft clay, submerged, or previously disturbed soil).
6. Surface/Ground Water/Water Table: Presence of water may erode or undermine the sides of the opening, special inspection of openings after rain.
7. Utilities – Underground/Overhead: Determine utilities before begin digging, utilize J.U.L.I.E. system, other utility companies, and property owner drawings for location of underground utilities, hand dig may be required as safety precaution in some situations. Observe overhead electrical lines – maintain 10 feet clearance from equipment and personnel.
8. Access/Egress: Must provide safe means at levels of 4-feet or deeper (ladders, stairs, ramps,...) and must have an access every 25 feet of lateral distance. Safe means provided in event of emergency evacuation.
9. Vibration: Caused from traffic, heavy equipment, trains, work operations, plant operations nearby...
10. Superimposed Loads Near Opening: Weight of heavy loads (equipment, material), buildings, poles, or other structures.
11. Employee Fall Hazards: Protect against falls if over 6 feet deep (barricades, handrails, flagging, fencing, body harness...
12. Public Protection/Traffic: Barricades, flagging, warning signs may be necessary. Protect public as well as workers.
13. Hazardous Work Operation: May be welding, chemicals, hot work (electrical),...
14. Personal Protective Equipment: May require hard hats, safety glasses, fall protection, respirators, suits,...
15. Other Hazards Observed: Protruding objects, exposed live electrical, chemicals, snow, ice, rain,...
16. Environmental: Unexpected discovery of chemical hazards or leaks, buried materials (asbestos, drums,...)
17. Safe Work Practices: Hand Placement, Line of Fire, Moving Blind, Area Conditions Controlled, Proper Lifting Practices, Following Procedures, Safe Electrical Work Practices Followed, Job Briefings Held.

### Excavations in Type C Soil

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 ½:1 or 34 degrees.

**(This is the only allowable method of Excavation Protection unless approved by the Safety Manger)**

# PRE-EXCAVATION CHECKLIST

(To be completed during the planning stage)

Date \_\_\_\_\_  
Job # \_\_\_\_\_  
Location \_\_\_\_\_

Superintendent \_\_\_\_\_  
Competent Person \_\_\_\_\_  
Dig # \_\_\_\_\_

## 1) Pre-construction:

**YES NO**

- A. J.U.L.I.E. one-call \_\_\_\_\_
- B. Overhead power lines \_\_\_\_\_
- C. Emergency procedures discussed with crew \_\_\_\_\_
- D. Date work will start \_\_\_\_\_
- E. Excavation will remain open \_\_\_\_\_ days
- F. Excavation will be approximately \_\_\_\_\_ deep

## 2) Surface Encumbrances:

**YES NO**

- A. Building or other structures \_\_\_\_\_
- B. Roads, alleys or sidewalks \_\_\_\_\_
- C. Utilities \_\_\_\_\_
- D. Will run-off water flow to excavation \_\_\_\_\_
- E. Adequate clearance for excavation & equipment \_\_\_\_\_

## 3) Soil Classification: Type A)\_\_\_\_\_ B)\_\_\_\_\_ C)\_\_\_\_\_

- A. Visual test performed \_\_\_\_\_
- B. Manual test performed \_\_\_\_\_

## 4) Soil Conditions:

**YES NO**

- A. Saturated \_\_\_\_\_
- B. Fissured \_\_\_\_\_
- C. Weak soil layers \_\_\_\_\_

## 5) Protection System:

**YES NO**

- A. Slope \_\_\_\_\_ B. Bench \_\_\_\_\_ C. Shore \_\_\_\_\_
- D. Shoring system \_\_\_\_\_
- E. Means of egress within 25' of workers \_\_\_\_\_
- F. Spoil pile 2' from excavation \_\_\_\_\_
- G. Materials 2' from excavation \_\_\_\_\_
- H. Potential for hazardous atmosphere \_\_\_\_\_
- I. Adjacent vibration source \_\_\_\_\_

**6) Special Conditions:**

**YES      NO**

- A. Adjacent structures supported
- B. Underground utilities supported
- C. Prior excavations nearby
- D. Undermined structures supported
- E. Fall protection for employees working above

_____	_____
_____	_____
_____	_____
_____	_____

**7) Sidewalk/Roadway Safety:**

**YES      NO**

- A. Excavation barricaded
- B. Fencing
- C. Barricade tape
- D. Lighted Barricades
- E. Orange safety vests
- F. Lane or street closures
- G. Flagging personnel needed

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

8) Make a reference drawing referring to the excavation, existing utilities, and surface encumbrances surrounding the excavation.

**Garmong Construction Services**

**DAILY EXCAVATION CHECKLIST**

Competent Person: \_\_\_\_\_ Job # \_\_\_\_\_  
Superintendent \_\_\_\_\_ Date \_\_\_\_\_  
Time \_\_\_\_\_

	YES	NO	N/A
1. Change in condition of adjacent surroundings	_____	_____	_____
2. Change in condition of adjacent structures	_____	_____	_____
3. Adjacent structures adequately supported	_____	_____	_____
4. Underground utilities adequately supported	_____	_____	_____
5. Hazardous atmosphere monitoring For what _____ Frequency _____	_____	_____	_____
6. Protective systems inspected	_____	_____	_____
7. New surface encumbrances	_____	_____	_____
8. Means of egress within 25' of workers	_____	_____	_____
9. Fall protection required	_____	_____	_____
10. Water accumulation	_____	_____	_____
11. Change in soil condition	_____	_____	_____
12. Exposure to vehicular traffic	_____	_____	_____
- Flagman	_____	_____	_____
- Barricades	_____	_____	_____
- Safety vests on all workers	_____	_____	_____
13. New vibration source	_____	_____	_____
14. Confined space procedure adhered to	_____	_____	_____
15. Rescue equipment available & inspected	_____	_____	_____

Comments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Signature

## EXCAVATION CHECKLIST

Date: \_\_\_\_\_

Completed By: \_\_\_\_\_

Location: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

### Checklist Findings

		Acceptable	Could Be Improved	Not Applicable
1.	Protective System (Sloping, Shoring, Benching, Trench Box, ...)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Depth of Cut	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Spoil Pile	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Hazardous Atmosphere (Potential Confined Space Classification)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Soil Classification (Always Type C – unless Proven Otherwise)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Surface/Ground Water/Water Table	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Utilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Access/Egress	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Vibrations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Superimposed Loads Near Opening (buildings, heavy equipment,...)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Employee Fall Hazards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Public Protection/Traffic (barricades, warning signs,...)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Hazardous Work Operations (welding, chemicals,...)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Personal Protective Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Other Hazards Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Environmental	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Safe Work Practices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Additional Comments:**