



Incidental Concrete Structures Inspection Class 202 (TCH3307)

A training course for the
Arizona Department of Transportation



Welcome



- What is your name?
- What do you do
- Which Org are you from?
- What experience do you have inspecting construction work?
- What experience do you have with minor structures?



Classroom Guidelines



- Breaks
- Telephone & Restrooms
- Turn off Cell Phones and Pagers
- Keep Drinks in Covered Containers
- Clean Up any Spills

0 - 3



Ground Rules

- Listen when others talk - Do not interrupt.
- Respect the opinions and attitudes of others
- We will use a flip chart as a "Parking Lot" for any questions that can not be answered today and will need more investigation.
- Share responsibility for training – If you do not understand something ask.

0 - 4

Incidental Concrete Structures Inspection Class Outline

- Introductions/housekeeping
- Concrete 202
 - Section 1 – Introduction and Preparations
 - Section 2 – Concrete Placement
 - Section 3 – Completing Concrete Construction
 - Section 4 – Summary of Key Requirements
 - Section 5 – Concrete Box Culverts
 - Section 6 – Documentation
- Class review
- Final Exam

1 - 1

Section One Introduction and Preparations

- Types of Incidental Structures
- Contract Documents
- Basic Concrete Construction
- Layout and Grade
- Foundations and Subgrades
- Forms and Falsework Erection
- Reinforcement Steel Placement
- Wire and Rebar Measurement Conventions

1 - 2

Introduction

Concrete uses in roadway construction



Incidental structures (202)



Pavement (203)



Major Structures (204 and 205)

1 - 3

Introduction

Types of Incidental Structures

- Generally any concrete structure other than a bridge
- Section 101.02 defines a bridge as a structure more than 20' long including multiple boxes

1 - 4

Introduction

Types of Incidental Structures

- Non-reinforced
 - Curb and gutter
 - Flatwork
 - ❖ Sidewalks
 - ❖ Driveways
 - Ditch Pavements
- Reinforced
 - Barrier Wall
 - Catch Basins
 - Slope Paving
 - Retaining Walls
 - Sound Walls
 - Box Culverts



1 - 5

Introduction

Characteristics of Incidental Structures

- Relatively small
- Limited load-bearing function
- Often precast

1 - 6

Introduction Contract Documents

- Supplemental Agreements
- Special Provisions
- Project plans
- Standard drawings
- Standard specifications
- Approved mix design
- Shop/working drawings

1 - 7

Basic Concrete Construction

- Cast-in-Place
 - Fixed Form
 - Slip Form
- Precast
- Shotcrete



1 - 8

Basic Concrete Construction Construction Processes

1. Layout and grade control
2. Foundation and subgrade preparation
3. Falsework and formwork erection
4. Reinforcement
5. Concrete placement
6. Concrete finishing
7. Concrete curing
8. Formwork and falsework removal
9. Backfill placement

1 - 9

Basic Concrete Construction Layout and Grade

- Layout and grade control
 - Section 925 of the Standard Specification describes survey requirements
 - Chapter XI of the Construction Manual covers the process
 - Contractors responsibility
 - Inspector to verify layout
 - Verify location and skew of box in relation to wash



1 - 10

Basic Concrete Construction Foundations and Subgrade

- Foundation and subgrade preparation
 - Sections 203-5.03 and 601-3.01
 - Safety of workers and inspectors
 - Verify at correct grade
 - Subgrade is firm and uniform
 - Proper bedding\backfill used



1 - 11

Basic Concrete Construction Forms and Falsework Erection

- Falsework and formwork erection
 - Section 601-3.02
 - Forms support horizontal loads, falsework supports vertical loads
 - Contractor responsible for design and construction
 - Safety everyone's responsibility



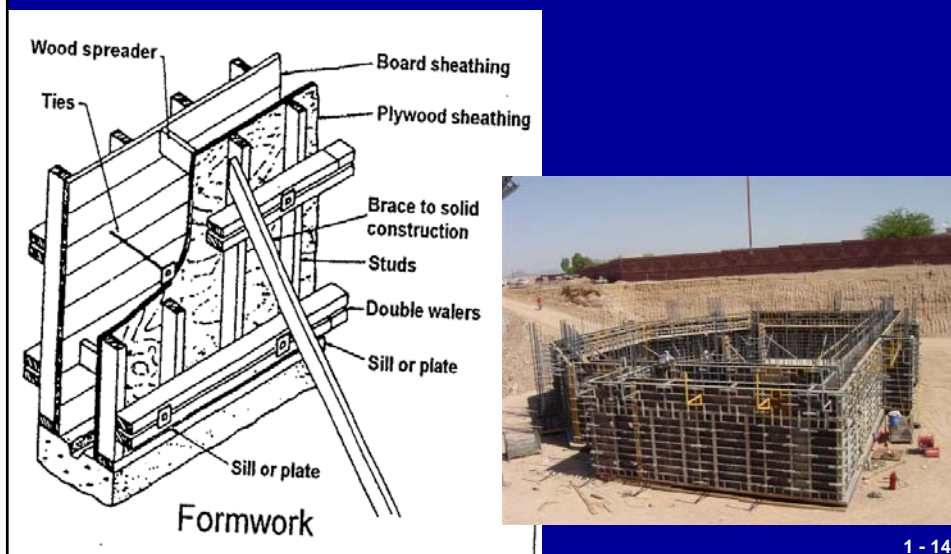
1 - 12

Basic Concrete Construction Forms and Falsework Erection

- Falsework and formwork erection
 - Wooden forms should be new or near new (critical for Type II Finish)
 - Smooth and uniform
 - Clean
 - Use an approved form release agent
 - Mortar-tight
 - Strong enough to support fresh concrete
 - Constructed to line and grade

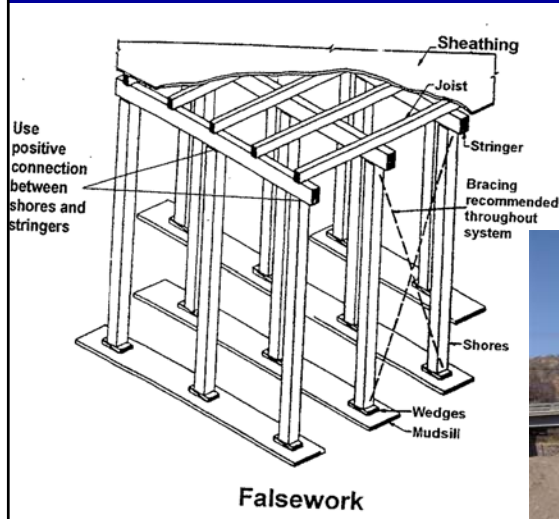
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Basic Concrete Construction Formwork



1 - 14

Basic Concrete Construction Falsework



1 - 15

Basic Concrete Construction Incidental Concrete Structures Inspection Part 1



1 - 16

Basic Concrete Construction Reinforcement Steel Placement

(Section 605 and PPD No. 1)

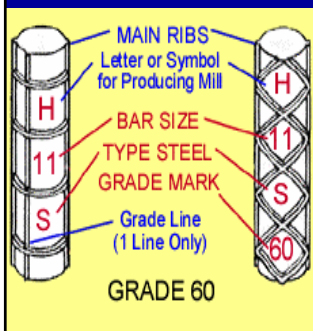


Bar Stock
Welded Wire Fabric
Fibers

1 - 17

Basic Concrete Construction Wire and Rebar Measurement Conventions

Bar Stock

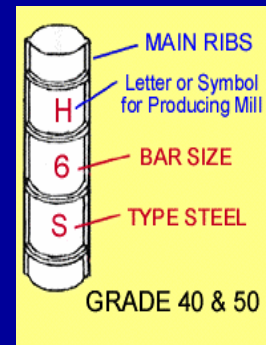


Deformed Bars

- Mill Mark
- Bar size in 8ths of inch
- Type of steel
- Grade mark
 - Grade 40 has no mark

Smooth Bars

- No markings



1 - 18

Basic Concrete Construction Wire and Rebar Measurement Conventions

Welded Wire Fabric

- **6x6 W1.4/1.4** is a designated mesh size. The “**6x6**” is the horizontal and vertical spacing of the strands in inches. This is the size of the squares of space bounded by the wire strands in the mesh. The “**1.4/1.4**” is the “**W**” number. This is the wire size (longitudinal/transverse) in cross sectional area measured in 1/100’s of a square inch (1.4 hundredths of a square inch).

1 - 19

Basic Concrete Construction Reinforcement

Fibers

Synthetic



Glass
Nylon
Fiberglass

Natural

Plant
Stone
Metallic



1 - 20

Basic Concrete Construction Reinforcement

- Delivery process

- Pre-shipment sampled
 - Receive 3 copies of shipping documents
 - Certificate of Compliance
 - Cut Sheet
 - Bending diagrams
 - Call to verify Lab number
 - Take a 7' sample randomly from shipment. (Not a "sample bar")
 - Allow steel placement but not concrete until lab gives okay
 - Ensure placed on dunnage



1 - 21

Basic Concrete Construction Reinforcement

- Placement

- Watch for excessive rust or other foreign matter
- Securely tied
- Bottom mat on approved chairs
- Spacing tolerances
- Check clearances to formwork
- Splices per plan details or as approved by Engineer



1 - 22

SECTION ONE

Introduction and Preparation

QUIZ

1 - 23

1. Which of the following overall concrete construction methods is generally the most typical for incidental concrete?

- a. Slip-form, cast in place
- b. Fixed-form, cast in place
- c. Precast

1 - 24

2. Which of the following contract documents provides the most specific information on the location, materials and dimensions of an individual structure?

- a. Standard Specifications
- b. Special Provisions
- c. Contract Plans

1 - 25

3. Which of the following basic processes in concrete construction are not applicable to slip-form concrete work?

- a. Setting forms
- b. Curing the concrete
- c. Backfilling
- d. Layout and grade controls

1 - 26

4. If a reference point appears to be out of line when checking alignment and grade controls, the inspector should:

- a. Make sure there is another reference point that can be used and remove it to avoid confusion
- b. Have the contractor replace it to a new alignment
- c. Notify the contractor
- d. Determine its proper location from the plans and relocate it

1 - 27

5. If the foundation material is unsuitable at the planned grade for the bottom of a structure, which of the following actions should be taken?

- a. Relocate the structure to a higher, more stable grade by adding an 8-inch layer of stable backfill
- b. Remove the unsuitable material and replace it with layered and compacted backfill
- c. Stop all work and contact the Structures Division

1 - 28

6. Which of the following is not a requirement for form faces in fixed-form construction?

- a. They must be mortar tight
- b. Any plywood must be like new if a class II finish is required
- c. They must be reusable
- d. Any bolt or rivet heads must be countersunk

1 - 29

7. Which of the following should not be permitted in placing reinforcing steel?

- a. Using 16-gauge or heavier wire ties at bar intersections
- b. Using a welding torch to facilitate bar bending
- c. A clearance between reinforcement and the form face that is 1/8 inch more than shown on the plans
- d. Using concrete blocks as spacers and supports

1 - 30

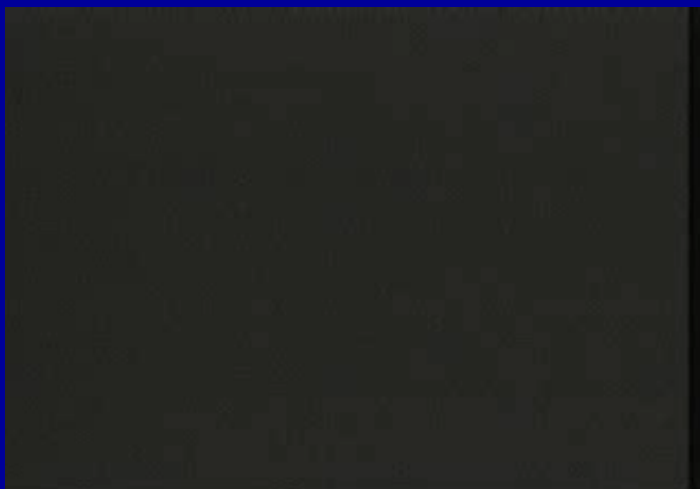
Section Two Concrete Placement

- Fixed-Form Concrete
- Slip-Form Concrete
- Precast Concrete



2 - 1

Concrete Placement Incidental Concrete Structures Inspection – Part 2



2 - 2

Concrete Placement

Fixed-Form Concrete

Fixed Form Cast-in-place concrete placement

- Sections 1006 and 601
- Weather Limitations
- Pre-placement Checks
- Placing Concrete
- Finishing unformed surfaces



2 - 3

Fixed-Form Concrete

Weather and Temperature Limits

Weather Limitations

- Apply to both fixed form and slip form work
- May not be placed in excessive rain
- Concrete must be between 50° and 90° F
- Do not place when air temperature falls below 40° F unless approved
- Do not place in frozen or ice coated forms
- Cool forms and rebar by light sprinkle
- Maintain proper temperature during cure

2 - 4

Fixed-Form Concrete Pre-Placement Checks

Pre-placement Checks

- Inspect forms and rebar and ties
- Ensure proper mix design ordered/delivered
- Wet down forms, foundation
- Check discharge time
 - ❖ 90 minutes agitator trucks
 - ❖ 45 minutes non-agitator trucks
 - ❖ 30 minutes in open trucks
 - ❖ Check revolutions of the barrel
- Quantlists



2 - 5

Fixed-Form Concrete Placing Concrete

Placing Concrete

- Visual check of consistency
- Placed as close as practical to final position
- Can free fall 8' in dry excavations if no caving and does not strike anything during fall
- Monitor pour rates
- Properly vibrated
 - ❖ Minimum frequency 8000 cycles/minute
 - ❖ Penetrate previous layer
 - ❖ Overlap zone of influence
- Perform required field sampling and testing

2 - 6

Fixed-Form Concrete Finishing Unformed Surfaces

Finishing unformed surfaces

- Struck-off at proper grade
- Smooth uniform surface
- Finish as required
- Cure application



2 - 7

Slip-Form Concrete Pre-Placement Checks

Pre-placement Checks

- Inspect slip-form machine
- Inspect rebar and extra bracing
- Check string line
- Ensure proper mix design ordered/delivered



2 - 8

Slip-Form Concrete Placing Concrete

Placing Concrete

- Visual check of consistency
- Closely monitor slump
- Monitor surface for indications of improper placement or technique
- Perform required field sampling and testing
- Cure application



2 - 9

Precast Concrete

Sections 203, 503, 601, 910, 1006

- Certificate of Compliance and ADOT stamp
- Check for damage
- Proper foundation
- Installation
- Joint treatment if multiple units

2 - 10

Precast Concrete Foundation

Foundation

- Correct bedding per plans
 - ❖ Structural backfill bedding
 - ❖ Grout, bearing pads or shims per plans
- Shaped or trimmed to provide full bearing
- Properly compacted
- Set to correct alignment and grade and offset

2 - 11

Precast Concrete Installation

Installation

- Proper handling/lifting
- Set to correct alignment and grade
- Adequate temporary support if needed
- Joint treatment if multiple units
- Removal of lifting devices and patching voids



2 - 12

Shotcrete

Section 912

- Dry mix or wet mix
- Forms and reinforcement anchored to prevent movement during placement
- Moisten forms and grade
- Grade control wires
- Keep nozzle perpendicular to surface
- Apply cure



2 - 13

SECTION TWO

Concrete Placement

QUIZ

2 - 14

1. Which of the following weather and temperature conditions would prevent placement of cast-in-place concrete, assuming no exceptions have been otherwise approved by the Engineer?

- a. An air temperature (in the shade) of 103° F
- b. A partially frozen foundation
- c. A concrete temperature of 92° F
- d. A concrete temperature of 37° F and rising

2 - 15

2. Foundations, forms and reinforcement should be thoroughly inspected for conformity with all requirements ...

- a. ...as they are prepared
- b. ...before any concrete is delivered to the pour site
- c. ... after concrete is delivered, but before it is discharged
- d. ... as concrete is being discharged

2 - 16

3. In placing concrete in forms, which of the following practices should not be allowed?

- a. Using tubes or pipes to carry the concrete
- b. Placing it in 15" layers
- c. Leaving enough time between layers to create a cold joint
- d. Piling it in the middle of the forms for distribution to other areas as it is consolidated

2 - 17

4. Which of the following types of structures may be constructed in pre-cast concrete sections?

- a. Curb and gutter
- b. Ditch pavement
- c. Barrier walls
- d. Sidewalk
- e. Catch basins

2 - 18

5. Which of the following practices should not be allowed in consolidating with a vibrator?

- a. Dragging it across the surface from one vibration point to the next
- b. Overlapping the effective areas of the vibration points
- c. Penetrating 8 to 10 inches into a previous layer
- d. Holding the vibrator for about one minute at each location

2 - 19

6. Which of the following processes used in fixed-form, cast-in-place concrete is not applicable to shotcrete?

- a. Alignment and grade controls
- b. Finishing exposed surfaces with floats and trowels
- c. Consolidating with vibrators
- d. Setting forms
- e. Placing reinforcement

2 - 20

Section Three

Completing Concrete Construction

- Concrete Joints
- Concrete Curing
- Formwork and Falsework Removal
- Finishing Concrete
- Backfill Placement

3 - 1

Completing Concrete Construction

Incidental Concrete Structures Inspection Part 3



3 - 2

Completing Concrete Construction Concrete Joints

Cold Joints – not allowed. Concrete to concrete interface.
Randomly occur when concrete in form has set prior to completion of pour.

Construction joints – Controlled cold joint per design

Expansion joint – Between separate pours. Use compressible material as joint material.

Weakened plane Joints – sawed or troweled section of pour.

3 - 3

Completing Concrete Construction Construction Joints

Construction joints

- Construct only at approved locations
- First pour
 - ❖ Proper grade/alignment
 - ❖ Rough unfinished surface
 - ❖ Keyway may be required
 - ❖ Proper extension of rebar
 - ❖ Clean
- Second Pour
 - ❖ Forms tight
 - ❖ Dampen interface
 - ❖ Proper concrete placement

3 - 4

Completing Concrete Construction Expansion Joints

Expansion joint

- Location
 - ❖ Used between adjacent separate structures
 - ❖ As specified on plans
- Construction
 - ❖ Plans location
 - ❖ Joint material
 - Correct type and thickness
 - Covers entire joint face
 - Concrete edges finished
 - ❖ Joint material (poured)
 - Correct materials
 - Correct depth of pour
 - Correct type of backer rod (if used)



3 - 5

Completing Concrete Construction Weakened Plane Joints

Weakened plane Joints

- Location
 - ❖ At specified maximum intervals
 - ❖ Stress points
- Construction
 - ❖ Formed
 - In fresh concrete
 - Large aggregate depressed at least 2"
 - Use edge tool on joint
 - ❖ Sawed
 - As soon as practical
 - To depths per plans/specifications
 - May be sealed



3 - 6

Completing Concrete Construction Concrete Curing

- Requirements
- Types
- Specification
- Sampling

3 - 7

Completing Concrete Construction Concrete Curing

- All concrete must be cured
- Curing starts immediately after finishing and continues uninterrupted for specified time
 - 7 days for Type II Portland Cement
 - 3 days for Type III Portland Cement
- Uniform application
- Breaks re-cured at $\frac{1}{2}$ original application rate
 - Overlap original application
- Class II finish completed prior to application

3 - 8

Concrete Curing Types of Curing

- Water cure
 - Required for bridge decks
- Liquid membrane forming compound
 - Exposed surfaces of formed concrete
 - 2 types – ensure using correct product
- Forms in place
 - Commonly used for first 24-36 hours of minor structures
- Combination
 - Most common for structures



3 - 9

Concrete Curing Specifications

- ADOT Standard Specifications
 - Section 601-3.06 Curing Structures
 - Section 908-3 Curing sidewalks
 - Section 1006-2.05 Material specifications
 - Section 1006-6.01 types and application rates
- AASHTO 148M Type 2 class A or class B for driving surfaces (White cure)
- AASHTO 148M Type 1D class A or class B for all other concrete items (Red pigmented)

3 - 10

Forms & Falsework Removal

- No forms/falsework may be removed without RE's approval
- Removal must not damage structure
- If removed prior to full cure period alternate curing method must be used
- Finishing operations should start as soon as forms are removed
- All forms must be removed



3 - 11

Forms and Falsework Removal

Falsework may not be removed

- Without RE's approval
- Until 10 days and 70% strength reached
- Until 5 days and design strength reached
- Other requirements meet – i.e. post tensioning
- Prior to opening structure to traffic



3 - 12

Finishing Concrete

- Purpose
 - Seal the surface
 - Provide uniform pleasing appearance
- Classes
 - Class I – All formed surfaces
 - Class II – All surfaces normally visible to the public
- Cure applied **AFTER** finish achieved

3 - 13

Finishing Concrete

Class I Finish: Section 601-3.05 (B)

- required on all formed surfaces
- All metal removed to at least 1" below surface
- All irregular areas cleaned to sound concrete
- Patched with specified mortar.

Cure applied **AFTER** finish achieved



3 - 14

Finishing Concrete

Class II Finish

- Section 601-3.05(C) requires on all surfaces normally visible to public
- Basic requirements same as Class I Finish
- Engineer may require if attempt at Class I Finish is unsatisfactory
- Surface is rubbed out with mortar paste to provide uniform appearance
- Mortar paste is to provide uniform appearance not be a plaster coat

Cure applied **AFTER** finish achieved



3 - 15

Backfill Placement

For non-earth retaining structures back fill may start after 72 hours and 2000 psi break

- Examples: Catch basins, buried portion of formed bridge piers
- Structure needs to be finished, cured, and painted to 1' below ground level (if required)
- Backfill has to uniformly support a load

Earth retaining structures need full concrete design strength and Engineers approval

Apply waterproofing/drainage materials as required

Follow embankment placement specifications

Ensure use of correct backfill material



3 - 16

SECTION THREE

Completing Concrete Construction

QUIZ

3 - 17

1. In constructing an expansion joint, the joint material is placed....

- a. At the bottom of the joint to the specified partial depth of joint
- b. To the full depth and length of the joint
- c. After the joint has been sawed
- d. After the concrete is fully cured

3 - 18

2. Which of the following types of incidental structures would generally not require any weakened plane joints? (Circle all correct)

- a. Curb and gutter
- b. Catch basins
- c. Sidewalks

3 - 19

3. In making a concrete construction joint, which of the following must be done before the next pour is started? (Circle all correct)

- a. The previous pour must be fully cured to at least 7 days
- b. The surface from the previous pour must be saturated with water
- c. An appropriate type of joint material is installed
- d. The surface of the previous pour must be cleaned free of any laitance
- e. All reinforcement must be clipped off 1" below the surface

3 - 20

4. Except when a rapid-curing concrete is used, cast-in-place pours must be cured for at least

- a. 24 hours
- b. 3 days
- c. 7 days
- d. 28 days

3 - 21

5. Which of the following curing methods is required for all concrete structures?

- a. Forms-in-place curing
- b. Water curing
- c. Curing compound
- d. Any one or combination of the above three methods
- e. None of the above

3 - 22

7. Which of the following practices should **not** be allowed in Class II finishing? (Circle all correct)

- a. Patching metal tie rod recesses as in a Class I finish
- b. Using enough mortar to produce a plaster coating
- c. using wood or rubber floats
- d. Brushing or sacking the surface in all four directions

3 - 23

8. Which of the following practices should **not** be allowed in backfilling around a structure?

- a. Placing and compacting backfill material in an 8-inch layer
- b. Waiting for the structure to reach 2000psi compressive strength before backfilling
- c. Completely backfilling one side of a wall before starting to backfill the other side
- d. Compacting each layer to 95% of the maximum density

3 - 24

Section Four

Summary of Key Requirements

- Curb & Gutter, Sidewalks & Driveways
- Catch Basins
- Barrier Walls
- Headwalls & Retaining Walls
- Ditch & Slope Pavements

4 - 1

Summary of Key Requirements Curb & Gutter, Sidewalks & Driveways

- Curb and Gutter, Sidewalks and Driveways (Section 908)
 - Require both expansion and weakened plane joints
 - Straight edge tolerance spec.
 - Light broom finish
 - 60% of design strength prior to use
 - Liquid membrane cure at 1 gallon per 150 Sq.Ft.



4 - 2

Summary of Key Requirements Catch Basins

Catch Basins (Section 503)

- Structural imbeds for grills
- Ensure correct type of grill
- Configuration of sump and wing floors
- Match lines and grade of adjacent curb or roadway

4 - 3

Summary of Key Requirements Headwalls & Retaining Walls

Headwalls & Retaining Walls (Section 502 and 601)

- Optional Construction joints often shown on plans
- Maintain specified pour rate
 - ❖ Maximum of 24" concrete lift
 - ❖ For large walls minimum of 35 cyd/hr pour rate
- Do not backfill until achieved 28 day strength
- Monitor backfill to prevent shoving wall



4 - 4

Summary of Key Requirements

Ditch & Slope Pavements

Ditch and Slope Pavements (Section 601 and 912)

- WWF most common reinforcement
 - ❖ Chairs not required
- Placement normally top to bottom
- Do not over consolidate and move down slope
- Check jointing details/location



4 - 5

Section Five

Concrete Box Culverts

- Key Points
- Reading Plans and Drawings

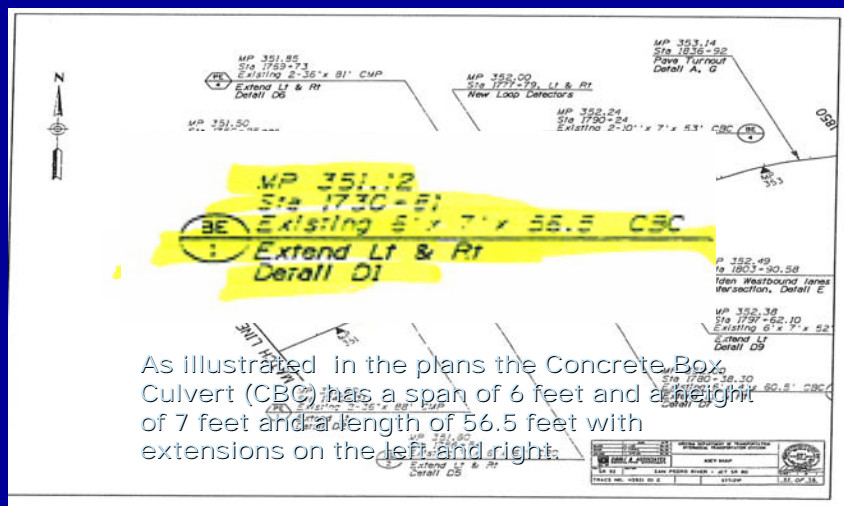


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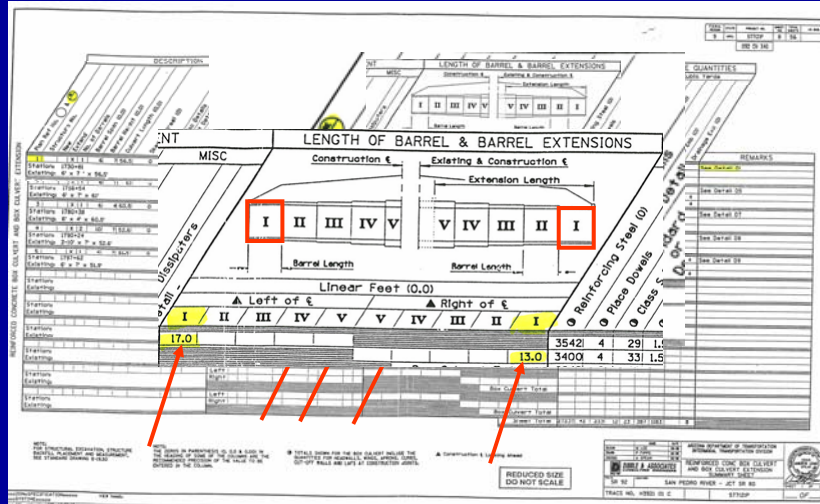
Concrete Box Culverts

- Section 601
- Plans will show box specific information
- B Standards show wall and rebar details
- C Standards give grading details
- Information given on “Box Culvert Summary Sheet”
- Watch pour sequence and construction joint details
- If multi-use may be special floor finishing requirements
- Proper construction and maintenance of top slab falsework

Concrete Box Culverts Key Map

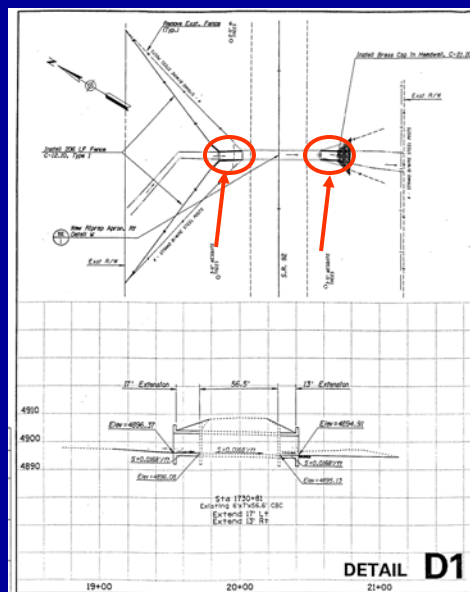


Concrete Box Culvert Plans Summary Sheet



5 - 4

Concrete Box Culvert Detail Sheet



5 - 5

Concrete Box Culvert B-02.10 Single Barrel

TABLE NO. 1
TABLE NO. 2
TABLE NO. 3
TABLE NO. 4

TOTAL NUMBER OF BARS IN THE CROSS-SECTION

TYPICAL SECTION

SEE B-02.10 FOR GENERAL NOTES AND MISCELLANEOUS DETAILS

DESIGNED BY: [Signature]
CHECKED BY: [Signature]
DATE: [Date]

DEPARTMENT OF TRANSPORTATION
STANDARD DRAWINGS
SINGLE BARREL
BOX CULVERT

Concrete Box Culvert B-02.10 Single Barrel

aa bars

TABLE NO. 1
0'-10' FILL

Span 5'	Height 1'	SI ab 1'	aa Spacing Length	cc		ee		oo		hh		F		
				Number	Spacing	Number	Spacing	Number	Spacing	Number	Spacing			
3'	9 1/2"	9"	12"	4	2	20	5	6"	7-2	14	4	9"	5-2	2'-6"
4'	9 1/2"	9"	12"	5	2	24	5	6"	7-2	16	4	8"	5-11	2'-9"
5'	9 1/2"	9"	12"	6	2	24	5	6"	7-2	16	4	6"	6-5	2'-9"
6'	9 1/2"	9"	12"	7	2	24	5	6"	7-2	16	4	6"	7-2	3'-0"
7'	9 1/2"	9"	12"	8	2	24	5	6"	7-2	16	4	6"	7-8	3'-0"
3'	10"	11"	12"	4	3	20	6	8"	9-6	18	4	6"	6-2	3'-5"
4'	10"	11"	12"	5	3	24	6	8"	9-6	20	4	6"	6-8	3'-5"
5'	10"	11"	12"	6	3	24	6	8"	9-6	20	4	6"	7-1	3'-4"
6'	10"	11"	12"	7	3	28	6	8"	9-6	20	4	6"	7-7	3'-4"
7'	10"	11"	12"	8	3	32	6	6"	9-6	22	4	6"	8-0	3'-3"
8'	10"	11"	12"	9	3	32	6	6"	9-6	22	4	6"	8-5	3'-2"
3'	10"	13"	12"	4	3	20	6	8"	11-10	22	5	6"	7-10	4'-5"
4'	10"	13"	12"	5	3	24	6	8"	11-10	22	5	6"	7-10	4'-5"
5'	10"	13"	12"	6	3	24	6	7"	11-10	24	5	7"	8-3	4'-4"
6'	10"	13"	12"	7	3	28	6	7"	11-10	24	5	7"	8-9	4'-4"
7'	10"	13"	12"	8	3	32	6	7"	11-10	26	5	7"	9-2	4'-3"
8'	10"	13"	12"	9	3	32	6	7"	11-10	26	5	7"	9-8	4'-3"
9'	10"	13"	12"	10	3	36	6	6"	11-10	28	5	8"	10-1	4'-2"
10'	10 1/2"	13"	12"	11	4	40	6	6"	11-10	28	5	8"	10-7	4'-2"
8'	11 1/2"	15"	9"	9	6	32	7	6"	14-2	38	6	6"	10-4	4'-8"
9'	11 1/2"	15"	8"	10	6	36	8	8"	14-2	38	6	6"	10-10	4'-8"
10'	11 1/2"	15"	6"	11	6	40	7	6"	14-2	40	6	6"	11-4	4'-8"
11'	12"	15"	8"	12	7	40	8	8"	14-2	42	6	6"	11-6	4'-4"
12'	12"	15"	6"	13	7	44	8	6"	14-2	46	6	6"	12-2	4'-6"

#5 aa bars (Typical)

bars (Typical)

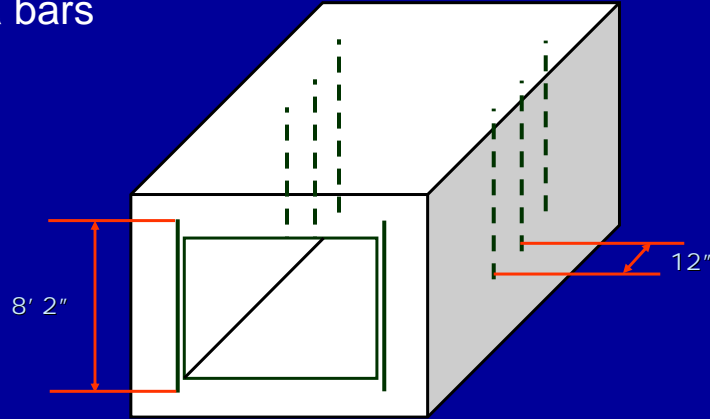
#4 cc bars @ 18"

Constr. Jt. (Typical)

#4 cc bars (Typ.)

Concrete Box Culvert B-02.10 Single Barrel

aa bars



Concrete Box Culvert B-02.10 Single Barrel

cc bars

TABLE NO. 1
0'-10' FILL

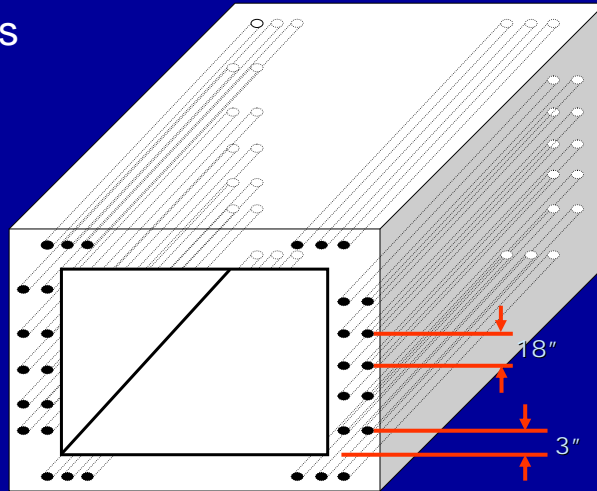
Span, '5'	Height, 'H'	Slab, 'T'	Mells, 'W'	Spacing	aa		cc		hh	
					Length	Number +	Length	Number +	Length	Number +
3'	3 1/2'	9"	12"	4'-2"	20	5	6'	7'-2"	14	4
4'	4 1/2'	9"	12"	5'-2"	24	5	6'	7'-2"	16	4
5'	5 1/2'	9"	12"	6'-2"	24	5	6'	7'-2"	16	4
6'	6 1/2'	9"	12"	7'-2"	28	6	8'	7'-2"	18	4
7'	7 1/2'	9"	12"	8'-2"	32	6	8'	7'-2"	18	4
8'	8 1/2'	9"	12"	9'-2"	36	6	8'	7'-2"	18	4
9'	9 1/2'	9"	12"	10'-2"	40	7	9'	9'-6"	20	4
10'	10 1/2'	11"	12"	11'-2"	44	7	9'	9'-6"	20	4
11'	11 1/2'	11"	12"	12'-2"	48	7	9'	9'-6"	20	4
12'	12 1/2'	11"	12"	13'-2"	52	8	9'	9'-6"	20	4
13'	13 1/2'	11"	12"	14'-2"	56	8	9'	9'-6"	20	4
14'	14 1/2'	11"	12"	15'-2"	60	8	9'	9'-6"	20	4
15'	15 1/2'	11"	12"	16'-2"	64	8	9'	9'-6"	20	4
16'	16 1/2'	11"	12"	17'-2"	68	8	9'	9'-6"	20	4
17'	17 1/2'	11"	12"	18'-2"	72	8	9'	9'-6"	20	4
18'	18 1/2'	11"	12"	19'-2"	76	8	9'	9'-6"	20	4
19'	19 1/2'	11"	12"	20'-2"	80	8	9'	9'-6"	20	4
20'	20 1/2'	11"	12"	21'-2"	84	8	9'	9'-6"	20	4
21'	21 1/2'	11"	12"	22'-2"	88	8	9'	9'-6"	20	4
22'	22 1/2'	11"	12"	23'-2"	92	8	9'	9'-6"	20	4
23'	23 1/2'	11"	12"	24'-2"	96	8	9'	9'-6"	20	4
24'	24 1/2'	11"	12"	25'-2"	100	8	9'	9'-6"	20	4
25'	25 1/2'	11"	12"	26'-2"	104	8	9'	9'-6"	20	4
26'	26 1/2'	11"	12"	27'-2"	108	8	9'	9'-6"	20	4
27'	27 1/2'	11"	12"	28'-2"	112	8	9'	9'-6"	20	4
28'	28 1/2'	11"	12"	29'-2"	116	8	9'	9'-6"	20	4
29'	29 1/2'	11"	12"	30'-2"	120	8	9'	9'-6"	20	4
30'	30 1/2'	11"	12"	31'-2"	124	8	9'	9'-6"	20	4
31'	31 1/2'	11"	12"	32'-2"	128	8	9'	9'-6"	20	4
32'	32 1/2'	11"	12"	33'-2"	132	8	9'	9'-6"	20	4
33'	33 1/2'	11"	12"	34'-2"	136	8	9'	9'-6"	20	4
34'	34 1/2'	11"	12"	35'-2"	140	8	9'	9'-6"	20	4
35'	35 1/2'	11"	12"	36'-2"	144	8	9'	9'-6"	20	4
36'	36 1/2'	11"	12"	37'-2"	148	8	9'	9'-6"	20	4
37'	37 1/2'	11"	12"	38'-2"	152	8	9'	9'-6"	20	4
38'	38 1/2'	11"	12"	39'-2"	156	8	9'	9'-6"	20	4
39'	39 1/2'	11"	12"	40'-2"	160	8	9'	9'-6"	20	4
40'	40 1/2'	11"	12"	41'-2"	164	8	9'	9'-6"	20	4
41'	41 1/2'	11"	12"	42'-2"	168	8	9'	9'-6"	20	4
42'	42 1/2'	11"	12"	43'-2"	172	8	9'	9'-6"	20	4
43'	43 1/2'	11"	12"	44'-2"	176	8	9'	9'-6"	20	4
44'	44 1/2'	11"	12"	45'-2"	180	8	9'	9'-6"	20	4
45'	45 1/2'	11"	12"	46'-2"	184	8	9'	9'-6"	20	4
46'	46 1/2'	11"	12"	47'-2"	188	8	9'	9'-6"	20	4
47'	47 1/2'	11"	12"	48'-2"	192	8	9'	9'-6"	20	4
48'	48 1/2'	11"	12"	49'-2"	196	8	9'	9'-6"	20	4
49'	49 1/2'	11"	12"	50'-2"	200	8	9'	9'-6"	20	4

Diagram showing bar placement details:

- aa bars: #4 cc bars spaced @ 18" (J, K, Spaces)
- hh bars: (Typical)
- cc bars: (Typ.)

Concrete Box Culvert B-02.10 Single Barrel

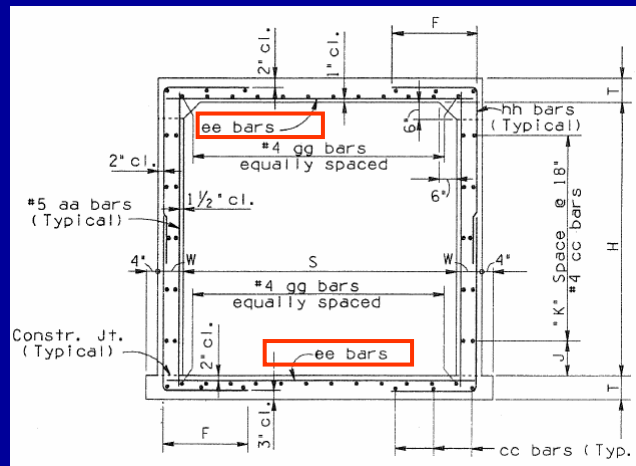
cc bars



5 - 10

Concrete Box Culvert B-02.10 Single Barrel

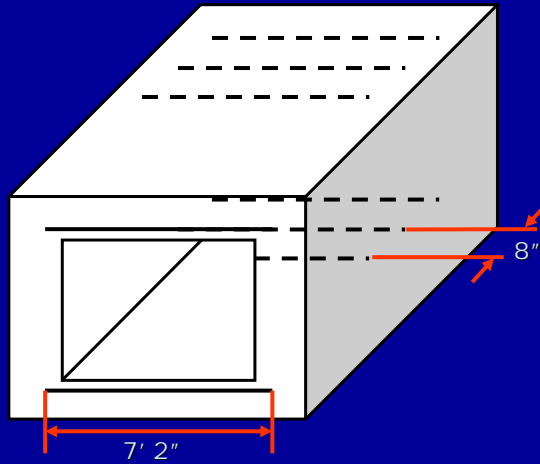
ee bars



5 - 11

Concrete Box Culvert B-02.10 Single Barrel

ee bars



Concrete Box Culvert B-02.10 Single Barrel

gg bars

TABLE NO. 1
0' - 10' FILL

Span - 5'	Height - 10'	Slab - 7'	Bells - 8'	aa		cc		ee		gg		hh	F	T
				Spacing	Length	Number	Bar Size	Spacing	Length	Number	Bar Size			
3'	9 1/2'	9'	12"	4'-2"	20	5	6"	7'-2"	14	4	9"	5'-2"	2'-6"	
4'	9 1/2'	9'	12"	5'-2"	24	5	6"	7'-2"	16	4	8"	5'-11"	2'-9"	
5'	9 1/2'	9'	12"	6'-2"	28	6	8"	7'-2"	18	4	6"	7'-2"	3'-0"	
6'	9 1/2'	9'	12"	7'-2"	32	6	8"	7'-2"	18	4	6"	7'-8"	3'-0"	
7'	9 1/2'	9'	12"	8'-2"	32	6	8"	7'-2"	18	4	6"	7'-8"	3'-0"	
3'	10'	11'	12"	4'-3"	20	6	8"	9'-6"	18	4	6"	6'-2"	3'-5"	
4'	10'	11'	12"	5'-3"	24	6	8"	9'-6"	20	4	6"	6'-8"	3'-5"	
5'	10'	11'	12"	6'-3"	24	6	8"	9'-6"	20	4	6"	7'-1"	3'-4"	
6'	10'	11'	12"	7'-3"	28	6	8"	9'-6"	20	4	6"	7'-7"	3'-4"	
7'	10'	11'	12"	8'-3"	32	6	8"	9'-6"	22	4	6"	8'-0"	3'-3"	
8'	10'	11'	12"	9'-3"	32	6	6"	9'-6"	22	4	6"	8'-5"	3'-2"	
3'	10'	13'	12"	4'-3"	20	6	8"	11'-10"	22	5	6"	7'-4"	4'-5"	
4'	10'	13'	12"	5'-3"	24	6	8"	11'-10"	22	5	6"	7'-10"	4'-5"	
5'	10'	13'	12"	6'-3"	24	6	7"	11'-10"	22	5	7"	8'-3"	4'-2"	
6'	10'	13'	12"	7'-3"	28	6	7"	11'-10"	24	5	7"	8'-3"	4'-4"	
7'	10'	13'	12"	8'-3"	32	6	7"	11'-10"	26	5	7"	9'-2"	4'-3"	
8'	10'	13'	12"	9'-3"	36	6	6"	11'-10"	28	5	8"	9'-8"	4'-3"	
9'	10'	13'	12"	10'-3"	40	6	6"	11'-10"	28	5	8"	10'-1"	4'-2"	
10'	10 1/2'	13'	12"	11'-4"	40	6	6"	11'-10"	28	5	8"	10'-7"	4'-2"	
8'	11 1/2'	15'	8"	9'-6"	32	7	8"	14'-2"	38	6	6"	10'-4"	4'-8"	
9'	11 1/2'	15'	8"	10'-6"	36	8	8"	14'-2"	38	6	6"	10'-10"	4'-8"	
10'	11 1/2'	15'	6"	11'-6"	40	7	8"	14'-2"	40	6	6"	11'-4"	4'-8"	
11'	12'	15'	8"	12'-7"	40	8	8"	14'-2"	42	6	6"	11'-6"	4'-4"	
12'	12'	15'	6"	13'-7"	44	8	6"	14'-2"	46	6	6"	12'-2"	4'-6"	

#5 aa (Typ.)

Constr. (Typ.)

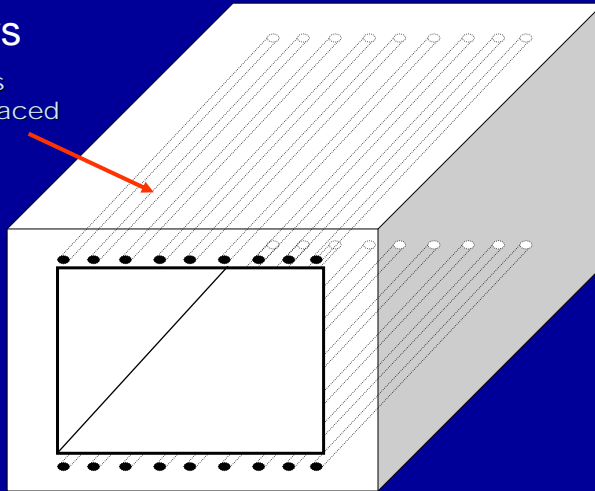
hh bars (Typical)

* K * Spc @ 18"

cc bars (Typ.)

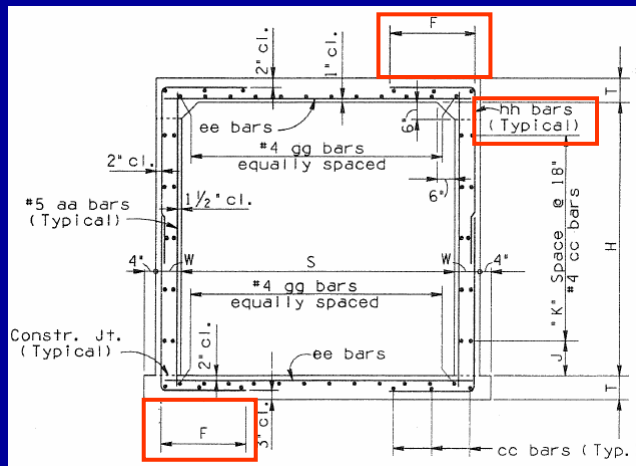
Concrete Box Culvert B-02.10 Single Barrel

gg bars
18 bars
Equally spaced

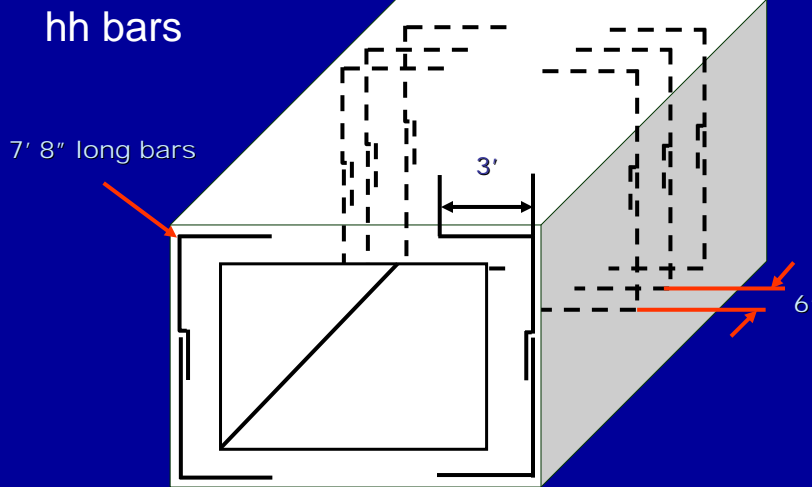


Concrete Box Culvert B-02.10 Single Barrel

hh bars



Concrete Box Culvert B-02.10 Single Barrel

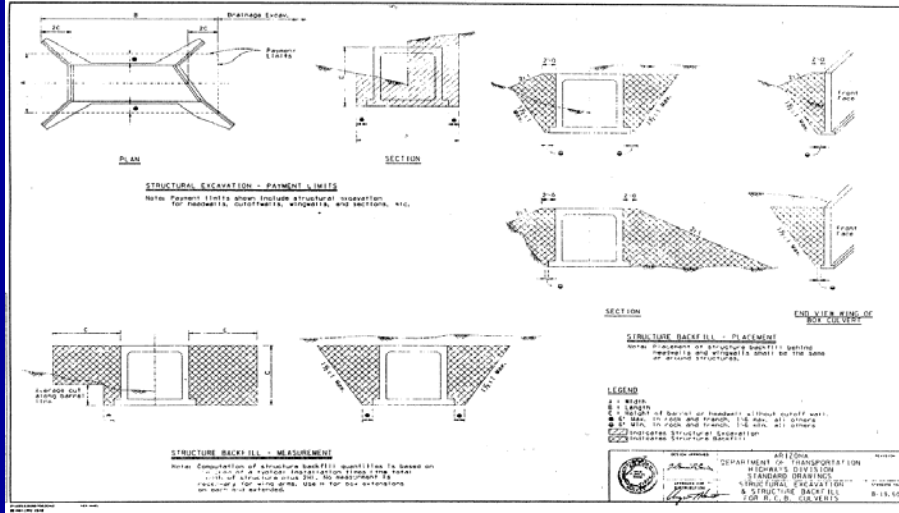


Concrete Box Culvert B-02.10 Single Barrel

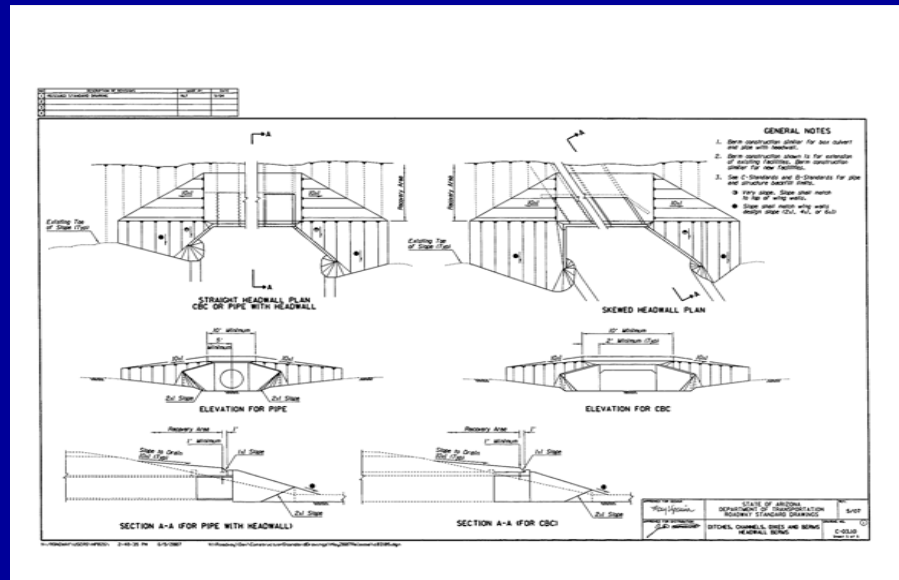
17ft (left) + 13ft
0.858(cy /
=25.7cy

		QUANTITIES PER LINEAR FOOT OF BARREL									
Span, S' Height, H'	Table I	Table II		Table III		Table IV		Table V			
		Concrete C.Y.	Reinf. Steel Lbs.	Concrete C.Y.	Reinf. Steel Lbs.	Concrete C.Y.	Reinf. Steel Lbs.	Concrete C.Y.	Reinf. Steel Lbs.		
3'	3'	0.635	90.0	0.563	95.7	0.611	104.2	0.659	107.7	0.684	118.6
	4'	0.691	104.4	0.618	104.7	0.667	113.2	0.715	127.4	0.763	128.4
	5'	0.747	117.6	0.674	116.4	0.722	121.8	0.771	133.6	0.819	134.7
	6'	0.802	137.8	0.729	126.1	0.778	141.5	0.826	138.6	0.874	144.5
	7'	0.858	146.7	0.785	135.1	0.833	150.4	0.882	147.5	0.930	153.4
4'	3'	0.841	123.8	0.778	123.7	0.812	125.7	0.866	143.5	1.029	150.7
	4'	0.908	138.6	0.846	133.3	0.940	145.2	1.034	150.1	1.097	173.0
	5'	0.976	144.3	0.945	157.9	1.008	157.7	1.102	160.7	1.196	164.0
	6'	1.044	153.3	1.013	166.8	1.107	165.4	1.170	163.8	1.264	170.5
	7'	1.112	177.1	1.081	170.8	1.175	158.8	1.238	171.2	1.332	220.3
5'	3'	1.180	182.7	1.149	177.0	1.243	181.8	1.337	198.7	1.400	199.5
	4'	1.022	151.4	1.060	193.8	1.215	197.7	1.330	210.9	1.485	209.8
	4'	1.102	160.4	1.140	204.6	1.295	206.9	1.410	213.3	1.565	238.6
	5'	1.182	165.0	1.221	210.6	1.375	215.6	1.491	241.0	1.645	220.3
	6'	1.262	173.4	1.340	202.0	1.455	227.0	1.610	253.6	1.725	229.1
6'	7'	1.343	182.5	1.420	211.6	1.535	225.8	1.650	255.2	1.806	232.1
	8'	1.423	188.1	1.500	235.3	1.654	233.6	1.770	262.5	1.886	267.4
	9'	1.503	198.3	1.619	243.4	1.735	269.9	1.850	255.2	1.966	276.4
	10'	1.622	206.4	1.699	244.4	1.815	276.6	1.969	282.4	2.085	277.7
	8'	1.803	313.2	1.940	289.8	2.123	291.5	2.307	295.4	2.535	336.2
7'	9'	1.856	325.9	2.033	300.2	2.216	337.3	2.445	348.2	2.624	352.8
	10'	1.988	353.4	2.126	310.5	2.354	321.2	2.538	326.2	2.721	357.9
	11'	2.127	345.8	2.218	354.4	2.447	362.5	2.630	375.1	2.813	373.9
	12'	2.219	414.3	2.356	345.2	2.540	398.4	2.723	431.2	2.957	421.0

Concrete Box Culvert B19.50 Structural Ex & Backfill



Concrete Box Culvert C-03.10 Headwall Berms



SECTION FIVE

Concrete Box Culverts

QUIZ

5 - 19

1. Which ADOT Standard Drawing would an inspector use to inspect the backfill of a box culvert?

- a. B-02.70
- b. C-03.10
- c. B-19.50

5 - 20

2. Where in the ADOT Bridge Standard Drawings would you find the culvert quantities for a triple barrel box culvert?

- a. B-02.70
- b. B-02.10
- c. B-02.20

5 - 21

3. Where in the ADOT Bridge Standard Drawings would you find the details for a box extension?

- a. B-19.50
- b. B-06.10
- c. B-01.11

5 - 22

4. Which plan sheet will show the elevations for the box culvert?

- a. Summary sheet
- b. Culvert detail (D-1) sheet
- c. Key map sheet

5 - 23

5. Which plan sheet will show what table to use for the box culverts?

- a. Summary sheet
- b. Key map
- c. Culvert detail sheet

5 - 24

6. Using the ADOT Bridge Standard Drawing B-02.10 table No. I, what is the slab (T) dimension for a 10'x10' box culvert?

- a. 11 ½ inch
- b. 10 ½ inch
- c. 16 ½ inch

5 - 25

Section Six

Documentation

- Measurement for Payment
- Key Information and Events
- Records and Reports

6 - 1

Documentation

- Reasons for documentation
 - Measurement for payment
 - Record of contractor activities
- Records and Reports used

6 - 2

Documentation Measurement for payment

- Measured Unit payment
- Line Item (lump sum) payment
 - "Lump Sum" as Unit of Measurement
 - Actual unit of measure but pay 100% (earthwork items)
- Measure to correct accuracy – Measurement for Payment portion of the Item Specification
- Be sure paying to correct item/section

6 - 3

Documentation Key Information and Events

- Narrative of days activities
 - Work being done
 - Prime or sub
 - Location of work item
 - Conversations with contractor
 - Samples taken/tests performed and results
- List any unusual occurrences
- List visitors

6 - 4

Documentation Records and Reports


- Daily Diary in Pen
 - List of forms on left side replaced many old stand alone forms
- Materials Certifications, Certificates of Analysis and other items you collect
- Sample tickets
- Quantlist Weblink:
 - (<http://adotnet/divisions/itd/checklist>)

6 - 5

Documentation Materials Certification Sampling and Testing

Materials Certifications,
Certificates of Analysis
and other items you collect

#p#3

**CONSOLIDATED
REBAR
INC.**  **CERTIFICATE OF COMPLIANCE**

Date: January 24, 2008

To: DBI-Balmain & Sons, Inc.
Project: Oregon-Alaska Center Hwy. (DB-46)
Address: 4000 West Main Street, Suite 200
ASTM Product No.: A615-42A-01P
CSI SA No.: 20061

Material: Reinforcing Steel Bar

Release No.: 13, 34, 35

Identification: Slitter No.: 807731, 807730

Specification: ASTM A615 GRADE 60 Manufactured in the U.S.A.



SIZE	WEIGHT	TEST RESULTS
#4	2.030#	11731
#4	2.030#	11811
#6	2.592#	11812

A.D.O.T. LAB NO. (W-351) 98

I certify that the material indicated above does conform to all requirements of the Specification ASTM A615 Grade.

CONSOLIDATED REBAR, INC.
Michael S. Sorensen
President and CEO
Nathan Sorensen
Project Manager

State of Arizona
County of Maricopa
Issued and collected before me this
14th day of January, 2008.

321 South 27th Avenue • Phoenix, Arizona 85009 • (602) 269-9900 • Fax (602) 269-8764

6 - 6

Documentation Sample Tickets

Sample tickets

PLEASE PRESS FIRMLY
WHILE FILLING OUT FORM

ARIZONA DEPARTMENT OF TRANSPORTATION
44-4031 R1002

Name of Material _____

Item No. or Specification Section No. _____

Sample No. _____ Lot No. _____ Test Lab _____

Sampled By _____ Date/Time _____

Sampled from _____
(Hot Plant, Stockpile, Truck No., Sta. No., Etc.)

Quantity Represented _____

Supplier _____
(Original Source, Manufacturer, Refinery, Etc.)

TRACS No. _____ ORG No. _____

Project No. _____

Project Engineer/Supervisor _____

Remarks: _____

6 - 7

CLASS REVIEW

This is your time to ask questions about subjects you didn't understand or feel were skipped over.