Answer Booklet

to be used as directed in the
Self-Instructional Course MANUAL,

BRIDGE AND CULVERT PLAN READING

ANSWER SHEET for

BRIDGE AND CULVERT PLAN READING QUIZ

□ PRE-TEST
□ POST-TEST

EMPLOYEE NUMBER _____
NAME (Optional) _____

- Use your *pencil* to place an **X** through the box corresponding to your choice. For example, if your choice as the best answer to an item is "B", you would show this as, □ ☒ □ □ .
- Mark *only one box* for each item. If you change an answer, erase your first **X** *clearly* and *completely* – then mark the box of your new choice.
- Be sure you show your answer beside the right item *number*. *Always double-check this.*

	A	B	C	D
1	□	□	□	□
2	□	□	□	□
3	□	□	□	□
4	□	□	□	□
5	□	□	□	□
	A	B	C	D
6	□	□	□	□
7	□	□	□	□
8	□	□	□	□
9	□	□	□	□
10	□	□	□	□
	A	B	C	D
11	□	□	□	□
12	□	□	□	□
13	□	□	□	□
14	□	□	□	□
15	□	□	□	□
	A	B	C	D

	A	B	C	D
16	□	□	□	□
17	□	□	□	□
18	□	□	□	□
19	□	□	□	□
20	□	□	□	□
	A	B	C	D
21	□	□	□	□
22	□	□	□	□
23	□	□	□	□
24	□	□	□	□
25	□	□	□	□
	A	B	C	D
26	□	□	□	□
27	□	□	□	□
28	□	□	□	□
29	□	□	□	□
30	□	□	□	□
	A	B	C	D

	A	B	C	D
31	□	□	□	□
32	□	□	□	□
33	□	□	□	□
34	□	□	□	□
35	□	□	□	□
	A	B	C	D
36	□	□	□	□
37	□	□	□	□
38	□	□	□	□
39	□	□	□	□
40	□	□	□	□
	A	B	C	D
41	□	□	□	□
42	□	□	□	□
43	□	□	□	□
44	□	□	□	□
45	□	□	□	□
	A	B	C	D

	A	B	C	D
46	□	□	□	□
47	□	□	□	□
48	□	□	□	□
49	□	□	□	□
50	□	□	□	□
	A	B	C	D

MONITOR'S COMMENTS (if any)	FOR SCORER'S USE ONLY
	A. No. not attempted, or marked more than once ..... _____ B. No. attempted, but missed ..... _____ C. (B), above, ÷ 3 ..... _____ D. Sum of A, B, & C ..... _____ E. 50 minus D ..... _____ F. SCORE (2 x E) ..... _____

ANSWERS TO PAGE 7

1. 1) *Barrel* 2) *Headwalls*
2. *The Parapet*
3. *The Curtain Wall*
4. *Wing*
5. *Floor*
6. *An indentation in the bottom slab*
   (Your answer need not be in exactly these same words.)
7. From one *Inside wall* to the other *Inside wall*
8. *No*

ANSWERS TO PAGE 10

1. *At the top of the bottom slab, in the trough*
2. *Inlet, higher*
3. *Outlet*
4. *Joint* (Or construction joint)
5. *On the end sections*
6. *Parapet*
7. *Flow Line*
8. *Perpendicular*
9. $\mathbb{L}$ *of culvert* and *a line perpendicular to roadway* $\mathbb{L}$

ANSWERS TO PAGE 12

1. *Outside edge of bottom slab*
2. *Outside face of wall*
3. *Inside face of wall*
4. *Top of slope to trough*
5. *Toe of slope to trough*

ANSWERS TO PAGE 15

1. *The Culvert* ℄ (and each other)
2. 1) *Barrel* 2) *Headwalls*
3. The *Curtain Wall*
4. The *Parapet*
5. *Wing*
6. *From the inside edge of one wall to the inside edge of the other wall*
7. 1) *Inlet Flow Line Elevation* 2) *Outlet Flow Line Elevation*
8. *On a line perpendicular to roadway* ℄
9. 1) ℄ *of Culvert* 2) *Line perpendicular to roadway* ℄
10. *Distance back to back of parapets at right angles (perpendicular) to center line of roadway*
11. 30' (From the General Notes)

ANSWERS TO PAGE 17

1. *Transverse*
2. *Vertical*
3. *Horizontal*
4. *Longitudinal*

ANSWERS TO PAGE 18

1. *Transverse*
2. *Vertical*
3. *Horizontal*
4. *Longitudinal*
5. *Transverse*
6. *Vertical*
7. *Longitudinal* (In slab)
8. *Horizontal* (In wall)

ANSWERS TO PAGE 20

1. *Parapet and Curtain*
2. *None* (The $\phi = 0^\circ$ Column says "Skew Only" on the p bar line.)
3. 8, 8, 8
4. 5/8"
5. *At 4" centers*
6. 6'5", 7', 8'4"

ANSWERS TO PAGE 22

1. *102* (2 X 50'+ 2, from the number column)

2. 6'3" (5 feet + 1 foot (12") + 3" = 6'3")

3. *Vertical position in the Wings* (Wingwalls)

4. *At one end only*

5. 1) *k* 2) *k*1 3) p (Any order)

6. *m*1 and *f*1 (The f1 bars are also in the barrel floor.)

7. *f*, *f*1, *m* (Any order)

ANSWERS TO PAGE 24

1. *24' 2"*, the culvert would have a *height of* 5' and be constructed on a *45° skew*.

2. *20*, *16*, *12*, *8* (In that order) (Two times the number of lengths given)

3. *11'3"*, in culverts constructed on a *45° skew* (All heights)

4. *Four* (This length is listed 2 times and that must be doubled.)

5. *2 - 11'3" b1 bars*
   2 - 16'3" b1 bars
   2 - 12'10" b1 bars
   2 - 17'10" b1 bars (Any order)

ANSWERS TO PAGE 25

1. *Curved* (As shown by the bar detail)
2. *One end only*
3. *Vertically* in the *wings*
4. ½" (As written in the size column of the Bill of Reinforcing)
5. *At 1' centers* (Parallel to each other, with 1' between the centers)
6. *Table 2*

ANSWERS TO PAGE 27

1. A 4 X 5 culvert on a 45° *skew*
2. 4 X 2 culverts; *straight*, on a 15° *skew*, and on a 30° *skew*
3. 4 - 5'10"
   4 - 5'2"
   4 - 4'6"
   4 - 3'11"
   4 - 3'3" (Any order)

ANSWERS TO PAGE 30

1. *From the top of Roadway Foreslope to the top of culvert directly below, on the deepest side.*
2. 6"
3. 5/8", 1/2", 5/8" (In that order)
4. 24 *cubic yards* (50 X .480)
5. 35.69 *pounds*
6. At 7 *inch centers*
7. 5'11", 5'8" (In that order)

ANSWERS TO PAGE 32

1. No (From the General Notes)
2. 1'8" (From the General Notes)
3. Dots
4. Lines
5. Bars *c* and *i*
6. *j bars*
7. 17'-10", 17'-6", 17'-2", 16'-10", 16'-6" (Any order)
8. 32 (8 different lengths, 4 of each)
9. *b*, *e* and *f* (From the General Notes)

ANSWERS TO PAGE 36

1. *Apron*
2. *The Curtain Wall*
3. D D
4. *@ 1'3" Centers*
5.
6. *Across the entire top of the apron* (Below the concrete, of course)
7. *Across the bottom of the apron* (Below the top reinforcing bars inside the concrete)
8. The *Front Face* reinforcing for both *wings*
9. The *Back Face* reinforcing for both *wings*

ANSWERS TO PAGES 38 & 39

1. *al*
2. 6/8" or 3/4"
3. 5/8"
4. *6 feet*
5. *10 feet*
6. *In the parapet, vertically*
7. *41 pounds*
8. *12*
9. *From Front Face of wings to Front Face of opposite wings at the outside end of the headwall*
10. *22 feet, 5 inches*
11. *1½ inches unless otherwise noted or shown*
12. *The longest and shortest*

ANSWERS TO PAGES 44 & 45

1. *A top slab*
2. *A culvert*
3. *A culvert extension* will be connected to the end of the *barrel section* of the existing culvert.
4. The *culvert extension*
5. 7'6" (The M dimension)
6. *When flume is normal* (perpendicular) *to* ℄ *of road and on 2 to 1 slope*
7. 8" (The U dimension shown in the End View)
8. *At 1 foot centers*
9. In the *top of the flume walls, horizontally*
10. *In the front face of the flume walls, vertically* (Shown on sections and on plan)
11. *m2 bars* (Shown on plan and in section B B)
12. *10'* (Same as culvert)

ANSWERS TO PAGE 50

1. *1161*
2. *1061*
3. *1961* (The 61 in each design number means 1961)
4. *T-98N, R-8W, Section 8*
5. *Decorah Township, Winneshiek County*
6. *196 + 29.00*
7. *The Upper Iowa River*
8. *F 1112(1)*
9. *November 6, 1962*
10. 1) *410 feet* 2) *30 feet* 3) *15°*

ANSWERS TO PAGE 52

1. *12/10/62* *10/24/62* *9/25/62*
2. *Bridge design No. 1161* (From the Layout)
3. *411.708 feet* *.078 mile*
4. *772.2 cubic yards* (From Estimate of Quantities)
5. *Standard Specifications of the Iowa State Highway Commission, Series of 1960 plus current Supplemental Specifications and Special Provisions*
6. *B.P.R. Circular Memorandum dated August 29, 1960 entitled "Unit Stresses for A.S.T.M. A-36 Carbon Steel"*

ANSWERS TO PAGE 55

1. Pier 3
2. 40' *Center to Center* (Written between piers 3 & 4)
3. *196 + 29.00*
4. *Four*
5. *198 + 33.99*
6. *194 + 24.05*
7. 69'-11 3/4" (The inch sign, '', is often omitted on the sheets.)
8. 90'
9. *Level, Horizontal*
10. *15°*
11. 869.0

ANSWERS TO PAGE 57

1. 90'
2. *Back* (Toward lower station numbers)
3. 864.8 to 865.0
4. 30'

ANSWERS TO PAGE 60

1. 878.9
2. 2½:1
3. 885.7
4. 2½:1 (As written on the north berm)
5. 878.2
6. *March 27, 1961*
7. 862.5±
8. 45'
9. *10" (deep) bearing piling, weighing 42 pounds per foot of length* (Your answer need not be in exactly the same words but you must have included all the same points.)
10. *It was not used, because of plan revision.*
11. 840, 920
12. 883.66
13. 856.50

ANSWERS TO PAGE 62

1. *The footing*
2. *The backwall (There is no Front Wall)*
3. *Bridge Seat*
4. *At the top*
5. *The column*
6. *The pier cap*
7. *887.91*
8. *880.48*
9. *885.00*
10. *The I beams*

ANSWERS TO PAGE 64

1. *197' 63.99*
2. *40' long. Steel H pile 10" deep, weighing 42 pounds per foot of length*
3. *880.48*
4. *885.57*
5. *Everything above the bearings*
6. *412.6*
7. *156*
8. *U S No 52*
9. *Footing*

ANSWERS TO PAGE 66

1. *1" = 100'*

2. *Because it is not regular size*

3. *Right*

4. *Office Relocation* $\mathbb{Q}$

5. *Easterly* (As shown by the water flow arrows in the river, in relation to the directional arrow)

6. *The approach fills* (As written in the General Notes)

7. *The Bridge Contractor*

8. *The Bridge Contractor*

9. *(Design) A.A.S.H.O. Series of 1961*
(Construction) Standard Specifications of the Iowa State Highway Commission, Series of 1960, plus current special provisions, and supplemental specifications.

ANSWERS TO PAGE 68

1. B-553 (As drawn on the Situation Plan)

2. 868.31

3. 90 *feet* (As estimated from Situation Plan)

4. 1) 862.6 (As written vertically along the left side of Test Hole B-553 on Sheet 2)

   2) *Bouldery Gravel*

5. 796.3 (Bottom of Hole Elevation)

6. *1.5 feet* (Test Holes B-589 – 592 were drilled in 1.5' of water.) (They are shown to be in the river.)

7. *19.0' thick* , 6.2' (In Test Hole B-550, the Bouldery Gravel layer is shown to begin at the end of the 6.2' layer of stiff sandy silt.)

ANSWERS TO PAGE 74

1. *Top of backwall, front face, and* $\mathbb{C}_L$ *of roadway* (Your answer need not be in exactly the same words.)

2. 884.99

3. 891.86

4. 1) *Abutment Bearing*

   2) *Roadway*

   3) *Abutment*

   4) *Bottom of footing*

   5) *Sloping front face of the footing*

   6) *Bridge Seat*

   7) *Backwall*

   8) *Paving Notch*

5. *The piling below*

6. 9

7. *1:4*

8. *4*

ANSWERS TO PAGE 76

1. 1) *1" (8/8")*

   2) *Footing*

   3) *Longitudinal*

   4) *Bent*

   5) *22*

   6) *20'6"*

   7) *1204 pounds*

2. *Structural Grade Steel* (From the table)

3. *5c1 bars*

4. *At 2'-0" centers* (15 spaces of 2' each is a distance of 30'. This information is given just below the Footing Plan.)

ANSWERS TO PAGES 78 & 79

1. *Footing*
2. *Backwall*
3. *Wings*
4. *At each end of an abutment, from the front of the bridge seat back to the wing wall*
5. *Paving Notch, top of backwall, bridge seat, slope from front of bridge seat to bottom of footing.* (In that order) (You could get this from the ℄ section or from the plan.)
6. *The Roadway Paving*
7. *Section 4133 of the I.S.H.C. Standard Specifications of 1960* (From the Abutment Notes)
8. *2"*
9. *To refusal in limestone*
10. 5/8"
11. *21.3*
12. 62.4
13. *4"*

ANSWERS TO PAGE 84

1. 24 (As shown on the Footing Plan and in the Total Estimated Quantities)

2. *None*

3. 48 (24 each)

4. 882.81 (From Table A)

5. 25 *4a4 bars at 1' centers in a transverse position and 12 6a3 bars, at 9" centers, longitudinal position* (From Footing Plan and Reinforcing Table)

6. *Rectangular* (Stirrups are bars 5f1 and 5f2-15, as listed in the Reinforcing Table. These are shown in the Bent Bar Details to be rectangular.)

7. *The top*

8. *The steps* (Left low step is lowest, at top of pier cap.)

9. 850.71 (From Table A on Sheet 4A)

ANSWERS TO PAGE 88

1. 249, 259, 349 (In that order) (As written under each heading on the sheet)

2. *Masonry Plate, 2 bolts needed*

3. 2 (As indicated in pier masonry plate diagram)

4. *1'2½"* (From diagram over: ROCKER R3A)

5. 4, 6.1 *pounds*

6. Your answer should include these points:

   The sole plate is attached to the beam.

   The pin is attached to the sole plate.

   The pin fits into the top of the rocker or fixed shoe but is not attached to either of them in any way.

ANSWERS TO PAGES 90 & 91

1. *A Masonry plate*
2. *By bars extending into the abutment backwall*
3. *Sole plate*
4. *Blocking Plate*
5. *Article 2408.46 of the Standard Specifications* (From the Bearing Notes)
6. *Paint and Canvas*
7. *Pintles*
8. *A pin*
9. 1) *A fixed shoe has a flat bottom while a rocker has a curved bottom*

   2) *A fixed shoe is anchored to the pier with 4 bolts. The rocker is not bolted to anything and its masonry plate is bolted with only 2 bolts.*

ANSWERS TO PAGE 95

1. *Pier 2* (It has a fixed shoe.)
2. *Straight up*
3. *Those on Piers 3 & 4*
4. *Away*
5. *Away*
6. -
7. +
8. *Lesser*

ANSWERS TO PAGES 96 & 97

1. 3 *inches*
2. 3¼"
3. 2½" (both)
4. -9/16", -¼", -¼"
5. 50°
6. *Below*
7. +
8. *Expansion*
9. *Contraction*
10. -1/8" (30° is halfway between 50° and 10°. -1/8 is halfway between -1/4 and 0.)

ANSWERS TO PAGE 100

1. 29' (Written on the left edge of the sheet)
2. 36" (36 W is written on each at the middle of the diagram.)
3. *160 pounds*
4. *Skewed line* (Parallel to pier skew)
5. *Over the piers and abutments*
6. *Those placed over the pier*
   1) *Are deeper* (24")
   2) *Are heavier* (76 pounds per linear foot)
7. 9' 8"
8. 9' 8" (4'10" on either side of $\mathcal{L}$)

ANSWERS TO PAGES 112 & 113

1. *Parabolic 1½" in 10'0* (As indicated at the top of the sheet above the HALF INTERMEDIATE SECTION)

2. *Tangent 3%*

3. *Rough* (Also from Half Intermediate Section)

4. *At 9" centers*

5. *1"*

6. *Sheet 1, Situation Plan*

7. *3 feet*

8. *A 3/4" Drip Groove*

9. 1) *Aluminum Bridge Rail Tubing*

   2) *Aluminum Rail Post Castings* (From Sheet 10, Specifications)

10. *8'*

11. *1/4" Bent Plate (PL) Rail Coupling*
    (As shown in Section DD, upper right corner)

12. ***Standard Specifications of the Iowa State Highway Commission Series of 1960 Plus current Special Provisions with the added provisions*** (From 3 under SPECIFICATIONS)