



UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234
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July 24, 1981

Mr. Clifford Simmons
Mr. Arthur Schmuhl
Mr. James Lapping
Mr. John Ramage
Mr. Paul Bouley
Mr. Ronald Stanevich
Prof. Jack Mickle
Mr. John Pannullo

Gentlemen:

Enclosed is a copy of my draft memorandum on the Boston Workshop. Please send me your comments before August 14. I shall revise the memo after I receive your comments. In particular, I want to make sure that I have no inaccuracies and that I didn't fail to address important issues which were raised.

Sincerely,

Felix Y. Yokel, Leader
Geotechnical Engineering Group
Structures and Materials Division
Center for Building Technology, NEL

Enclosure

cc: Mr. John Chambless
Mr. Edward Hayden
Mr. William Driskill
Mr. Paul Henson
Mr. Bill Zoino
Mr. Richard Critchell
Mr. Robert Briant
Mr. Clayton Morin
Mr. C. Joseph Williams



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MEMORANDUM FOR Records of the NIOSH Excavation Project

From: Felix Y. Yokel

Subject: Workshop in Boston, Massachusetts, July 14, 1981

This memorandum is to record my overall impression and my reaction to important questions that were raised in the Workshop. I expect that a Workshop report will be prepared by the Organizing Committee on the basis of taped records and written depositions.

(1) General: This was the last in a series of five Workshops and many issues that were raised were discussed in previous Workshops and will therefore not be discussed herein in much detail. My general impression was that the AGC group participating in this Workshop did not formulate strong opinions on specific issues like those expressed in some of the previous Workshops (Wisconsin - local options; Atlanta and Dallas - strong emphasis on the issue of "qualified person," the 24-ft. depth limit and an increased allowable slope for Type A soils; San Francisco - adoption of some concepts from the proposed California Standard). This is perhaps an indication of a greater diversity in work practice in the New England and Mid-Atlantic regions. Members of the New Jersey NUCA were generally supportive of the recommendation. Representatives of trench box manufacturers submitted a position statement (see Attachment 1) which did not substantially differ from that submitted in Dallas (which is discussed in the Dallas memorandum). Other trench box manufacturers, which communicated with me prior to the Boston Workshop do not agree with this statement and are supportive of our recommendations. A letter discussing the trench box manufacturers statement in the Dallas Workshop is attached (Attachment 2). Representatives of the Eastman Kodak Company came in with prepared recommendations, which are generally supportive of the proposed revisions of Subpart P but also make numerous specific recommendations. To some extent, the Kodak submission is a new viewpoint since it reflects the needs of an owner/contractor organization which is primarily engaged in the repair of utility damage as distinct from utility construction in which most of the AGC and NUCA contractors are engaged (Attachment 3). AFL-CIO in essence reiterated statements made in previous Workshops. In the opening statement, the AFL-CIO representative stated that Contractors and Unions should make joint recommendations. The substance of the AFL-CIO position was summarized in the following statement: Excavation safety could be accomplished in several ways:

1. by Hamurabi's Code,
2. by OSHA enforcement,
3. by an Engineer, and/or
4. by a Standard Practice.

AFL-CIO would like to see that the workers in 95% of all excavations be protected by a standard practice, and in the remaining 5% by an engineer.

The ASFE representative noted that ASFE is working on a summary recommendation which will reflect their position on various issues. ASFE also noted that comments should be consolidated by an industry-wide committee in a unified summary. ASFE stressed that local practices should be recognized and should supplement the national provisions. This concept goes somewhat beyond my recommendations for local options which I conveyed in the Wisconsin and California memos, and perhaps reflects a better long-term approach, however the implementation of this concept requires additional work.

I particularly welcome the concept of a joint industry recommendation advanced by AFL-CIO and ASFE. I strongly recommend to go beyond that and develop consensus industry standards. It is my judgement, on the basis of the five regional Workshops, that such a standard can be successfully developed and adopted in a relatively short time. Federal regulations which are backed by such a standard could probably be less sweeping, more effective, and less difficult to enforce.

(2) Soil Classification: Two issues were raised in conjunction with the proposed soil classification:

1. It was suggested that we go back to the matrix classification (Attachment 4).
2. It was stated that the footnotes are too complex.

In conjunction with #1, I have no doubt that in terms of categorizing soils for stability and lateral pressure, the matrix classification is the best solution. It would permit us to distinguish between sands and medium clays in Type B soils and between submerged sands and soft clays in the Type C soils. This would result in enhanced safety and economy. The problem with the matrix is that you cannot memorize the 16 matrix intercepts, except if you have a photographic memory. Thus you would have to use some visual aid on the job, such as a printed table, or a table engraved on some metal plaque. I personally do not believe that you can get foremen to use a chart routinely. It is bad enough that we will have to do this for surcharge effects. I would, however, strongly recommend that 1) we use the matrix as an educational tool, and 2) we perhaps try to use it in the field on an experimental basis.

In conjunction with #2, the footnotes to Table 1 play an important role. I will give an example: there is no way a geotechnical engineer could ever determine for sure whether you have a "compacted sharp sand" as shown in Table P-1 of the present OSHA regulations. Thus you can never resolve a

dispute. The footnote in Table A on the other hand will tell you exactly what soils fall into Class A, B or C. The footnotes also convey other important information such as the thumb test. I doubt very much they can be simplified without creating ambiguities.

(3) Excavation Below Bottom of Sheeting: Three points were made:

- 1) It was suggested to change the wording of 1926.652(5)(iii) to read "Short-term excavation up to ft. below . . ." Sometimes an excavation may be long-term, but the sheeting is undercut for a short time to install a pipe.
- 2) It was suggested to limit the length of permitted undercutting.
- 3) It was noted that in California undercutting is rounded, so that the depth below sheeting on the side of a trench is less than in the middle.

(4) Position of Upper Strut Below Top of Trench: It was stated by a shoring industry representative that it is common practice to place the upper strut 2 ft. below the top of the trench. New Jersey NUCA stated that in their area the distance tends to be 3 ft. There is no stipulation in our proposal, but perhaps there should be one tied to sheeting thickness.

(5) Guidelines: Trench box manufacturers noted that the guidelines are referenced in the proposed Subpart P revision and should therefore be subject to public comment. An OSHA representative noted that no guidelines would be referenced in the regulations.

(6) Page 5, Section 1926.650(i): It was noted that the statement would force a truck driver to leave the truck while it is loaded and is thus too restrictive. It should perhaps state "No unprotected person . . ." AFL-CIO noted that it should state "no persons shall be permitted under loads" - regardless how the loads are handled. It was also proposed to strike the last sentence in (i).

(7) Page 5, Section 1926.650(h): "Approved respiratory protection" should not be listed as the only means of protection.

(8) Page 6, Section 1926.650(j): In spite of the California recommendation, Workshop participants favored keeping "competent person."

(9) Page 6, Section 1926.651(a): Some participants felt the statement is not very clear. The California version (see San Francisco memo) which I read to the participants was favored.

(10) Page 7, Section 1926.651(e): A representative from the Operating Engineers noted that this section should list equipment that is used in excavation work and no other equipment. It was also noted that equipment positioned on top of the slope at the end of the excavation should be excluded - only equipment placed next to the sides of finished excavations. It was also noted that the word "near" is much too vague and that this Section may be redundant.

(11) Page 7, Section 1926.651(g): It was again recommended to eliminate this section. It was noted that the "stoplog" only adds hazards.

- (12) Page 7, Section 1926.651(k): The need for this section was questioned (note comments in San Francisco memo).
- (13) Page 7, Section 1926.651(i) and (j): It was proposed to eliminate these sections.
- (14) Page 8, Section 1926.651(m), (r), (t): It was proposed to eliminate these sections. (m) is self evident, (r) and (t) are meaningless.
- (15) Page 8, Section 1926.651(o): It was noted that protection in a belled hole is too complicated an issue to be handled as an excavation.
- (16) Page 8, Section 1926.651(p): It was suggested that one means of exit is enough for small excavations.
- (17) Page 8, Section 1926.651(s): It was proposed to eliminate the first sentence. Trench box representatives propose to use "equivalent protection." This is tied to their objection to our pressure diagrams.
- (18) Competent Person: It was proposed that competent persons should be trained - superintendents licensed, foremen trained.
- (19) Page 9, Figure 1: It was noted that while the 1 to 1 slope in the figure reflects accepted engineering practice, a footnote should be added noting that distance from footing should be increased if water seeps into the side of the excavation.
- (20) Page 9: It was noted that both the "competent" and the "qualified" person should be designated by the employer.
- (21) Page 10, (a)(3): St. Louis AGC proposed that the depth limit below which an engineer must be involved should not be applied to sloped excavations.
- (22) Page 10, (b)(1): It was suggested that in the Northeast, short-term excavations could be 3 or even 7 days, and perhaps more. Parameters identified were desiccation for sands, fissuring and creep for clays, sensitive clays, and effects of water.
- Again opinions were expressed to drop the distinction, but it was recognized that we would have to become more conservative.
- (23) Page 10, (b)(4)(i): Trench box people suggested that this section is confusing. It was however noted by ASFE the alternative of having to use an engineer may be even less attractive. I believe that the use of the "adjusted depth" is a necessary evil.
- (24) Page 13, (ii), last paragraph: Shoring systems, trench shields and trench boxes . . . The allowable 33 percent strength increase was questioned.

(25) The "Operating Engineers" representative noted that he feels that there is a tendency for those who should assume responsibility for the safety of the men to avoid it. I believe that this feeling by AFL-CIO underlies their position in the dispute surrounding the "qualified person" concept. Perhaps the dispute can be resolved by looking at this problem.

(26) New Mexico AGC noted that great difficulties arise from the fact that bid documents prepared by municipalities and government agencies do not recognize the excavation safety problem (i.e. excavation quantities paid on the basis of 1/4 to 1 slope, etc.)

Attachments (4)

Boston July 14, 1981

STATEMENT OF POSITION AND RECOMMENDATIONS
ON
REVISION TO SUBPART P
OF THE
SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION
PRESENTED BY
THE MAJOR MANUFACTURERS OF TRENCH BOXES
AND TRENCH SHIELDS OF THE UNITED STATES

John B. Cook
Efficiency Production, Inc.

Wendell Wood
Griswold Machine & Engineering

GENERAL STATEMENT OF POSITION

A review in detail has been made of the proposed revisions in Subpart P 1926.650 - .651 - .652 - .653.

This review was made by, and on behalf of, the major trench box manufacturers of the United States, and represents their consensus opinion of the changes in the proposed standards.

It is our position that the intent to clarify and simplify, as it relates to the revised changes of Subpart P, has failed, and in fact, has made it more confusing and more difficult to apply in the field. The proposed design criteria as they relate to trench boxes do not conform to accepted engineering practices. We have specific recommendations for changes in the proposed revisions.

It is also our position - that if the Guidelines are going to be referenced within Subpart P and therefore become effectively a part of the law - they should be discussed publicly as a part of the workshop and in public hearings.

1926.650 GENERAL PROTECTION REQUIREMENTS - NO COMMENT

1926.651 SPECIFIC EXCAVATION REQUIREMENTS

PAGE

8 - item (s) Should read ... Portable trench boxes or sliding trench shields may be used for the protection of personnel. Where such trench boxes or trench shields are used they shall be designed, constructed and maintained in a manner which will provide equivalent protection to that provided by the shoring required for the excavation as defined by accepted engineering practice.

1926.652 SPECIFIC SHORING, SLOPING AND SHIELDING REQUIREMENTS

PAGE

9 - item 2a Should read ... Qualified Engineer

10 - item (b) (1) Should be no arbitrary distinction between long-term and short-term excavation.

10 - item (4) (i) We recommend that this section be clarified and simplified for effective field application.

13 - item (ii) a Should read ... lateral pressure at the bottom of excavation equal to the equivalent weight effect (W_e) in Table 1 times the depth of cut with lateral pressure diagram appropriate to the construction as determined by an engineer.

 We object to the footnotes attached to Table 1 as being too technical and overly complicated for interpretation by field personnel, and recommend they be simplified.

13 - item (ii) c The last paragraph of this section should read ... shoring systems shall be designed in accordance with accepted engineering practices.

PAGE

(This statement excludes the 33% increase in allowable working stresses or an equivalent strength reduction.)

13 - item (iii)
Paragraph 2

Should read ... Shoring systems and trench shields shall be selected in the field on the basis of accepted engineering practice.

13 - item (iii) (a) Trench shields, trench boxes, and pre-fabricated strutwale assemblies and other pre-fabricated assemblies shall be rated for the maximum depths in all types of soils in which they can be selected and used accordingly from charts prepared by the manufacturer.

16 - item (4)(iii)(c) Should read ... rated by an engineer

16 - item (5)(iii) Should read ... Excavation up to 3 feet below the bottom of sheeting, trench boxes, or trench shields is permitted provided that: ... (and we agree with items a & b.)

1926.653 DEFINITIONS APPLICABLE TO THIS SUBPART

PAGE

18 a

Should read ... Accepted engineering practices, those requirements or practices which are compatible with standards required by a registered professional engineer.

Question - why are you making reference to the guidelines when they are not meant to be a part of the law?

19 m

Should be eliminated.

19 o

Should read ... Negotiable slope is a slope on which a person can egress from or ingress to an excavation with relative ease and speed to assure reasonable safety.

PAGE

19 t

Should be eliminated.

19 z

Should read ... See Figure 4 (Correction)

GUIDELINES SUPPLEMENTING SUBPART P

If the Guidelines are going to be referenced within Subpart P, do they not become effectively a part of the law? If so, they should be discussed publicly as a part of the workshop and in public hearings.

ANSWERS TO DR. YOKEL'S QUESTIONS

- #1 No comment.
- #2 No comment.
- #3 No comment on 24 foot limitation.
On question of should qualified person be substituted for engineer ... "No, as it relates to this specific question."
- #4 No distinction should be made between short-or long-term excavation.
- #5 No comment.
- #6 No comment.
- #7 Yes, and should be conveyed as part of the definitions.
- #8 No comment.
- #9 Yes.
- #10 Yes.
- #11 No comment.
- #12 No.
- #13 No - Statement should not be deleted.

While this is true, I feel that the participants in these Workshops have the knowledge and experience to address all the issues involved and will do so successfully.

(2) Opposition to Change in Existing Provisions: Opposition to a change in the present version of Subpart P was expressed by an Illinois contractor who works primarily on highway projects. This time I gained some insight into the rationale for this position. I noted in my Wisconsin memo that people who tend to agree with our recommendation are less likely to express their opinion in the Workshop than those who oppose certain recommendations. The same thing happened to some extent when we conducted our field study. Almost all the contractors that responded were dissatisfied with Subpart P. However, the responding contractors who now have concern about changes in the existing regulations are more involved in earthwork, wide excavations, borrow pits, etc., where conflicts with OSHA do not normally arise. They are concerned with two issues.

- a. The present provisions have been interpreted in the courts in past litigations. These interpretations by court rulings tell the contractor precisely what he can do. When we now propose to change the wording of many provisions, there will again be uncertainty about their interpretation by the courts, and we will lose the benefit of experience gained in past conflicts.
- b. We merged "trenches" and "excavations". There is now concern that as a result new restrictions will be imposed on excavation work. Part of this problem can probably be resolved by a clear definition of "exposure." However we need to carefully review our new recommendations to make sure that they do not inadvertently result in unnecessary restrictions on excavation work. An example of this, which was noted in the Workshop, would be the application of Section 1926.651(d) to borrow pits.

(3) Use of OSHA Regulations on Federal Projects: It was noted that other Federal Agencies are not bound by OSHA regulations and use their own procedures. This situation can lead to specifications which are difficult to implement while using methods which comply with our recommendations. I am not sure what can be done about that, but the situation could be brought to the attention of the Administration at an appropriately high level by the participating organizations of the Workshops.

(4) Trench Boxes: Trench box manufacturers suggested that the lateral-load requirements for trench boxes should be different from those for shoring. This is based on the contention that a trench box can deflect considerably and in general will not restrain lateral soil movement as much as a shoring system, thus causing the pressure distribution to resemble that acting on a retaining wall. This would make the square pressure diagrams associated with the Standard Practice too conservative. At this time I cannot evaluate the technical merits of this claim in detail, but I have several preliminary thoughts:

- a. In addition to the allowable stress increase for short-term excavation, we also allow a 20 percent load reduction for wales and a 33 percent reduction for sheeting. These reductions, which account for arching effects would apply to the horizontal framing members and the skin of a trench box. I wonder if the industry considers taking advantage of these reductions in their analysis.
- b. The trench boxes I saw had about equal stiffness (in terms of lateral displacement characteristics) near the top and bottom. Thus, I cannot see how a trench box could act like a retaining wall, namely rotate inward while the base is fixed.
- c. It is obvious that a trench box permits greater lateral inward displacements of the excavation wall than a shoring system. In granular soils this will result in a reduction in lateral soil pressures. In clays, however, the situation is more complex. Overconsolidated clays such as those in Austin, Texas where we conducted pressure measurements (NBS GCR 80-202) will develop tension cracks upon lateral expansion, resulting in increased lateral soil pressures. It should be noted that Type B soils include clays.
- d. The greatest problem that would arise if stiffness characteristics of shoring systems are considered is complexity (which our recommendations are designed to avoid). Each case would have to be considered on its own merit. Considering the inadequacies and complexities of present models for soil/structure systems and our general lack of data on lateral pressures in shallow braced excavations, it may be difficult to make a convincing case, and detailed analysis would not be much better than an educated guess.
- e. While the proposed square pressure diagrams may be on the conservative side, the 40 lb/ft.³ equivalent weight effect is not conservative for medium clays which fall under Type B soils and are the most common soil type.

It may be helpful if ASFE could review this problem. I am very much afraid that we may be creating an albatross as soon as we deviate from the principle of simplicity in the standard practice.

(5) Configuration of Excavations with Compound Slope: Two problems were discussed in conjunction with Figure 2, page 12:

- a. It was suggested to remove the sharp corners in the drawn cross-sections, since these cannot be dug in the field with ordinary equipment. I suggest that we draw broken lines for the idealized cross-section and back these up with solid lines showing more rounded corners.
- b. The bank adjacent to the work area was discussed. In the previous two Workshops there seemed to be a consensus that the height of the bank should be increased to 4 ft. In this Workshop it was suggested to permit a 5 ft. bank for large pipes. In the latter case, worker protection would be derived from the large diameter pipes. I have some problems with the suggestion:



A 100-year start on tomorrow

July 13, 1981

Comments by Kodak Park Division of Eastman
Kodak Company at Boston, MA, Workshop,
Trenching & Excavation Standards, on Working
Draft prepared by National Bureau of Standards
dated February 20, 1981.

The Kodak Park Division of Eastman Kodak Company does a large portion of the construction and maintenance of its buildings and underground utility lines. This includes excavations for buildings and other major structures as well as trenching for new water, sewer, and electric services. It also includes excavation for emergency repair of these underground services. We are also involved with many trenching and excavation contractors at all of our locations in the U.S. and expect that the execution of this work be done safely and efficiently.

The hazards of inadequately shored or braced excavations are well recognized by experienced persons active in that type of construction. Unfortunately, satisfactory source standards were not available when OSHA promulgated the existing 1926 standards and their subsequent enforcement efforts have not been entirely productive in the reduction of serious accidents or in providing assistance in needed safety precautions.

We believe ~~that the~~ National Bureau of Standards has done a commendable job in drafting these suggested revisions. They have recognized that excavation site conditions are widely variable and the application of judgment for each location by knowledgeable people is needed. The proposed standard is written in performance language and the supplemental non-mandatory guidelines that are included should be very helpful in the solution of specific problems. Eastman Kodak supported a similar approach used by OSHA in the revision of the General Industry Standards for Fire Protection which were adopted last December, and the Electrical Workplace Standards which were adopted in April 1981.

Attached are our comments on the identified issues plus some addition items. We will be pleased to elaborate on these comments if additional information would be helpful.

Some Issues that Should be Considered in the Workshop

1. Page 6. Section 1926.651(a): This section appears to fall within the scope of Subpart S. Should it be dropped?

A. Subpart S, Tunnels and Shafts, Caissons, Cofferdams, and Compressed Air is not the appropriate place to call for locations of utilities prior to excavation. The problem of interrupting utilities and the resulting employee hazards are most likely to be found while preparing surface excavations and thus belongs in Subpart P.

2. Page 8. Section 1926.651(p): Should the exit requirements for excavations start at 5 ft rather than 4 ft depth?

Please refer to our general comments on this section.

A. Yes, it is reasonable to expect the type of individuals who work in excavations to have the strength and agility to make his own way out of a 5 ft deep excavation without the aid of something or someone else. Also, the additional one-foot allowance will include many trenches, and a pipe is often present which would serve as a step to aid the exit process. Also, in trenches, the work is being done in a constantly changing location and the need to frequently move the ladder or exit device may be considered a nuisance by the trench workers if they do not believe it is practical to use.

Should exit requirements be waived for excavations which are wide enough to permit people to escape toward the center of the excavation?

A. Yes, the major concern for death or injury is in the relatively narrow excavations such as trenches where escape during rapid cave-in is very much more difficult because escape options are far fewer than in wider excavations. The alternative requirement should be that the excavated area allow unimpeded movement away from the excavation walls to a safe location.

We believe this is desirable. However, it may be helpful to add a sentence to the excavation definition:

Should it be recognized that large enough pipes or other covered structures can shelter people?

The intent of this question is not clear. A large pipe being installed can serve as a temporary refuge, but it does not seem appropriate to include that as part of a planned protection system in lieu of shields or shoring. However, a permissible practice would be to permit the use of the pipe as a shelter while the trench shield is being relocated which is a normal procedure in many situations. Alternatively, existing large pipes or structures adjacent to the excavated area can serve as a type of shoring to help support the excavation side. Good judgment and sometimes engineering analysis may be required, however, for the use of pipes that appear to give marginal support.

Should "negotiable slope" be better defined?

A. This definition seems adequate for its purpose, though there may be some arguments about a person's ability to climb a slope being used. Perhaps the only validation required should be a physical demonstration of an employee using the slope to egress or ingress before work begins.

3. Page 9. Section 1926.652(a)(2)

a) Could the depth limitation in the "Standard Practice" be extended to 24 ft?

Whether the excavation is 20 ft or 24 ft before requiring the services of a registered engineer is somewhat arbitrary. There should be some limit, however, and since the 20 ft limit has been used in several standards, such as the New York State Code Rule 23, it probably should be kept.

b) Should a "qualified person" be substituted for an "engineer"?

There are probably relatively few registered engineers who would be competent in the design of earth shoring systems or slopes, and there are probably many capable people who are not registered professional engineers who have developed suitable expert qualifications in this area. The definition of "qualified person" probably is more descriptive than the definition for "engineer" in determining a person competent in designing shoring systems and earth slopes.

4. Page 10. Section 1926.652(b)(1): Should the short-term excavation definition extend to 7-days rather than 1-day? If so, do we need more conservative requirements?

We do know that a 7-day definition for short-term excavation can be applied to most soil conditions in our area. The more commonly found soils which may range in grain sizes from clays to gravels would most likely permit a 7-day short-term definition in other parts of the country as well.

There are basically two conditions which normally change the strength of insitu soil with time after an excavation has been made, both having to do with changes in water content:

1. If an excavation is dug below the water table surface, or if an excavation is partially filled with water and this water is rapidly drawn down by pumping, relatively large pore water pressures between the soil particles remain. This may cause a temporary stability problem which will improve with time as excess pore pressures dissipate. So, when excavating primarily fine grain or relatively impermeable soils such as clays and silts, the initial water condition is important. When the walls stabilize after the water is pumped out, short-term excavation criteria can be safely applied, as long as the excavation is not allowed to refill with water. Paragraph 1926.651(d) and note 3(b) of table 1 of the draft Subpart P revision recognize this problem.
2. When excavating in granular or permeable soils such as sands, there will be a temporary apparent cohesion caused by negative pore pressures in the partially saturated, draining soils. This negative pore pressure is caused by capillary tension. As the soil in the excavation walls dries, the negative pore pressures will dissipate making the soil weaker in shear and possible causing sloughing or slides. This is a condition which will deteriorate with time and the length of time will depend on how fast the soil in the excavation walls will dry to a significant depth. Probably in normal conditions, instability will occur considerably later than 7 days after the excavation work, particularly when the excavation wall is covered with sheeting, retarding evaporation of water.

We feel the large majority of the cases will allow the extension of short-term to 7 days. Perhaps an extension to 3 days might be a good compromise which would allow, as a worst case, excavation before a weekend to backfilling after a weekend, as long as water is not allowed to accumulate in the excavation and be pumped down again.

5. Page 11. Table 1: Should the stipulation of maximum slope be limited to 3/4:1? Should the suggested performance requirement (footnote b)(the "stable slope" concept) be used? Will this approach work?

A. The 3/4:1 maximum slope should be reasonable.

Judgments of the description of the soil encountered, degree of saturation and changing conditions as the excavation progresses might overlook something, possibly resulting in a marginal stability problem from time to time. There should be some means to correct such shortcomings if there is evidence of instability, and the provision to flatten the slope by 1/6:1 should be appropriate. This adjustment should be made before anyone enters the excavation.

6. Page 12. Figure 2: Should the allowable bank next to the work area in Cases II, III, and IV be increased to 4 ft? Should "Case IV" be limited to excavation by trenching machines?

A. The purpose, usually, for having a subtrench at the bottom of a sloped excavation is to provide a better lateral restraint for the pipe after the pipe is bedded and in place. This, in most cases, allows the pipe to withstand greater overburden and ground surface loads without failure. For large pipes (6 ft or more in diameter), it may be important to be allowed a deeper subtrench. For employee safety purposes, whether 3 or 4 ft is used is arbitrary, and would probably depend on judgment of the increased risk, if there is any, by going to the 4 ft subtrench. The potential volume of sliding soil, indicated by the spaces between the solid and dotted lines in figure one, does seem to be relatively small even at 4 ft. The upper portion of the trench would have to be widened or flattened to accommodate the 4 ft subtrench in order to meet the table 2 criteria. Finally, at 4 ft, the head and shoulders of most workers would be outside of the subtrench. It seems reasonable to us to extend the subtrench depth to 4 ft.

7. Page 13. Section 1926.652(b)(4)(ii): This section, unlike most others in Subpart P, is not addressed to the man in the field but to those who pre-design shoring systems. Yet the section is necessary to avoid unreasonable vagueness. Should this section be at the end of Subpart P? Should part of it be conveyed as definitions?

A. These loadings are already in the, "Guidelines Supplementing Subpart P, Section 2.2.2, 'Operational Loads'." If these loadings, with the possible exception of the impact load, are meant to also apply to job designed shoring, which Subpart P does not say, then these provisions should remain in the body of this Subpart where they are.

8. Page 16. Section 1926.652(b)(5)(ii): This section makes it difficult to implement some of the slope configurations allowed in figure 2. Should the proposed performance statements be substituted to give more options, or alternatively, should more options be specified or the specified options identified as examples of implementing the performance statement?

A. The performance statement, (Workers in excavations must be protected against rolling or sliding objects.) is really all that is needed here. Suggestions as to how this may be accomplished may be placed in the appendix if beneficial.

No mention of the amount of slope required before provisions are applied should be made. It depends on the specific situation.

9. Page 16. Section 1926.652(b)(5)(iii): Should the allowable excavation below the bottom of shoring or shields be increased to 3 ft?

A. It certainly would be useful, in some cases, to be able to extend short-term excavations to 3 ft below the shoring. It is useful to aid in the bedding of pipe. Also, more importantly to us, it better allows working around underground obstructions with shoring, particularly when reexcavating to repair a broken watermain, sewer, or similar items in a congested area. We feel it is reasonable to allow this extension if adequate attention is paid to possible unstable conditions below the shoring.

We also believe this section should be reworded to clarify that the short-term excavation requirement applies to the work below the bottom of the sheeting or shoring system. An excavation for a building or large structure would come under the long-term definition. It is often necessary to make short-term excavations within this excavation for drain lines, footings, etc. The present wording could be interpreted as prohibiting this practice. We suggest that this section be revised to read:

"A short-term excavation up to 3 ft below the bottom of sheeting, trench shields, or trench boxes is permitted provided that:."

10. Page 18. Definition of accepted engineering requirements. Should a "registered architect" be omitted since architects do not deal with excavations?
- A. This is not an area in which architects are normally involved, however, there is probably no good reason why they should be excluded, as long as they have adequate background and experience, just as any registered engineer working with excavations should.
11. Page 18. Definition of "Competent Person." Should the definition be rewritten to require that the competent person be working at the excavation site?
- A. We would consider this to be good practice.
12. Should "Mass Movement of Soil or Rock" be defined?
- A. The term should be self-explanatory. It should include any ground movement involving volumes greater than those associated with spalling of rock, or sloughing of soil and surface erosion of soil. Perhaps the latter terms should be defined. The only place these terms appear in Subpart P is in the definition of "Fractured Rock."
13. Page 52. Old 1926.651(c): Should this statement be deleted? Even though this matter is addressed elsewhere, this statement conveys the intent of Section 1926.652 in simple language.
- A. This statement should be deleted. It is clearly redundant with the new Section 1926.652(a).

In addition to "Some Issues that Should be Considered in the Workshops," we have some additional comments or questions.

1. Page 7. Section 1926.651(e): We feel that this requirement should apply to completed portions of excavations. This would clarify that the intent is not apply the shoring requirement in the areas where the excavation equipment is working. Substitute "completed sides" for "side" in line 4.
2. Page 7. Section 1926.651(g): Excavating equipment may be considered mobile. Is it necessary to place stop logs or barricades in front of this equipment during excavation, particularly tracked equipment or those using outriggers?
3. Page 8. Section 1926.651(p): This section currently appears to apply only to trenches. We believe exit conditions should be considered for all types of excavations. Large excavations should have a minimum of two means of exit. A second condition could be a smaller excavation of up to approximately 1500 sq ft where one exit would be permitted. A third condition would be similar to what is currently proposed.
4. Page 11. Table 1: Recognizing that many times the excavation faces are saturated only part of the way up, could we consider the soil to be type C to the top of the saturation zone and types A or B above that with the appropriate We's applied?
5. Page 11. Table 1: The Matrix Classification System shown in NBS BSS 127, June 1980, is simple to use and offers more flexibility. Would it be possible to replace in Subpart P the simplified Classification System with the Matrix Classification System, or at least offer the latter in an appendix or another section as an alternate.
6. Page 18. Section 1926.653(j): Excavation

The draft standard does not define trench or give any criteria to distinguish between a trench or excavation as is done in the current standards. We believe this is desirable. However, it may be helpful to add a sentence to the excavation definition stating that trenches are excavations or alternatively adding a Trench definition which could state,

Trench: "One type of excavation commonly used for the installation of piping, etc."

This would provide emphasis to employers who primarily do trench type excavation work that the entire standard is applicable to their operations.

7. Page 19. Section 1926.653(1): Fractured Rock

Can rock have fractures in it and yet be considered by definition unfractured? It is rare to find especially sedimentary rock that is not fractured, yet we would consider that much of it would not readily spall or crumble when excavated with vertical slopes. We believe unstable rock would be a more suitable term for this definition.

Table 3.3 Soil Classes in Matrix Classification System

Soil	Soil Condition		Water in Trench			
			No		Yes	
			Fissures		Fissures	
		No	Yes	No	Yes	Yes
Stiff Cohesive ^{a/}	I		II		III	
Medium Cohesive ^{a/}	II		III		III	IV
Granular ^{b/}			II		III	
Soft			IV		IV	

Notes:

1. Water in Trench is assumed whenever water drains into the trench from the soil forming the bank, or water is retained by tight sheeting, or there is a possibility that the trench may become fully or partially flooded before workers leave it, or may be entered by workers within 6 hours after more than half its depth was flooded and pumped out.
2. Vibrations: Soils subject to vibrations by heavy traffic, pile driving or similar effects shall always be assumed fissured.
3. Stiff Cohesive Soils^{a/} include stiff clays and cohesive or cemented sands and gravels (till, hardpan). Stiff clays included have an unconfined compressive strength (pocket penetrometer reading) $q_u = 1.5 \text{ tsf}^c/$ or larger.
4. Medium Cohesive Soils^{a/} have an unconfined compressive strength (pocket penetrometer reading) between 0.5 and 1.5 $\text{tsf}^c/$.
5. Granular Soils^{b/} are gravels, sands and silts that can stand on a slope steeper than 3 hor.: 1 vert. without spalling or slumping.
6. Fractured Rock shall be treated as granular soil. Intact rock is exempt from shoring and sloping requirements.
7. Soft Soils are cohesive soils ^{a/} with an unconfined compressive strength (pocket penetrometer reading) of 0.5 $\text{tsf}^c/$ or less and granular soils that can not stand on a slope of 3 hor.: 1 vert. without slumping (much).
8. Layered Systems (two or more distinctly different soil or rock types, micaceous seams in rock) which dip toward the trench wall with a slope of 4 hor.: 1 vert. or steeper are considered Class IV soils.
9. Disturbed Cohesive Soils (backfill) shall be treated as fissured medium cohesive or soft cohesive soil.
10. Spaced Shoring Systems (skeleton sheeting or skip shoring) are permitted in stiff and medium cohesive soil with maximum center to center spacing in accordance with Table 3.5.

^{a/} Cohesive Soils are clays (fine grained) or soils with a high clay content which have cohesive strength. They do not crumble, can be excavated with vertical sideslopes, are plastic (can be molded into various shapes and rolled into threads) when moist and are hard to break up when dry.

^{b/} Granular Soils have no cohesive strength. They normally can not be excavated with vertical sideslopes (some moist granular soils will exhibit apparent cohesion and temporarily stand on a vertical slope), they can not be molded when moist and crumble easily when dry.

^{c/} 1 tsf = 96 kPa

|||
T & B - Scottdale Contractors, Inc.



|||
General Contractors

July 7, 1981

P. O. BOX 866
SCOTSDALE, GA. 30079
292-7721

United States Department of Commerce
National Bureau of Standards
Building 226, Room 3162
Washington, D. C. 20234

Att: Dr. Felix Y. Yokel

Dear Sir:

Mr. John Chambliss of the Georgia Branch A.G.C. has forwarded a copy of your draft memorandum on the Atlanta Workshop for my comment.

Comparing your memo with notes I made during the meeting, I believe the memo accurately states the responses to the issues raised.

Thank you for being in Atlanta with us and please accept this note as the response of the Georgia Branch A.G.C.

Sincerely,

T. P. Samford

ASSOCIATED PUBLIC WORKS CONTRACTORS

OF GREATER MILWAUKEE, INC.

JOHN DRAKE
Executive Director

2835 N. MAYFAIR ROAD
MILWAUKEE, WIS. 53222
TELEPHONE: 778-1080

June 30, 1981

Mr. Felix Y. Yokel
United States Dept. of Commerce
National Bureau of Standards
Bldg. 226, Room B-162
Washington, D. C. 20234

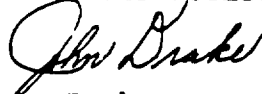
Dear Mr. Yokel:

We have received a copy of your "Memorandum for Records of the NIOSH Excavation Project" of the Workshop held in Milwaukee on June 9, 1981 and would like to express our sincere appreciation of your evaluation of many of the points that have concerned our industry since we have implemented the OSHA Regulations in our operations. Your interest in this vital matter has exhibited a very practical consideration of these problems that our important to us.

Following the meeting our committee appreciated the necessity of submitting a more detailed analysis of Chapter 6 Wisconsin Code and we are meeting with representatives of the State of Wisconsin Department of Industry, Labor and Human Relations on Tuesday, July 7, after which we will be preparing information that we will submit to you as soon as possible.

Very truly yours,

ASSOCIATED PUBLIC WORKS CONTRACTORS



John Drake
Executive Director

JD:gs

**ASSOCIATED
GENERAL
CONTRACTORS**
of Greater Milwaukee, Inc.



2733 West Wisconsin Avenue • Post Office Box 08374
Milwaukee, Wisconsin 53208 • (414) 933-7661

June 30, 1981

Dr. Felix Yokel
United States Dept. of Commerce
National Bureau of Standards
Bldg. 226, Room B162
Washington D.C. 20234

RE: Draft Memorandum
Milwaukee Workshop
June 9, 1981

Dear Dr. Yokel:

We have reviewed your draft memorandum and feel that it accurately and concisely reflects the Milwaukee proceedings. You have covered the major areas of local concern in your memo.

We wish to take this opportunity to thank you for your consideration of our problems. You are to be commended for your excellent effort in producing data for a workable OSHA Excavating Standard.

We have forwarded your calculations for subchapter 6 to the State of Wisconsin so that they could compare them with their original data. We will keep you updated.

Sincerely,


Edward J. Hayden

EJH/jma

cc: Art Schmuhi
Gil Czaplewski
Dick Snow

August 25, 1981

Dr. Felix Yokel
United States Department of Commerce
National Bureau of Standards
Bldg. 226, Room B162
Washington, D.C. 20006

Re: Secretarial Report
Trenching and Shoring Workshop
Milwaukee, Wisconsin
June 9, 1981

Dear Dr. Yokel:

We are enclosing our report of the Trenching and Shoring meeting held in Milwaukee on June 9, 1981. Attached to it are copies of the written statements received.

We wish to thank you again for coming to Milwaukee to hear our concerns and ideas and to commend you on your excellent efforts to develop an equitable standard for trenching and excavating operations.

Please feel free to contact us if we can be of any assistance to you.

Sincerely,



Edward J. Hayden
Safety Director

cc: James Elliot
John Ramage
John Drake

Enclosures

EJH/kg

Report of the Local Sponsors Workshop

Workshop to Review and Comment on the National Bureau of Standards Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations.

June 9, 1981
Red Carpet Inn
Milwaukee, WI

This document constitutes the report of the local sponsors of the referenced workshop. The attendance at the workshop was as follows:

Art Schmuhl	AGC National
John Ramage	ASFE
Dr. Felix Yokel	NBS
Gary L. Dowty	AGC-Indiana
Jim Lapping	BTC-AFL-CIO
Jack Mickle	AFL-CIO
Greg Johnson	ACC
Paul Bouley	OSHA-Washington
David Schuman	S.J. Groves
Bruce Weber	Warzyn Engineering
Patrick Harrison	Milwaukee Testing
Jeffrey Miller	Giles Engineering
Kevin Foley	AFL-CIO
Roy Mururo	Laborers Local 113
James Elliott	Milwaukee Bldg. Trades
Janomiso Plocchilin	Operating Engineers #139
Russ Adam	OSHA-Region 5
Jack Peterson	OSHA-Wisconsin
Tom Crandal	OSHA-Wisconsin
George Bradberry	Underground & Shoring Service
Ed Hayden	AGC-Milwaukee
Melvin Lischefski	OSHA-Wisconsin
Fred Becker	Becker Construction
Robert Hanna	OSHA-Wisconsin
Harvey Peterson	C.G. Schmidt
Gil Czaplewski	Klug & Smith
Philip Kerry	Kenny Construction
John Drake	Associated Public Works
Walter Schmitz	Rock Contractors
Lawrence Michael	Associated Public Works
Ray Olson	Globe Contractors
Philip Santacrose	Thomasini Contractory
Kennie Hatfield	K.M. Durn Co.
Ted Trulson	F.P. & T. Company
George Stepanik	AGC-Wisconsin

Jack Love
Joseph Ramuta
Jack Delaney
Thomas Peterson
Richard Snow
Alan Carlson
Milan Racic
Robert Glukas
Donald Zehm
Jim Bonness
Russell Zehetner

D & K Construction
Michaels Pipeline Construction
DILHR
Johnson Brothers
AGC-Milwaukee
AGC-Milwaukee
Allied Industry Workers
Soil Testing Services
OSHA
Koch & Bonness
MSS

We are attaching written copies of statements made at the meeting by:

Associated Public Works Contractors
Rock Contractors Inc.
S.J. Groves Inc.
Building and Construction Trades Council
Associated General Contractors of Greater Milwaukee

In addition we are attaching a comment received from Al Johnson Construction Company, who were not able to be represented.

The balance of the comments were oral and not submitted in writing. The workshop was recorded for reference.

As with all programs of this type, there was a wide divergence of ideas, interests and philosophies. There was, however, one point that achieved local consensus—any OSHA standard covering trenching and excavation must be clear and concise so that the workers in the field can understand what is required to provide a safe workplace and it should cover as many situations as possible with standard practices.

Other points of discussion included:

1. The use of local codes as approved substitutes without further engineering requirements Wisconsin has an existing code titled Wisconsin Administration code. Rules of Industry, Labor and Human Relations, Trench, Excavation and Tunnel Construction. In common usage this is referred to as Chapter 6. Arguments advanced for permitting its use for compliance included;

1. Its history and track record.
2. Its familiarity to both companies and employees.
3. Its use of the same size timber with various spacings depending on conditions.
4. Its allowance of 1/2 to 1 in certain soil types.

The whole crux of the discussion centers around alternatives allowed as compliance to any standard. A great many Wisconsin area people feel that existing and proven local codes should be allowable.

2. One provision of subchapter 6 must be singled out because of its number of supporters. The regulations allow a slope of 1/2 foot to one for dry or moist soils. The steepest allowable slope in the proposal is 3/4 to 1. Several speakers stated that they knew of no failure in trenches properly sloped according to Chapter 6 requirements. In metropolitan areas less slope means less disruption of existing services and facilities (roads, streets, sidewalks, utilities and lawns. It also decreases exposure time and area when working adjacent to heavily traveled roads.

3. The Consulting Engineers expressed concern over the increasing occurrence of third party liability suits. Requirements for engineers to design and oversee all trenching and shoring protective mechanisms would increase the liability of the foundation engineer. The engineers stress the need for a code that takes a reasonable approach to the involvement of the consulting engineer and their liability exposure.

4. Closely allied to the concerns of the engineers is the question of competent versus qualified persons. Part of the problem stems from a lack of understanding of the difference between the two terms. The national AFL-CIO position is that a license is required. In Milwaukee, contractors contend that a competent person i.e. "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them" is sufficient for most situations. Similarly, their definition of a Qualified Person would delete the words "by possession of a recognized degree, certificate, or professional standing or." Contractors contend that their on-the-job employees are in the best position to react to job conditions and take proper safety measures. Part of the contractor's fears about strict requirements for engineers stems from the belief that the requirements will increase the amount of "force account" work done by municipalities that have engineers on their payrolls and are not bound by OSHA requirements in any event.

5. Several parties expressed concern over standards enforcement. In particular they feel that it must be positively stated that provisions of the standard apply only to areas where there is employee exposure. If employees do not enter portions of the trench or excavation no protection should be required.

6. It was recommended that all portions of the existing standard be carefully reviewed before they are included in a new standard. For example salt calcium chloride and cil are no longer environmentally allowable methods of dust control (1926.651 i) and stop logs are impossible to use in backfilling situations (1926.652 g)

7. Dr. Yokel's study has gone a long way in analyzing what most parties agree has been a weakspot in OSHA regulations. There is however many more opposing viewpoints to be reconciled. We believe that these area workshops represent a positive advancement in the development of OSHA Standards since they give all local groups an opportunity to provide their input into future standards. This can help provide standards that are workable, viable, and effective.

James N. Elliott
James Elliot, Milwaukee Building Trades Council

John Ramage
John Ramage, American Society Foundation of Engineers

John Drake
John Drake, Associated Public Works Contractors

Edward J. Hayden
Edward Hayden, Associated General Contractors of Greater Milwaukee

ASSOCIATED PUBLIC WORKS CONTRACTORS OF GREATER MILWAUKEE, INC.

JOHN DRAKE
Executive Director

2836 N. MAYFAIR ROAD
MILWAUKEE, WIS. 53222
TELEPHONE: 778-1050

COMMENTARY BY: ASSOCIATED PUBLIC WORKS CONTRACTORS of Greater
Milwaukee, Inc.

TO: U. S. DEPARTMENT OF COMMERCE NATIONAL BUREAU
OF STANDARDS

WORKSHOP - JUNE 9, 1981 - MILWAUKEE, WIS.

WORKING DRAFT OF SUGGESTED REVISION IN SUBPART P OF THE SAFETY AND
HEALTH REGULATIONS FOR CONSTRUCTION BASED ON BUILDING SCIENCE
SERIES REPORT BSS 127 BY: FELIX Y. YOKEL.

My name is John Drake. I am the Executive Director of the Associ-
ated Public Works Contractors and have been since 1965. Prior to
that I had been working as an engineer for the City of Milwaukee
from 1927-1940, primarily on sewer and tunnel construction and
from 1940-1965 I was superintendent and officer of 2 large sewer & WATER
construction companies.

The Association appreciates the opportunity to participate in this
workshop. We feel that the efforts to revise OSHA Rules and Regu-
lations are very important to the industry not only for the safety,
but for the economics involved.

Since 1935 this Association's members have performed the bulk of
the sewer, water and utility work in the State of Wisconsin.

In 1952 we were pleased to have participated with other elements
of the construction industry to assist in developing the WISCONSIN
ADMINISTRATIVE CODE, Rules of Industry, Labor and Human Relations,
Trench Excavation and Tunnel Construction Code Section 6.01, parts
of which are attached. We are proud to advise you of the fact that
not a single injury or fatality has occurred with the use and
utilization of the WISCONSIN CODE Chapter 6.

We respectfully request and suggest that this Code, with the accompany-
ing tables, be considered at least equal or superior to the present
OSHA requirements and become a part of them.

With respect to the draft recommendations of The National Bureau of
Standards we have the following comments on the issues to be con-
sidered for the workshops on page 3:

1. We feel that no change is necessary.

June 9, 1981

2. Yes, 5' rather than 4'.
Yes, exit requirements should be waived.
Yes, large enough pipes should be recognized as shelter.
Definition, "negotiable slope" is satisfactory.
3. Yes, we feel the depth limit could be, in standard practice, extended to 24'.

A qualified person should be substituted for an engineer.

4. Yes, 7 days should be considered rather than 1.
5. We definitely feel the maximum slope should not be limited to three-quarters to one.

The suggested performance requirement should be used; it is a workable approach.

6. Yes, we agree the allowable bank should be increased.
Excavation should not be limited to trenching machines.
7. No comment.
8. Yes, we agree with more options on proposed performance statements.
9. Yes, we certainly agree that the excavation of the bottom of shoring shields be increased to 3' or more under proper conditions.

10. Yes, a registered architect should be omitted.
11. Our operation requires that competent people be employed.
We feel the judgment of the degree of competency should also be extended to the enforcement officer.
12. Yes, mass movement of soil or rock should be defined.
13. Yes, it should be deleted.

In general we would also like the workshop to emphasize:

1. A reasonable evaluation of sloping. This is probably one of the biggest items to be considered. The history of this industry indicates that predetermining a slope is practically an impossibility. This is where the proper, competent person's judgment should be considered more valuable than textbook calculated slopes. Certainly the necessity of bracing shallow trenches, those below 5', in many instances, is most impractical and a costly item.

June 9, 1981

2. The predetermining of the depths, whether 20 or 24', is again very difficult to predetermine because of the varying soil conditions and other circumstances.
3. A very important item is the practical evaluation of the "timbering" and bracing of trenches. The variation of "timbering" sizes in OSHA although calculated to provide the right support, is not practical. The more practical installation would be uniform timber sizes with variation of spacing.
4. The greater majority of our work is under "short term excavation." Restricting this to 1 day would be most impractical and we feel the extension to 7 days is important.
5. The consideration of the depth below "shields" is a very important item. An evaluation of the specific job being constructed and the soil conditions should certainly determine the allowable distance below the shield.

We realize the concern, not only of our industry, but our entire country regarding the necessity of safety standards. We also appreciate your making this attempt to make the standards for our industry not only to provide a safe place for our men, but to also safeguard the industry.

Thank you, very much, for this opportunity to speak, not only for myself but for our members.

John Drake, Executive Director
Associated Public Works Contractors

TABLE 4—TRENCH TIMBERING REQUIREMENTS

For trenches over 42 inches in width up to and including 12 feet in width

Depth of Trench	Uprights	Cross Braces	Stringers
Over 4 1/2 ft. to 10 ft. incl.	(*)	6x6 inch timbers spaced horizontally 7 ft. face to face	6x6 inch timbers spaced 4 ft. c-c
		6x6 inch timbers spaced horizontally 11 ft. face to face	6x6 inch timbers spaced 4 ft. c-c
Over 10 ft. to 20 ft. incl.	(*)	6x6 inch timbers spaced horizontally 7 ft. face to face	6x6 inch timbers spaced 4 ft. c-c
		6x6 inch timbers spaced horizontally 11 ft. face to face	6x6 inch timbers spaced 4 ft. c-c
Over 20 ft. to 30 ft. incl.	(*)	6x6 inch timbers spaced horizontally 7 ft. face to face	6x6 inch timbers spaced 3 ft. c-c
		6x6 inch timbers spaced horizontally 11 ft. face to face	6x6 inch timbers spaced 3 ft. c-c
Over 30 ft. to 40 ft. incl.	(*)	6x6 inch timbers spaced horizontally, 7 ft. face to face	6x6 inch timbers spaced 3 ft. c-c
		12x12 inch timbers spaced horizontally 11 ft. face to face	12x12 inch timbers spaced 3 ft. c-c

(*) Uprights shall consist of 2 inch planks and spaced to comply with specifications for trenches less than 42 inches in width.

TABLE 5—TRENCH TIMBERING REQUIREMENTS

For trenches 4 1/2 to 15 feet in depth, 3 1/2 to 12 feet in width, and cut in hard soil*

Depth (ft.)	Width (ft.)	Uprights	Cross Braces
4 1/2 - 8	3 1/2 - 12	2x6 inch planks spaced 4 ft. c-c	2—2x6 inch struts spaced 4 ft. c-c
8 - 12	3 1/2 - 12	2x6 inch planks spaced 4 ft. c-c	3—2x6 inch struts spaced 4 ft. c-c
12 - 15	3 1/2 - 12	2x6 inch planks spaced 4 ft. c-c	4—2x6 inch struts spaced 4 ft. c-c

*In case unstable soil is encountered, bracing shall immediately revert back to that called in Table 4.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; am. (1) (intro.), (6) and (9), Register, September, 1978, No. 372, eff. 10-1-78

Register, September, 1978, No. 372
Trench, Excavation and Tunnel Construction

Reproduced from
best available copy.



**Wisconsin
Administrative Code
Rules of
INDUSTRY, LABOR AND HUMAN
RELATIONS**

**TRENCH, EXCAVATION AND
TUNNEL CONSTRUCTION**

Cite the rules in this Code as

(for example)

Wis. Adm. Code section Ind 8.01
INDUSTRY, LABOR AND HUMAN RELATIONS
201 East Washington Ave.
Madison, Wisconsin 53702

Part II

TRENCHES AND EXCAVATIONS

Ind 8.06 Timbering requirements and procedures for trenches and other excavations. (1) BRACE OR SLOPE. All areas in trenches in which persons are permitted to work shall be adequately and securely timbered or sloped as follows.

(a) *Depth. Exception.* Trenches cut in hard solid soil need not be braced or sloped if less than 4½ feet in depth. Trenches cut in loose or sandy soil need not be braced or sloped if less than 3 feet in depth.

(b) *Rock. Exception.* Trenches need not be timbered if excavated in solid rock and if there have been no previous known excavations within the minimum lateral distance of the depth of the trench being excavated. The total depth of the trench must be in rock or any over burden must be sloped or braced.

(c) *Sloping. Exception.* Trenches need not be timbered if the sides are cut down to the angle of repose. The angle of repose shall not be considered greater than one to one-half (measuring one foot of rise to each ½ foot horizontal) for dry or moist soils and not more than one to one for wet or heavy soils.

(2) **PARTIAL SLOPE AND BENCHES.** When the sloping of trench walls to the angle of repose does not extend to the bottom of the trench, level benches 2 feet wide shall be provided between the toe of the slope and the top edge of the vertical walls. The vertical part of a partially sloped trench shall be braced according to its vertical depth below the bench. If benches are not provided as in case of the necessary trimming back of loose material at the surface, the trench shall be braced according to its

Register, September, 1978, No. 273
Trench, Excavation and Tunnel Construction

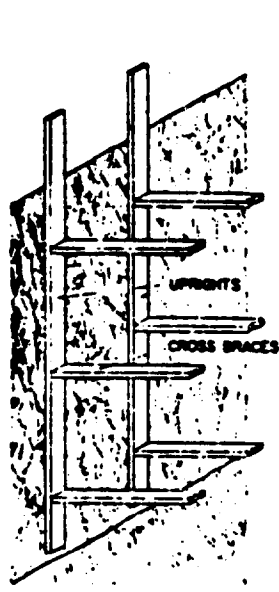


Fig. 1.—Trench Timbering—
Solid Soil

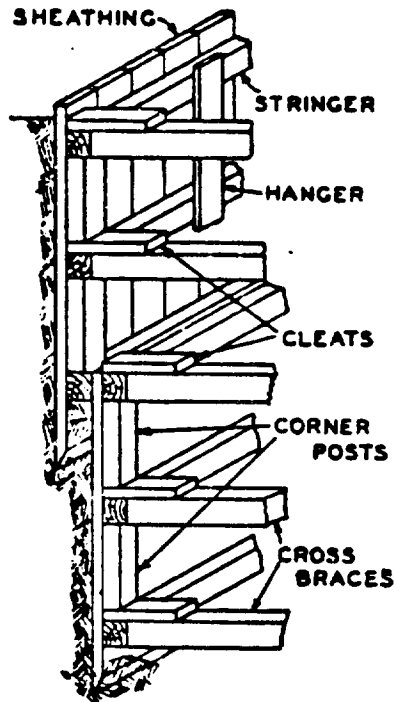


FIG. 2.—Trench Timbering—
Loose Soil

Register, September, 1978, No. 973
Trench, Excavation and Tunnel Construction

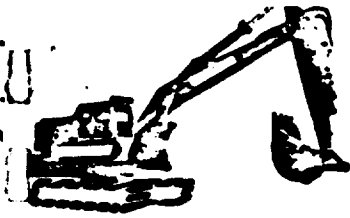
Revised September, 1974, No. 23
Trench, Excavation and Trench Construction

WISCONSIN ADMINISTRATIVE CODE

TABLE 2—TRENCH TIMBERING REQUIREMENTS
For trenches over 10 feet and not exceeding 15 feet in depth and width not exceeding 42 inches

	Kind of Soil	Uprights	Cross Braces	Stringers**
Where no parallel excavations exist or have existed within 15 ft.	Hard, solid soil	2x6 inch planks spaced 4 ft. c-c	*3—2x6 inch planks or equivalent for depth under 13 ft.; 4 for depths 13 ft. to 15 ft.	None
Previous excavations 10 to 15 ft. from trench	Hard, solid soil	2x6 inch planks spaced 3 ft. c-c	*3—2x6 inch planks or equivalent for depths under 13 feet; 4 for depths 13 ft. to 15 ft.	None
Previous excavations less than 10 ft. from trench	Hard, solid soil	2x6 inch planks spaced 2 ft. c-c	*3—2x6 inch planks or equivalent for depths under 13 ft.; 4 for depths 13 ft. to 15 ft.	None
Irrespective of any previous excavations	Soil that splits easily	2x6 inch planks spaced 2 ft. c-c	*3—2x6 inch planks or equivalent for depths under 13 ft.; 4 for depths 13 ft. to 15 ft.	1x6 inch boards placed back of uprights near top of trench
Irrespective of any previous excavations	Sand, gravel filled in ground or very wet soil	2 inch tight sheathing	3x6 inch timbers or equivalent, spaced 6 ft. c-c	6x6 inch timbers or equivalent—3 for depths under 13 ft.; 4 for depths 13 ft. to 15 ft.

Notes—c means center to center
 *In lieu of these cross braces for each upright, 3x6 inch stringers may be used with substantial cross braces spaced horizontally sufficient to give equivalent protection, but in no case exceeding 6 feet.
 **Stringers shall be properly supported by posts or chairs.



ROCK CONTRACTORS, INC.

287 - 27th STREET
CALEDONIA, WI 53108
TELEPHONE (414) 835-2935

COMMENTARY ON SUGGESTED REVISION IN SUBPART P
OF THE SAFETY AND HEALTH REGULATIONS FOR
CONSTRUCTION BASED ON BUILDING SCIENCE SERIES
REPORT BSS 127

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
WORKSHOP - JUNE 9, 1981
MILWAUKEE, WISCONSIN

GENTLEMEN:

MY NAME IS WALTER P. SCHMITZ, PRESIDENT OF ROCK CONTRACTORS, INC.
287 - 27TH STREET, CALEDONIA, WISCONSIN. I AM A REGISTERED
PROFESSIONAL ENGINEER WITH A MASTER OF SCIENCE DEGREE IN CIVIL
ENGINEERING. I HAVE HAD 33 YEARS OF EXPERIENCE IN THE DESIGN AND
INSTALLATION OF UNDERGROUND IMPROVEMENTS UTILIZING TRENCH EXCAVATION
AND TUNNEL CONSTRUCTION. I PREVIOUSLY WAS ENGINEER - IN - CHARGE
OF CONSTRUCTION FOR THE CITY OF MILWAUKEE, RESPONSIBLE FOR ALL
SEWER, WATERMAIN, AND PAVEMENT CONTRACT CONSTRUCTION IN THE CITY.
I ALSO AM A PAST PRESIDENT OF THE ASSOCIATED PUBLIC WORKS
CONTRACTORS ASSOCIATION OF GREATER MILWAUKEE AND A PAST PRESIDENT
OF THE MUNICIPAL ENGINEERS ASSOCIATION. FOR A NUMBER OF YEARS I
WAS CHAIRMAN OF THE CITIZENS'S ADVISORY COMMITTEE FOR REVISIONS TO
THE TRENCH, TUNNEL AND CAISSON BRACING REQUIREMENTS OF THE STATE
OF WISCONSIN ADMINISTRATIVE CODE.

INCORPORATED 1954

AFTER REVIEWING THE PROPOSED STANDARDS, I AM PARTICULARLY CONCERNED WITH TWO AREAS. THE FIRST IS TRENCH SLOPING AND THE SECOND IS TIMBERING REQUIREMENTS FOR TRENCHES, SHAFTS, AND TUNNELS. I AM CONCERNED FOR TWO REASONS - FIRST, THE ACTUAL SAFETY OF OUR MEN WHO WORK IN THE TRENCHES - SECONDLY, THE PRACTICAL APPLICATION OF THE STANDARDS TO THE TYPES OF SOIL IN WISCONSIN AND THE MATERIALS AVAILABLE TO US FOR BRACING AT A REASONABLE COST IN OUR STATE.

CHAPTER 6 OF THE WISCONSIN ADMINISTRATIVE CODE OF THE DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS HAS BEEN USED FOR APPROXIMATELY THIRTY YEARS FOR TRENCH EXCAVATION AND TUNNEL CONSTRUCTION BRACING REQUIREMENTS. DURING THIS TIME IT HAS HAD A REMARKABLE RECORD OF PERFORMANCE. DURING MY 33 YEARS OF DEEP INVOLVEMENT IN THE INDUSTRY, I AM UNAWARE OF ANY ACCIDENT OR INJURY CAUSED BY THE FAILURE OF THE SLOPING AND BRACING REQUIREMENTS OF THIS CODE.

ACCIDENTS AND INJURIES DO OCCUR DURING BRACING INSTALLATION AND I SEE NUMEROUS REQUIREMENTS OF THE NEW STANDARDS WHICH WILL LEAD TO A POSSIBILITY AND PROBABILITY OF INJURIES. TIME AVAILABLE TO ME WILL NOT ALLOW DETAILING THESE AT THIS TIME, BUT I WILL BE PLEASED TO HELP IN ANY CONFERENCE WITH THE BUREAU TO DISCUSS THESE PROBLEMS.

BECAUSE OF THE REMARKABLE SAFETY PERFORMANCE OF CHAPTER 6 OF WISCONSIN'S ADMINISTRATIVE CODE, I IMPLORER THE BUREAU OF STANDARDS AND THE DEPARTMENT OF LABOR TO ALLOW THE FOLLOWING SECTIONS OF THE CODE TO BE ALLOWED TO BE USED AS AN "EQUAL OR SUPERIOR" ALTERNATIVE FOR USE IN WISCONSIN TO THE PROPOSED OSHA STANDARDS. THESE SECTIONS ARE:

PART II IN ITS ENTIRETY

PART III TABLE 6, TABLE 7
IND 6.12 THROUGH 6.22 INCLUDING
FIGURES THROUGH 12.

A CAREFUL APPRAISAL OF THE RECORDS OF THE WISCONSIN DEPARTMENT OF INDUSTRY, LABOR, AND HUMAN RELATIONS WILL SUPPORT THE FINE SAFETY RECORD I HAVE REFERRED TO AND WE HOPE THE DEPARTMENT OF LABOR WILL SEE FIT THROUGH THE BUREAU OF STANDARDS RECOMMENDATION TO ALLOW THE SUGGESTED ALTERNATIVE. I AM ABSOLUTELY CERTAIN INJURIES AND DEATHS WILL BE PREVENTED.

THANK YOU FOR YOUR SERIOUS CONSIDERATION OF THIS RECOMMENDATION.

SINCERELY,
ROCK CONTRACTORS, INC.



Walter P. Schmitz, President

TO

FROM

Mr. Edward J. Hayden
 The AGC of Greater Milwaukee
 P.O. Box 08308
 2733 West Wisconsin Avenue
 Milwaukee, WI 53208

S. J. GROVES & SONS CO.
 P. O. Box 2009
 Springfield, Illinois 62705
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SUBJECT Comments for the workshop on suggested revision in 29 CFR 1926, Subpart P

DATE
 10 June 81

Dear Ed,

The attached list of comments, presented at the workshop June 9, 1981, is for your record. Inasmuch as this was the first of the workshops on this subject, I feel there is no real evidence which would support the change to the existing regulations. Thanks again for the opportunity to present our views on the matter.

David L. Shuman
 David L. Shuman

SPEED-MEMO

- 1) THE CURRENT STANDARDS ALLOWS THE PROTECTION REQUIRED FOR THE EMPLOYEES, BY THE EMPLOYER, FREE OF HAZARDS.
- 2) THE RECOMMENDED CHANGES WILL INCREASE COSTS TO PERFORM THE WORK, WHICH WILL ADVERSLY AFFECT OWNERS (TAXPAYERS)
- 3) THE EXISTING REGULATION ARE SOUND AND IF WE ACCEPT A CHANGE OF THIS TYPE IT WILL DEVELOPE AN AREA OF LIABILITY WHICH STILL DOES NOT RELEIVE THE EMPLOYER OF THE RESPONSIBILITY OF PROVIDING A SAFE AND HAZARD FREE WORK ENVIRONMENT.
- 4) NEW REGULATIONS DO NOT ALLOW ACCEPTED INDUSTRY PRACTICE.
- 5) HAS INDUSTRY HAD ANY SERIOUS PROBLEMS WITH TABLE P-1, IN EXISTING REGULATION ?
- 6) THE NEW REGULATIONS WILL PLACE STRINGENT CONDITIONS ON SMALL BUSINESS, UNLESS THE CONTRACT IS AWARDED UNDER SECTION 8(a) (COST PLUS) OF THE SMALL BUSINESS ACT.
- 7) THE RECOMMENDATIONS DO NOT SHOW ANY COST EFFECTIVE BENEFIT.
- 8) WILL OSHA INSPECTORS BE ABLE TO UNDERSTAND THE REGULATIONS AS PROPOSED, AND PROPERLY INSPECT ?

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DISCUSSION OF:

WORKING DRAFT OF SUGGESTED REVISION IN SUBPART P OF
THE SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION
BASED ON BUILDING SCIENCE SERIES REPORT BSS 127

by Felix Y. Yokel

by

BUILDING AND CONSTRUCTION TRADES DEPARTMENT AFL-CIO
JACK L. MICKLE

MILWAUKEE, WISCONSIN

JUNE 9, 1981

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Dr. Yokel is to be commended for his efforts to improve upon the Occupational Safety and Health Administration, (OSHA), 29 CFR Part 1926. Subpart P, Excavation, Trenching and Shoring Regulations document.

The Building and Construction Trades Department, AFL-CIO has been supportive of and assisted Dr. Yokel, where possible, since he began work on this project with the National Bureau of Standards in June, 1976.

In January, 1977 the B&CTD began the planning stage of a "Trenching Hazard Identification Task Force", hereinafter called the Task Force, to help the NBS obtain employee input aimed at hazard identification. In March, 1977 the Task Force met for a four day "retreat" type workshop; the six labor and management members brought with them 182 years of experience in trenching and related work. The charge was "to identify procedures and conditions that create safety hazards during excavation and trenching operations". Others present for the deliberations were Jim E. Lapping, Director of Safety and Health, B&CTD, as coordinator; Felix Y. Yokel as Technical Observer for the NBS and Jack L. Mickle, Chairperson. The final report (1)* was filed with the NBS in April, 1977. The final report appears in appendix G of NBSIR 80-1988 (2).

In September, 1978 Dr. Yokel (3) presented the preliminary findings and recommendations of the NBS study. Out of that two-day workshop came the agreement for this series of workshops to bring the results of Dr. Yokel's NBS study to the attention of labor, management and engineers in the field. Actually the essence of the working draft we are using for this workshop was printed in the Concrete Pipe News (4) in April of this year.

Since the 1978 workshop the B&CTD has responded to a number of requests for criticisms of drafts by Dr. Yokel.

* Numbers in parentheses refer to references given at the end of this paper.

Two premises underlie all remarks and criticisms given in this critique:

That the worker be assured of safe and healthful working conditions, and

that the journeyman worker and the compliance officer as well as the management representative be able to fully understand the precautions that have been taken and the protective measures that have been provided to assure worker safety and health, or that the safety of the worker on the job be placed in the hands of a licensed professional.

The first premise is spelled out in the preamble of the Occupational Safety and Health Act of 1970.

The second premise assumes that an average journeyman or compliance officer, using the official OSHA regulations governing excavation and trenching safety, can determine whether or not the safety provisions on any jobsite are in compliance with the appropriate regulations. If the provisions are not "standard practice" as outlined in the regulations then there must be a certificate issued by a licensed professional which assures the worker that the jobsite safety and health measures have been designed by and certified by the licensed professional.

There are undoubtedly many "competent persons" and "qualified persons" who are quite capable of designing a safe worksite, but how are they to be identified by the worker or compliance officer? The license is the evidence. All licensing laws have encountered competent or qualified persons and have eventually incorporated them into or excluded them from practice. While there are probably quite capable people who know a great deal about medicine or law, the prudent individual seeks the licensed practitioner when medical or legal opinions or services are sought.

Actually suggesting that registered engineers need to be consulted is not new with this suggestion. Thompson and Tanenbaum (5) recommend substantial involvement of registered engin-

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wers in construction activities requiring trenching or excavations.

In view of the foregoing, this discussion will be concerned with only the first 20 pages of Dr. Yokel's working draft which outlines "standard practice". Even portions of the first 20 pages probably belong in the "guidelines" which have been included to assist professionals. It is also assumed that only the "standard practice" will eventually be recommended for inclusion in the OSHA regulations Subpart P; Dr. Yokel has indirectly suggested that by what was included in the article which he co-authored in the Concrete Pipe News.(4).

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COMMENTS ON SELECTED ITEMS ON PAGES 1-20 OF THE WORKING DRAFT

Page	Location	Comment
1	item 3	?boxes. It is addressed to contractors, shoring manufacturers and engineers..." Why address it to the contractor unless the contractor is also an engineer?
2	item 5	"...which would aide field personnel and contractors in the selection of shoring." Once again, these persons are going to be dealing with the standard practice unless they are licensed professionals in their own right.
2	last line	Note that a qualified person is not an engineer (recognizing this as just an example)
3&4	All Issues	The items listed on pages 3 and 4 will be considered individually as they encountered in the text.
5	(g)	..be provided with and shall be instructed (required) to wear
5	(i)	...shall be permitted under loads handled by power-shovels, derricks, or hoists (equipment) This item is too specific for not listing all equipment which is used to handle loads; for example, backhoes are not listed.
6	(j) 2nd para. line 8	...or the shoring system, and shall increase-protection-against-slides-and-save-ins-if-necessary (see that all work in the excavation shall cease until necessary precautions have been taken to safeguard employees.)
6	(c)(1) line 3	?..shall be effectively stored and retained at least 2 (3) feet or more from the edge of the excavation." The Task Force specifically stated that 3 feet was necessary for proper protection.
6	(c)(2) line 3	"...may use effective barriers or other effective retaining-devices-in-lieu-thereof in order..." Task Force recommended extending tight sheeting above ground level as an effective barrier. Twelve to 18 inch extensions were discussed.
8	(l) line 2	?.. equipment, they shall be designed-and constructed by qualified persons..." Design implies work done by a licensed professional.
8	(o)	This item is silent with respect to straight sided pier holes; some confusion has arisen because 1926; straight sided holes are covered elsewhere. 800(h)(3)
8	(p)	When employees are required to be in trenches 4 (5) feet deep...." Leave at 4 feet.

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Page	Location	Comment
8	(s)	"...boxes or shields are used they shall be designed (and certified as to use by a professional engineer and shall be maintained in a manner which will provide protection for the worker.)" Strike the balance of (s).
9	(a)(1)a	Excavations less than 5 ft. deep, except when examination-of-the-ground-by-a-competent-person-indicates-that hazardous ground movement may occur."
9	(a)(2)	"Excavations from 5 ft. to 20 ft. (24-ft-?) deep.." Why consider 24 feet? A better choice might be 15 feet for standard practice. Thompson and Tanebaum data (5) indicate that 87 per cent of the fatalities and injuries occur in excavations less than 20 feet deep and that 2 per cent occur in those less than 15 feet deep. Hinze and Carino (2) state in their summary that their "...study showed that most trenchwork is between 5 and 15 feet deep with the trench width usually being about 3 feet." Cass (6), speaking about the stacking of two standard 7 ft. aluminum hydraulic shores, notes that where the trench is over 14 feet deep (page 68) "other shoring systems should be applied" and on (page 72) "Maximum trench depth, this method, is 15' (4.58 m). Over 15' (4.58m), see Fig. 60.2, multi-type shoring." Multi-type shoring shown on Fig 60.2 is a different system using aluminum hydraulic shoring and plywood backing. A maximum depth of 15 feet for standard practice seems appropriate.
9	(a)(2)a line 3	"...sloping requirements must be determined by an engineer (a-qualified-person?) ."
9	(a)(2)b Figure 1	May lead an individual to believe that FOOTING A is not a cause for concern; this could be dangerous. It is worthy of note that the role of the engineer has not been challenged at this point where property damage as well as personal injury is possible.
10	(a)(3)	See comments under: page 9 (a)(2). Fifteen ft. depth may be a better limit for standard practice rather than 20 ft.
10	(b)(1) line 6	The distinction between short-term and long-term is very difficult to reckon with; virtually no firm data exists. Not only stresses in the mass vary with time, but environmental factors may be critical. Twenty-four hours seems more logical than seven days.

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Page	Location	Comment
11	bottom of page last two lines	There may be some merit to allowing steeper slopes in some cases. The Task Force indicated that slopes flatter than 1:1 were probably not necessary for worker safety. Slopes of 1:1 were recommended for most conditions.
12	Fig. 2 Case IV	This particular configuration should be made a part of the "guidelines" proposed by NBS. While the configuration looks good on paper, it may be difficult to understand and/or enforce in the field. If included in standard practice the 3 ft. max bank should be retained.
13	(b)(4)(i)b.	See the first four lines at the top of page 13. Table 2 is necessary in standard practice only if Fig. 3(b) is retained. Moving the option shown as Fig. 3(b) to the guidelines removes the need for Table 2 which is confusing and also removes the need for special tables and figures outlining the placement of shoring in the lower part of the ditch.
13	(b)(4)(i)c.	For standard practice it may be worthwhile to include all surcharges, including allowances for heavy equipment, in the adjusted depth. The Task Force recommended a minimum of 300 pounds per square foot for surcharge. Dr. Yokel has greatly simplified Table 3 but it still can be confusing. Moving Table 3 to the guidelines and greatly increasing the surcharges to allow for heavy equipment may lead to "overdesigned" shoring and shields, but standard practice would thereby be greatly simplified.
13	(ii)b.	The Task Force recommended a 500 lb gravity load.
13	(ii)c.	This statement is not clear. Does this mean a 240 ft-lb impact load per square foot? The entire (ii)c. should become a part of the guidelines and removed from standard practice.
13	(ii)	This entire section devoted to the required strength of shoring systems, trench shields and trench boxes needs to be moved to the guidelines.
16	b.	If some of the previous suggestions are followed, hydraulic shores and other assemblies can be brought into standard practice. At a meeting in October, 1980 with NBS and members of the hydraulic shoring industry it was agreed that reasonably simple charts for the selection of shores can be developed. This seems to be in keeping with Cass' (6) recommendations for depth to 14 or 15 ft. There is no question that the resulting system would be greatly over-designed

Page	Location	Comment
		at times, but the freedom to use standard practice for most work (2) and thereby not requiring the services of an engineer seems to outweigh the disadvantages of overdesign.
16	c.	Timber shoring is properly located in the guidelines; selection must be by an engineer. The guidelines are for the use of licensed professionals.
16	(5)(ii) last two lines	The statement in parentheses is a vague performance specification which detracts from a well stated, precise paragraph.
16	(5)(iii)	Excavation below the bottom of bottom of the protective element has merit; exactly how much to allow is difficult to determine. Certainly engineers can design specific protection for unique circumstances, the guidelines will help, but permitting excavation below the protection device in standard practice will require very careful consideration.
18	(a)	"...with standards required by a-registered-architect, a registered professional engineer, or other duly licensed or-recognized authority. ..."
19	(m)	Twenty-four hours for short term seems most reasonable.
19	(o)	Negotiable slope needs to be specified; 1½:1 seems reasonable.
19	(r)	How is a qualified person to be identified? Unless there is a specific procedure anyone can claim to be a qualified person. No objection is the qualified person is permitted to use standard practice only.
19	(t)	same argument; use 24 hours for short term.
19	(aa)	<u>Stable Slope</u> . A meaningless term unless it is arrived at by a licensed engineer. This term has no place in Standard Practice!
20	(gg)	Working loads are best relegated to the guidelines where they can be dealt with by an engineer.

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Summary

There must be clear separation between Standard Practice and cases where an engineer has certified the procedure to be followed.

It is recommended that Standard Practice be permitted to a depth of cut of 15 feet; this includes most excavation and trenching work. At depths greater than 15 feet, or for special work, the engineer must assume full responsibility for the design of the protective system. The 15 ft. depth needs verified.

Standard Practice must be written such that the protective measures resulting from the application of Standard Practice are observable, measurable, understandable by all parties (with application of the regulations) and provide for the safety and health of the worker. It is recognized that Standard Practice may at times result in substantial overdesign, but this would not be new to the construction field.

It is anticipated that competent or qualified persons working for the contractor would select methods within Standard Practice to protect workers, but that any deviation from Standard Practice would need to be designed by an engineer. The engineer is recognizable by a professional license.

Several items which need consideration: construction right of way requirements, toxic materials, safety program as an item in the bid document, soil conditions and utilities in the bid document and better safety education for all. The Task Force final report lists other concerns.

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References

1. Building and Construction Trades Department AFL - CIO. Trenching Hazard Identification Task Force; Final Report. Prepared for the National Bureau of Standards; Building Safety Section; James C. Bryson, Chief. April, 1977.
2. Hinze, Jimmie and Nicholas J. Carino. A Study of Work Practices Employed to Protect Workers in Trenches; NBSIR 80-1988. National Bureau of Standards. March 1980.
3. Salomone, Lawrence A. and Felix Y. Yokel. Proceedings, Federal Workshop on Excavation Safety, September 19 and 20, 1978. National Bureau of Standards. July, 1979.
4. Yokel, Felix Y., Riley M. Chung and Ronald L. Stanevich. New Concepts for Construction Practice Standards for Excavations. Concrete Pipe News; pages 28-33, vol 33 no 2, April, 1981.
5. Thompson, Louis J. and Ronald J. Tanenbaum. Excavations, Trenching & Shoring: the responsibility for design and safety. Sponsored by the Associated General Contractors of America. A report of the Texas A & M Research Foundation. College Station Texas. September, 1975.
6. Cass, W. Martin "Red". Common Sense in the Common Trench. Equipment Guide-Book Company; 2800 West Bayshore Road, Palo Alto, California 94303. 1979.

**ASSOCIATED
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• **Associated General Contractors of Greater Milwaukee**

**Statement for the Workshop on the National Bureau of Standards
Recommended Technical Provisions for Construction Practice in
Shoring and Sloping of Trenches and Excavations.**

June 9, 1981

The Milwaukee Construction Industry Safety Council is a co-operative effort originated and administered by the AGC of Greater Milwaukee. As such we aid in the safety programs of 800 area construction firms.

In answer to the specific issues outlined in the working draft we take the following position.

1. We feel that 1926.651 (a) is pertinent to a trenching and shoring standard. Most underground services are located in shallow trenches. Any excavation below 18 inches can encounter buried utility lines. Many states have laws requiring utility notification.
2. We believe that exit requirements should begin at five feet. Observation indicates that working crews seldom use available ladders unless the excavation is over five feet deep anyway. Using five feet would cause a well defined trigger point for action since it correlates directly with the start of trenching and shoring requirements.

It is indisputable that larger excavations allow effective escape to the center in case of collapse. Consideration should be given to the use of this method. The same is true of large pipes or other covered structures.

3. We feel that "qualified person" should be substituted for "engineer". The actual work crews are in the best position to judge the situation. Qualified on the job supervision should be sufficient for everyday situations. We feel that you have developed a workable definition of "qualified person".

4. The concept of short term vs. long term excavation is a difficult one to deal with. The stability of the sides of the excavation is more a function of climate and other factors than the length of time an excavation remains open.
5. The State of Wisconsin allowed a slope of 1/2 to one for dry or moist soils in its old code. The code was in existence for over 30 years. We know of no incidents of a failure in a trench sloped according, to Wisconsin's code. We would request that you investigate the validity of the 1/2 to 1 slope for some situations. Its use in Wisconsin would indicate that it does offer adequate employee protection. The advantages are obvious. Less material is excavated with less disruption to existing roads, driveways, lawns, sidewalks, buildings and utilities. A performance standard allowing 1/2 to 1 might be a viable alternative to this proposal.
6. We have not taken a formal position on this question.
7. 1926.652 (b) (;;) is not appropriate for use by the person in the field. We appreciate the necessity of including it in any standard and concur that it would be better if placed separately in the standard and/or transferred to definitions.
8. Workers must be protected from objects rolling or sliding from sloped ground. We do not believe that how this protection is accomplished should be specified. The employer and employees should be allowed great latitude in methods of providing this protection.
9. Most stress appears to be in the middle of a trench. We know of no safety reason why a shield cannot ride at least 3 feet up from the bottom in good or average soils.
10. We support the deletion of architects from the list of "accepted engineering requirements.
11. We believe that a competent person should be on the jobsite.
12. Degrading a mass movement of soil or rock does not appear to be necessary.
13. Old 1926.651 (c) can be eliminated since it is adequately covered elsewhere.

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of Greater Milwaukee, Inc.

We also wish to address other areas in the proposed standard. On page seven 1926.651 (g) the use of stop logs is required. This is not practical for backfilling operations or for installing bedding in long trenches.

1926.651 (i) covers the methods of keeping down dust. The application of large amounts of salt, calcium, chloride, and oil is not always an environmental sound dust control option.

On page 17 two tables appear (4a and 4b that serve the same purpose. We suggest that 4a be eliminated and all spacing be done on a center to center basis.

We favor a standard that permits the use of accepted engineering codes and practices for the installation of shoring. This allows for the use of charts on the site as a guide to installing safe shoring.

We are concerned about the practical applications of the standard. No contractor has a complete lumberyard on the site. He can effectively protect his employees by using the same sizes of timber in a different depths and soil types. This can be accomplished by decreasing the spacing and increasing the number of struts. Forcing contractors to use excessively large timbers will result in more back injuries. Greater than necessary sloping requirements means more exposures to traffic hazards in the metro area where most trenching is done.

We support a practical standard that effectively protects employees without being economically burdensome. We believe this study is making excellent progress in this regard.

AL JOHNSON CONSTRUCTION CO.
General Contractors

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June 5, 1981

Edward J. Hayden
AGC of Greater Milwaukee
P.O. Box 08308, Milwaukee, Wi.

RECEIVED
JUN - 8 1981
AGC-MILWAUKEE

Re: WORKSHOP, Trenching & Shoring Std's.

Hi Ed,

I have no plans for attending the June 9th session, your city, but from confidence that you'll be a participant, I take this action.

On three separate occasions, I've made a close review of the "working draft of suggested revisions for Subpart P, 1926, OSHA". Overall, I consider the document much superior to present form and probably as realistic and comprehensible as might be developed.

The enclosed set of copy sheets from certain pages of the "draft" include my markings from reviews... Maybe in this way, and through you, I might contribute to a "consensus opinion", even though trenching-work is almost non-existent in our operations.

Best Regards,
M. O. Dumas

encl.

P.S. — Thanks for the regular mailings
of "For Safety's Sake"

SOME ISSUES THAT SHOULD BE CONSIDERED IN THE WORKSHOPS:

1. Page 6. Section 1926.651(a): This section appears to fall within the scope of Subpart S. Should it be dropped? NO
2. Page 8. Section 1926.651(p): Should the exit requirements for excavations start at 5 ft, rather than 4 ft depth? NO
(This would remove most excavations less than 4 ft deep from the scope of Subpart P.) Should exit requirements be waived for excavations which are wide enough to permit people to escape toward the center of the excavation? Should it be recognized that large enough pipes or other covered structures can shelter people? Should "negotiable slope" be better defined? yes
3. Page 9. Section 1926.652(a)(2): Could the depth limitation in the "Standard Practice" be extended to 24 ft? If so, should there be a more stringent limit for Class C soils? Should a "qualified person" be substituted for an "engineer", and if so, is the definition of a "qualified person" good enough so that a determination of who is a "qualified person" is possible? (This issue also applies to other sections of the working draft.) NO
4. Page 10. Section 1926.652(b)(1): Should the short-term excavation definition extend to 7-days rather than 1-day? If so, do we need more conservative requirements? NO
5. Page 11. Table 1: Should the stipulation of maximum slope be limited to 3/4:1? Should the suggested performance requirement (footnote b) (the "stable slope" concept) be used? Will this approach work? NO
6. Page 12. Figure 2: Should the allowable bank next to the work area in Cases II, III and IV be increased to 4 ft? Should "Case IV" be limited to excavation by trenching machines? NO
7. Page 13. Section 1926.652(b)(4)(ii): This section, unlike most others in Subpart P, is not addressed to the man in the field, but to those who pre-design shoring systems. Yet the section is necessary to avoid unreasonable vagueness. Should this section be at the end of Subpart P? Should part of it be conveyed as definitions? yes

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SAFETY DIRECTOR

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8. Page 16. Section 1926.652(b)(5)(ii): This section makes it difficult to implement some of the slope configurations allowed in Fig. 2. Should the proposed performance statements be substituted to give more options, or alternately, should more options be specified or the specified options identified as examples of implementing the performance statement? *OK as drafted*
9. Page 16. Section 1926.652(b)(5)(iii): Should the allowable excavation below the bottom of shoring or shields be increased to 3 ft? *yes*
10. Page 18. Definition of "Accepted engineering requirements" Should "a registered architect" be omitted since architects do not deal with excavations? *yes*
11. Page 18. Definition of "Competent Person": Should the definition be re-written to require that the competent person be working at the excavation site? *yes?*
12. Should "Mass Movement of Soil or Rock" be defined? *no*
13. Page 52. Old 1926.651(c): Should this statement be deleted? *No* even though this matter is addressed elsewhere, this statement conveys the intent of Section 1926.652 in simple language.

SUBPART P - EXCAVATIONS AND SHORING

1926.650-GENERAL PROTECTION REQUIREMENTS

- ✓(a) The regulations contain minimum requirements for the protection of workers in, and adjacent to, excavations against death and injury.
- ✓(b) Walkways, runways, and sidewalks shall be kept clear of excavated material or other obstructions and no sidewalks shall be undermined unless shored to carry a minimum live load of one hundred and twenty-five (25) pounds per square foot.
- ✓(c) If planks are used for raised walkways, runways, or sidewalks, they shall be laid parallel to the length of the walk and fastened together against displacement.
- ✓(d) Planks shall be uniform in thickness and all exposed ends shall be provided with beveled cleats to prevent tripping.
- ✓(e) Raised walkways, runways, and sidewalks shall be provided with plank steps on strong stringers. Ramps, used in lieu of steps, shall be provided with cleats to insure a safe walking surface.
- ✓(f) All Employees shall be protected with personal protective equipment for the protection of the head, eyes, respiratory organs, hands, feet, and other parts of the body as set forth in Subpart E of this part.
- ✓(g) Employees exposed to vehicular traffic shall be provided with and shall be instructed to wear warning vests marked with or made of reflectorized or high visibility material.
- ✓(h) Employees subjected to hazardous dusts, gases, fumes, mists, or atmospheres deficient in oxygen, shall be protected with approved respiratory protection as set forth in Subpart D of this part.
- ✓(i) No person shall be permitted under loads handled by power shovels, derricks, or hoists. Employees shall be required to stand away from any vehicle being loaded *by mechanized equipment on facility.*

- ✓(j) A competent person shall inspect the excavation for evidence of possible cave-ins or slides, and indications of structural failure in members of the shoring system. If evidence of possible cave-ins or slides or structural failures is apparent, all work in the excavation shall cease until necessary precautions have been taken to safeguard employees.

The competent person shall conduct an overall *thorough* inspection of the excavation and the ground adjacent to the excavation at least twice daily and shall conduct a special inspection after every rainstorm, penetration of water into the excavation, or other disturbance that could weaken the soil or the shoring system, and shall *direct the* increased protection against slides and cave-ins ~~where necessary~~ *where deficiencies ~~are found~~ conditions are found.*

Dewatering operations and equipment shall be monitored by a competent person to insure their proper operation and precautions shall be taken to safeguard the workers in the excavation if dewatering equipment malfunctions.

1926.651-SPECIFIC EXCAVATION REQUIREMENTS

- ✓(a) Prior to opening an excavation, efforts shall be made to determine whether underground installations; i.e., sewer, telephone, water, fuel, electric lines, etc., will be encountered, and if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.
- ✓(b) Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.
- ✓(c) (1) In excavations which employees may be required to enter, excavated or other material shall be effectively stored and retained at least 2 feet or more from the edge of the excavation.
- (2) As an alternative to the clearance prescribed in subparagraph (1) of this paragraph, the employer may use effective barriers or other effective retaining devices in lieu thereof in order to prevent excavated or other materials from falling into the excavation.

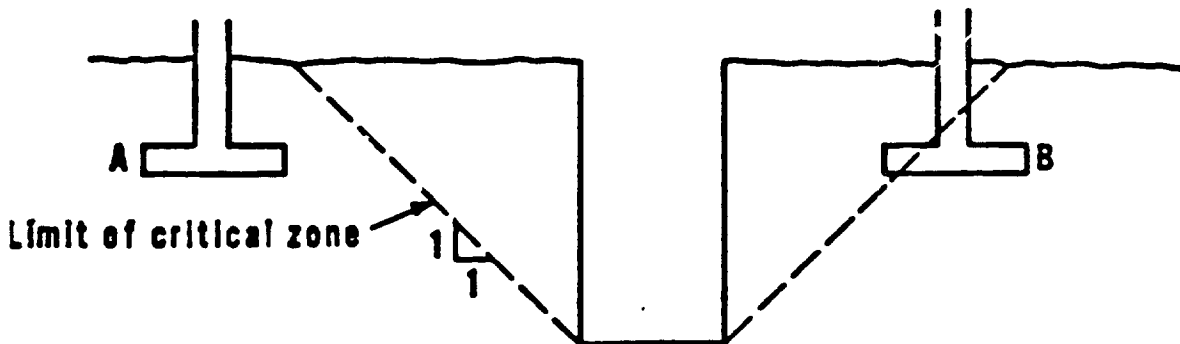
- ✓(d) Diversion ditches, dikes or other suitable means shall be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Water shall not be allowed to accumulate in an excavation, unless this condition is considered in the design and in the initial work plan and adequate provisions are made to protect workers.
- (e) If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, the side of the excavation shall ~~be shored~~ *be stabilized* as necessary to resist the extra pressure due to such superimposed loads.
- ✓(f) Blasting and the use of explosives shall be performed in accordance with Subpart U of this part.
- ✓(g) When mobile equipment is utilized or allowed adjacent to excavations, substantial stop logs or barricades shall be installed. If possible, the grade should be away from the excavation.
- ✓(h) Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be backfilled.
- (i) ~~If possible, dust conditions shall be kept to a minimum by the use of water, salt, calcium chloride, oil, or other means.~~ *effective means.*
- ✓(j) In locations where oxygen deficiency or gaseous conditions are possible, air in the excavation shall be tested. Controls, as set forth ~~is in~~ *in* Subparts D and E of this part, shall be established to assure acceptable atmospheric conditions. When flammable gases are present, adequate ventilation shall be provided or sources of ignition shall be eliminated. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line, basket stretcher, etc., shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.
- ✓(k) Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.

- ✓ (l) Where structural ramps are used for employees or equipment, they shall be designed and constructed by qualified persons in accordance with accepted engineering requirements.
- ✓ (m) All ladders used on excavation operations shall be in accordance with the requirements of Subpart L of this part.
- ✓ (n) Materials used for shoring, sheeting, and underpinning of structures adjacent to excavations shall not be damaged or weakened by corrosion, deterioration or prior use to an extent that will cause them to have a minimum strength less than that required in Section 1926.652(b)(4)(ii).
- ✓ (o) Employees entering bell-bottom pier holes shall be protected by the installation of a removable-type casing of sufficient strength to resist shifting of the surrounding earth. Such temporary protection shall be provided for the full depth of that part of each pier hole which is above the bell. A lifeline, suitable for instant rescue and securely fastened to a shoulder harness, shall be worn by each employee entering the shafts. This lifeline shall be individually manned and separate from any line used to remove materials excavated from the bell footing.
- ✓ (p) When employees are required to be in trenches 4 (5?) feet deep or more, an adequate means of exit, such as a ladder, steps or a negotiable slope shall be provided and located so as to require no more than 25 feet of lateral travel. *A is best*
- ✓ (q) Shoring shall follow the excavation as closely as practical in order to avoid long sections of unshored excavation.
- ✓ (r) Members of the shoring system shall be installed in their proper position and secured to prevent failure.
- ✓ (s) Portable trench boxes or sliding trench shields may be used for the protection of personnel in lieu of a shoring system or sloping. Where such trench boxes or shields are used they shall be designed, constructed, and maintained in a manner which will provide protection equivalent to that provided by the shoring required for the excavation.
- ✓ (t) Backfilling and removal of trench support shall progress together from the bottom of the trench. Struts shall be released slowly and, in unstable soils, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

1926.652-SPECIFIC SHORING, SHIELDING AND SLOPING REQUIREMENTS

(a) Acceptable Practice

- (1) The following excavations are exempt from shoring, shielding and sloping requirements:
 - ✓ a. Excavations less than 5 ft. deep, except when examination of the ground by a competent person indicates that hazardous ground movement may occur.
 - ✓ b. Excavations in unfractured rock.
- (2) Excavations from 5 ft. to 20 ft. (~~24 ft. ?~~) deep shall be shored, shielded or sloped in accordance with the Standard Practice in Section 1926.652(b) with the following exceptions:
 - ✓ a. If there is a deviation from the provisions of the Standard Practice, shoring, shielding or sloping requirements must be determined by an engineer (a qualified person ?) *or other experience qualified person.*
 - ✓ b. An engineer shall determine the shoring, shielding or sloping requirements whenever the bottom of a building foundation adjacent to the excavation which has not been secured by underpinning extends into the critical zone delineated in Figure 1.



- ✓ FOOTING A: Standard practice can be followed
- ✓ FOOTING B: An engineer shall be consulted

✓ Figure 1. Effects of Nearby Foundation Loads That Must be Determined by an Engineer

(3) For all excavations deeper than 20 (24?) ft., except those in unfractured rock, an engineer (qualified person?) shall determine the shoring, shielding or sloping requirements, and assure its proper installation or use

either or other experience

(b) Standard Practice

✓(1) Scope

The Standard Practice provides a method by which field conditions are related to shoring, shielding and sloping requirement.

The Standard Practice makes a distinction between short-term and long-term excavations (see definition in 1926.653 - 24 hours (7 days?) is the division point).
NO - Maybe 36-48 hours

✓(2) Soil Classification

Soils are divided into three types: A, B, and C. For each soil type the "equivalent weight effect", w_e , to be used for the calculation of lateral soil pressure on shoring systems, and the maximum permissible sideslope for sloped excavations are stipulated. Table 1 provides guidance for the selection of the soil type.

✓(3) Sloped Excavations

Sloped excavations shall not have sideslopes steeper than those stipulated in Table 1. If there is any indication of general or local instability, slopes shall be cut back to the stable slope. The slope configurations shown in Figure 2 can be used.

✓(4) Shored and Shielded Excavations

✓(i) Determination of Adjusted Depth

For the purpose of selecting shoring systems, trench shields, or trench boxes the depth of excavations shall be assumed greater than the actual depth in order to allow for spoil piles, construction equipment and sloping ground. This adjusted depth (H_a) shall be determined as follows:

✓a. For ground sloping down from the supported or shielded excavation wall, level ground, or ground sloping up from the supported or shielded excavation wall with a slope less than 3 hor. in 1 vert. the Adjusted Depth (H_a) is the actual depth of the supported excavation (H) plus 2 ft. (surcharge allowance). (See Figure 3(a).)

- ✓b. Hydraulic shores or other pre-fabricated sub-assemblies or members of shoring systems shall be rated for allowable working loads and selected with the aid of the charts in the guidelines supplementing Subpart P, or selected directly from special charts prepared by the manufacturer.
- ✓c. Timber shoring shall be selected with the aid of charts in the guidelines supplementing Subpart P or from special charts prepared by an engineer (qualified person?).
- ✓d. Any other shoring system can be pre-designed and rated by an engineer (qualified person?) and selected on the basis of soil type and equivalent depth from charts prepared for this purpose.

✓(5) Special Provisions

✓(i) Intersecting Trenches

When two trenches intersect and one trench is shored, the intersecting trench shall also be shored from the intersection of the two trench walls to a distance of not less than its depth.

✓(ii) Sloping Ground

If the ground behind an excavation wall slopes up from the excavation wall and the ground slope exceeds 3 hor. in 1 vert. workers in the excavation must be protected against objects rolling or sliding from the sloped ground. This can be accomplished by projecting the sheeting at least 18 inches above the ground surface or by a specially constructed protective toeboard. If spaced sheeting is used provisions shall be made to close the gaps between projecting sheeting members. (Workers in excavations must be protected against rolling or sliding objects?)

✓(iii) Excavation Below the Bottom of Sheeting, Trench Shields, or Trench Boxes

Excavation up to ^{6K} 2 ft. (3 ft. ?) below the bottom of sheeting, trench shields or trench boxes is permitted in short-term excavations provided that:

- ✓a. No soil movement below the bottom of the sheeting, trench shield or trench box is evident; and
- ✓b. The forces acting on the bracing, trench shield, or trench box are calculated for the full depth of the excavation, and the lowest wales and struts are designed to resist the forces that would result if the sheeting would be projecting to the bottom of the excavation.

1926.653 DEFINITIONS APPLICABLE TO THIS SUBPART

~~omit~~
OK?

- ✓(a) "Accepted engineering requirements (or practices)" Those requirements or practices which are compatible with standards required by a (registered architect) a registered professional engineer, or other duly licensed or recognized authority. Guidance for accepted engineering practices pertaining to excavation safety is provided in the guidelines supplementing Subpart P.
- ✓(b) Acceptable Practice is a practice which meets the minimum requirements in Section 1926.652(a).
- ✓(c) Adjusted Depth is the actual depth from the bottom of the excavation to the top of the supported excavation wall plus an additional depth to allow for surcharge, sloping ground, or heavy equipment as stipulated in Section 1926.652(b)(4)(i).
- ✓(d) Allowable Working Stresses are allowable stresses determined in accordance with accepted engineering practices.
- ✓(e) Belled Excavation is a part of a shaft or footing excavation, usually near the bottom and bell-shaped; i.e., an enlargement of the cross section above.
- ✓(f) Clear Spacing of sheeting members is the distance between the edges of sheeting members over which the soil is unsupported (see Figure 4).
- ✓(g) Competent Person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
- 20 ✓(h) Engineer is a (registered) professional engineer.
- ✓(i) Equivalent Weight Effects (w_e) is the weight effect stipulated in Table 1 which is used to calculate pressures on shoring systems.
- ✓(j) Excavation is any manmade cavity or depression in the earth's surface except as noted, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of excavation. Excavations do not include tunnels and shafts, caissons and cofferdams covered by Subpart S of the Safety and Health Regulations for Construction.
- ✓(k) Excavation Wall is the side of an excavation, rising from the bottom of the excavation to the ground surface.

- ✓ (l) Fractured Rock is rock which could spall or crumble when excavated with vertical slopes. Fractured rock slopes secured against mass movement and spalling by rock bolts, netting, or other means approved by a qualified person are considered stable (equal to unfractured rock).
- ✓ (m) Long-Term Excavations are excavations which are open for more than 24 hours (7 days?) 36-48 hours (Not 7 days)
- ✓ (n) Mud Sills are wales which are installed at the level of the bottom of the excavation wall.
- ✓ (o) Negotiable Slope is a slope on which a person can readily egress from or ingress to an excavation.
- ✓ (p) Qualified Person means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
- ✓ (q) Safety Margin is any measure of excess strength over that required to resist the working loads.
- ✓ (r) Sheeting is composed of members of the shoring system which are in direct contact with the soil in the supported bank.
- ✓ (s) Shoring Systems are structural systems supporting the bank of an excavation.
- ✓ (t) Short-Term Excavations are excavations which are open for 24 hours (7 days?) or less. 36-48 hours (Not 7 days)
- ✓ (u) Sides, Walls, or Faces are the vertical or inclined earth surfaces formed as a result of excavation work.
- ✓ (v) Slope is an incline expressed as a ratio of horizontal distance to vertical rise.
- ✓ (w) Spaced Sheeting is sheeting in which the members bearing against the excavation wall are spaced (see Figure 6). Figure 4?
- ✓ (x) Spalling is the continuous flaking and falling of soil or rock from an unsupported trench wall.
- ✓ (y) Standard Practice is the trenching and shoring practice in Section 1926.652 (b).
- ✓ (z) Struts are the primary support members of a shoring system including but not limited to cross braces, raker braces, jacks and backties (see Figure 6) Figure 4?
- ✓ (aa) Stable Slope is the slope which will remain stable for the duration of the excavation.

Raker braces or backties are not illustrated

- ✓(bb) Structural Ramp is a ramp built of material other than soil or rock.
- ✓(cc) Supported Wall is that part of an excavation wall which is supported by a shoring system or shielded by trench boxes or trench shields.
- ✓(dd) Trench Box see trench shield.
- ✓(ee) Trench Shield is a protective device which shields workers in a trench from the effect of mass movement of soil or rock and which can be moved along as work progresses.
- ✓(ff) Wales (walers) are members of the shoring system which are directly supported by struts and which in turn provide support to the sheeting (see Figure 4).
- ✓(gg) Working Loads are loads which should reasonably be anticipated to occur and which must be resisted with appropriate safety margins, determined in accordance with accepted engineering practice.

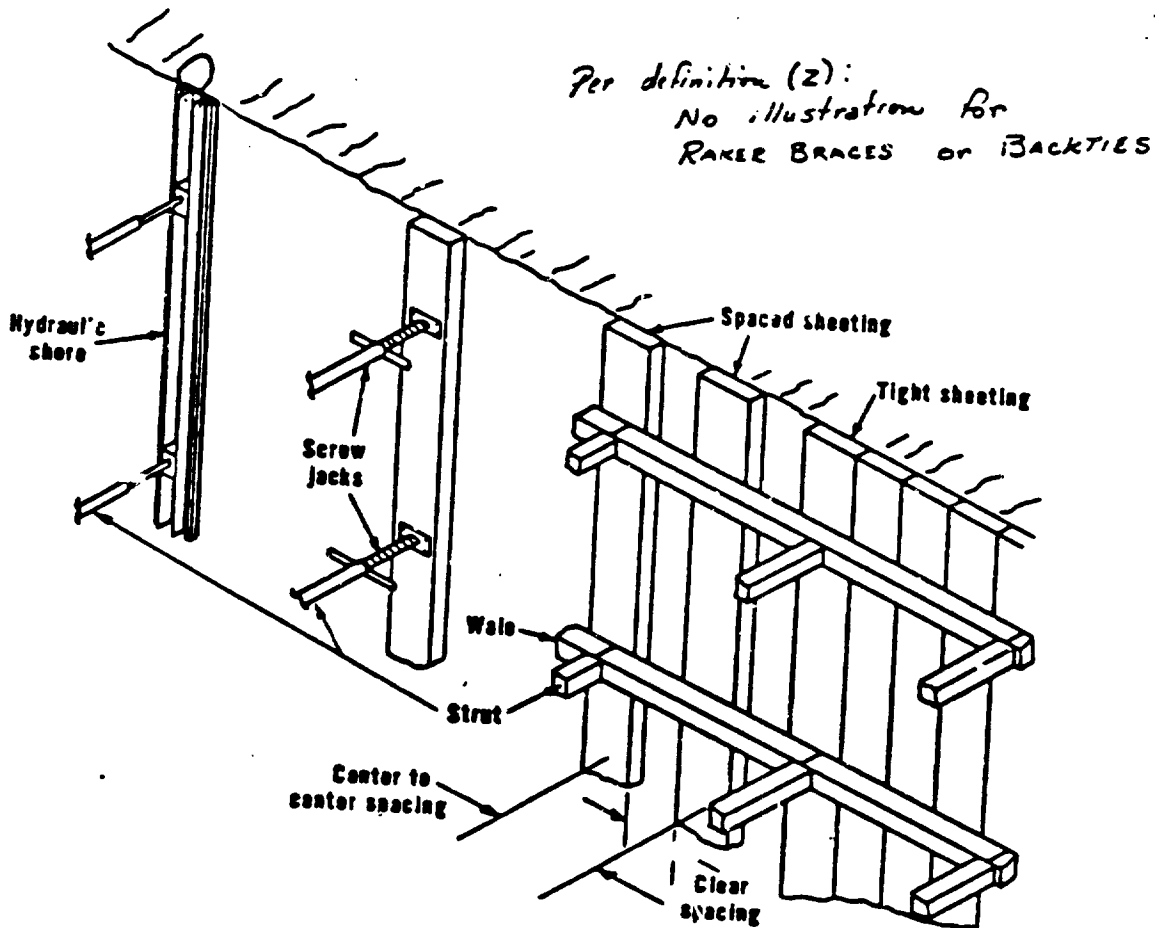


Figure 4. Components of the Shoring System

Minutes of Trenching and Shoring Workshop - Dallas

There were 41 persons in attendance at the AMFAC Hotel at Dallas/Ft. Worth Airport on June 30, 1981. Arthur L. Schuhl, Director of Safety and Health Services for the Associated General Contractors, opened the workshop with an explanation of why the workshops were being held. He then turned it over to Bill Driskill, of the Texas Heavy, Municipal & Utilities Branch of A.G.C., who had agreed to serve as secretariat for the meeting. There were self-introductions and the representatives from the National Sponsors were introduced and asked for comments.

John Cook, representing the National Utility Contractors Association, made a statement that, "at this time NUCA is not taking a position on the working draft of Subpart P and will wait to see what the final draft is."

The next sponsor was Jack Mickle, representing the Building and Construction Trades Department of the AFL-CIO. Mr. Mickle provided a draft with the Building Trades recommendations on the revisions of Subpart P. He stated that the stand the Building Trades have taken is that whatever we wind up with has to be understandable by all. (Mr. Mickle's full text is attached to these minutes.) Mr. Mickle stated that his group had spent most of its' time looking at the first twenty pages of the proposed document, minus the first five pages. Based on this, he made the following recommendations: (1) Remove the misunderstandings such as the definition of stable slope. (2) Recommend the removal of Table P-2. (3) Include hydraulic shoring in standard practice with manufacturers certifications for use on the shore and shields be included in standard practice with manufacturers certification on the shield.

See attached document of Mr. Mickle's for all of their recommendations.

Mr. Sal M. Gosioglu, representing A.S.F.E., stated that his group has distributed the working draft to their members for comments and the comments will be forwarded to their A.S.F.E. representative, Mr. John Romage, for presentation at the Boston Workshop.

On conclusion of the statements by the sponsors, Dr. Yokel was called upon to explain what would be done with the products of the various workshops. He stated that the information from the workshops would be discussed with OSHA and NIOSH representatives and the regulations would be re-drafted. Dr. Yokel strongly recommended that the parties at the workshops should form a committee with the possibility of a meeting, or meetings, in Washington, D. C. with the idea of coming up with a consensus standard for submission to OSHA.

Dr. Yokel then gave a video presentation on the NBS study that was funded by OSHA. He stated that some 127 recommendations were made on arriving at the working draft by various groups such as labor, A.G.C., A.S.F.E. and other interested parties. Following Dr. Yokel's presentation on the various recommended changes in his working draft on Subpart P, and some of the comments on the proposals in previous workshops, the workshop was opened for comments.

John Cook, speaking for trench shield manufacturers, offered that it was their consensus view after they had reviewed in detail the working draft, that the attempt to clarify and simplify, as it relates to the revised changes in Subpart P, has failed and, in fact, has made it more confusing and more difficult to apply in the field and the proposed design criteria, as it relates to trench boxes, does not conform to accepted engineering practices and they have specific recommendations to be made later in the workshop.

The following comments were made after Mr. Cook's presentation:

(1) Del Talley, Executive Director, Austin A.G.C., raised the question as to why the American Society of Safety Engineers are not involved? It was Mr. Talley's feeling that A.S.S.E. should be involved in some manner since that organization represents the safety professionals in the United States.

Mr. Talley also asked about the adjusted depth chart and surcharge chart and what is the involvement of the American Society of Civil Engineers? Dr. Yokel then explained the charts again and stated the idea of the charts was to be simple enough so the man in the field could readily understand the standard. There was considerable discussion of the chart on page 14-Table 3 and the need to clarify this.

(2) Jerry Rosch, Brown & Root, Inc., Houston Texas, commented on the selection of competent people or qualified people and stated that OSHA has told them that the employer is to select that person and they (Brown & Root) go with the man with the most experience. Mr. Rosch requested that definitions be included that explain clearly what a competent person and qualified person is. Dr. Yokel stated that the definitions are in the documents but probably need more work to clarify them.

(3) John Collins, Kent Nowlin Construction Co., New Mexico, asked what happens with a six foot hole that is opened for eight days? Does it have to be designed by a qualified engineer? What is the definition of long term and short term?

(4) Walter Ruff, Ruff Construction Co., Dallas, Texas, commented and raised the question that long term and short term is predicated on a shoring system being involved. What if the contractor chose, instead of shoring, laid back or sloped to a safe angle, how would the long term and short term definition apply?

(5) Leroy Balsler, Robert E. McKee, Dallas, Texas, stated that page 11 on Soil Classification for the Standard Practice is too arbitrary since soils vary from area to area.

Following these comments, Dr. Yokel went over the document step by step and asked for comments on item 1-7 page 3.

(1) John Cook, representing the trench box industry, commented on number 3 as to whether a qualified person should be substituted for an engineer. He felt the answer should be no, but that there are other areas in the working draft where a qualified person should apply but declined to say where. On number 4, he felt that more conservative requirements were not needed and short-term should be 7 days. On item 5, he stated that they felt the allowable slope in Table 1 is not in accordance with acceptable engineering practices and the stable slope concept should be used. On Item 7, their answer is yes it should be conveyed as part of definition.

(2) Phil Becker, Utilities Consolidated, San Antonio, Texas commented in regard to page 3 item 2, he felt that on exit requirements from a ditch, the exit requirements other than a ladder should be allowed such as shoring as a means or a negotiable slope allowed. On item 3 he feels that the 24 foot depth on the standard practice should be utilized and it is a common practice in his area for the industry. On Item 4, or short term and long term excavation, he feels that it is confusing building construction with utility construction and it is standard practice to leave areas such as manholes open a week or so. On Item 5, he felt stable slope should be the concept used. Item 6 - Leave it at two feet.

Item 9 - This needs to be determined at the time it is used but don't tie it down.

Item 11 - He is against having an engineer on the job, but use a qualified person. If you insist on an engineer, put it in the design and make it a bid item and everyone would bid on these items.

Mr. Becker stated that common sense must prevail in considering these proposals.

(3) Walter Ruff, Ruff Const Co., Dallas, Texas

Item 2 - 5' instead of 4'. Pipe should be recognized as a shield if large enough.

Item 3 - It should be extended to 24 feet and it is industry practice to work this deep. Job foreman should be recognized as a qualified person and an engineer should not be involved unless he include the shoring system at the design stage and be a bid item and OSHA write the law that the engineer's errors and omission will stand at the courthouse and let him be responsible for his design.

Item 4 - Short term definition should be deleted.

Item 6 - Leave it at two feet.

Item 9 - Should be a determination on each individual job.

Item 10 - Omit architect.

(4) Alan Hollingsworth, S. J. Groves & Sons.

Item 1 - This should not be dropped in that it causes problems on Highway projects.

Item 2 - Definition should be clear on negotiable slope.

Item 3 - Are we better off to leave this the way it is?

Item 4 - It is very controversial and many factors should be considered in order to establish a definition of "short term" or "long term" excavation.

Item 5 - Use the current regulations.

Item 6 - The current regulation is adequate. (2 feet)

Item 7 - What men in the field are we talking about? We recommend consideration be given to existing industry practice.

Item 8 - Bypass

Item 9 - No problem with this.

Item 10 - If we are going to have all these different people involved, let's name everybody since state laws, like in Illinois, can name every party and each named can be responsible for some portion.

Item 11 - No real problem, but tell us specifically what you want us to do.

Item 12 - 1926,650 gives us enough rationale to understand.

Item 13 - No significant problem with existing regulations.

The construction industry has not had good participation in this workshop paper and more across the country should be consulted.

(4) Phil Becker then referred those present to page 12 and page 15 and asked Dr. Yokel to explain open excavation without shoring and sloped excavation.

(5) Joe Kinnikin, AGC of New Mexico - Contractors in Texas and New Mexico are having a problem with 3/4 to 1 slope. We are dealing with undisturbed soils and not the molten soils like back east.

Dr. Yokel then asked for comments on page 5A. He stated that the two previous workshops had commented that these provisions should not apply when workmen are not exposed to mass movement of soil or rock. John Collins, of Kant Nowlin Const Co., asked the question about where employee exposure occurs and how far away from the face of an excavation does a workman have to be to not be exposed?

Alan Hollingsworth, of S. J. Grove, commented on page 7 that 651E & D appear to him to apply to borrow pits with water accumulating. He felt that a compliance officer who is not an engineer might make a judgment call that would cause more litigation. Dr. Yokel said this provision was carried over from the previous regulations.

Jerry Rosch, of Brown & Root, commented on section J. Emergency procedures in a confined space should be defined in J on page 7.

Walter Ruff, of Ruff Construction Co., commented on page 7 (e) and felt that this is impossible to meet. On (9) it should be deleted and item (k) it is not practiced on small ditch and should be deleted.

George Bradberry felt paragraph 1, page 8 should be dropped completely.

John Cook, representing trench boxes, stated item (5) should read "as defined by accepted engineering practice" at the end of that statement. Also reverse the words "protection equivalent" to read "equivalent protection". This refers to pre-designed trench boxes.

Alan Hollingsworth, of S. J. Grove & Co., felt that specific trenching requirements should stay such and not be put in general excavation so the contractor can readily identify what he is supposed to do.

Phil Becker, of Utilities Consolidated, commented on page 8 on ladders and the length they must come above the trench and would reply in writing. On (p), it should be 5 instead of 4 and approximately 24' and not 25' specifically. On (q), he felt the section should be deleted. On (t), Mr. Becker recommended it be deleted.

Bill White, of the Houston Contractors Association, commented on page 7 (j), it should be deleted per prior meeting held by OSHA on this subject. Dr. Yokel asked Mr. White to submit specific recommendations after the workshop is over since it was not brought to his attention that the meetings were held when he made the study.

Jerry Rosch, of Brown & Root, remarked on page 8 (o) where you approach the situation on rescue, you are limiting yourself when you indicate shoulder harness without any, etc. following it because in situations there are times, and it has been proven, that harnesses, if a man wears shoulder harness or parachute harness or whatever, it is very difficult to get him out if you are on a vertical pull. I suggest you reword it this way, "adequate life-saving equipment suitable for instant rescue, shall be required of each employee entering the shaft. Employee personal protective equipment should include, but not limited to, harnesses, wristlets, or other acceptable devices. You need some leeway on this.

Jack Brown, Ruff Construction Company, commented on page 9 on acceptable practices on excavations less than 5' and on all charts still show the angle of repose from the bottom of a trench. If 652 C is to remain in the standards, you are contradicting it with these type photographs on the angle of repose. I would prefer to keep 652 C as it is rather than the proposed regs.

Phil Becker of Utilities Consolidated then commented on page 9 concerning the definition of unfractured rock should be clear in that if rock, if cracked, it doesn't mean that it is going to fall down. He continued by commenting on No. 2, page 9. He asked why limit excavations to be shored to 20 or 24 feet? He recommended that it read 5 feet and deeper or 5 feet and below shall be shored.

Mr. Becker recommended that a qualified person handle excavations below 24 feet. He stated that if Mr. Yokel is going to recommend that it is required, that anyone other than a qualified person on the project to excavate below 24 feet in depth, that he would like to see that Mr. Yokel require, in the Federal Register, that engineers design it in the project, in the plans, and have a bid item for that particular portion of that project. He reemphasized his point by saying that a qualified person can handle excavations below 24 feet and that if Mr. Yokel is going to recommend that it be an engineer's design, that Mr. Yokel recommend that it also be a sublimited design in the plans and have a bid item for it.

Continuing on page 9, no. 2, part B, Mr. Becker commented that should be in the plans and have a bid item for that area. If not, then that should be a qualified person that shall determine the shoring. He takes objection to the way it is written.

On page 10, Mr. Becker objects to No. 3 in regard to 20-24 feet. Wants engineer put in parenthesis and qualified person in capital letters. Number one under scope, page 10, would like to see short term and long term eliminated.

Walter Ruff, Ruff Construction Company - Eliminate the short term and long term and leave it up to the contractor. He commented that short term and long term takes away from the way a contractor can effectively operate his project and costs are going to escalate.

Del Tally, Austin AGC - Commented on page 10, No. 1, and said that it applies to building contractors also. Almost all building excavations are open more than seven days for basements, etc. Delete short term and long term.

John Collins, Kent Nowlin - Commented that we do not have the ground water in this area of the United States, as they do in the Northern states, so saddle us with something that applies to Wisconsin is unfair and vice versa.

Phil Becker, Utilities Consolidated - Page 11, objects to (5) rock and (c) long term excavation.

Joe Kinnikin, New Mexico AGC - Page 11, Type A, stated the need to recognize native soils and conditions. Need to define it better and reword it.

Del Tally, Austin AGC - Page 11, Chart - A, 3/4:1 should be returned to 4:1.

Phil Becker, Utilities Consolidated - Page 12, commented on the drawing. It is not always benched like it is shown and could be confusing to OSHA inspectors.

Del Tally, Austin AGC - Page 12, commented that three foot maximum for bottom bench needs to be discussed. Why couldn't it be 5 feet?

Walter Ruff, Ruff Construction - Added to the wording of that clause (page 12), that if it were required, by the size of the conduit, to be deeper than four feet, the fact that you would have the safety factor there that a worker could get into the conduit in case of a collapse that you could take exception to the rule above four feet if the conduit so required for proper embedment. The pipe is strong enough to hold all of the dead (load, weight) of backfill, it will be a safe haven to a laborer in case of collapse, to crawl into it even if it were up to five feet.

Del Tally, Austin AGC - Asked why five feet would not be acceptable there (page 12)? Commented that it is confusing to field people in having different footages. Like requiring a ladder at four feet, shoring at five feet, why not say at five feet you need to do this? Just have one depth.

Alan Hollingsworth, S. J. Groves & Song - Commented on page 12. Industry is concerned about specifications from a contract owner that says he will place pipe in a specific type of performance activity. And then you indicate that we will shore; slope in accordance to given OSHA standard criteria. Hollingsworth said it seems to be a "Catch 22" situation for the contractors. Since OSHA regulations are not applicable to any governmental agencies, that puts the contractor in a situation where we have to conform, but the people writing the plans and specs do not. That makes the contractor put a price on a job that is not stipulated for him to do so. Contractors could do a better job if government agencies had to conform to the regulations and then there would not be an absence of this information available to the contractors.

Joe Kinnikin, New Mexico AGC - Page 11 and 12, depth of trench, commented that this will make the contractor shore in cities because of right-of-way requirements.

Del Tally, Austin AGC - Page 15, what is the alternative to drawing (c) showing heavy equipment? Usually you do not operate under the regime.

George Bradberry, Shoring Service, Page 15 (in diagrams A & C) recommended to shave off shoring extending above the top of the trench because it usually serves as no purpose.

Phil Becker, Utilities Consolidated. Page 16 (D) - Eliminate engineer. Commented that there could be several other shoring systems that would not have to be pre-designed by an engineer. Objects to the words "any other shoring systems".

Del Tally - Austin AGC - Page 16 (iii) - Take out the words "short term excavation". Second paragraph of (iii), two feet should be three feet.

Jack Mickel - Building and Construction Trades - Commented on the qualified person/engineer discussion. He stated that these standards are going to be used by everybody. The contractors at this meeting have qualified people, but there are other small contractors who do not and they will wind up killing people. That is why the term engineer is used. He raised the question of how do you define or determine a qualified person?

Alan Hollingsworth - S.J. Groves & Son - Added to the comments of Mr. Mickel. We cannot regulate morality. To add additional regulations to make others who do not comply with these rules is not going to achieve the goal. Mr. Hollingsworth also had a comment on Page 16 (iii). He was concerned about the wording "no soil movement".

Johnny Hall - SACC, Inc. - A piece of paper does not qualify anyone to do anything. The qualified person is the guy who is going to have to wind up doing it in the end. Recommend that licensing be left out completely.

Alan Hollingsworth, S. J. Groves & Sons, Page 18(A) last sentence. Asked the question if the last sentence in (A) is still a part of the definition? He does not want supplemental guidelines given to OSHA and not given to the contractor. Recommended having everything that's meaningful in the standards and not have any back-door guidelines that is not available to the industry, so we will know what to conform to and no one else will have a different viewpoint. He added that we do not want to overlook product liability.

Del Tally, Austin AGC - Page 18(H) - Need to leave out the word registered because some engineers are not registered engineers. Page 19(C) - Fractured Rock - commented that if it is not falling, it must be all right. Added that bolts and netting to prevent massive movement of the rock is pretty tough,

and doesn't know how that is going to work. Said that items (M) & (T) should be removed.

Bobby Hargroder - Du-Mor Enterprises - Believes that (L) on page 19 should read, fractured rock - rock which could spall or crumble when excavated with vertical slopes. Fractured slopes secured against mass movement and spalling. Recommends that competent person needs to be put in place of qualified person.

In reaching page 20 of the Working Draft of suggested revisions, Dr. Yokel stated that the other workshops did not cover anything other than the material up to page 20. He then asked for general comments from the audience.

Jack Brown - Ruff Construction Company - Asked if this is drafted up and we use all these technical people, engineers, and formulas, then when it is put into effect, are we still going to get these four week "wonder" compliance officers to come out and check all of this technical stuff?

Alan Hollingsworth - S. J. Groves & Son - Mr. Hollingsworth had these final comments. He started out by saying he was concerned with the reason why OSHA wanted to review and revamp sub-part P. It is his opinion that it is not for employee safety, but for looking at shoring and sloping characteristics. Unless there is statistical data that says the present standard has not worked and it is causing a significant amount of injuries and fatalities, then why are we revising something that we don't know why we are revising? He brought out the point that he knew of several instances where governmental agencies were performing these trenching and excavating requirements and there were fatalities and not even an OSHA compliance review was held because they are exempt from these regulations. He asked if the statistics available reflect the real picture of the people who must conform to OSHA regulations. Mr. Hollingsworth stressed that he did not

want to let factors become requirements unless they are based on sound findings.

Mr. Hollingsworth continued his comments by saying he fully understands that a lot of contractors have not conformed to the requirements of the standards and therefore the industry has suffered. But sub-part P of the regulations has sustained a high degree of success in achieving the goal in the field of trenching and shoring. The industry has had 11 years of use of the OSHA regulations and has thus improved the safety factors to establish an acceptable set of industry practices. If new proposed standards are accepted, we will again start the litigation process to establish a new set of legal precedence. Mr. Hollingsworth commented that in light of the economic impact of the construction industry and the government, we cannot afford another 11 years to establish new legal precedence only because we want to replace the industry expertise with more educational certificates.

Another concern of Mr. Hollingsworth is it appears whenever there are factors outside the proposed standard practices, present work must cease until a registered engineer can establish the certified criteria and procedures to insure safety factors for all interested parties. Employees will be sent home without pay and can affect additional crews that will also be sent home. Unless the contractor has a registered engineer on his payroll, which many do not, he must seek to find one to take the responsibility to establish the new procedure as established by the regulations. The amount of delay this will cause is an unknown factor, but it can only cause costs to soar and have the loss of valuable work time. A registered engineer cannot insure the safety implied by the proposed regulations.

Mr. Hollingsworth then had a few critical questions he asked. What statistics are available to show that the current regulations have done to escalate the cause of injuries or fatalities? If changes are warranted,

has a cost benefit analysis been made to allow for a better understanding of the regulatory impact?

In summation, Mr. Hollingsworth said that if the short set of regulations has not created significant problems for management and the safety of their employees, then let's not consider efforts to reinvent the wheel and redundancy.

After those comments, Dr. Yokel made a short statement and turned the meeting over to Bill Driskill. There being no further questions or comments, the meeting was adjourned.