



Shotcrete Preconstruction Meeting Agenda

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Project		Date	
General Contractor		Permit Number	
Project Superintendent		Concrete Supplier	
Reinforcing Steel Placer		Mix Design Number	
Concrete Placing Sub.		Concrete Strength	
Structural Engineer		Cement Content	
Shotcrete Contractor		Special Inspector	
COB Building Inspector		Other:	

Scope of Work

Structural Members

Please indicate the members to receive shotcrete:

- ☐ Basement walls and/or site retaining walls
- ☐ Top-down construction (If this is selected, review [Appendix A](#))
- ☐ Interior/exterior shear walls*
- ☐ Pilasters or in-wall columns* (if this is selected, go to the [Pilaster/Column](#) section)
- ☐ Other: _____

Has the structural engineer of record or designee approved these structural members and areas to be placed using shotcrete: ☐ Yes ☐ No

Important: Items with an asterisk () require approval by the COB Building Official prior to shooting. General Contractor should account for this and submit accordingly for review and approval.*

Typical Situation

Please be specific regarding typical walls. Include reinforcement steel size, pattern, spacing, and orientation that will be encountered by the nozzleman for most of the project.

Typical wall thickness: _____

☐ Single ☐ Double Curtain

Where is the curtain located in the wall? _____

Clearances: Inside Face: _____ Outside Face: _____

Describe the reinforcement, including dowels or other embeds and such.

Questions: _____

Worst Case Situation

Please be specific regarding typical walls. Include reinforcement steel size, pattern, spacing, and orientation that will be encountered by the nozzleman for most of the project.

Typical wall thickness: _____

☐ Single ☐ Double Curtain

Where is the curtain located in the wall? _____

Clearances: Inside Face: _____ Outside Face: _____

Describe the reinforcement, including dowels or other embeds and such.

Questions: _____

Pilasters/Columns, Beams/Corbels, Footings/Slabs *

Please be specific regarding reinforcement steel size, pattern, spacing, and orientation that will be encountered by the nozzle man for members such as pilasters/columns, beams/corbels, and footings/slabs. Include scope of work information such as ties and stirrups and all embedded items like weld plates, plumbing, mechanical, electrical, etc. *Important: Items with an asterisk (*) require approval by the COB Building Official prior to shooting. General Contractor to account for this and submit accordingly for review and approval.)*

Overhead/Above Shoulder Work

Is overhead or above shoulder height shooting required? ☐ Yes ☐ No. Indicate reasons for overhead or above shoulder work:

Is shotcrete to be placed under up to existing floor? ☐ Yes ☐ No. Indicate preparation requirements for existing floor:

Is bird's mouth procedure to be used? ☐ Yes ☐ No. If yes, list the nozzle men who will perform the procedure:

Pre-Placement

What is the most difficult part of this work from the contractor's point of view?

Floor or ceiling dowels present a problem for the nozzleman. Where floor or ceiling dowels are projecting into the path of the nozzleman and crew, can the dowels be placed upside down (see Figure 1) and cast with the slab so the tails protrude into the wall above or can the tails of the dowels that protrude into the path of the nozzleman be tied together ("tee-peed"—see Figure 2) so there are clear spaces for the nozzleman to access the wall?

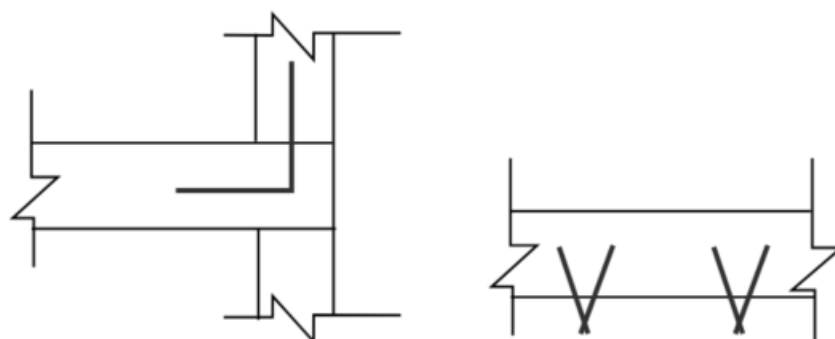


Figure 1 and 2: Turning Tails Up (Section View) and Tee-Pee'ing (Plan View)

Reinforcement

The maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction test panels that adequate encasement of larger will be achieved. (IBC 1908.4)

Where No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of 2-1/2 inches. When bars larger than No. 5 are permitted, there shall be a minimum clearance of 6 diameters of the bars used. Where two curtains of steel are provided, the curtain nearer the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of 6 bar diameters. (IBC 1908.4.2)

Lap splices of reinforcing bars shall be the **noncontact lap splice method** with a minimum of 2 inches between bars and not more than 6 inches apart. (IBC 1908.4.3).

The use of **contact lap splices** necessary for support of the reinforcing is permitted where approved by the building official, based on satisfactory preconstruction tests that show that adequate encasement of the bars will be achieved, and provided that the splice is oriented so that a plane through the center of the spliced bars is perpendicular to the surface of the shotcrete. (IBC 1908.4.3)

Will contact lap splices be used in this project? ☐ Yes ☐ No If contact lap splices are going to be used in this project, the preconstruction test panel shall be built with the contact lap splices.

Furthermore, the contact lap splices shall be specified in the COB-approved plans. What detail shows the contact lap splices? _____

Where bars must be tied together, they should be tied so that from the nozzleman’s viewpoint only one bar is visible. Wire chairs (spiders) or open-legged plastic chairs should be used. Do not use dobies or heavy plastic chairs (lawn furniture) with angled legs and cross braces.

Items must be more securely fastened for shotcrete than for traditionally placed concrete. The shotcrete crew will refuse to place shotcrete in any area where loose rebar or embedded items are discovered. The special inspector will test every area to ensure no movement will occur during shotcrete placement. Forms must be tight and unyielding.

Joints

When shooting stops for the day, when work will be unfinished, and/or construction joints are required on long walls, taper construction joints at approximately 45 degrees from the receiving surface. Form joints by cutting plastic shotcrete. Joints at slab intersections shall be made at 90 degrees. Roughen shotcrete in the joint face while it is still plastic. (ACI 506.2 3.2.1; IBC 1908.7)

What is the plan for this project?

Back Form

Back form consists of:

- ☐ Earth
- ☐ Lagging
- ☐ Temporary Shotcrete
- ☐ CMU
- ☐ Clay Brick
- ☐ Clay Tile
- ☐ Wood
- ☐ Other: _____

Is a mechanical bond required between the form and the shotcrete? ☐ Yes ☐ No

If yes, does the form need to be wetted or saturated prior to placing the shotcrete?

If no, how will the form be sealed off?

Approximate Cubic Yardage of Shotcrete Work

Walls: _____ Pilasters/Columns: _____ Beams: _____

Corbels: _____ Footings: _____ Slabs: _____

Maximum yardage per pump and placing crew per 8-hour shift: _____

Estimated start date of work: _____

The most difficult part of this work is: _____

Accessibility and Site Conditions

The nozzleman must have a reasonably smooth flat surface to stand on. The area in front of the wall should not be used to store materials or equipment. Scaffolding should allow for interim levels of planking.

Standing water needs to be removed and only the shotcrete crew and inspection teams should be near the work area. During the rainy season, all standing water must be either diverted away from the nozzlemen's area or pumped. Contractor shall be responsible for providing weather protection, ventilation, and lighting as required.

Conditions for this job:

Cold and Hot Weather Requirements

In **cold** weather, shooting may only proceed when the ambient temperature is more than 40°F. Shooting shall stop when the ambient temperature is 40°F and falling unless measures are taken to protect the shotcrete. Shotcrete material temperature, when shot, shall not be less than 50°F. Do not place shotcrete against frozen surfaces. (ACI 506.2)

In **hot** weather, do not place shotcrete when temperature is above 95°F. The temperature of reinforcement and receiving surfaces shall be below 90°F prior to shotcrete placement. (ACI 506.2)

Qualifications of the Shotcrete Contractor

List at least (5) recent completed shotcrete projects of similar size and complexity. (ACI 506.2 1.4.1.9) Is the shotcrete contractor acceptable to the structural engineer of record? ☐ Yes ☐ No

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

Nozzlemen and blow pipe operators proposed for this project.

Important: Attach **current copies of the ACI Nozzleman Certification** for each nozzleman listed below. Indicate if the trainees will be used.

Nozzlemen	Blow Pipe Operators

Is this project eligible for training? ☐ Yes ☐ No Will the EOR allow training? ☐ Yes ☐ No

If yes, list the names of the trainees and limitations for the trainees:

Preconstruction Qualifying Test Panels

As noted under [Reinforcement](#), the maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction test panels that adequate encasement of larger bar will be achieved. Are preconstruction test panels required for the project by the EOR? ☐ Yes ☐ No

Important: Among other things, **a preconstruction test panel may still be required** for No. 5 bars based on the configuration of the reinforcement (e.g. spacing, etc.), if the nozzleman is not certified, etc. Please check with the COB Building Inspector for confirmation.

Are preconstruction test panels required for the project by the COB? ☐ Yes ☐ No

Test panels shall be shot, cured, cored (or sawn), examined and tested prior to the commencement of the project. (IBC 1908.5) Typical preconstruction test panels shall be 4 feet x 4 feet x thickness of the member. (COB Policy)

Is the owner requesting that the special inspector to be present for the preconstruction qualifying test panels? ☐ Yes ☐ No

If not, how will the certification of the preconstruction test panels happen?

Construct preconstruction test panels for the examination by the EOR, the COB Building Inspector, and the special inspector (if requested by the owner) prior to the placement of shotcrete. The general contractor shall notify the engineer of record, the COB Building Inspector, and the special inspector (if requested by the owner) of the time and place of the preconstruction test testing.

The sample panels shall be representative of the project and simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing unless substitute equipment is approved by the building official.

Reports of the preconstruction test panels shall be submitted to the EOR and COB Building Inspector. (ACI 506.2 1.5; IBC 1908.5) The grading of the cores shall be approved by the EOR—see [Appendix B](#). Only nozzlemen with a test panel mean core grade as approved by the EOR shall be allowed to place job shotcrete.

What is the mean core grade required by the EOR? _____

For preconstruction test panels required for nozzleman/blow pipe operator qualifications, include the number, size of panels, and location of panels, if other than jobsite:

Curing Procedures

During the curing periods specified herein, shotcrete shall be maintained above 40°F and in moist condition. (IBC 1908.9)

Initially, shotcrete shall be kept continuously moist for 24 hours after shooting is complete unless sealed with an approved curing compound. (IBC 1908.9.1) Will the shotcrete be sealed with an approved compound? ☐ Yes ☐ No

Final curing shall continue for seven days after shooting, or for three days if high-early-strength cement is used, or until the specified strength is obtained. Final curing shall consist of the initial curing process, or the shotcrete shall be covered with an approved moisture-retaining cover. (IBC 1908.9.2)

Natural curing shall not be used in lieu of that specified in this section unless the relative humidity remains at or above 85 percent and is authorized by the engineer of record. Will this project use natural curing and has it been approved by the EOR? ☐ Yes ☐ No

Please describe any additional curing procedures that will be used for this project:

Placement

Proper shooting procedures shall be maintained throughout the project. No rebound shall be used, and any drop offs or sloughing shall be removed, including all material above the damaged area. Overspray must be blown off steel while concrete is plastic where construction or cold joints occur. If overspray hardens, it must be removed before subsequent shotcrete placement.

No one is permitted to climb on or otherwise disturb the reinforcing steel during or after shotcrete placement. If vibrations are detected in the rebar or forms, work will be stopped until the problem has been eliminated. Contractor to coordinate with other trades for construction activities adjacent to the locations where shotcrete placement is occurring. Water migrating in or around shotcrete placement must be diverted until shotcrete has achieved its final set.

It is the general contractor's responsibility that:

1. The ironworkers have finished placing and securing the reinforcing steel.
2. The shotcrete contractor has placed the guide wires.
3. Sacrificial steel is in place. (See section [Special Inspection and Testing](#))
4. The special inspector has approved it all, prior to the scheduled start of shooting.

Special Inspection and Testing

Test Panels for Testing During Construction

Special inspection and tests of shotcrete shall be in accordance with ACI 506.2. Provide copies of all test results to the contractor, owner, architect, engineer, concrete supplier and building inspector. (ACI 506.2 1.6.6)

Compression strength tests are required for each 50 cubic yards of shotcrete or portion thereof placed each day from each shotcrete mix. Strength test panels shall be nominal 16 inches x 16 inches x 5 inches. At the discretion of the EOR, 12 inches x 12 inches panels may be used. (ACI 506.2 1.6.3.1; IBC 1908.10)

Testing for Shotcrete Bond to Substrate, Flexural Strength, and Toughness

Is testing for shotcrete bond to substrate, flexure strength, and toughness required for this project? ☐ Yes ☐ No

If yes, describe the procedure (including required locations, number of samples, etc.) to be used in accordance with ACI 506.2 1.6.3 and 1.7.6.

Testing In-Place Shotcrete

Unless the contract documents and COB-approved plans stipulate that in-place shotcrete test specimens are to be used, are in-place test specimens required? ☐ Yes ☐ No

If yes, EOR to specify the number of core specimens and required locations:

If required, but not specified above by the EOR, a minimum of 3 sacrificial steel locations for each day shotcrete is placed shall be used. Furthermore, it is recommended that sacrificial steel be installed in the middle of the wall horizontally and 3 feet from any return or opening. More locations may be required if additional nozzlelemen are utilized.

Is this acceptable to the EOR? ☐ Yes ☐ No

The contractor must be able to locate sacrificial steel intersections precisely after the shotcrete is placed. Cores shall be 3-inch diameter and pass through all steel but not through the cover concrete, waterproof membrane, or form. Cores should not be cut until the shotcrete has been in place for 48 hours.

Where cores are required from in-place work as part of the shotcrete qualification procedure, no additional shotcrete shall be placed until approval is given by the EOR and the building inspector. Confirm if work will stop until the in-place cores are evaluated by the EOR. ☐ Yes ☐ No

Other Issues

Appendix A: Top-Down Shotcrete Issues

Open cut restrictions: _____

Horizontal construction joints must be sloped so that the back (earth) side is lower than the front (inside) face of the wall.

Only clean, sandy, free draining soils may be used to form horizontal construction joints. If the naturally occurring soils are not clean sandy soils, then clean damp sand will be imported and placed a minimum of one-inch thick on top of the existing soil at the joint.

Final configuration of the earth surface at the horizontal construction joint will be checked and repaired by hand approximately 10 feet in front of the nozzleman as they work down the wall. This will be done by: _____

Under no circumstance will shotcrete be placed on a muddy or dusty soil base or a soil or sand base that has not been hand tamped to a tight, uniform consistency. This soil must support fresh shotcrete without moving and breaking the bond between the shotcrete and the resteel.

A horizontal, impervious joint backing material such as a drainage fabric or tar paper must be located at the horizontal construction joints and must extend about one foot above and below the joints. This allows power washing of the joint without displacing the soil behind the joint.

After excavation, horizontal construction joints (soffits) will be cleaned of all dirt, mud, rocks (more than 1.5 inches in diameter), roots or other organic material by power washing and/or air pressure and/or hand scraping and brushing.

Any soffit area which does not slope down with the lowest part in the back (earth face) will be chipped and contoured by hand to the proper configuration.

Blow pipe operators will keep the air stream away from unprotected earth surfaces and make every effort not to blow dirt into the shotcrete as it is being placed. Any area known or suspected of including dirt will be removed and reshot.

The excavator, special inspector and shotcrete crew will pay special attention to the spacing of the reinforcing steel to assure the horizontal construction joints occur between the grid pattern, so every horizontal bar is completely encapsulated in concrete in one lift.

The minimum length of wall that will be complete prior to the shotcrete contractor starting work is _____. The special inspector will notify the City of Bellevue if there is not compliance with this minimum.

An adequate work bench is necessary for proper footing for nozzleman. Flat, firm work area extending six feet from the wall is best. Loose soil and/or a sloped or cluttered work surface can prevent the nozzleman from maintaining proper shooting techniques.

Shotcrete works best where the pump can be situated within 200 feet of the application area. Pumping shotcrete over 300 feet is not recommended since it can adversely affect the consistency of the shotcrete.

Appendix B: Shotcrete Grades

Grade 1: Shotcrete specimens are solid; there are no laminations, sandy areas, or voids. Small air voids with a maximum diameter of 1/8 in. and maximum length of 1/4 in. are normal and acceptable. Sand pockets, or voids behind continuous reinforcing steel are unacceptable. The surface against the form or bond plane shall be sound, without a sandy texture or voids.

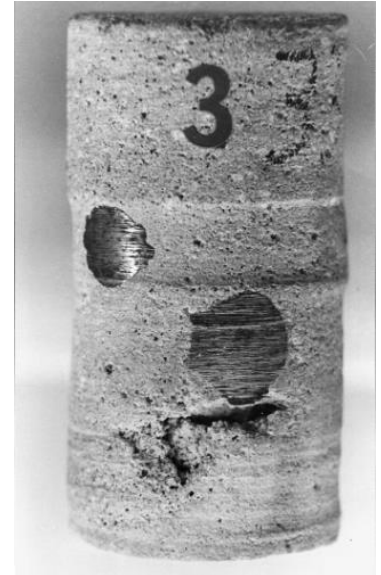
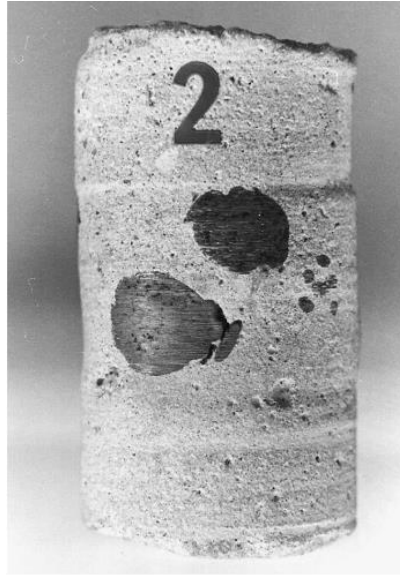
Grade 2: Shotcrete specimens shall have no more than two laminations or sandy areas with dimensions not to exceed 1/8 in. thick by 1 in. long. The height, width and depth of voids shall not exceed 3/8 in. Porous areas behind reinforcing steel shall not exceed 1/2 in. in any direction except along the length of the reinforcing steel. The surface against the form or bond plane shall be sound, without a sandy texture or voids.

Grade 3: Shotcrete specimens shall have no more than two laminations or sandy areas with dimensions exceeding 3/16 in. thick by 1-1/4 in. long, or one major void, sand pocket, or lamination containing loosely bonded sand not to exceed 5/8 in. thick and 1 1/4 in. in width. The surface against the form or bond plane may be sandy with voids containing overspray to a depth of 1/16 in.

Grade 4: The core shall meet in general the requirements of Grade 3 cores, but may have two major flaws such as described for Grade 3 or may have one flaw with a maximum dimension of 1 in. perpendicular to the face of the core with a maximum width of 1-1/2 in. The end of the core that was shot against the form may be sandy and with voids containing overspray to a depth of 1/8 in.

Grade 5: A core that does not meet the criteria of core grades 1 through 4, by being of poorer quality, shall be classified as Grade 5.

(See the page that follows for visual representations.)



Shotcrete Cores: Grades 1 – 5 (Top Left to Bottom Right)

Source: Specification for Shotcrete (ACI 506.2-95)