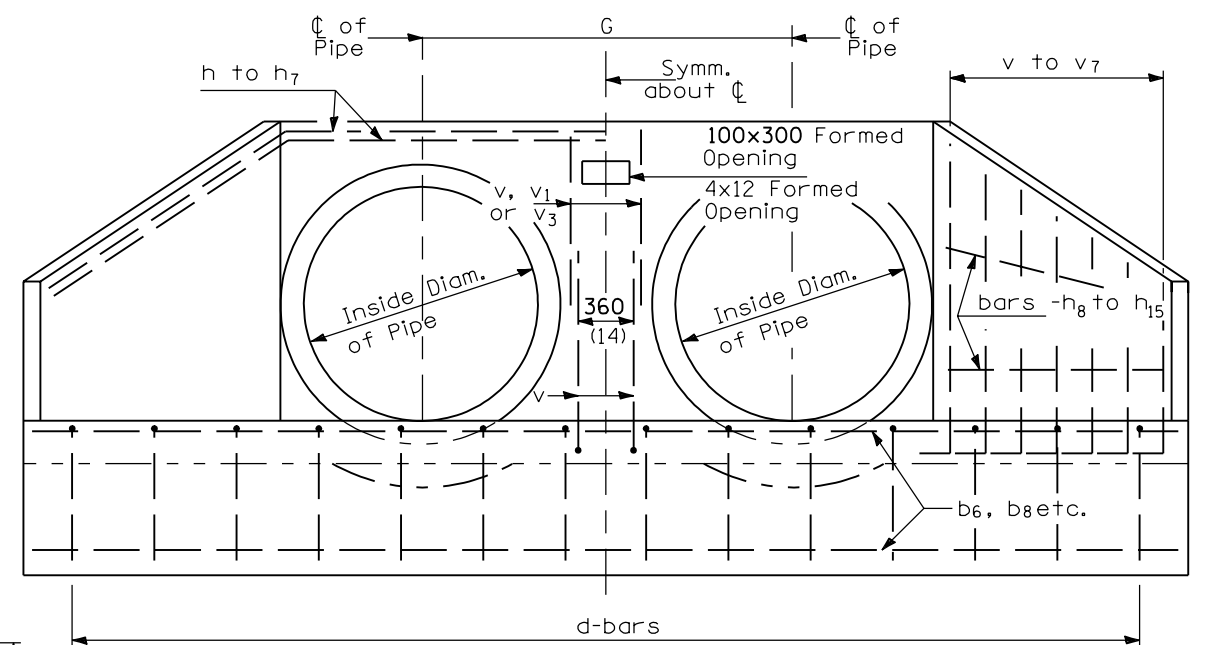
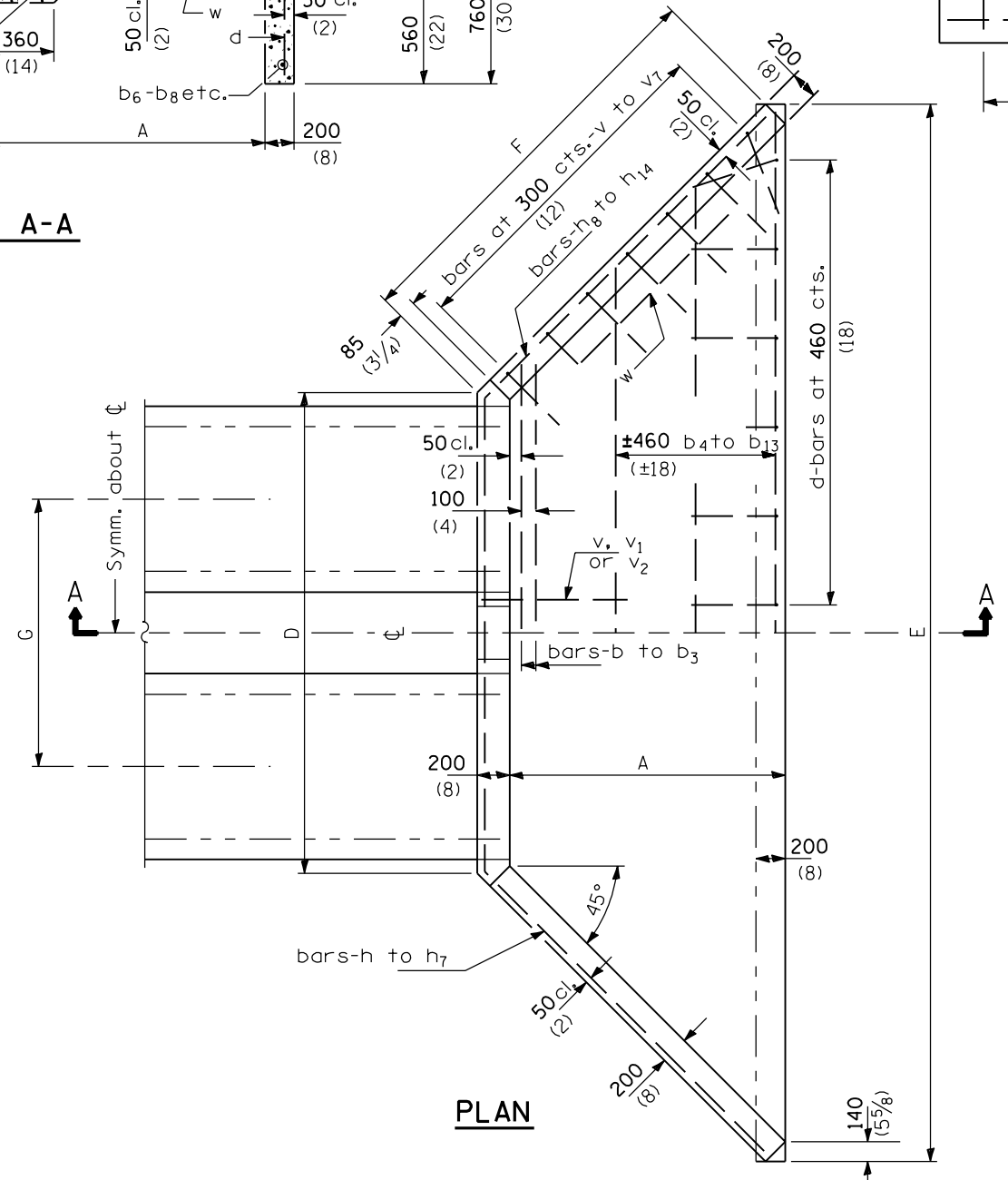


**SECTION A-A**



**END ELEVATION**



**PLAN**

**GENERAL NOTES**

\* If embankment slope above headwall is flatter than 1:2, provide wings for 1:2 slope.

All slope ratios are expressed as units of vertical displacement to units of horizontal displacement (V:H).

All dimensions are in millimeters (inches) unless otherwise shown.

DATE	REVISIONS
1-1-97	Renum. Standard 2103-2.
6-15-94	Moved G.N. to Specs. Added slope note. Added Metric.

**REINFORCED CONCRETE END SECTIONS FOR MULTIPLE (2 & 3) PIPE CULVERTS 1050 mm (42") THRU 1500 mm (60") DIA. AT RIGHT ANGLES WITH ROADWAY**

(Sheet 1 of 3)

**STANDARD 542121**

Illinois Department of Transportation

APPROVED January 1, 1997  
*Ralph E. Anderson*  
 ENGINEER OF BRIDGES AND STRUCTURES

APPROVED January 1, 1997  
*Raymond*  
 ENGINEER OF DESIGN AND ENVIRONMENT

ISSUED 1-1-97

### DIMENSIONS OF STRAIGHT BARS

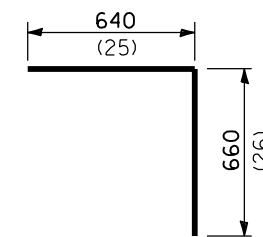
BAR	SIZE	LENGTH (m)		BAR	SIZE	LENGTH (m)	
		2-PIPES	3-PIPES			2-PIPES	3-PIPES
b	No. 15 (No. 5)	3.58 (11'-9")	5.33 (17'-6")	h <sub>8</sub>	No. 15 (No. 4)	1.45 (4'-9")	1.45 (4'-9")
b <sub>1</sub>	No. 15 (No. 5)	3.96 (13'-0")	5.87 (19'-3")	h <sub>9</sub>	No. 15 (No. 4)	1.6 (5'-3")	1.6 (5'-3")
b <sub>2</sub>	No. 15 (No. 5)	4.27 (14'-0")	6.32 (20'-9")	h <sub>10</sub>	No. 15 (No. 4)	1.83 (6'-0")	1.83 (6'-0")
b <sub>3</sub>	No. 15 (No. 5)	4.65 (15'-3")	6.94 (22'-9")	h <sub>11</sub>	No. 15 (No. 4)	1.98 (6'-6")	1.98 (6'-6")
b <sub>4</sub>	No. 15 (No. 4)	4.42 (14'-6")	6.25 (20'-6")	h <sub>12</sub>	No. 15 (No. 4)	2.21 (7'-3")	2.21 (7'-3")
b <sub>5</sub>	No. 15 (No. 4)	4.95 (16'-3")	7.01 (23'-0")	h <sub>13</sub>	No. 15 (No. 4)	2.44 (8'-0")	2.44 (8'-0")
b <sub>6</sub>	No. 15 (No. 4)	5.26 (17'-3")	7.32 (24'-0")	h <sub>14</sub>	No. 15 (No. 4)	2.67 (8'-9")	2.67 (8'-9")
b <sub>7</sub>	No. 15 (No. 4)	5.49 (18'-0")	7.47 (24'-6")	w	No. 15 (No. 4)	1.22 (4'-0")	1.22 (4'-0")
b <sub>8</sub>	No. 15 (No. 5)	5.79 (19'-0")	7.7 (25'-3")				
b <sub>9</sub>	No. 15 (No. 5)	6.25 (20'-6")	7.92 (26'-0")				
b <sub>10</sub>	No. 15 (No. 4)	6.48 (21'-3")	8.23 (27'-0")				
b <sub>11</sub>	No. 15 (No. 4)	7.01 (23'-0")	8.46 (27'-9")				
b <sub>12</sub>	No. 15 (No. 4)	7.32 (24'-0")	9.3 (30'-6")				
b <sub>13</sub>	No. 15 (No. 4)	7.92 (26'-0")	10.36 (34'-0")				

### DIMENSIONS AND QUANTITIES

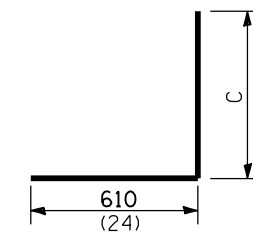
DESIGN NO.	NOMINAL DIAM. of PIPE	SLOPE of FILL	DIMENSIONS FOR ALL MULTIPLES										QUANTITIES			
			2 PIPES					3 PIPES					2 PIPES		3 PIPES	
			A	B	C	F	G	D	E	D	E	Concrete 2 End Secs. m <sup>3</sup> (cu. yds.)	Reinf. Bars 2 End Secs. kg (lbs.)	Concrete 2 End Secs. m <sup>3</sup> (cu. yds.)	Reinf. Bars 2 End Secs. kg (lbs.)	
D1.05 m-1/2 (D42-1/2)	1050 (42)	1:1/2	1.01 (3'-4")	660 (26)	1.33 m (4'-4 1/2")	1.52 m (5'-0")	1.75 m (5'-9")	3.23 m (10'-7")	5.38 m (17'-8")	4.98 m (16'-4")	7.13 m (23'-5")	5.4 (7.1)	250 (440)	7.1 (9.3)	300 (540)	
D1.05 m-2 (D42-2)	1050 (42)	1:2	1.35 m (4'-5")	660 (26)	1.33 m (4'-4 1/2")	1.99 m (6'-6 1/4")	1.75 m (5'-9")	3.23 m (10'-7")	6.04 m (19'-10")	4.98 m (16'-4")	7.8 m (25'-7")	6.7 (8.8)	300 (540)	8.7 (11.4)	360 (640)	
D1.2 m-1/2 (D48-1/2)	1200 (48)	1:1/2	1.12 m (3'-9")	740 (29)	1.5 m (4'-11")	1.7 m (5'-7")	1.93 m (6'-4")	3.58 m (11'-9")	5.98 m (19'-8")	5.51 m (18'-1")	7.91 m (26'-0")	6.4 (8.4)	280 (510)	8.5 (11.1)	340 (610)	
D1.2 m-2 (D48-2)	1200 (48)	1:2	1.52 m (5'-0")	740 (29)	1.5 m (4'-11")	2.24 m (7'-4 1/4")	1.93 m (6'-4")	3.58 m (11'-9")	6.75 m (22'-2")	5.51 m (18'-1")	8.68 m (28'-6")	8.2 (10.7)	360 (630)	10.5 (13.7)	420 (740)	
D1.35-1/2 (D54-1/2)	1350 (54)	1:1/2	1.27 m (4'-2")	810 (32)	1.66 m (5'-5 1/2")	1.88 m (6'-2")	2.11 m (6'-11")	3.94 m (12'-11")	6.6 m (21'-8")	6.05 m (19'-10")	8.71 m (28'-7")	7.6 (10.0)	330 (580)	10.0 (13.1)	400 (700)	
D1.35 m-2 (D54-2)	1350 (54)	1:2	1.7 m (5'-7")	810 (32)	1.66 m (5'-5 1/2")	2.49 m (8'-2")	2.11 m (6'-11")	3.94 m (12'-11")	7.46 m (24'-6")	6.05 m (19'-10")	9.57 m (31'-5")	9.8 (12.8)	380 (670)	12.5 (16.3)	450 (800)	
D1.5 m-1/2 (D60-1/2)	1500 (60)	1:1/2	1.4 m (4'-7")	890 (35)	1.83 m (6'-0")	2.06 m (6'-9")	2.29 m (7'-6")	4.29 m (14'-1")	7.2 m (23'-8")	6.58 m (21'-7")	9.49 m (31'-2")	8.9 (11.7)	370 (650)	11.7 (15.3)	440 (790)	
D1.5 m-2 (D60-2)	1500 (60)	1:2	1.88 m (6'-2")	890 (35)	1.83 m (6'-0")	2.74 m (9'-0")	2.29 m (7'-6")	4.29 m (14'-1")	8.16 m (26'-10")	6.58 m (21'-7")	10.45 m (34'-4")	11.5 (15.0)	440 (780)	14.7 (19.2)	530 (930)	

### DIMENSIONS OF BENT BARS

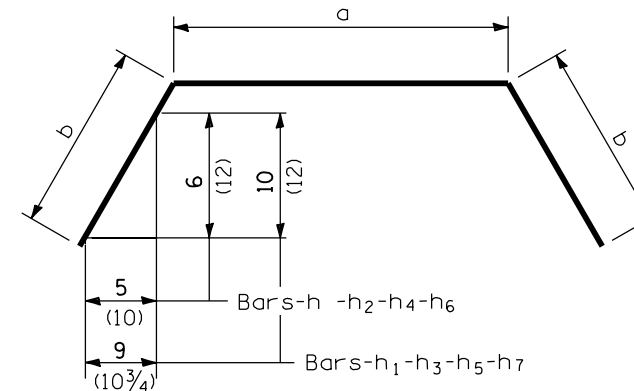
No. 15-bars v to v <sub>7</sub> (No. 5)			No. 15-bars h to h <sub>7</sub> (No. 5)						
BARS	c	TOTAL LENGTH	BARS	2-PIPES			3-PIPES		
				a	b	TOTAL LENGTH	a	b	TOTAL LENGTH
v	1.83 m (6'-0")	2.44 m (8'-0")	h	3.18 m (10'-5")	1.57 m (5'-2")	6.32 m (20'-9")	4.93 m (16'-2")	1.57 m (5'-2")	8.07 m (26'-6")
v <sub>1</sub>	1.68 m (5'-6")	2.29 m (7'-6")	h <sub>1</sub>	3.18 m (10'-5")	2.03 m (6'-8")	7.24 m (23'-9")	4.93 m (16'-2")	2.03 m (6'-8")	8.99 m (29'-6")
v <sub>2</sub>	1.52 m (5'-0")	2.13 m (7'-0")	h <sub>2</sub>	3.53 m (11'-7")	1.78 m (5'-10")	7.09 m (23'-3")	5.46 m (17'-11")	1.80 m (5'-11")	9.06 m (29'-9")
v <sub>3</sub>	1.37 m (4'-6")	1.98 m (6'-6")	h <sub>3</sub>	3.53 m (11'-7")	2.31 m (7'-7")	8.15 m (26'-9")	5.46 m (17'-11")	2.3 m (7'-6 1/2")	10.06 m (33'-0")
v <sub>4</sub>	1.22 m (4'-0")	1.83 m (6'-0")	h <sub>4</sub>	3.87 m (12'-9")	1.98 m (6'-6")	7.83 m (25'-9")	6.0 m (19'-8")	2.0 m (6'-6 1/2")	10.0 m (32'-9")
v <sub>5</sub>	1.07 m (3'-6")	1.68 m (5'-6")	h <sub>5</sub>	3.87 m (12'-9")	2.51 m (8'-3")	8.89 m (29'-0")	6.0 m (19'-8")	2.53 m (8'-3 1/2")	11.06 m (36'-3")
v <sub>6</sub>	910 (36)	1.52 m (5'-0")	h <sub>6</sub>	4.24 m (13'-11")	2.18 m (7'-2")	8.60 m (28'-3")	6.53 m (21'-5")	2.18 m (7'-2")	10.89 m (35'-9")
v <sub>7</sub>	760 (30)	1.37 m (4'-6")	h <sub>7</sub>	4.24 m (13'-11")	2.79 m (9'-2")	9.82 m (32'-3")	6.53 m (21'-5")	2.83 m (9'-3 1/2")	12.19 m (40'-0")



No. 15 (No. 4) - BAR d



No. 15 (No. 4) BARS v to v<sub>7</sub>



No. 15 (No. 4) BARS - h to h<sub>7</sub>

Bend in field  
One Required in each headwall

All dimensions are in millimeters (inches) unless otherwise shown.

REINFORCED CONCRETE END SECTIONS FOR MULTIPLE (2 & 3) PIPE CULVERTS 1050 mm (42") THRU 1500 mm (60") DIA. AT RIGHT ANGLES WITH ROADWAY (Sheet 2 of 3)

**STANDARD 542121**

Illinois Department of Transportation

APPROVED January 1, 1997  
*Ralph E. Anderson*  
ENGINEER OF BRIDGES AND STRUCTURES

APPROVED January 1, 1997  
*Raymond J. Hall*  
ENGINEER OF DESIGN AND ENVIRONMENT

ISSUED 1-1-97

**BARS IN ONE END SECTION - 2 PIPES**

1050 Pipe (42)				1200 Pipe (48)				1350 Pipe (54)				1500 Pipe (60)			
D1.05-1/2 (D42-1/2)		D1.05-2 (D42-2)		D1.2-1/2 (D48-1/2)		D1.2-2 (D48-2)		D1.35-1/2 (D54-1/2)		D1.35-2 (D54-2)		D1.5-1/2 (D60-1/2)		D1.5-2 (D60-2)	
BARS	No.	BARS	No.	BARS	No.	BARS	No.	BARS	No.	BARS	No.	BARS	No.	BARS	No.
d	12	d	13	d	13	d	15	d	14	d	16	d	16	d	18
b	2	b	2	b <sub>1</sub>	2	b <sub>1</sub>	2	b <sub>2</sub>	2	b <sub>2</sub>	2	b <sub>3</sub>	2	b <sub>3</sub>	2
b <sub>4</sub>	1	b <sub>4</sub>	1	b <sub>5</sub>	1	b <sub>5</sub>	1	b <sub>6</sub>	1	b <sub>6</sub>	1	b <sub>7</sub>	1	b <sub>7</sub>	1
b <sub>6</sub>	2	b <sub>6</sub>	1	b <sub>8</sub>	2	b <sub>8</sub>	1	b <sub>8</sub>	1	b <sub>9</sub>	1	b <sub>9</sub>	1	b <sub>9</sub>	1
		b <sub>8</sub>	2			b <sub>10</sub>	2	b <sub>10</sub>	2	b <sub>12</sub>	2	b <sub>11</sub>	2	b <sub>12</sub>	1
												b <sub>13</sub>	2		
h	2	h <sub>1</sub>	2	h <sub>2</sub>	2	h <sub>3</sub>	2	h <sub>4</sub>	2	h <sub>5</sub>	2	h <sub>6</sub>	2	h <sub>7</sub>	2
h <sub>8</sub>	4	h <sub>10</sub>	4	h <sub>9</sub>	4	h <sub>12</sub>	4	h <sub>10</sub>	4	h <sub>13</sub>	4	h <sub>11</sub>	4	h <sub>14</sub>	4
v <sub>7</sub>	6	v <sub>7</sub>	8	v <sub>7</sub>	4	v <sub>7</sub>	4	v <sub>6</sub>	4	v <sub>6</sub>	6	v <sub>5</sub>	6	v <sub>5</sub>	8
v <sub>4</sub>	4	v <sub>4</sub>	6	v <sub>5</sub>	4	v <sub>5</sub>	8	v <sub>4</sub>	4	v <sub>4</sub>	6	v <sub>3</sub>	4	v <sub>3</sub>	6
v <sub>3</sub>	2	v <sub>3</sub>	2	v <sub>3</sub>	4	v <sub>2</sub>	4	v <sub>1</sub>	4	v <sub>1</sub>	4	v	6	v	6
				v <sub>1</sub>	2	v <sub>1</sub>	2	v	2	v	2				
w	2	w	2	w	2	w	2	w	2	w	2	w	2	w	2


**BARS IN ONE END SECTION - 3 PIPES**

1050 Pipe (42)				1200 Pipe (48)				1350 Pipe (54)				1500 Pipe (60)			
D1.05-1/2 (D42-1/2)		D1.05-2 (D42-2)		D1.2-1/2 (D48-1/2)		D1.2-2 (D48-2)		D1.35-1/2 (D54-1/2)		D1.35-2 (D54-2)		D1.5-1/2 (D60-1/2)		D1.5-2 (D60-2)	
BARS	No.	BARS	No.	BARS	No.	BARS	No.	BARS	No.	BARS	No.	BARS	No.	BARS	No.
d	15	d	17	d	17	d	19	d	19	d	21	d	21	d	23
b	2	b	2	b <sub>1</sub>	2	b <sub>1</sub>	2	b <sub>2</sub>	2	b <sub>2</sub>	2	b <sub>3</sub>	2	b <sub>3</sub>	2
b <sub>4</sub>	1	b <sub>4</sub>	1	b <sub>5</sub>	1	b <sub>5</sub>	1	b <sub>6</sub>	1	b <sub>7</sub>	1	b <sub>8</sub>	1	b <sub>8</sub>	1
b <sub>5</sub>	2	b <sub>5</sub>	1	b <sub>8</sub>	2	b <sub>8</sub>	1	b <sub>9</sub>	1	b <sub>11</sub>	1	b <sub>11</sub>	1	b <sub>10</sub>	1
		b <sub>8</sub>	2			b <sub>11</sub>	2	b <sub>11</sub>	2	b <sub>12</sub>	2	b <sub>12</sub>	2	b <sub>12</sub>	1
												b <sub>13</sub>	2		
h	2	h <sub>1</sub>	2	h <sub>2</sub>	2	h <sub>3</sub>	2	h <sub>4</sub>	2	h <sub>5</sub>	2	h <sub>6</sub>	2	h <sub>7</sub>	2
h <sub>8</sub>	4	h <sub>10</sub>	4	h <sub>9</sub>	4	h <sub>12</sub>	4	h <sub>10</sub>	4	h <sub>13</sub>	4	h <sub>11</sub>	4	h <sub>14</sub>	4
v <sub>7</sub>	6	v <sub>7</sub>	8	v <sub>7</sub>	4	v <sub>7</sub>	4	v <sub>6</sub>	4	v <sub>6</sub>	6	v <sub>5</sub>	6	v <sub>5</sub>	8
v <sub>4</sub>	4	v <sub>4</sub>	6	v <sub>5</sub>	4	v <sub>5</sub>	8	v <sub>4</sub>	4	v <sub>4</sub>	6	v <sub>3</sub>	4	v <sub>3</sub>	6
v <sub>3</sub>	2	v <sub>3</sub>	2	v <sub>3</sub>	4	v <sub>2</sub>	4	v <sub>1</sub>	4	v <sub>1</sub>	4	v	6	v	6
				v <sub>1</sub>	2	v <sub>1</sub>	2	v	2	v	2				
w	2	w	2	w	2	w	2	w	2	w	2	w	2	w	2

All dimensions are in millimeters (inches) unless otherwise shown.

**REINFORCED CONCRETE END SECTIONS  
FOR MULTIPLE (2 & 3) PIPE CULVERTS  
1050 mm (42") THRU 1500 mm (60") DIA.  
AT RIGHT ANGLES WITH ROADWAY**  
(Sheet 3 of 3)

**STANDARD 542121**

 Illinois Department of Transportation	APPROVED _____ January 1, 1997 <i>Ralph E. Anderson</i> ENGINEER OF BRIDGES AND STRUCTURES	ISSUED 1-1-97
	APPROVED _____ January 1, 1997 <i>Raymond H. Howell</i> ENGINEER OF DESIGN AND ENVIRONMENT	