

BRIDGE REHABILITATION

Maintaining
and
Repairing Existing
Structures

Types of Bridge Rehabilitation

- ◆ Bridge Deck Overlays
- ◆ Bridge Deck Widening or Replacement
- ◆ Making Bridge Decks Continuous and/or Composite
- ◆ Expansion Device Repair/Replacement
- ◆ Bridge Rail Retrofits
- ◆ Bridge Repainting
- ◆ Epoxy Chip Seals
- ◆ Bearing Repair/Replacement
- ◆ Substructure Repair

Original Construction Plans and Shop Plans

Bridge Rehabilitation Project Plans are Generally Developed Using Original Constr. Plans and Shop Plans. Therefore:

- ◆ Verify all existing dimensions and details.
- ◆ If something is found that deviates from plans, notify Office of Bridge Design before allowing work to continue.

Bridge Rehabilitation and Maintenance

These Projects Can be More Difficult and Complex Than New Construction.

- ◆ Carefully review plans sequence.
- ◆ Several types of rehabilitation on one structure.
- ◆ Rehabilitation of several structures may be included in one project.

Concrete Repair

Most Types of Bridge Rehabilitation/Repair Require Some Type of Concrete Repair:

- ◆ Breakout of Existing Concrete and Placing New
- ◆ Grouting
- ◆ Epoxy Injection of Cracks

Concrete Breakout

- ◆ Thoroughly Review Plans for Limits of Breakout.
- ◆ Sawcut Perimeter of Breakout Area.
- ◆ Sandblast Contact Surface Before Placing New Concrete.
- ◆ Care Required Around Resteel to be Re-used.
- ◆ Make Sure Equipment is Suitable for Type of Breakout.

Concrete Breakout

- ◆ “EXTREME” Care Required Around Other Structure Components

Absolutely No Nicks or Gouges Allowed on Steel Girders

Concrete Repair

Immediately Notify the
Bridge Construction Engineer
of

Any Inadvertent Damage to
Resteel, Girders, or Other Structure Components
PRIOR to Continuing Work

Reinforcing Steel

Resteel That is to be Re-Used Shall:

- ◆ Have concrete removed and be abrasive blast cleaned.
- ◆ Shall be properly straightened.
- ◆ Shall be relatively free of gouges.
 - ◆ Gouges shall be no deeper than 1/4 bar diameter.
 - ◆ Several consecutive bars damaged should be repaired/replaced
- ◆ Cut as required by plans to assure proper splice length.

Field Bending Resteel

- ◆ Bars Need to be Bent Around a Sufficient Radius.
 - ◆ Too sharp of radius will result in a kink, which essentially means that the bar has yielded.
- ◆ Smaller Bars (#4 & #5) Are Usually Bent Easily.
- ◆ Larger Bars May Require Heat.
 - ◆ Heat to a dull red
 - ◆ Cool Bar at Air Temp.
 - ◆ (Cooling with water will change physical properties)

Resteel Bending Radius

Bar Size	Radius (inches)
#4	3
#5	3 3/4
#6	4 1/2
#7	5 1/4
#8	6
#9	9 1/2
#10	10 3/4
#11	12



Epoxy Coating

Plans May Require Applying Epoxy Coating to Existing Resteel.

- ◆ Abrasive blast clean bar immediately prior to application.
- ◆ Use Epoxy Touch-up Coating Material supplied by a manufacturer of epoxy coated resteel.

(Do Not Allow Coatings from Spray Cans)

- ◆ Make sure all surfaces are adequately coated.
- ◆ Cure for 24 hours or as per manufacturer's recommendations, whichever is more stringent.

Mechanical Rebar Splices

Used to Splice Resteel When a Conventional Lap Splice is not Practical.

- ◆ Use only when specified or approved by Bridge Constr. Engineer.
- ◆ Must be capable of developing 125% of the yield strength of bar. (Make sure intended for Grade 60.)
- ◆ Epoxy coated or other approved corrosion resistant material required when splicing epoxy coated resteel.



Grout Repairs

- ◆ Used When Concrete Breakout and Replacement is not Structurally Necessary.
- ◆ Used in Voids and Gaps That Are Large Enough to Allow Cleaning and That Can be Easily Accessed.
- ◆ Used to Repair “Honeycomb.”

Surface Preparation

- ◆ Remove All Loose or Foreign Material.
- ◆ Chip Away Any Unsound Concrete.
 - ◆ Honeycomb area should be chipped out to sound concrete.
- ◆ Flush Surfaces With Water and Allow to Dry to a Surface Dry Condition.

Grout

- ◆ Sand/Cement Grout is Used Unless Otherwise Specified or Approved (*Section 460.3.R*).
- ◆ When Commercial Grout is Specified or Approved, Grout Shall Conform to the Following:
 - ◆ Portland Cement Based
 - ◆ Non-Metallic (*No Aluminum Powder*)
 - ◆ Non-Shrink

Placement of Grout

- ◆ Grout Should be Tightly Packed Into All Recesses and Holes to Completely Fill the Voids.
- ◆ Grout Should be Wet Cured for not Less Than 3 Days, or as Required by the Manufacturer's Recommendations.

Epoxy Injection

Tighter Cracks and Voids Are Repaired by Injecting Epoxy Resin Adhesive Into Them.

- ◆ Clean concrete surface along crack.
- ◆ Blow foreign material out of crack using compressed air.
- ◆ Injection ports are installed in the crack at intervals.
- ◆ Crack is sealed between injection ports.
- ◆ Epoxy is injected at lower port until epoxy runs out of next port up.
- ◆ Lower port is sealed and process continued in next port up.

Epoxy Resin Adhesive

Epoxy Resin Adhesive Shall Conform to all
Provision Including Gel Time and Epoxy Content
AASHTO M235 (ASTM C881)
and Shall be of the Proper Type, Grade and Class.

Epoxy Resin Adhesive

Type:

- ◆ Separates epoxies by intended application
- ◆ Most often specified in the plans (Type IV generally specified)

Grade:

- ◆ Separates epoxies by flow characteristics
- ◆ Grade 1 is low viscosity (very flowable)
- ◆ Grade 2 is medium viscosity
- ◆ Grade 3 is non-sagging

Class:

- ◆ Defines allowable temperature ranges for use

Installing Dowel Bars In Concrete

Many Types of Repairs Require That Holes
be Drilled Into Concrete and Dowel Bars
be Epoxied Into the Holes

Dowel Bar Installation Procedures

- ◆ Drill Holes in Concrete to Diameter and Depth Specified
- ◆ Clean Out Hole With Compressed Air
- ◆ Make Sure That Epoxy is mixed According to manufactures Specifications
- ◆ Beginning at Back of Hole, Fill Hole 1/3 to 1/2 Full of Epoxy
- ◆ Insert Dowel Bar by Rotating Bar While Inserting Into the Hole. (*Dipping bar into epoxy or painting epoxy onto bar and then inserting is NOT allowed.*)

Bridge Deck Overlays

Low Slump Dense Concrete



Low Slump Dense Concrete Overlay

Low Slump Dense Concrete (LSDC) is Most Common Type of Bridge Deck Overlay Used.

- ◆ Is a very stiff, low slump, high density, low permeability concrete.
- ◆ Protects against chloride penetration.

Surface Preparation

The Bond Between the Bridge Deck and the Overlay is Critical, Therefore, Special Attention Needs to Given to Proper Surface Preparation.

Equipment Required

- ◆ Scarifier or Milling Machine
- ◆ Power Hand Tools
 - ◆ 30 lb. Jack Hammers
 - ◆ 15 lb. Chipping Hammers
- ◆ Concrete Saw
- ◆ Abrasive Blasting Equipment

Types of Concrete Removal

Several Types of Concrete Removal Are Required to Properly Prepare the Surface and to Remove Delaminated Concrete.

Type 1A Removal

Type 1A Removal Intended to Remove Surface Contaminants and to Provide a Sound Bonding Surface

- ◆ Consists Primarily of Scarifying 1/4 Inch Off of Entire Deck (*Curb Face and Curb Lines Done by Hand*)
- ◆ May Also Include Scarification of Approaches
- ◆ Additional Depth of Scarification May be Specified in Some Areas to Improve Profile
- ◆ Accurate Grade Control During Scarification is Essential



Type 2A Removal

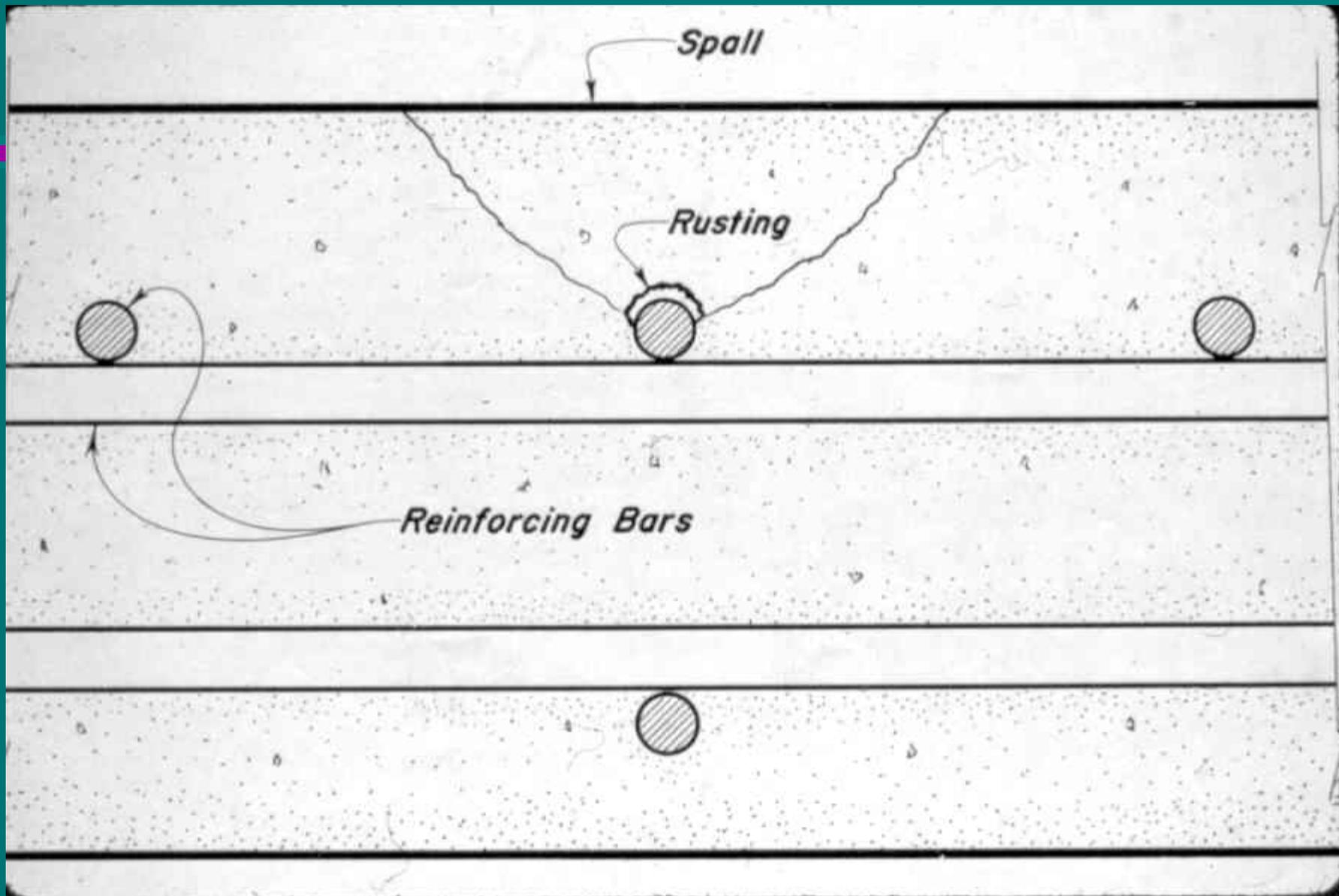
- ◆ Type 2A Removal is intended to be used when removing an existing overlay
 - ◆ Consists of additional passes with scarification equipment to remove thin unsound areas of previous overlay
 - ◆ Only used when ordered by the Engineer
 - ◆ Extreme care must be used to assure no damage to resteel
 - ◆ Use cover meter prior to scarification
 - ◆ Stop if steel is encountered

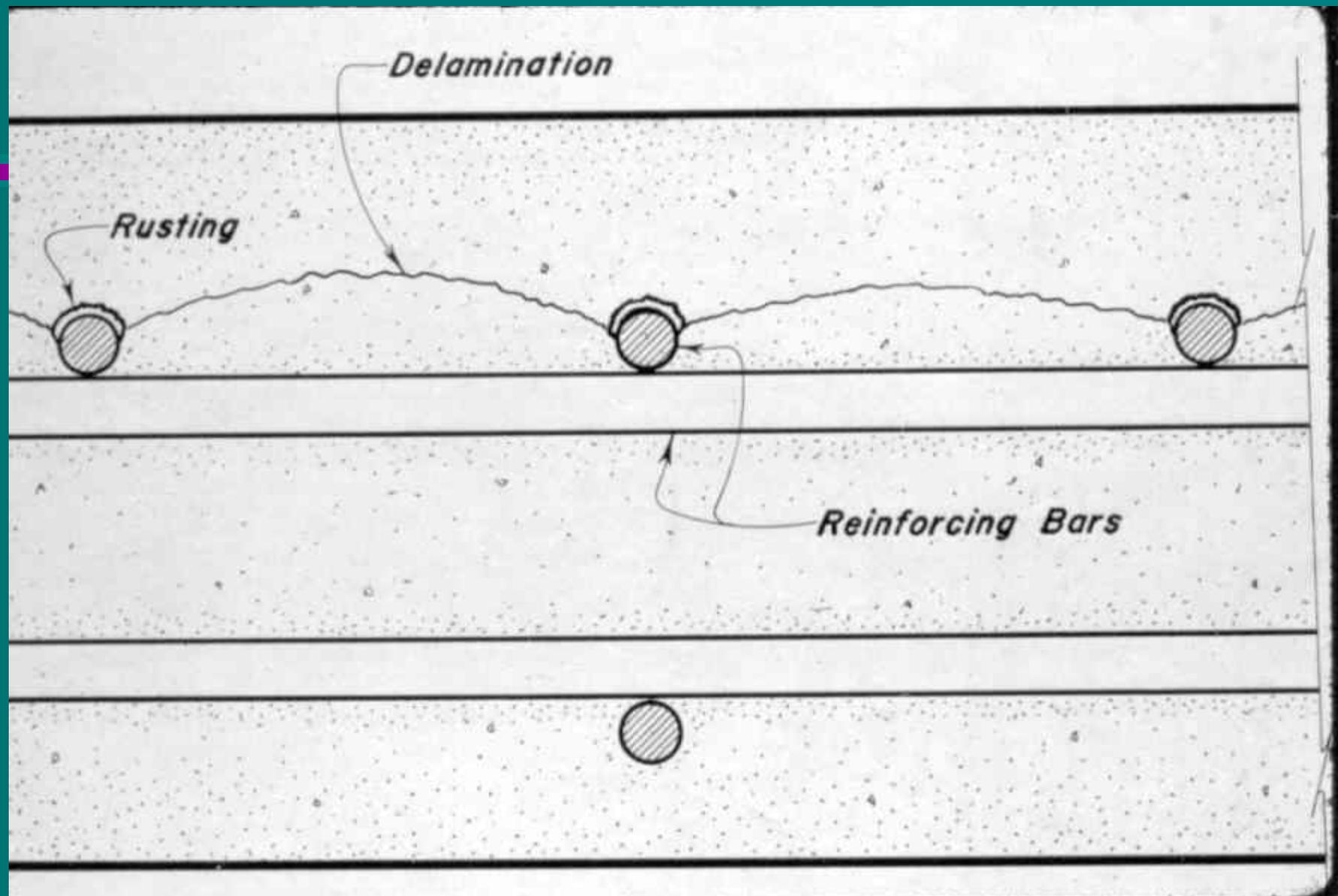


Extra Depth Removal

Additional Concrete Removal May be Required to Remove Delaminated Concrete.

- ◆ Areas of Delaminated Concrete Are Determined by Sounding:
 - ◆ Chain Drag
 - ◆ Hammer
- ◆ These Areas Are Marked Out, The Removal Done, and Areas Measured and Documented for Payment.





Type 1B Removal

- ◆ Type 1B Removal is Only Done in Areas Determined to be Delaminated and That Have Been Marked Out.
- ◆ Depth of Type 1B Removal is From the Top Deck Surface Down to the Top of the Top Mat of Resteel.
- ◆ After Type 1B Removal is Complete, the Areas Are Re-Sounded to Determine if Additional Depth of Removal is Required.



Type 1C Removal

- ◆ Type 1C Removal is Done Only in Areas Where Delaminated Concrete is Found to be Deeper Than the Top of the Top Mat of Resteel.
- ◆ The Bottom Limit of the Type 1C Removal Will Vary Anywhere From the Top Limit Down to the Top of the Bottom Mat of Resteel.
- ◆ These Areas Should be Re-Sounded Periodically During Removal, and Removal Should Cease When Sound Concrete is Encountered.



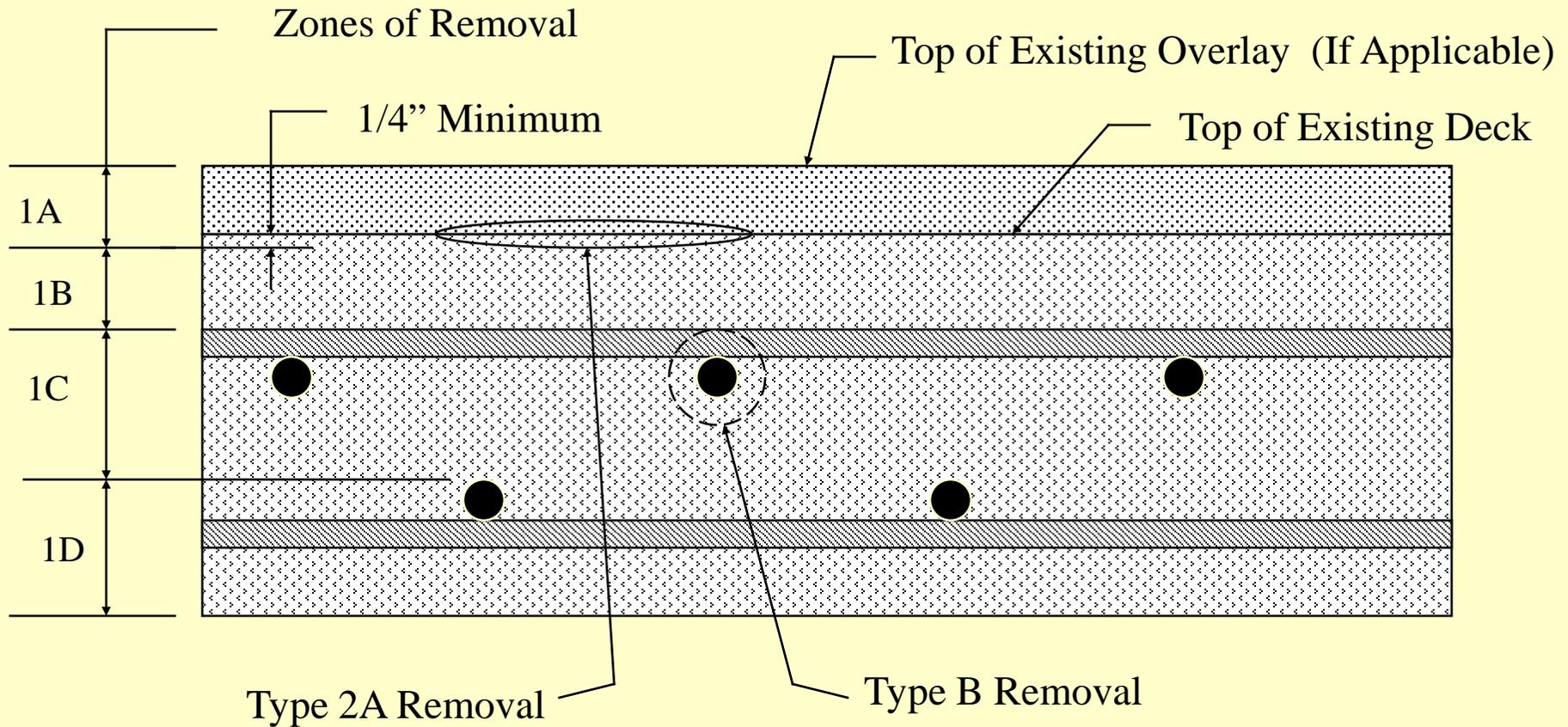
Type 1D Removal

- ◆ Type 1D Removal is Done Only in Areas Where Delaminated Concrete is Found to be Deeper Than the Top of the Bottom Mat of Resteel.
- ◆ Areas of Type 1C Removal Are Re-Sounded and if Delaminated Concrete is Found, These Areas are Then Removed to Full Depth.

Type B Removal

- ◆ Type B Concrete Removal is the Removal of Concrete From Around the Periphery of Resteel.
- ◆ Is Generally Used When an Isolated Rebar Has Lost Concrete Bond on More Than 1/2 of the Circumference.
 - ◆ Type 1C Removal may be ordered by the Engineer in lieu of Type B Removal.
- ◆ Removal Should Result in a Minimum of 3/4 Inch Clearance Around the Bar.

Zones of Removal



Concrete Removal Specification Requirements

Scarified Surface Shall be Continuously Kept Clean.

- ◆ Upon Completion of Type 1A Removal (Scarification):
 - ◆ Traffic is NOT permitted on the scarified surface.
 - ◆ Construction equipment on the scarified surface should be minimized.
 - ◆ Equipment that is allowed on deck shall be equipped with diapers to prevent oil or grease from contaminating surface.
 - ◆ If grease or oil contamination does occur, additional scarification, removal, or detergent cleaning is required.

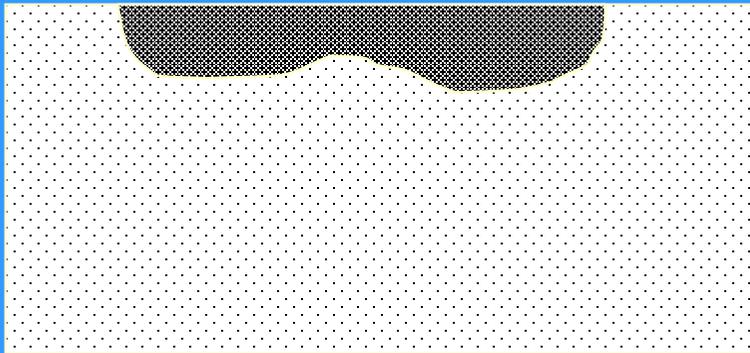
Concrete Removal Specification Requirements

- ◆ Jack Hammers No Heavier Than 30 Lbs. Are Allowed for Type 1B Removal (*Down to Top Mat of Resteel*).
- ◆ Jack Hammers No Heavier Than 15 Lbs. Are Required When Working Around Resteel.
- ◆ Extreme Care Shall be Taken to Prevent Damage to Resteel

Concrete Removal Specification Requirements

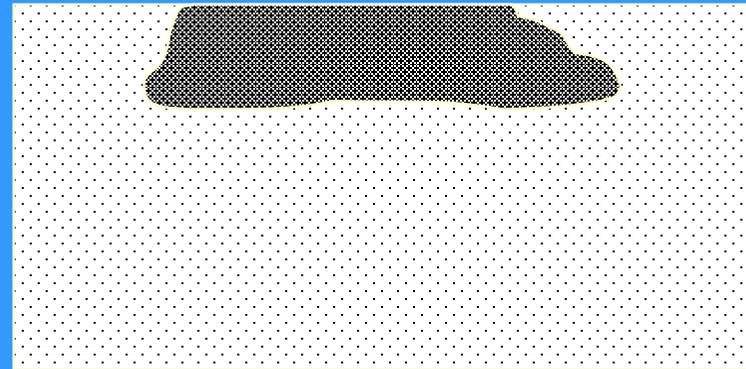
- ◆ Edges of Removal Area Shall be Nearly Vertical.

CORRECT



Nearly Vertical or Slightly
Tapering Inward.

INCORRECT



Reverse Taper

Too Much Removal?

◆ If More Than 30% of:

◆ The longitudinal bars on a continuous concrete bridge

OR

◆ The transverse bars on a girder bridge

Are Freed-Up in Any 10 Foot Wide Area, Contact the Bridge Construction Engineer Before Continuing Removal



Abrasive Blast Cleaning of Deck

- ◆ No More Than 24 Hours Prior to Concrete Placement, the Deck Surface Shall be Abrasive Blast Cleaned
 - ◆ To Remove Contaminants
 - ◆ To Enhance Bond
- Re-Blasting is Required When:
 - ◆ Delays result in exceeding 24 hour limitation
 - ◆ Rain or other contamination occurs after initial blasting
- ◆ Thoroughly Blow Off Deck With Compressed Air



Full Depth Holes

Deep Holes Created By Type 1C / 1D Removal:

- ◆ Require Shoring From Bottom Side of Deck.
- ◆ Are Filled Up to the Level of The Scarified Surface Prior to Placement of Low Slump Dense Concrete Overlay.
 - ◆ Use Class A45 Concrete
 - ◆ Cure With Wet Burlap and Poly Sheeting Until 2000psi

Concrete Mix Design

Low Slump Dense Concrete Mix Design Per Section 550 of Standard Specifications

Absolute Volume Per Unit Volume

Course Aggregate	0.312088
Fine Aggregate	0.312088
Air	0.060000
Water	0.160255
Cement	<u>0.155569</u>
	1.000000

Concrete Mix Adjustments

Mix Proportions Need to be Adjusted for Actual
Specific Gravity of Materials

Specific Gravity = (Material Density) / (Density of Water)

Example Mix Adjustment

Specific Gravities

* Rock = 2.65

* Sand = 2.65

⊗ Cement = 3.14

Water = 1.00

- * Specific Gravity may be obtained from Office of Materials.
- ⊗ From Cement Cert's. (Usually \cong 3.14)

Example:

Rock: $2.65(62.4)(27)(0.312088) = 1394$ Lbs.

Sand: $2.65(62.4)(27)(0.312088) = 1394$ Lbs.

Cement: $3.14(62.4)(27)(0.155569)$
 $= 823$ Lbs.

Water: $1.00(62.4)(27)(0.160255) = 270$ Lbs.

- ◆ *No Adjustment for Air Required*
- ◆ *Still Need to Adjust for Moisture in Aggregate.*

Mobile Concrete Mixer

Specifications Require That Concrete Be
Proportioned & Mixed

By A

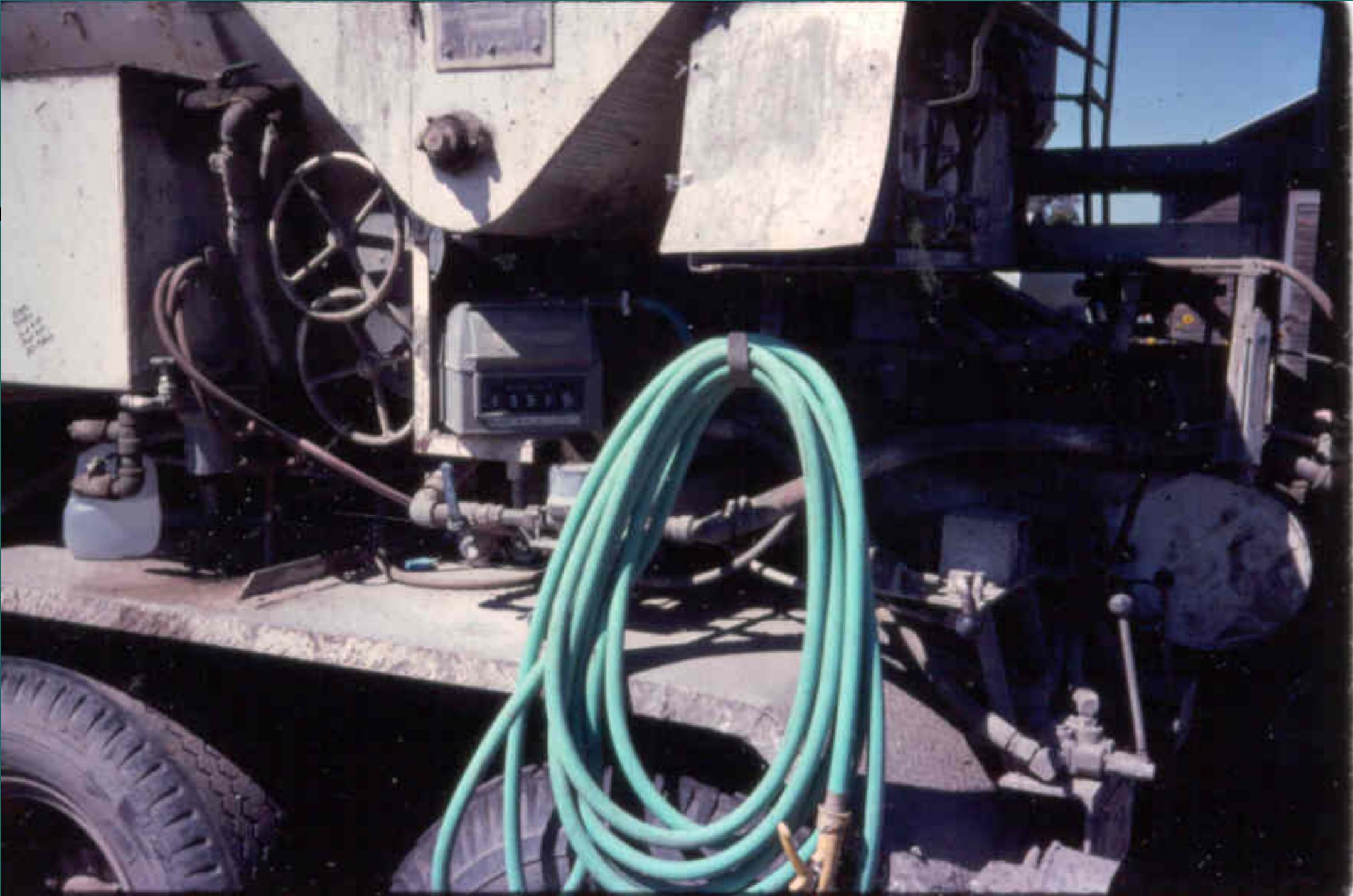
“Self Contained Mobile Continuous Mixing Unit”
(Conforming to Section 460.3.E)

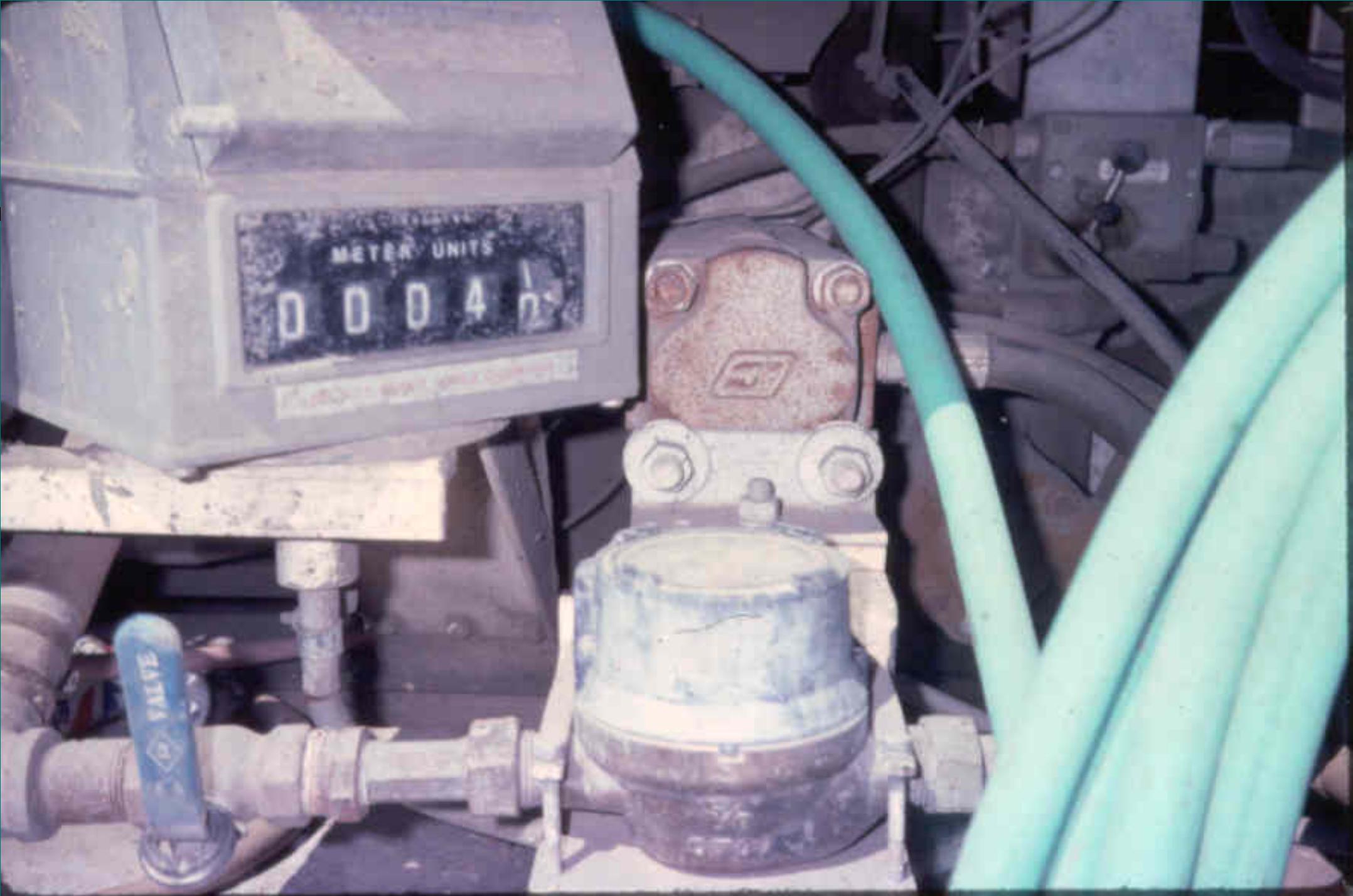


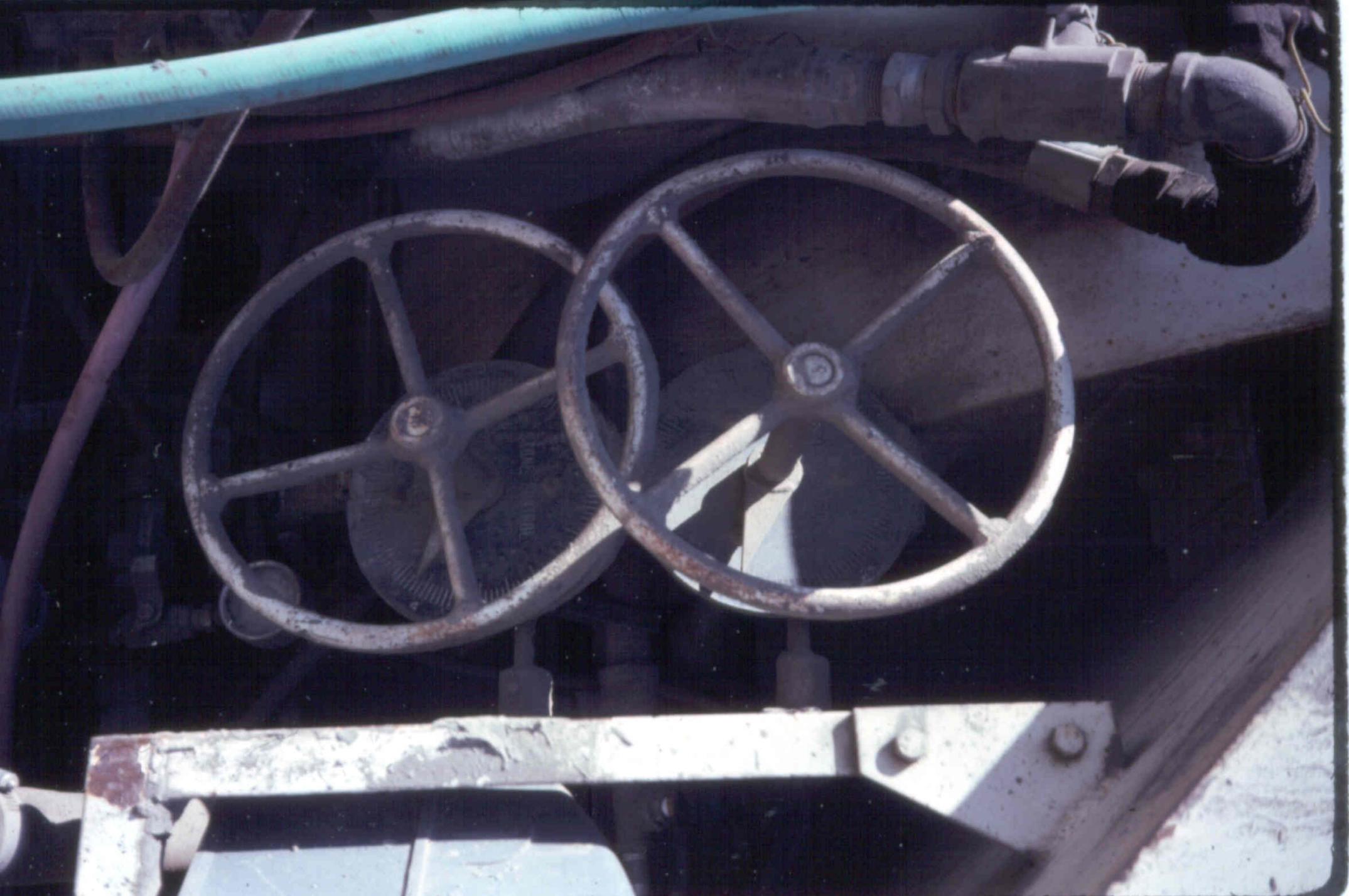


Mobile Mixer Calibration

- ◆ Mobile Concrete Mixers Are Required to be Calibrated at Least Once Annually.
- ◆ Yield Test Performed Prior to Each Pour.
 - ◆ If yield test indicates mobile mixer is not in proper calibration, re-calibrate and forward mobile mixer calibration form to the Concrete Engineer.











Yield Test

- ◆ 1/4 Cubic Yard Form
 - ◆ Supplied by Contractor
 - ◆ Take measurements to verify form is proper size
- ◆ Determine Cement Meter Count for 1/4 Cu. Yard
- ◆ Set Mobile Mixer at Operating Speed
- ◆ Set Meter Count at Zero
- ◆ Discharge Concrete until Cement Reading is Reached
- ◆ Form Should be Full, but With No Overspill



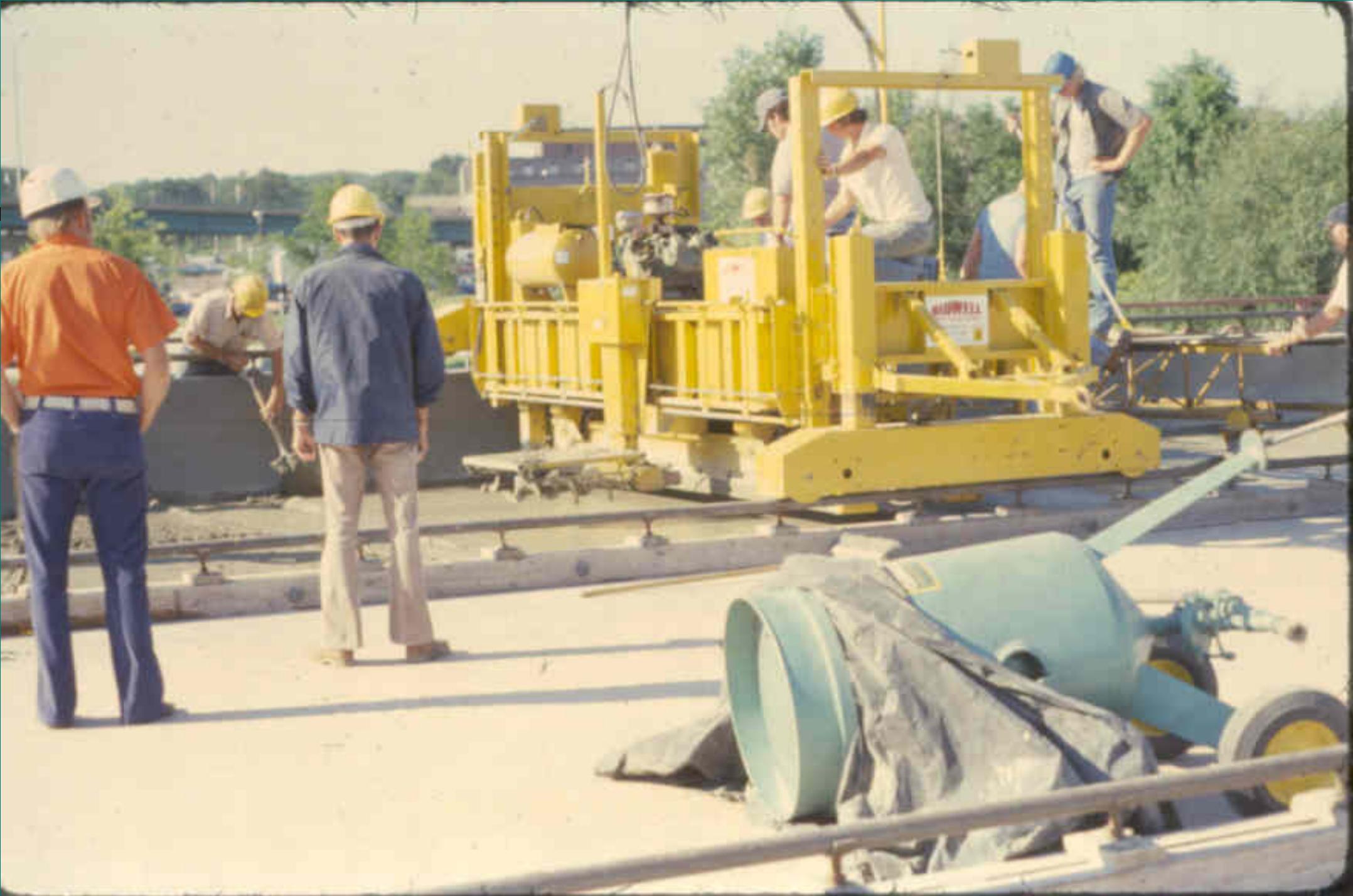
Low Slump Finish Machine

- ◆ A Special Finish Machine Designed for Use on Low Slump Dense Concrete is Required.
 - ◆ Mechanical strike off
 - ◆ Oscillating screed
 - ◆ Capable of forward and reverse motion.
 - ◆ Capable of raising screeds to clear surface when traveling in reverse
 - ◆ Capable of providing control of vertical position, tilt, and crown shape

Finish Machine Screed

- ◆ Additional Screed(s) Requirements:
 - ◆ Effective weight of 75 psf.
 - ◆ Screed face at least 5 inches in width.
 - ◆ Turned up or rounded leading edge.
 - ◆ Internal Vibrators (*Min. of one per 5 ft*).
 - ◆ Capable of finishing to within 1” of curb face.
 - ◆ Extend at least 6 inches beyond centerline sawcut.







Setting Screed Rails To Grade

- ◆ Screed Rails Should be Set to Plans Grade.
 - ◆ Make a “Dry Run” with the Finish Machine and Check Distance from Bottom of Screed to the Top of the Scarified Surface.
 - ◆ If measurements indicate that the overlay thickness is:
 - ◆ Less than 2 inches
 - ◆ Greater than 3 inches
- then, gradeline adjustments may be required.

Gradeline Adjustments

- ◆ Items to Consider When Making Gradeline Adjustments:
 - ◆ Will smooth ride be maintained?
 - ◆ On the Bridge
 - ◆ On Approaches
 - ◆ Will water drain off deck without ponding?
 - ◆ How will adjacent lane be affected?

Low Slump Dense Concrete Limitations

- ◆ 40 Ft. Per Hour Minimum Rate of Pour.
- ◆ Maximum Width of Placement is 24 Feet.
- ◆ Seasonal Limitations
 - ◆ Not After October 1
 - ◆ Not Before May 1
- ◆ Surface Temperature $\geq 40^{\circ}\text{F}$
- ◆ Concrete Temperature
 - ◆ Placed Between 45°F and 80°F
 - ◆ Maintained $> 45^{\circ}\text{F}$ for 72 Hours After Placement
- ◆ No Placement Allowed if Air Temperature is $> 85^{\circ}\text{F}$.
 - ◆ May be Necessary to Place Concrete at Night or Early AM
 - ◆ If $> 80^{\circ}\text{F}$, Fogging Equip. Required

Limitations Due to Hot Weather

- ◆ During Periods of Extreme Hot Weather it May be Difficult to Maintain the Concrete Temperature Below the Specified Maximum of 80°F.
- ◆ The Engineer May Authorize the Maximum Temperature to Be Increased to 85°F Provided the Following Conditions Are Met:
 - ◆ The Course Aggregate Piles are Flushed With Cool Water.
 - ◆ Wet Burlap is Placed as Soon as the Concrete Surface Will Support It Without Deformation.
 - ◆ Water Tank on the Mobile Mixer is Not Filled Until Immediately Prior to Concrete Placement, at Which Time It is Filled With Cold Water. (*The Addition of Ice to the Water Tank is Permitted.*)

Concrete Requirements

- ◆ Slump: 1 Inch Maximum
- ◆ Air Content: 5% to 7%
- ◆ Compacted Density to 98% of Rodded Unit Weight
 - ◆ Determined by use of Nuclear Gage.

Required Testing

Slump Test

Air Content

Concrete Temp.

Unit Weight

Nuclear Density Testing





Placement of Low Slump Dense Concrete

- ◆ Clean, Dry Surface Must be Maintained.
- ◆ Grout is Applied to Surface Immediately Prior to Concrete Placement.
 - ◆ Grout shall be scrubbed into surface, abutting curb face, and vertical surface of previously placed lane.
 - ◆ 50 % Cement & 50% Sand (by weight).
 - ◆ Just enough water added to form a thick slurry.
 - ◆ Must be placed such that concrete is placed prior to grout drying.
 - ◆ Excess grout should not be allowed to pond in low areas.





Placement of Low Slump Dense Concrete

- ◆ Concrete Usually Place by “Concrete Buggy”.
 - ◆ Plywood, plastic, or other adequate material to protect surface from contamination
- ◆ Finish Machine Shall Mechanically Consolidate the Concrete to 98% of the Rodded Unit Weight.
- ◆ Suitable “Spud Vibrator” Required for:
 - ◆ Longitudinal joints at curb lines and adjacent lanes
 - ◆ In areas where overlay thickness is greater than 3 inches.





Finishing

- ◆ Concrete Shall be Struck Off 1/4 Inch Above Grade.
- ◆ Concrete Shall be Consolidated and Finished by the Finish Machine.
- ◆ Hand Finishing May be Required Behind the Finish Machine to Provide a Tight, Uniform Surface.
(Do Not Allow Finishers To Apply Water To Deck During Hand Finishing)
- ◆ After Finishing, All Vertical Joints With Adjacent Concrete Shall be Sealed by Painting With Grout.
- ◆ The Surface Shall be Broomed and Transverse Tined.



Curing

- ◆ Place “WET” Burlap on Finished Surface.
 - ◆ Burlap should be wet, but well drained.
 - ◆ Do NOT allow dry burlap to be placed and then wetted.
 - ◆ Burlap should be placed as soon as surface will support it without deformation.
 - ◆ Usually approx. 10 minutes
 - ◆ Failure to apply within 30 minutes shall be cause for rejection



Curing

- ◆ The Wet Burlap Cure is Required for at Least 72 Hours.
 - ◆ Burlap is kept continuously wet by automatic sprinkling or wetting system.
 - ◆ After 24 hours, the Contractor may cover the wet burlap with white polyethylene sheeting in lieu of the sprinkling or wetting system.

Superimposed Loads

- ◆ No Traffic on Completed Surface for 72 Hours.
- ◆ Adjacent Concrete Shall Not Be Placed for 36 Hours
 - ◆ Except Continuation From a Transverse Construction Joint in the Same Lane is Permitted When the Concrete is 12 Hours Old

Low Slump Dense Concrete That Is **NOT** In Specification

- ◆ Do Not Allow Out-of-specification Material to be Placed.
- ◆ Out-of-Specification Material Inadvertently Placed Should be Removed and Replaced.
 - ◆ Small amounts can be shoveled off or removed by “BobCat” and placement continued.
 - ◆ Large amounts of out-of-specification concrete should result in removal by “Bobcat” or small loader and the area being flushed with water.

Epoxy Chip Seal

Consists of an Epoxy Resin
and Cover Aggregate

Placed On a Properly Prepared Concrete Surface

Surface Preparation

- ◆ Surface Preparation is Performed by:
 - ◆ Diamond Grinding
 - ◆ Removal of delaminated or loose concrete
 - ◆ Filling removal holes with concrete
 - ◆ Shot-blasting to ICRI concrete surface profile (CSP-5)
 - ◆ Abrasive Blast Cleaning the concrete surface
 - ◆ Cleaning with Compressed Air or Vacuum

Concrete Removal / Replacement

- ◆ Delaminated or Loose Concrete Shall be Removed.
- ◆ Concrete Removal and Replacement Procedures Are Much Like Those Used for Low Slump Overlays:
 - ◆ Sound Deck
 - ◆ Remove Unsound Concrete
 - ◆ Abrasive Blast Clean Removal Areas
 - ◆ Fill with bag mix according to manufacturer's recommendations
 - ◆ Place, Float, and Wet Cure for 48 hrs.
 - ◆ Dry for 48 hrs.

Bridge Deck Preparation

- ◆ After bridge deck is ground the entire Surface shall be thoroughly shot-blasted to ICRI concrete surface profile (CSP-5) to remove all Contaminants.
- ◆ The Entire Deck Surface is Blown Clean with Compressed Air or Vacuum Cleaned to Remove All Dust and Loose Debris.
- ◆ Abrasive Blast Cleaning Shall be Done Within 24 Hours of Placement of the Epoxy Chip Seal



Epoxy Chip Seal Placement Limitations

- ◆ Epoxy Chip Seal Cannot be Placed on Any New Concrete for 28 Days.
 - ◆ Traffic is permitted when concrete has attained 4000 psi.
- ◆ Deck and ambient temperature between 50° and 100°
- ◆ Surface Shall Dry for 24 Hours after Rain.
- ◆ Epoxy and Bridge Deck Temp. is Anticipated to be 65°F or Greater for at Least 4 Hours.

Epoxy Requirements

- ◆ Two Component Epoxy
 - ◆ Base Component
 - ◆ Hardener
 - ◆ Epoxy must be stored out of the sun and kept dry and must remain between 50° and 85° degrees



Placement of First coat of Epoxy

- ◆ Mix, Store and Apply Epoxy in Accordance With Manufacturer's Recommendations.
 - ◆ Broadcast Over Surface with "Notched Squeegee" at a minimum spread rate of one gallon per 40 square feet



Aggregate Application

- ◆ Aggregate:
 - ◆ Basalt Cover Aggregate applied immediately after epoxy is applied
 - ◆ Apply aggregate to refusal reapply on wet spots that appear



Placement of Second coat of Epoxy

- ◆ After First coat has sufficient time to harden (2 to 6 hours depending on temp.) remove excess aggregate
- ◆ In the event of rain the deck must be dried for 24 hours and deck will be abrasive blasted
- ◆ Apply second coat of epoxy with a minimum of 1 gallon per 20 square feet
- ◆ Broadcast aggregate to refusal



Removal of Excess Aggregate

- ◆ After Epoxy Has Cured to a Tack-Free Touch, the Excess Aggregate is Removed by:
 - ◆ Brooming
 - ◆ High-Pressure Air
 - ◆ Vacuuming





Acceptance

- ◆ Pull off test must be preformed prior to opening lane to traffic.
- ◆ Pull-off test should be preformed according to ASTM D4541-02 with the addition of using a diamond or carbide-tipped core drill bit to score through the chip seal with little of no removal of concrete prior to placement of the detaching assembly.

Pull-off tests with a resulting load of 250 psi or more shall be considered passing. All pull-off tests with a resulting load of less than 250 psi shall be retested according to the type of failure. There are three possibilities or combinations thereof as described below:

- ◆ Failure in the concrete substrate (concrete failure) - The Contractor shall perform one additional test within one foot of the failing test.
- ◆ Detaching assembly adhesive failure (adhesive failure) - The Contractor shall perform one additional test within one foot of the failing test.
- ◆ Separation of the epoxy chip seal from the concrete surface (epoxy failure), or pullout of the aggregate from the epoxy (epoxy or aggregate failure) - The Contractor shall perform two additional pull-off tests. One test shall be performed between 10 ft and 15 ft back from the failing test and one test shall be performed between 10 ft and 15 ft ahead of the failing test.





Other Types of Bridge Rehabilitation

Bridge Deck Widening / Replacement

Making Bridge Decks Continuous or Composite

Bridge Repainting

Questions

