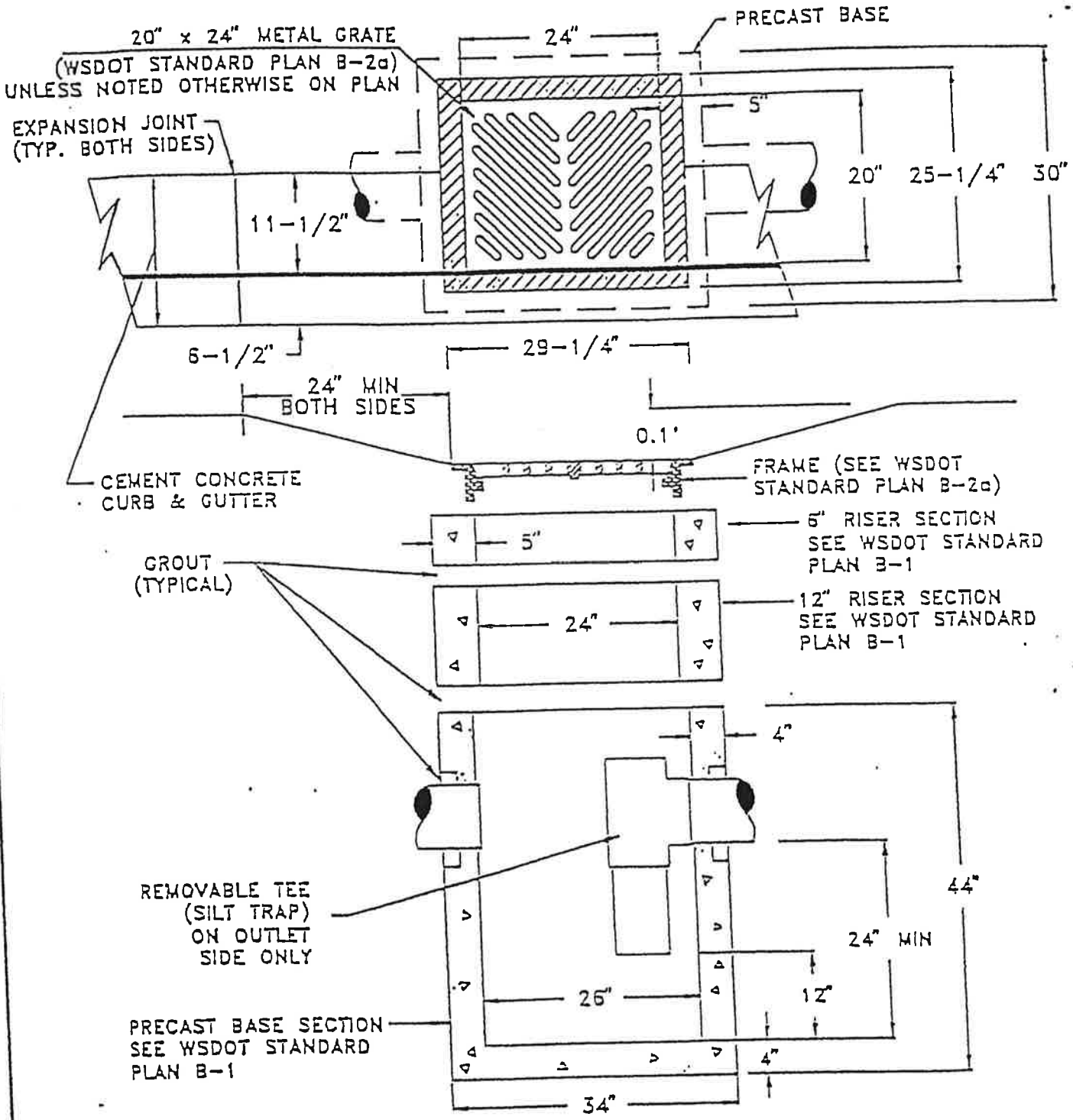
LIST OF DRAWINGS

CHAPTER 3 - STORM DRAINAGE

TITLE	DRAWING
Runoff Coefficients for Storm Sewers	**3-00**
Silt Trap Tee and Depression	3-02
Type 1 Catch Basins	3-03
Type 2 Catch Basin, 48 and 54 inch	3-04
Type 2 Catch Basin, 72 and 96 inch	3-05
Miscellaneous Catch Basin Details	3-06
Vaned Grate for Catch Basin and Inlet	3-07
Type 2 Catch Basin with Oil Separator	3-08
Type 2 Catch Basin with Baffle Oil Separator	3-09
Reinforced Concrete Single Box Culvert	3-10
Flared End Sections	3-11
Subgrade Drain	3-12
Pipe Compaction and Backfill Designs	3-13
Concrete Pipe Anchor	3-14
Low Pressure Air Test	3-15
Culvert Pipe Schedules	3-16
Vertical Connection	3-17
Type 1 Sidewalk Drain for Building & Downspout	3-18
Type 2 Sidewalk Drain for Building & Downspout	3-19
Sidewalk Drain - Commercial	3-20
Sidewalk Drain - Residential	3-21
Area Inlet	3-22
Miscellaneous Manhole Details	3-23
Manhole Ring and Cover	3-24
Concrete Inlet	3-25



NOTE:

1. CATCH BASIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH SPECIFICATIONS IN WSDOT STANDARD PLAN B-1.

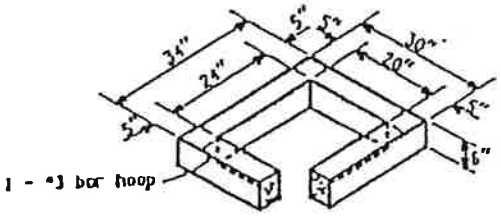
CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

SILT TRAP TEE AND DEPRESSION DETAIL

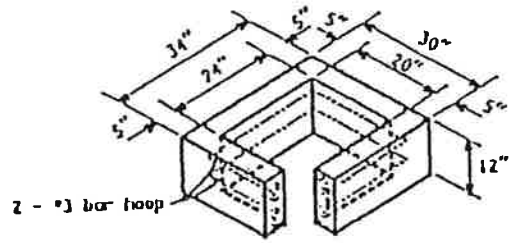
APPROVED BY
CITY ENGINEER _____ DATE _____

REF	DWN	CKD	DATE 6/24/94	FILE FIG 3-(

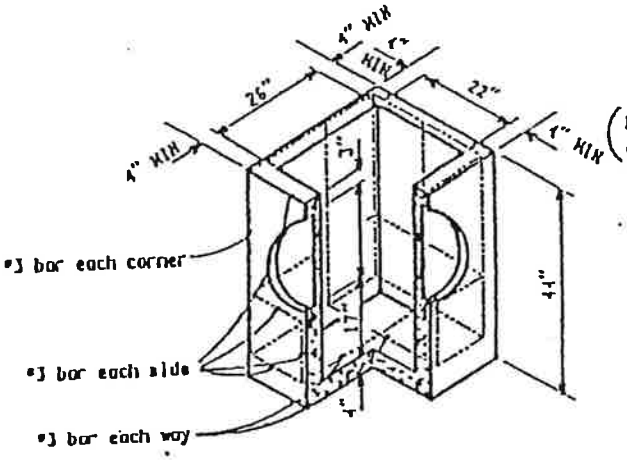
Frame and grate
(See Standard Plan for details)



6" Riser Section



12" Riser Section



Precast Base Section
(Measurement at the top of the base)

Notes:

Catch Basins to be constructed in accordance with ASTM C 478 (AASHTO M 199) & ASTM C 890 unless otherwise shown on plans or noted in the Standard Specifications.

As an acceptable alternate to rebar, welded wire fabric having a minimum area of 0.12 square inches per foot may be used. Welded wire fabric shall comply to ASTM A 497 (AASHTO M 221). Wire fabric shall not be placed in the knockouts.

The bottom of the precast base section may be rounded.

Precast bases shall be furnished with cutouts or knockouts. Knockouts shall have a wall thickness of 2" minimum.

Knockouts may be on all 4 sides with maximum diameter of 20". Knockouts may be either round or "D" shape. Pipe to be installed in factory supplied knockouts.

Knockout or cutout hole size is equal to pipe outer diameter plus catch basin wall thickness.

The maximum depth from the finished grade to the pipe invert is 5'-0".

The taper on the sides of the precast base section and riser section shall not exceed ½"/ft.

Catch basin frame and grate shall be in accordance with Standard Specifications and meet the strength requirements of Federal Specification RR-F-621D. Mating surfaces shall be finished to assure non-rocking fit.

Frame and grate may be installed with flange down or cast into riser.

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

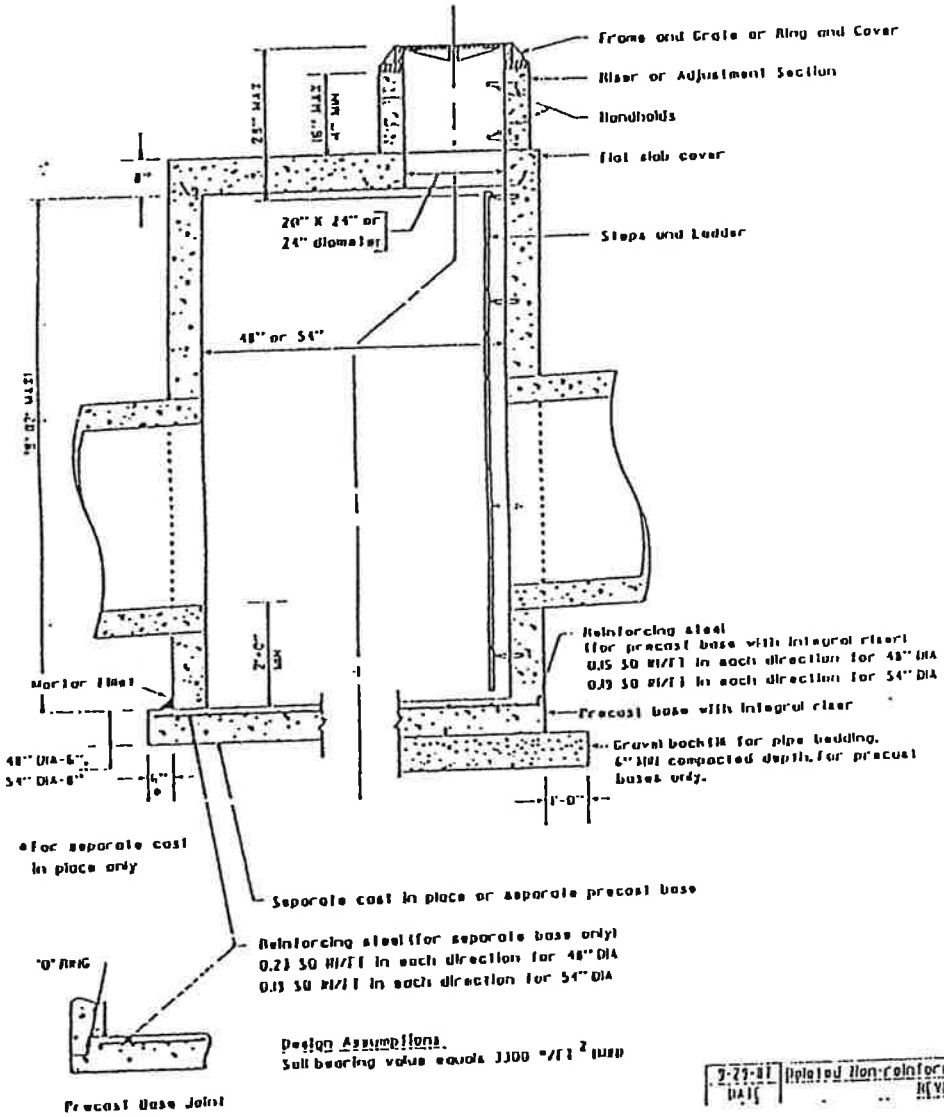
TYPE 1
CATCH BASIN

APPROVED BY
CITY ENGINEER _____ DATE _____

DWN | CKD | DATE 6/24/94 | FILE FIG 3-0

WSDOT STANDARD PLAN

REF



NOTES

Catch Basins to be constructed in accordance with ASTM C 478 (AASHTO M 199) & ASTM C 890 unless otherwise shown on plans or noted in the Standard Specifications.

Handholds in riser or adjustment section shall have 3" minimum clearance. Steps in catch basin shall have 6" minimum clearance. No steps are required when "D" is 4' or less.

All reinforced cast in place concrete shall be Class A. All precast concrete shall obtain 4000 PSI@ 28 days.

Precast bases shall be furnished with cutouts or knockouts. Knockouts shall have a wall thickness of 2" minimum.

Knockout or cutout hole size is equal to pipe outer diameter plus catch basin wall thickness. Maximum hole size is 36" for 48" catch basin, 42" for 54" catch basin. Minimum distance between holes is 8".

Frame and grate or ring and cover shall be in accordance with Standard Specifications and meet the strength requirments of Federal Specification RR-F-621D. Mating surfaces shall be finished to assure non-rocking fit.

All base reinforcing steel shall have a minimum yield strength of 60,000 PSI and be placed in the upper half of the base with 1" minimum clearance.

The bottom of the precast Catch Basin may be rounded.

For details showing frame and grate, ring and cover see Standard Plan "Metal Frame and Grate for Catch Basin and Inlet".

For details showing ladder, steps, handrail and top slab see Standard Plan "Miscellaneous Catch Basin Details".

Frame and grate may be installed with flange down or cast into riser.

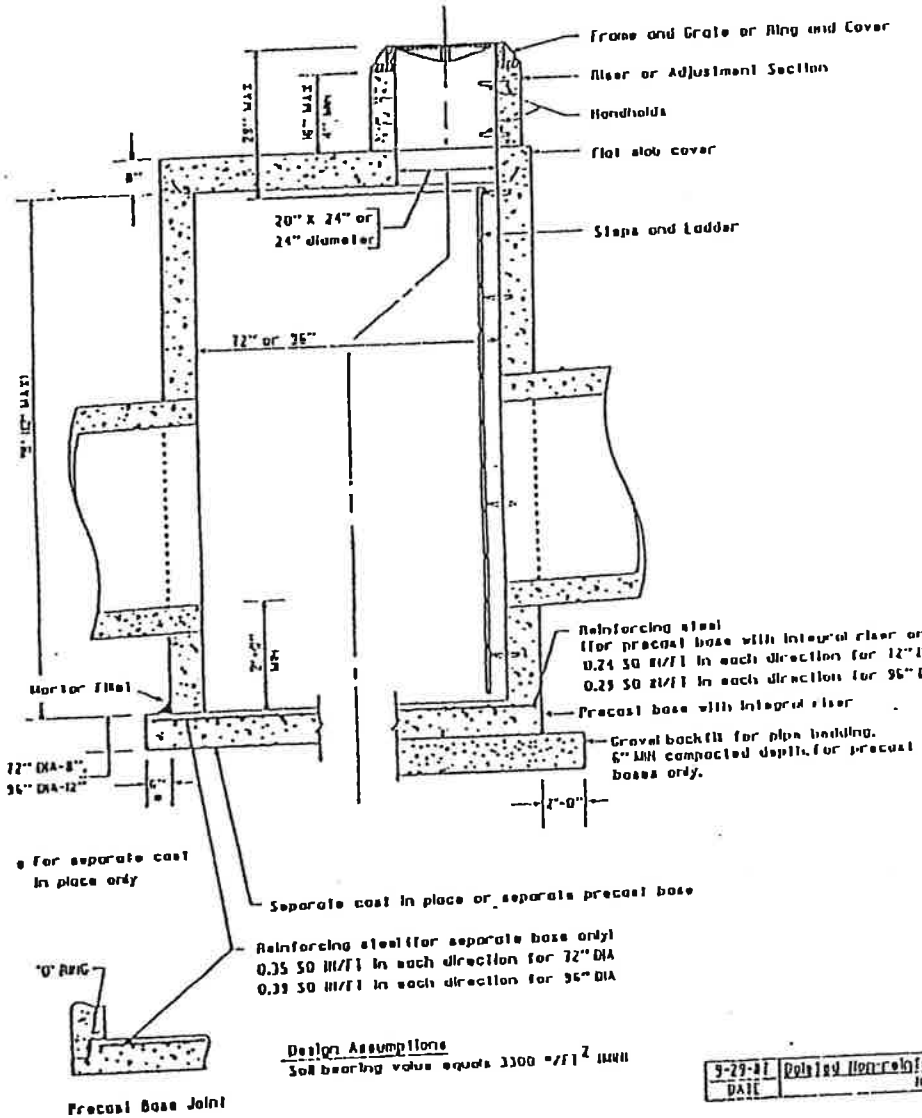
DATE	REVISION	DD	BY	APP'D
9-29-81	Deleted Non-reinforced Concrete note			

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

TYPE 2 CATCH BASIN 48 AND 54 INCH

APPROVED BY CITY ENGINEER _____ DATE _____

DWN | CKD | DATE 6/24/94 | FILE FIG 3-0



Design Assumptions
Soil bearing value equals 3300 #/FT^2 MIN

NOTES

Catch Basins to be constructed in accordance with ASTM C 478 (AASHTO M 199) & ASTM C 890 unless otherwise shown on plans or noted in the Standard Specifications.

Handholds in riser or adjustment section shall have 3" minimum clearance. Steps in catch basin shall have 6" minimum clearance. No steps are required when "D" is 4' or less.

All reinforced cast in place concrete shall be Class A. All precast concrete shall obtain 4000 PSI @ 28 days.

Precast bases shall be furnished with cutouts or knockouts. Knockouts shall have a wall thickness of 2" minimum.

Knockout or cutout hole size is equal to pipe outer diameter plus catch basin wall thickness. Maximum hole size is 60" for 72" catch basin, 84" for 96" catch basin. Minimum distance between holes is 12".

Frame and grate or ring and cover shall be in accordance with Standard Specifications and meet the strength requirments of Federal Specification AA-F-621D. Mating surfaces shall be finished to assure non-rocking fit.

All base reinforcing steel shall have a minimum yield strength of 60,000 PSI and be placed in the upper half of the base with 1" minimum clearance.

The bottom of the precast Catch Basin may be rounded.

For details showing frame and grate, ring and cover see Standard Plan "Metal Frame and Grate for Catch Basin and Inlet".

For details showing ladder, steps, handrail and top slab see Standard Plan "Miscellaneous Catch Basin Details".

Frame and grate may be installed with flange down or cast into riser.

9-29-81 DATE	Deleted Non-reinforced Concrete Base REVISION	DR DT	APP'D

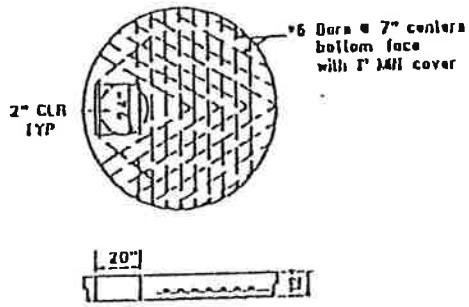
CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

TYPE 2 CATCH BASIN 72 AND 96 INCH

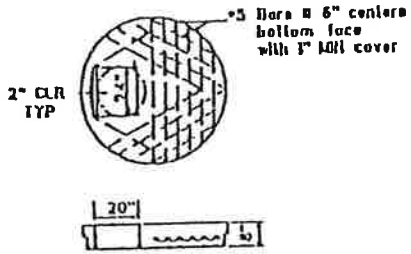
APPROVED BY CITY ENGINEER _____ DATE _____

DWN | CKD | DATE 6/24/94 | FILE FIG 3-03

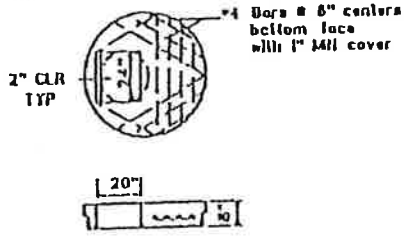
STANDARD PLAN



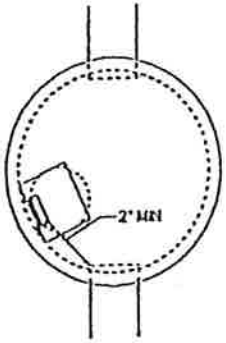
96" TOP SLAB



72" TOP SLAB



48" & 54" TOP SLAB



TYPICAL ORIENTATION
FOR ACCESS AND STEPS

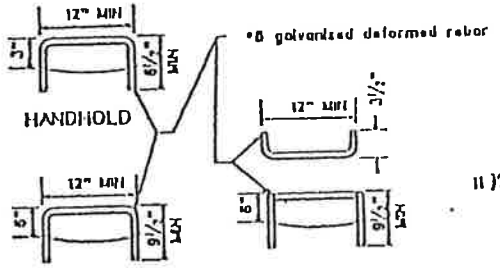
NOTES:

1. Proprietary catch basin steps are acceptable, provided that they conform to Section R, ASTM C 478 (AASHTO M 199) and meet all WSDOT requirements.

2. Catch basin step legs shall be parallel or approximately radial at the option of the manufacturer, except that all steps in any catch basin shall be similar. Penetration of outer wall by a leg is prohibited.

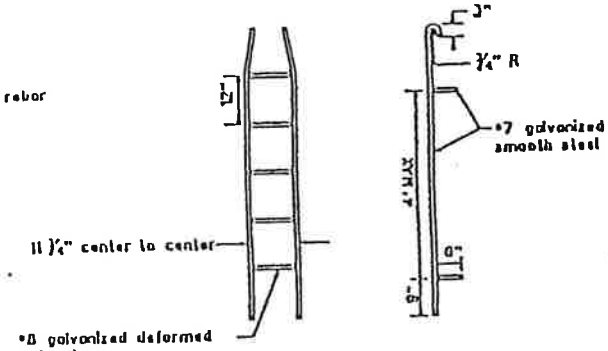
3. Slab opening may be 24" x 20" or 24" diameter.

4. As an acceptable alternate to rebar, welded wire fabric having a minimum area of 0.12 square inches per foot may be used. Welded wire fabric shall comply to ASTM A 497 (AASHTO M 221).

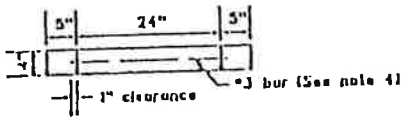


CATCH BASIN STEP

DROP RUNG
CATCH BASIN STEP



PREFABRICATED LADDER



GRADE RING

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

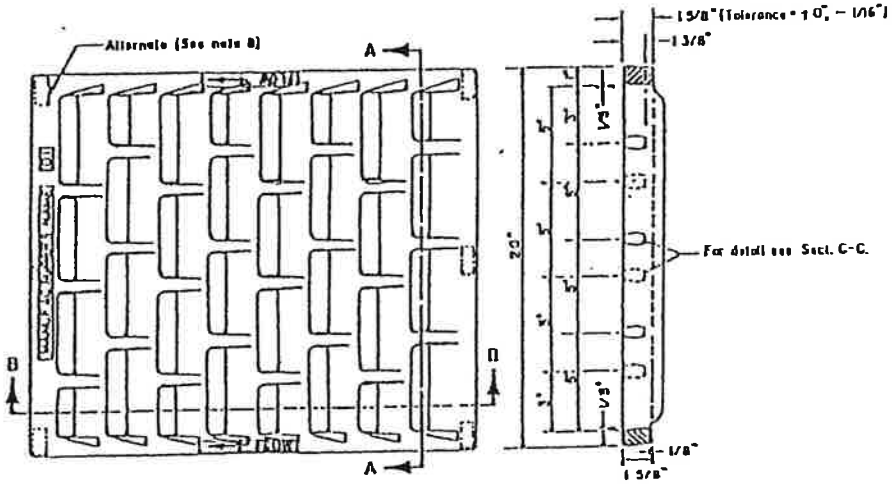
MISCELLANEOUS
CATCH BASIN DETAILS

APPROVED BY
CITY ENGINEER _____ DATE _____

DWN | CKD | DATE 6/24/94 | FILE FIG 3-06

WSDOT STANDARD PLAN

REF

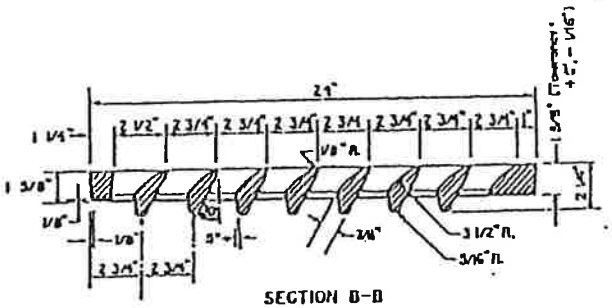


TOP VIEW

SECTION A-A

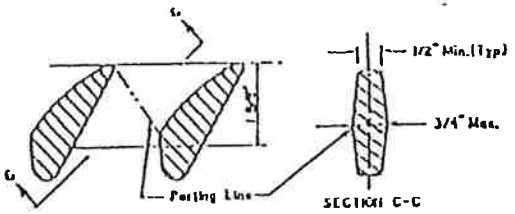
NOTES:

1. The name of the manufacturer and direction of flow shall be embossed on the top surface of each Grate. Lettering to be recessed 1/16".
2. Material shall be in accordance with Division 9 of the Standard Specifications "Metal Frame and Grate for Catch Basins or Inlets."
3. The material used for the grate shall be designated by embossing either DI(for Ductile Iron) or CS(for Cast Steel) near the name of the manufacturer.
4. Dimensions shall have a ± 1/16" tolerance, except as noted.
5. Edges shall have 1/8" radius, 1/8" chamfer, or complete deburring.
6. The frame shall be manufactured in accordance with Standard Plan B-2a.
7. Welding is not permitted.
8. As an alternate, 8 pads 1 1/2" x 3/4" x 1/8", integrally cast with the grate, may be used.



SECTION B-B

Approximate weight = 101 Lbs.



VANE DETAIL

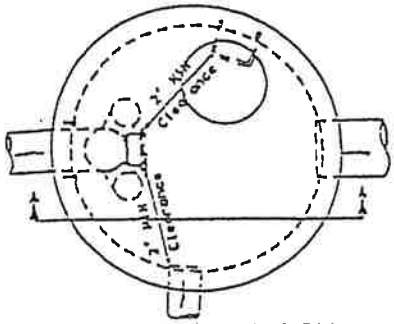
SECTION C-C

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

VANED GRATE FOR CATCH BASIN AND INLET

APPROVED BY
CITY ENGINEER _____ DATE _____

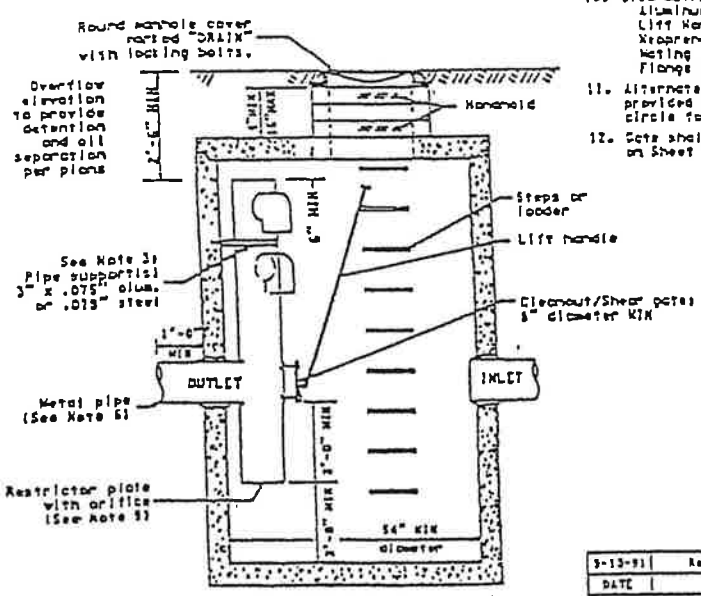
DWG | DXD | DATE | FILE



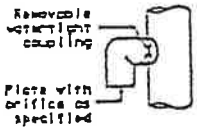
PLAN VIEW

NOTES

1. Except as shown or noted, units shall be constructed in accordance with the requirements for Catch Basin Type 2, 54" minimum diameter.
2. For details showing Grate Ring, Ladder, Steps, Manholes, and Top Slabs, see Standard Plan "Miscellaneous Catch Basin Details".
3. Pipe supports and restrictor/separator shall be of the same material, and be anchored at 3' MAX spacing by ½" DIA stainless steel expansion bolts or embedded 2" in wall.
4. The restrictor/separator shall be fabricated from .060" aluminum, or .064 aluminized steel, or .064" galvanized steel plate in accordance with AASHTO M 36, M 196, M 197, and M 214. Galvanized steel shall have Treatment 1.
5. Outlet shall be connected to culvert or sewer pipe with a standard coupling band for corrugated metal pipe, or grouted into the bell of concrete pipe.
6. The vertical riser stem of the restrictor/separator shall be the same diameter as the horizontal outlet pipe, with an 8" minimum diameter.
7. Frame and ladder or steps are to be offset so that:
   A. Cleanout gate is visible from top.
   B. Climb-down space is clear of riser and gate.
   C. Frame is clear of curb (if any exists).
8. Multi-orifice elbows may be located as shown or all on one side of riser to assure ladder clearance. Size of elbows and placement to be determined by the Engineer.
9. Restrictor plate with orifice as specified in the contract plans. Omit plate if for oil pollution control only. Specified opening to be cut round and smooth.
10. Cleanout/Shear gate:
    Aluminum alloy per ASTM B-26-70-32a or cast iron ASTM A48 Class 30B as required.
    Lift Handle either solid or tubing with adjustable hook as required.
    Neoprene rubber gasket required between riser mounting flange and gate flange.
    Mating surfaces of lid and body to be machined for proper fit.
    Flange mounting bolts shall be ½" DIA stainless steel.
11. Alternate cleanout/shear gates to the design shown on sheet 2 are acceptable, provided they meet the material specifications above and have a six bolt, 10 ½" bolt circle for bolting to the flange connection.
12. Gate shall not open beyond the clear opening as shown on "Max Opening of Gate" on Sheet 2, by limited hinge movement, stop tab, or some other device.



SECTION A - A



ELBOW DETAIL

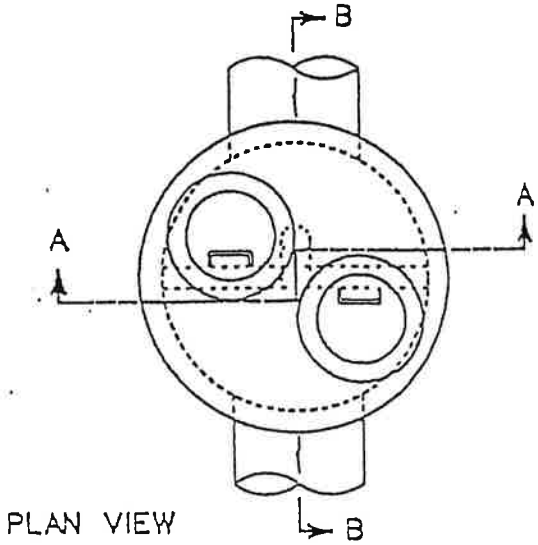
9-13-91	Revised Notes, Elbow Detail	JJB	*
DATE	REVISION	BY	APPRV'D

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

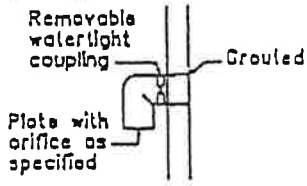
TYPE 2 CATCH BASIN WITH OIL SEPARATOR

APPROVED BY
CITY ENGINEER _____ DATE _____

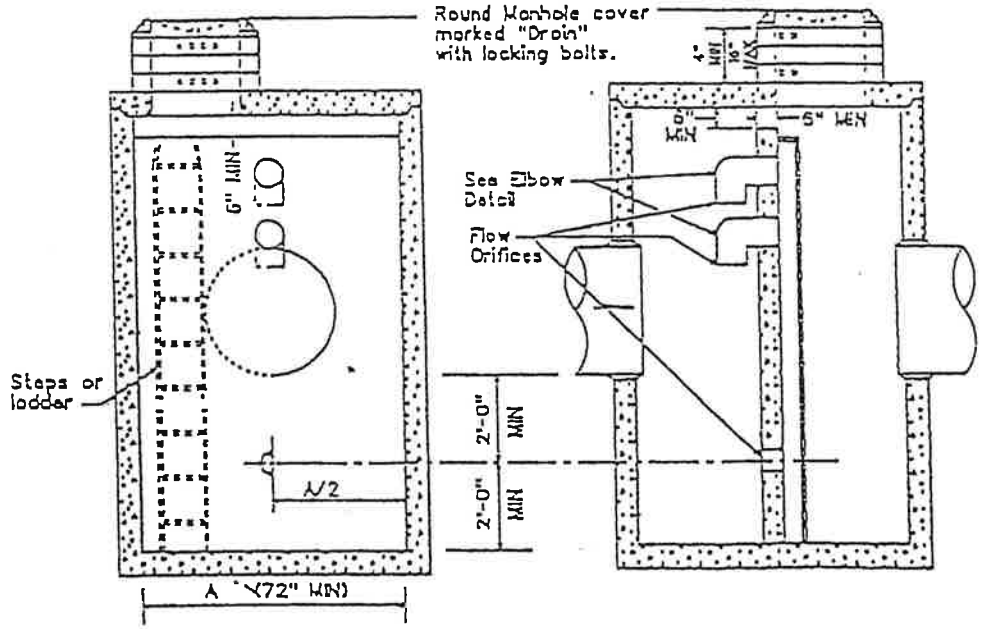
REF	DWN	CKD	DATE	FILE
			6/24/94	FIG 3-0



PLAN VIEW



ELBOW DETAIL



SECTION A - A

SECTION B - B

ELEVATION VIEW

NOTES

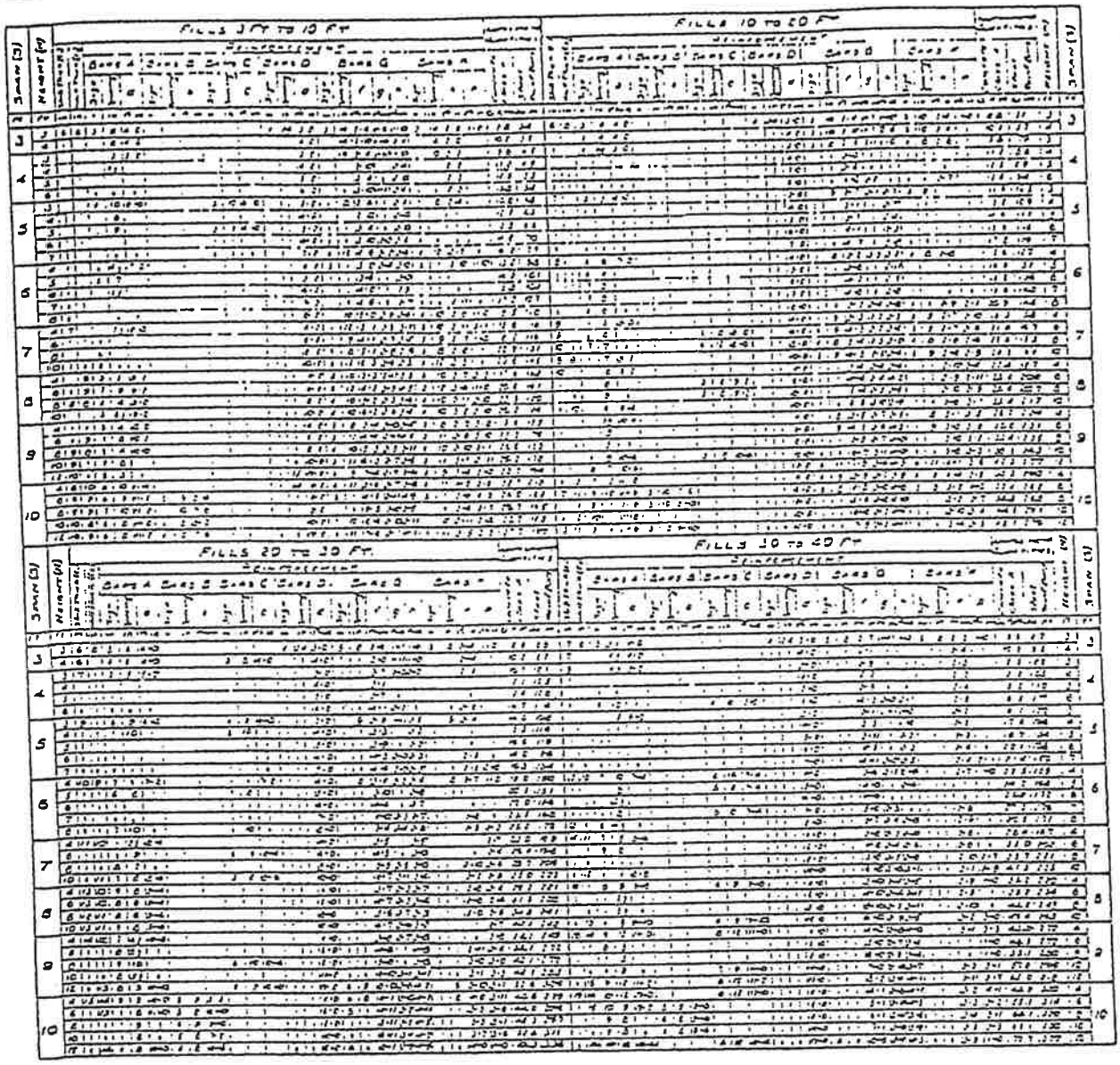
1. Except as shown or noted, units shall be constructed in accordance with the requirements for Catch Basin Type 2, 72" & 96".
2. For details showing Grade ring, Ladder, Steps, Handholds and Top slabs, see Standard Plan "Miscellaneous Catch Basin Details".
3. See Contract Plan for size and location of all orifices.
4. Pipe sizes, slopes and all elevations as shown in the plans.
5. Baffle wall shall have #4 bar at 12" spacing each way.
6. Precast baffle wall shall be keyed and grouted in place.
7. Bottom orifice plate to be 1/4" minimum galvanized steel and attached with 1/2" stainless steel bolts. Omit orifice plate if only for oil separation.
8. Upper flow orifice shall be aluminum, aluminized steel or galvanized steel (see Standard Plan "Catch Basin Type 2 With Flow Restrictor - Oil Separator). Galvanized steel shall have Treatment 1.

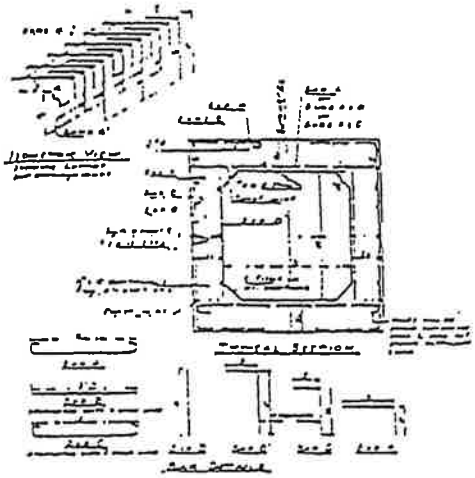
CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

TYPE 2 CATCH BASIN WITH BAFFLE OIL SEPARATOR

APPROVED BY CITY ENGINEER _____ DATE 9/27/9

REF	DWN	CKD	DATE	FILE
WSDOT STANDARD PLAN			6/24/94	FIG 3-0





NOTES

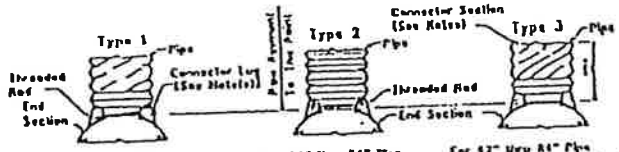
CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

REINFORCED CONCRETE SINGLE BOX CULVERT

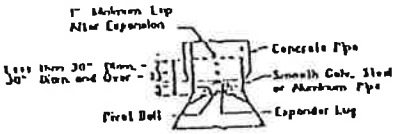
APPROVED BY
CITY ENGINEER _____ DATE _____

REV	DWN	CKD	DATE	TITLE
			6/24/94	FIG 3-11

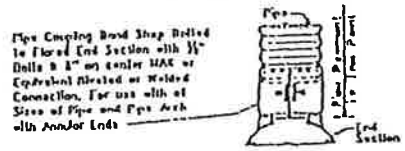
WSDOT STANDARD PLAN



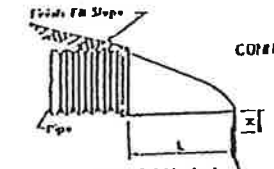
DESIGN A
CONNECTION TO METAL PIPE



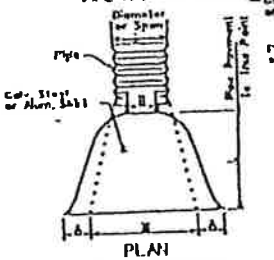
DESIGN B
CONNECTION TO CONCRETE PIPE
INLET END ONLY



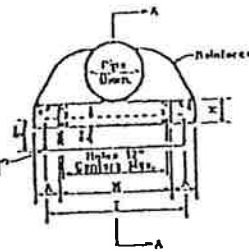
DESIGN C
CONNECTION TO METAL PIPE
OR CONCRETE PIPE, OUTLET ONLY



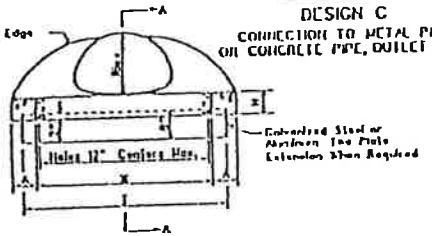
SECTION A-A
PIPE AND PIPE ARCH



PLAN
PIPE AND PIPE ARCH



ELEVATION
PIPE



ELEVATION
PIPE ARCH

NOTES

The diameter of the end section of Design B shall be the inside diameter of the concrete pipe.

Skirt sections shall be made in one piece for round pipe with a diameter of 12" to 24" inclusive and for pipe arches with a rise of 12" to 20" inclusive. Skirt sections for larger sizes of pipes may be multiple pieces in conformance with the included values shown.

Design A end sections for 42" thru 84" diameter and 48" x 33" thru 83" x 57" arch with annular corrugations and of helically corrugated pipe arch include one foot of pipe length as a connector section. The connector section shall be attached to the end section by welds, rivets or bolts and shall be the same thickness as the end section.

Design C may be used in lieu of Design A for of metal pipe sizes except as noted. Coupling bands may be any acceptable type for the pipe specified.

Multiple panel skirts shall have lap seams which are to be thoroughly joined by 3/8" galvanized rivets or bolts.

For 60" thru 84" diameter pipe and 77" and 83" x 57" pipe arch, the reinforced end shall be supplemented with galvanized stiffener angles of the following sizes:

60" thru 72" diameter pipe

42" x 2" x 1/4" galvanized angle

77" x 53" and 83" x 57" pipe arch

12 1/2" x 2 1/2" x 1/4" galvanized angle

78" and 84" diameter pipe

The above galvanized angles shall be attached by 3/8" galvanized rivets and bolts.

Angle reinforcement will be placed under the center panel seams on the 77" x 53" and 83" x 57" pipe arch sizes.

As an alternative to the connector lug and threaded rod used on 12" thru 24" Culvert pipe, the attachment may be made with a 1" wide strap of 16 gage galvanized steel fastened with a 1/4" diameter, 8" long galvanized bolt and one square head nut.

PIPE DIA (Inches)	THICKNESS (Inches) Steel	THICKNESS (Inches) Aluminum	A ±Tol.	B Max.	H ±Tol.	L 1/4" Tol.	W ±Tol.	T ±Tol.	Skirt	End Section Slope
12	0.064	0.060	6	6	6	21	24	31	1 Pc	2 1/2:1
15	0.064	0.060	7	8	6	28	30	40	1 Pc	2 1/2:1
18	0.064	0.060	8	10	6	31	36	48	1 Pc	2 1/2:1
21	0.064	0.060	9	12	6	36	42	57	1 Pc	2 1/2:1
24	0.064	0.075	10	13	6	41	48	66	1 Pc	2 1/2:1
30	0.079	0.075	12	15	8	51	60	70	2 Pc	2 1/2:1
36	0.079	0.105	14	17	9	60	72	84	2 Pc	2 1/2:1
42	0.109	0.105	16	22	11	69	84	108	2 Pc	2 1/2:1
48	0.109	0.105	18	27	12	78	90	132	2 Pc	2 1/2:1
54	0.109	—	16	30	12	84	102	132	2 Pc	2 1/2:1
60	0.109	—	18	33	12	87	111	156	2 Pc	2 1/2:1
66	0.109	—	18	36	12	87	120	162	2 Pc	2 1/2:1
72	0.109	—	18	39	12	87	126	168	2 Pc	2 1/2:1
78	0.109	—	18	42	12	87	132	192	2 Pc	2 1/2:1
84	0.109	—	18	45	12	87	138	198	2 Pc	2 1/2:1

PIPE ARCH DIMENSION (Inches) Span	Rise	THICKNESS (Inches) Steel	THICKNESS (Inches) Aluminum	A ±Tol.	B Max.	H ±Tol.	L 1/4" Tol.	W ±Tol.	T ±Tol.	Skirt	End Section Slope
17	13	0.064	0.060	7	8	6	18	30	40	1 Pc	2 1/2:1
21	15	0.064	0.060	7	10	6	23	38	48	1 Pc	2 1/2:1
24	18	0.064	0.060	8	11	6	28	42	57	1 Pc	2 1/2:1
28	20	0.064	0.075	9	11	6	33	48	66	1 Pc	2 1/2:1
35	24	0.079	0.075	10	14	8	39	60	70	2 Pc	2 1/2:1
42	29	0.079	0.105	12	16	8	48	75	83	2 Pc	2 1/2:1
49	33	0.109	0.105	13	21	9	53	83	102	2 Pc	2 1/2:1
57	38	0.109	0.105	16	24	12	63	90	111	2 Pc	2 1/2:1
64	43	0.109	0.105	16	30	12	70	102	120	2 Pc	2 1/2:1
71	47	0.109	0.135	16	33	12	77	111	144	2 Pc	2 1/2:1
77	53	0.109	—	16	36	12	77	126	162	2 Pc	2 1/2:1
83	57	0.109	—	16	39	12	77	138	138	2 Pc	2 1/2:1

DATE	REVISION	BY
9-22-88	Modified Design A & added note	
9-4-87	Changed Payment to Payment for Designs A & C	
12-20-83	Revised Pipe Arch Dimensions	

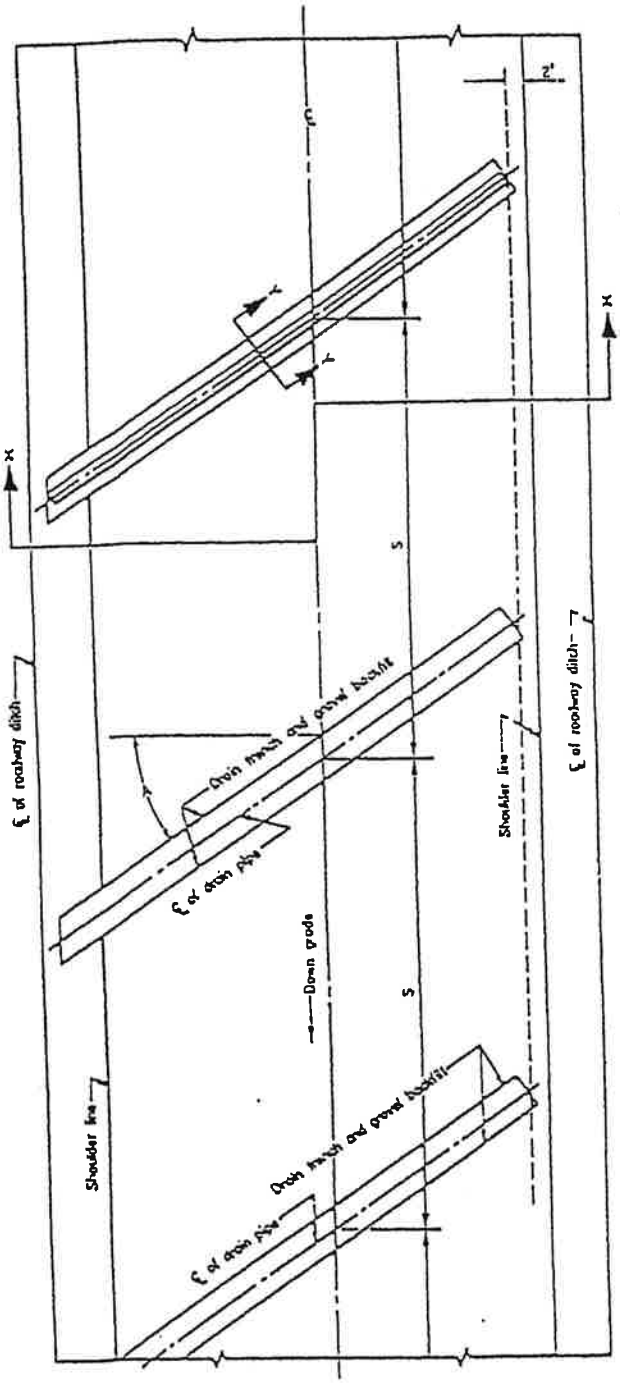
CITY OF AIRWAY HEIGHTS:
DEPARTMENT OF PUBLIC WORKS

FLARED END SECTIONS

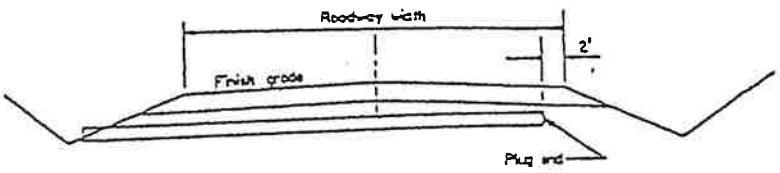
APPROVED BY
CITY ENGINEER _____ DATE _____

DWN | CKD | DATE 6/24/94 | FILE FIG 3-11

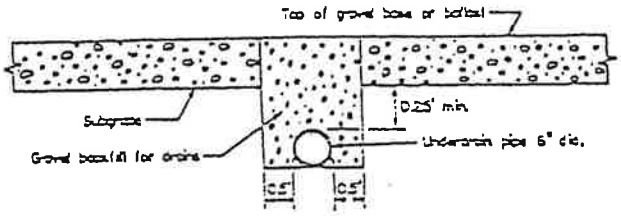
WSDOT STANDARD PLAN



PLAN



SECTION X-X



SECTION Y-Y

NOTES:

Underdrains of this type shall be constructed after the gravel base and/or ballast is in place.

The spacing (S) shall be as required for the particular project but not more than 500 feet on grades in excess of 2.5%.

The pattern may have to be varied in case of a special design for springs or free water in the subgrade.

The angle (A) shall vary to provide a minimum gradient on the drain of 0.5%.

Directional roadways of multilane highways shall be drained independently of one another. Drainage flow, preferably, should be away from the median.

Section Y-Y indicates the minimum required area of excavation. The Contractor may, upon the approval of the Engineer, excavate additional area if required for his convenience; however, no additional payment will be made over that provided for herein.

The pipe shall be 6 inch diameter Underdrain Pipe.

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

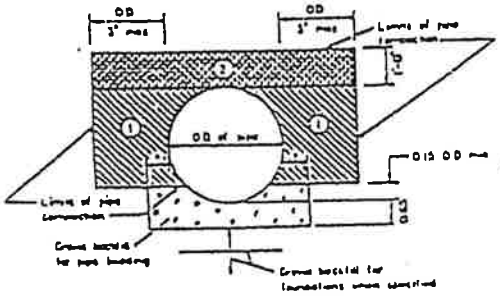
SUBGRADE DRAIN

APPROVED BY
CITY ENGINEER _____ DATE _____

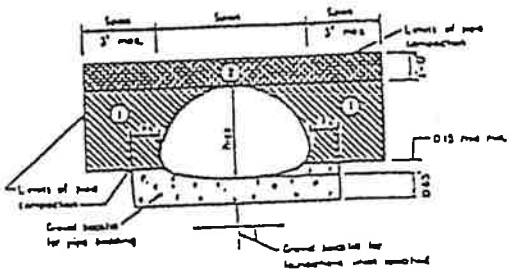
DWN	CKD	DATE	FILE
		6/24/94	FIG 3-

REF

WSDOT STANDARD PLAN



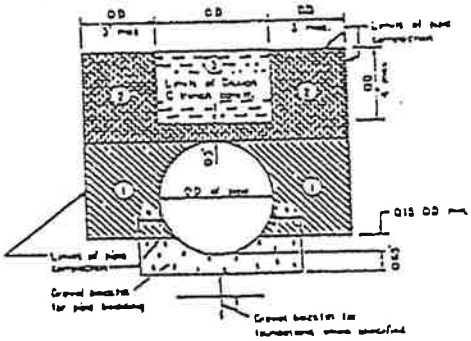
DESIGN A
(For Metal and Concrete Pipe)



TYPICAL PIPE-ARCH INSTALLATION

CLEARANCE BETWEEN PIPES
MULTIPLE INSTALLATIONS

PIPE	SIZE	MIN. DIST. BETWEEN BARRELS
CIRCULAR PIPE CONCRETE & METAL DESIGN A (DIAMETER)	12" to 24"	12"
	30" to 54"	DIAM ÷ 2
	60" to 120"	48"
CIRCULAR PIPE CONCRETE ONLY DESIGN C (DIAMETER)	12" to 36"	24
	42" to 96"	72"
	108" to 120"	72"
PIPE-ARCH METAL ONLY (SPAN)	18" to 36"	12"
	42" to 142"	SPAN ÷ 3
	148" to 288"	48"



DESIGN C
(For Concrete Pipe With Circular Reinforcement Only)

LEGEND
PIPE COMPACTION ZONE

1. Backfill material placed in 0.5' loose layers and compacted to 95% maximum density
2. Backfill B or C compaction
3. Backfill areas of hole with sand or similar dry, compacted material.

NOTES:

1. Pipe compaction limits shown on this plan are for pipe construction in an embankment. For pipe construction in a trench, the horizontal limits of the pipe compaction zone shall be the walls of the trench.
2. All steel and aluminum pipe and pipe-arches shall be installed in accordance with Design A.
3. Concrete pipe with elliptical reinforcement shall be installed in accordance with Design A.
4. Concrete pipe, plain or with circular reinforcement, shall be installed with Design A or a combination of Designs A and C, as determined by the Engineer.
5. For Design C, it is essential that the walls for Zone 3 be constructed as near vertical as possible.
6. O.D. is equal to the outside diameter of a pipe or the outside span of pipe-arch. The dimensions shown as O.D. with 3' and 4' maximum shall be O.D. until O.D. equals 3' and 4' at which point 3' and 4' shall be used.
7. 1'-0" for diameters 12" through 42" and for spans through 50". 2'-0" diameters greater than 42" and for spans greater than 50".

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

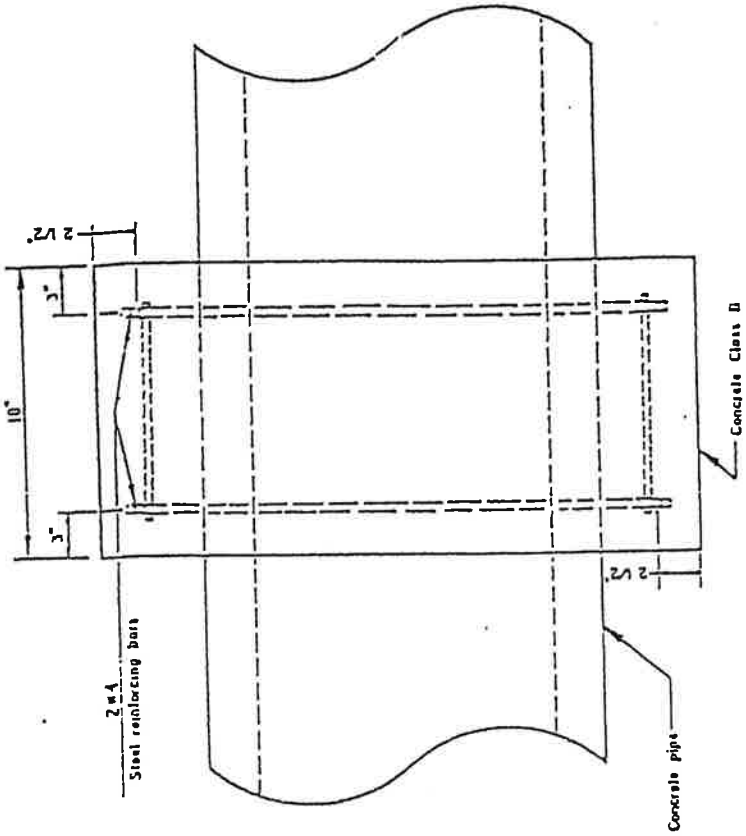
PIPE COMPACTION AND BACKFILL DESIGNS

APPROVED BY
CITY ENGINEER _____ DATE _____

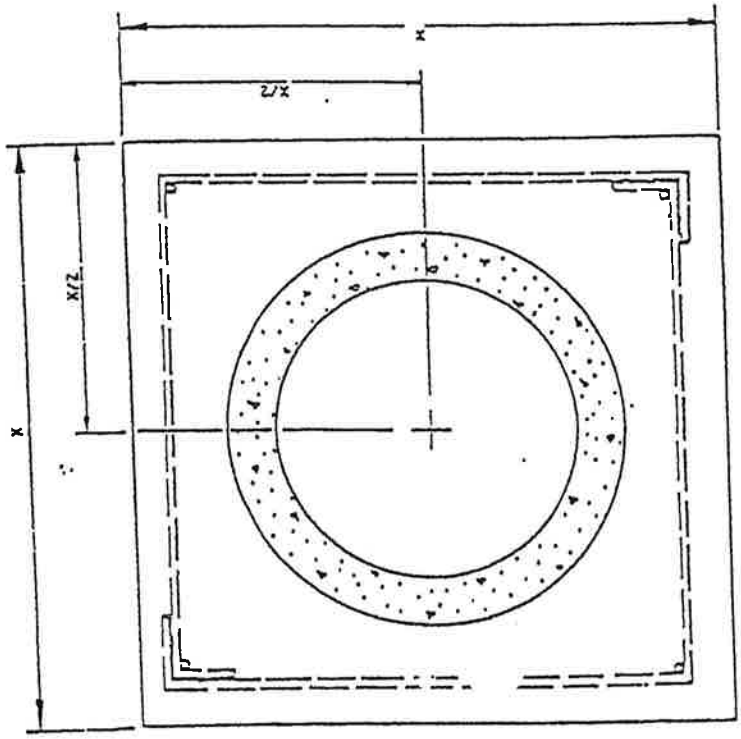
DWN	CKD	DATE	FILE
		6/24/94	FIG 3-1

REF

WSDOT STANDARD PLAN



NOTE
Reinforcing steel shall be Grade 40 or Grade 60.



PIPE DIAMETER	CONCRETE CLASS B APPROX. CY.	DIMENSION X
12"	0.3	2'-4"
18"	0.4	2'-11"
24"	0.5	3'-6"
30"	0.6	4'-1"
36"	0.7	4'-8"
42"	0.8	5'-3"
48"	0.9	5'-10"
54"	1.1	6'-5"
60"	1.3	7'-0"

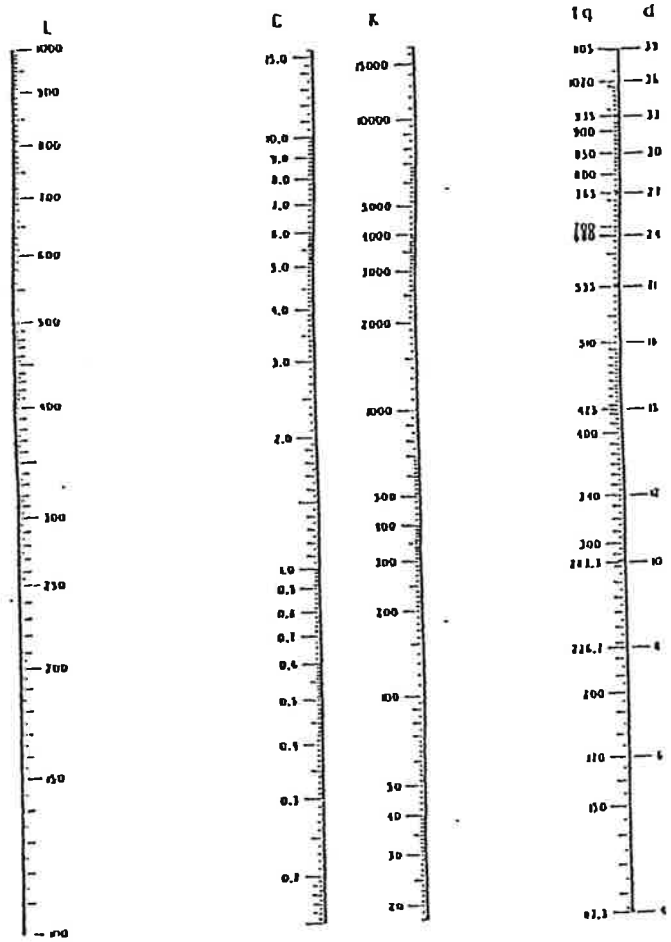
CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

CONCRETE PIPE ANCHOR

APPROVED BY
CITY ENGINEER _____ DATE _____

REF WSDOT STANDARD PLAN

DWN | CKD | DATE 6/24/94 | FILE FIG 3-1



NOMOGRAPH FOR THE SOLUTION OF $K=0.01d^2L$, $C=0.0003882\ dL$ & $tq = K \div C$

NOTES:

When the Contractor elects to use the low pressure air method for testing pipe, the following procedure, together with the use of the nomograph, shall be used for conducting the acceptance test.

1. Clean pipe to be tested by propelling a snug fitting inflated rubber ball through the pipe with water.

2. Plug all pipe outlets with suitable test plugs. Brace each plug securely.

3. If the pipe to be tested is submerged in ground water, insert a pipe probe, by boring or jetting, into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test shall be increased by this amount.

4. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.

5. Check exposed pipe and plug for abnormal leakage by coating with a soap solution. If any failures are observed, bleed off air and make necessary repairs.

6. After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.

7. After the two minute period, disconnect air supply.

8. When pressure decreases to 3.5 psig, start stop watch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. This time interval should then be compared with the time required by specification as computed below.

9. List size and length of all portions of pipe under test in table similar to one shown below.

10. By use of the accompanying nomograph, compute K and C. Use scales d and L, read K and C, and enter these values in the table.

11. Add all values of K and all values of C for pipe under test.

12. If the total of all C values is less than one, enter the total of all K values into the space for "Time Required by Specification".

13. If the total of all C values is greater than one, divide the total of all K values by the total of all C values to get tq. To make this division with the nomograph, use scales C and K and read tq.

14. When testing storm sewer pipe the allowable leakage is 0.0040 cu. ft. per minute per square foot of internal pipe surface area. Divide the time, tq, as calculated in Note 13, by two.

d Diameter (inches)	L Length (feet)	$K = 0.01d^2L$	$C = 0.0003882\ dL$
		Total K_____	Total C_____
Time required by specification = tq_____			

WSDOT STANDARD PLAN

REF

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

LOW PRESSURE
AIR TEST

APPROVED BY
CITY ENGINEER _____ DATE _____

DWN | CKD | DATE 6/24/94 | FILE FIG 3-15

ALTERNATES FOR 12" THRU 30" DIA. CULVERT PIPE

SCHEDULE	PIPE DIAMETER	CULVERT PIPE			
		CONCRETE		STEEL thickness	ALUMINUM thickness
		* DESIGN A TRENCH	* DESIGN C TRENCH	* DESIGN A TRENCH	* DESIGN A TRENCH
A (2'-15' FILL)	12"	PLAIN or CLASS IV	NOT REQUIRED	0.064" (16 Ga.)	0.060" (16 Ga.)
	18"	" "	"	"	"
	24"	" "	"	"	"
	30"	CLASS III	"	"	"
B (15'-25' FILL)	12"	CLASS V	NOT REQUIRED	"	"
	18"	"	"	"	"
	24"	"	"	"	"
	30"	"	"	"	"
C (25'-40' FILL)	12"	NONE	PLAIN or CLASS III	"	"
	18"	"	" "	"	"
	24"	"	" "	"	"
	30"	"	CLASS III	"	"
D (40'-60' FILL)	12"	NONE	CLASS IV	"	"
	18"	"	"	"	0.060" (16 Ga.)
	24"	"	"	0.064" (16 Ga.)	0.075" (14 Ga.)
	30"	"	"		

* Reference Standard Plan B-11

NOTES
The Contractor shall provide the schedule and diameter of culvert pipe called for on the plans and/or special provisions and has the option of furnishing any of the acceptable alternates shown in the table, except when specifically provided otherwise in the plans or special provisions.

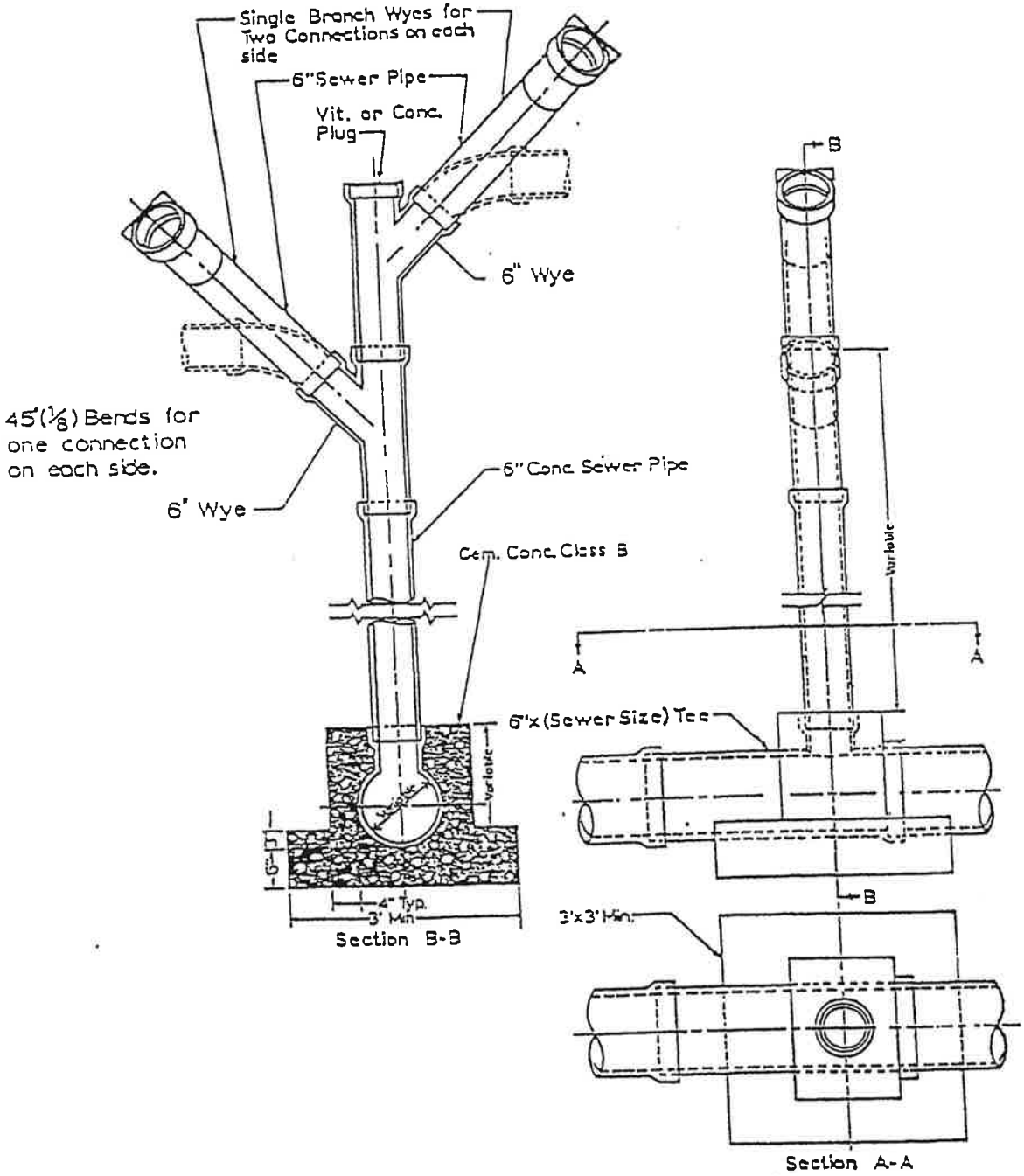
CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

CULVERT PIPE SCHEDULES

APPROVED BY
CITY ENGINEER _____ DATE _____

DWN	CKD	DATE	FILE
		6/24/94	FIG 3-1

REF WSDOT STANDARD PLAN

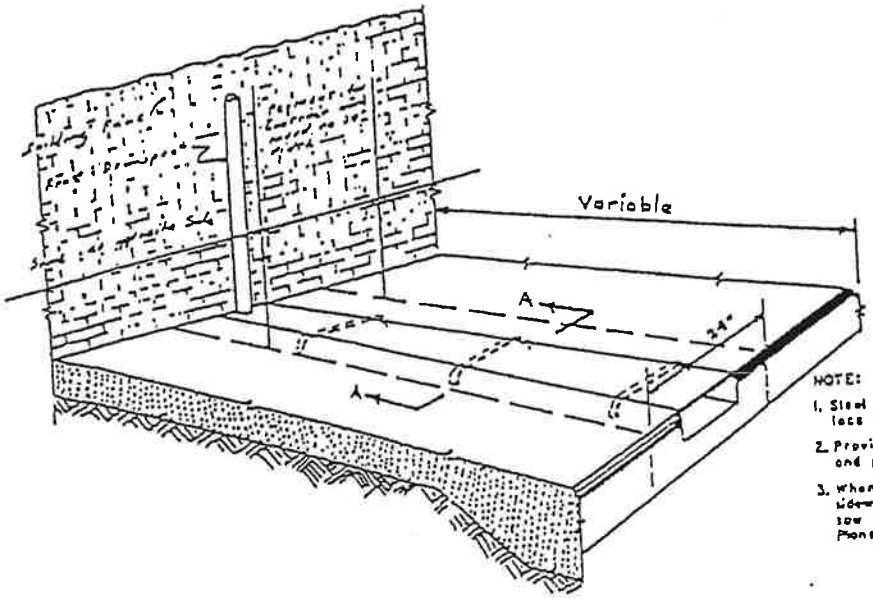


CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

VERTICAL CONNECTION

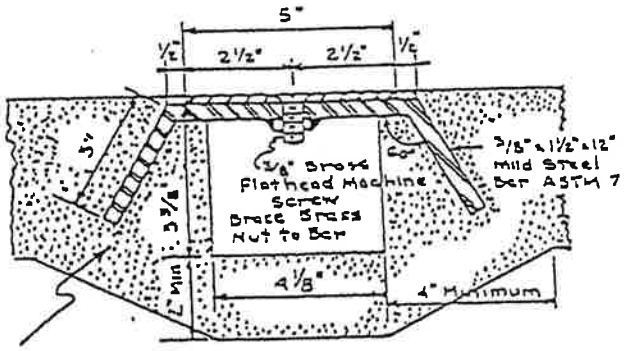
APPROVED BY CITY ENGINEER _____ DATE _____

REF	DWN	CKD	DATE	FILE
WSDOT STANDARD PLAN			6/24/94	FIG 3-1



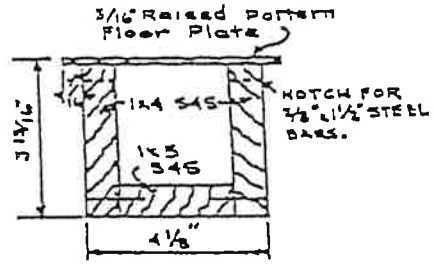
NOTE:

1. Steel plate to end 1/2" from face of curb.
2. Provide space between bldg. and plate for downspout.
3. When drain is placed in existing sidewalk the sidewalk shall be saw cut as specified in Contract Plans.



Cement Concrete Class B

SECTION A-A



Note: Forms to be removed.

FORMING DETAIL

BAR SPACING
(See Notes)

NOTES:

For walks 6" and less use 2 bars, 6" to 10" use 3 bars, and walks over 10" use 4 bars.

Concrete shall be Cement Concrete Class B

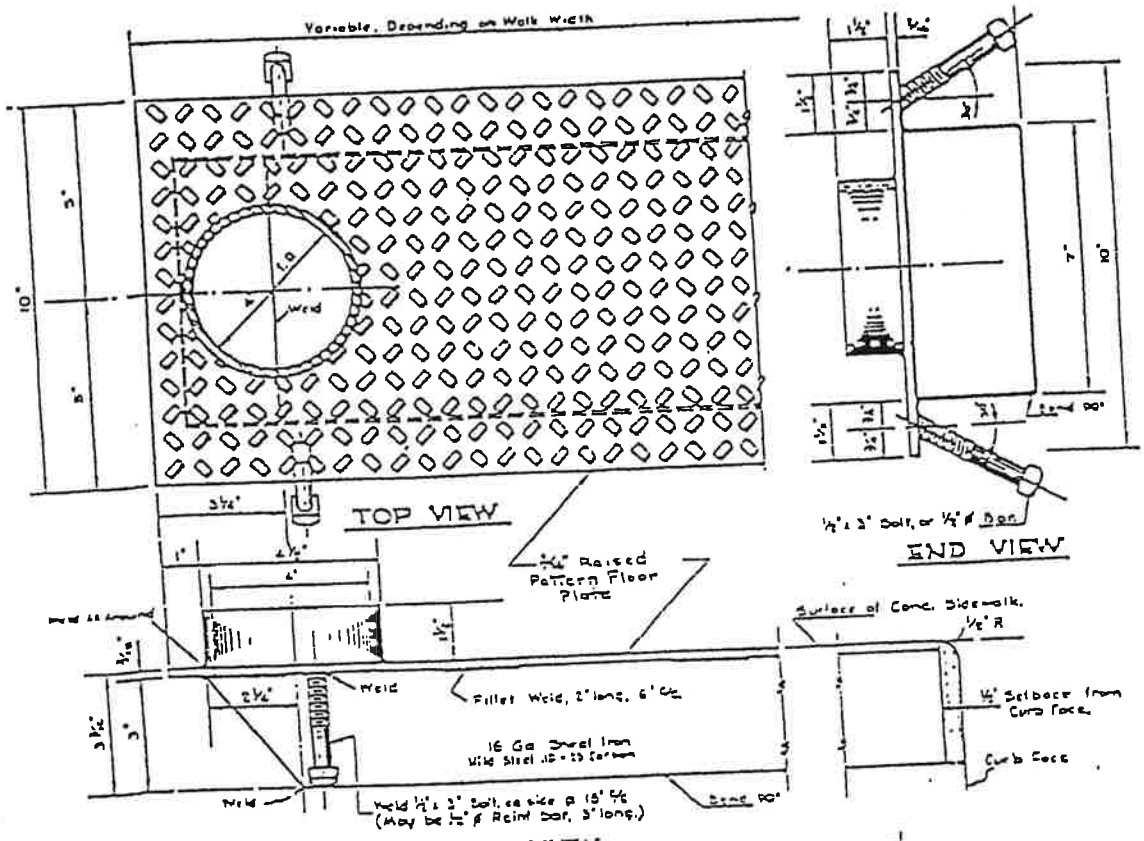
CITY OF AIRWAY HEIGHTS.
DEPARTMENT OF PUBLIC WORKS

TYPE 1 SIDEWALK DRAIN FOR BUILDING DOWNSPOUT

APPROVED BY CITY ENGINEER _____ DATE _____

DWN	CKD	DATE	FILE
		6/24/94	FIG 3-

REF WSDOT STANDARD PLAN



NOTES:

When drain is placed in existing sidewalk the sidewalk shall be saw cut as specified in the Contract Plans.

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

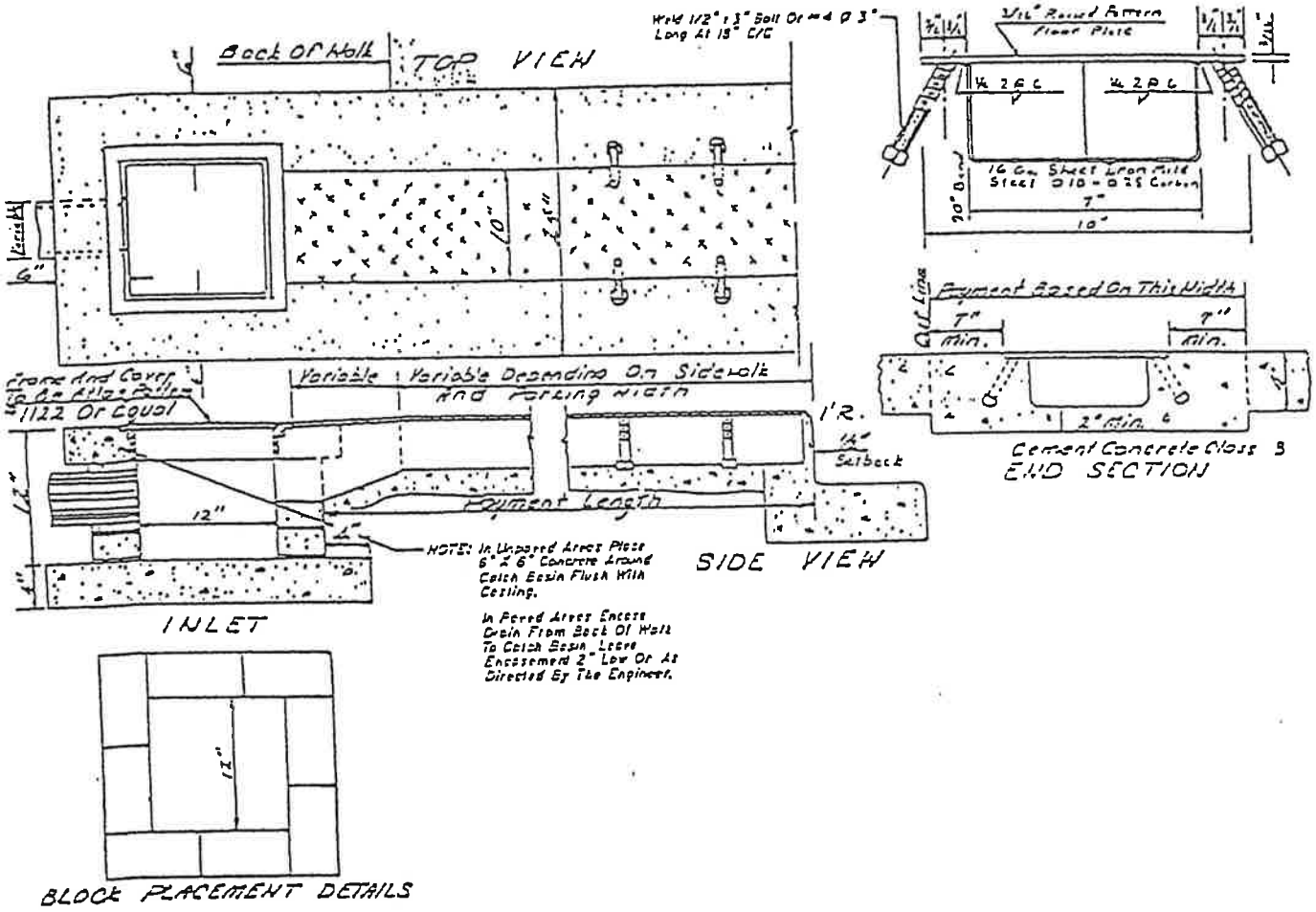
TYPE 2 SIDEWALK DRAIN FOR BUILDING DOWNSPOUT

APPROVED BY
CITY ENGINEER _____ DATE _____

DWN	CKD	DATE	FILE
		6/24/94	FIG 3-1

REF

WSDOT STANDARD PLAN



CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

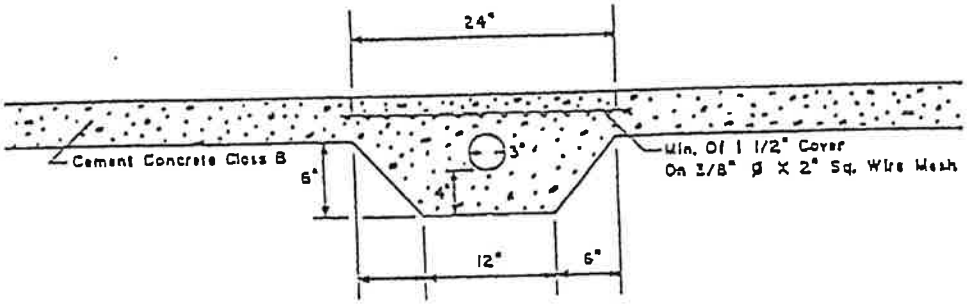
SIDEWALK DRAIN COMMERCIAL

APPROVED BY
CITY ENGINEER _____ DATE _____

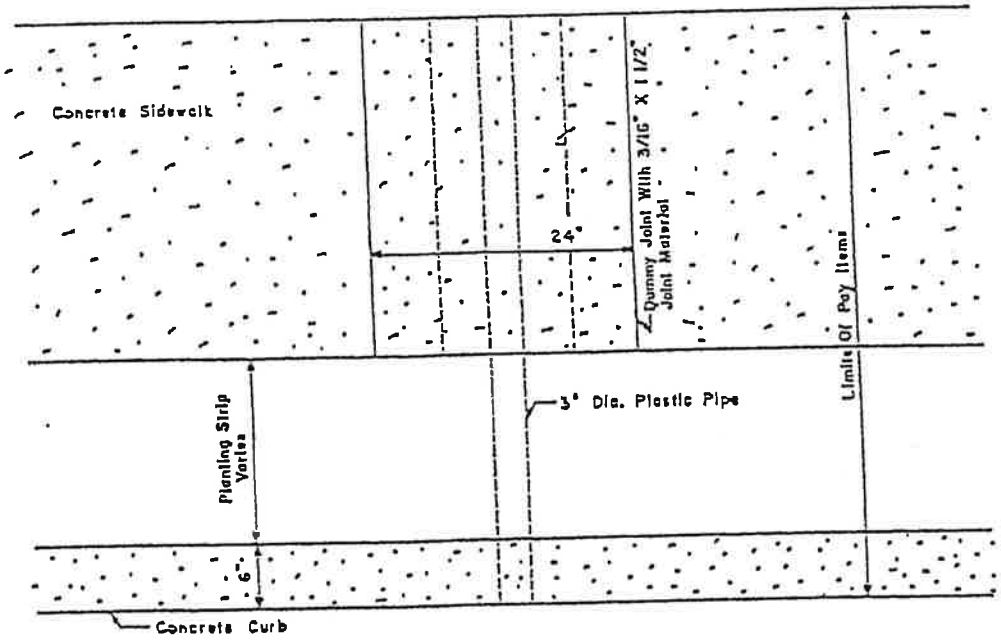
DWN	CKD	DATE	FILE
		6/24/94	FIG 3-20

RD

WSDOT STANDARD PLAN



ELEVATION



PLAN

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

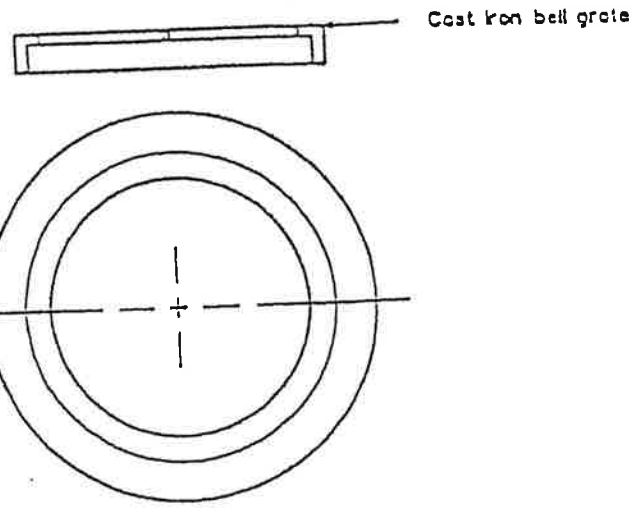
SIDEWALK DRAIN RESIDENTIAL

APPROVED BY
CITY ENGINEER _____ DATE _____

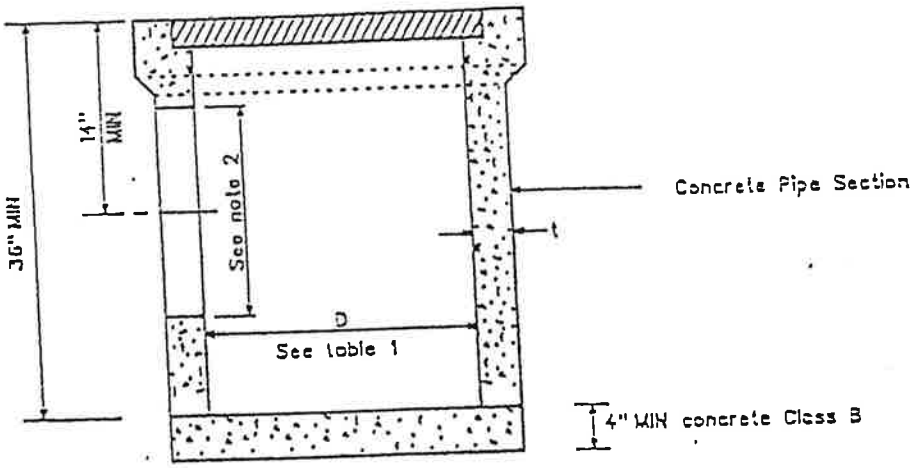
DWN	CKD	DATE	FILE
		6/24/94	FIG 3-21

REF

WSDOT STANDARD PLAN



PLAN VIEW



ELEVATION VIEW

Outlet pipe DIA B	Inlet DIA (D)
6"	12"
8"	18"
12"	24"

Table 1

NOTES

1. Area inlets to be constructed from concrete pipe, in accordance with ASTM C 14 unless otherwise shown on the plans or noted in the Standard Specifications.

2. Cutout hole size is equal to outlet pipe outside diameter plus area inlet wall thickness.

3. Connection to outlet pipe to be mortared and made flush with inside of the area inlet wall.

4. Cast iron bell grate shall meet the strength requirements of Federal Specification RR-F-621D. The grate shall have slots (holes) that constitute 50% open area for drainage. Inlet bell surface shall be finished to assure non-rocking fit with any cover position.

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

AREA
INLET

APPROVED BY
CITY ENGINEER _____ DATE _____

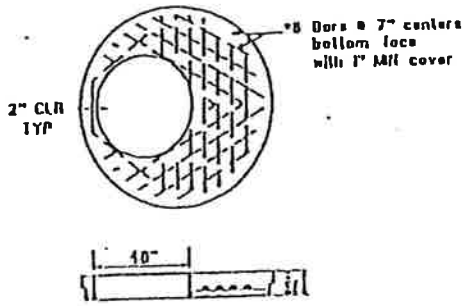
DWN	CKD	DATE	FILE
		6/24/94	FIG 3-22

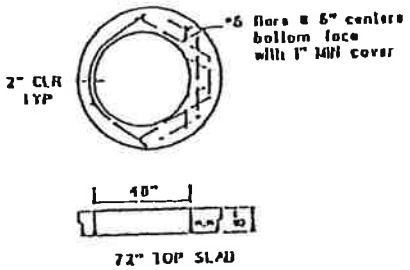
RDF

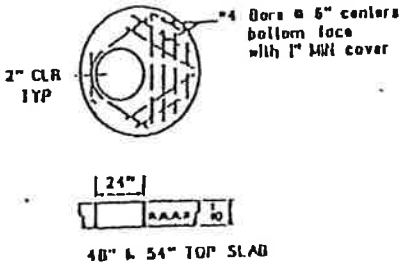
WSDOT STANDARD PLAN

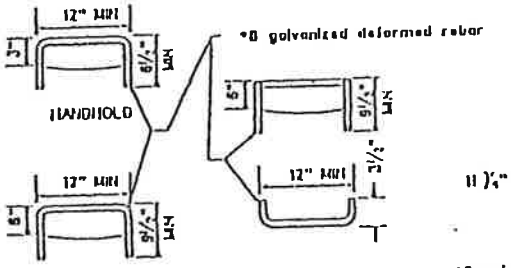
NOTES:
Proprietary manhole steps are acceptable, provided that they conform to Section R, ASTM C 478 (AASHTO M 199) and meet all WISHA requirements.

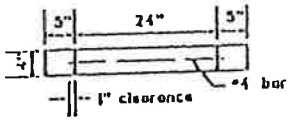
Manhole step legs shall be parallel or approximately radial at the option of the manufacturer, except that all steps in any manhole shall be similar. Penetration of outer wall by a leg is prohibited.

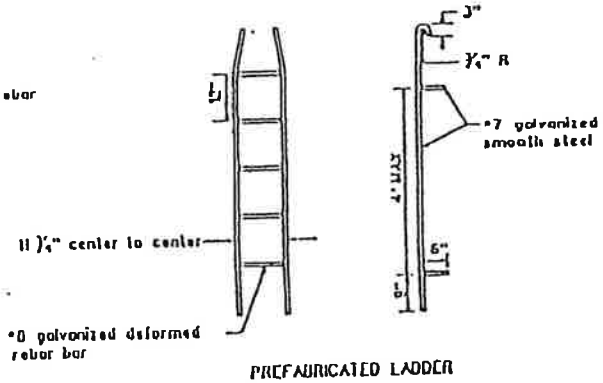












CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

MISCELLANEOUS
MANHOLE DETAILS

APPROVED BY
CITY ENGINEER _____ DATE _____

DWN | DKD | DATE 6/24/94 | FILE FIG 3-23

WSDOT STANDARD PLAN

REF

Notes

Gasket and groove may be in the seat or underside of cover.

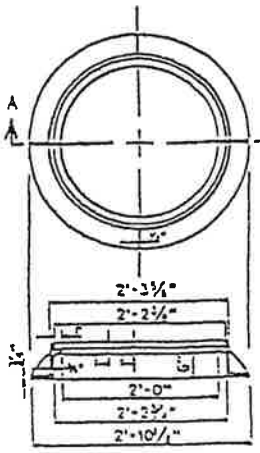
For bolt down manhole ring and covers that are not watertight, the neoprene gasket, groove and washer are not required.

Washer shall be lead or neoprene.

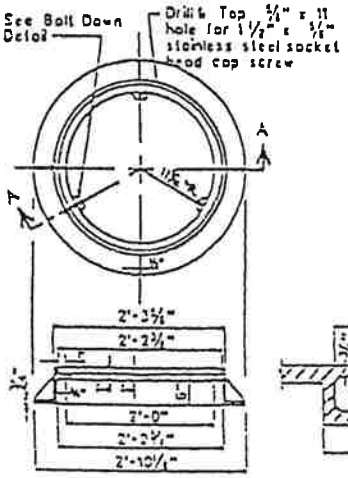
Unless otherwise shown on the Plans, or specified in the Special Provisions, Type 1, Standard Manhole Rings and Covers shall be used on WSDOT contracts.

In lieu of blind pick notch for storm sewer manhole covers, drill three 1 inch diameter holes at 120° spacing.

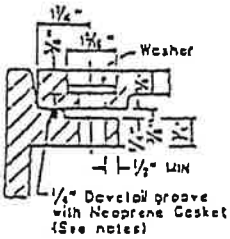
For Manholes Type 4,5,& 6 see Standard Specifications for Manhole Rings and Covers.



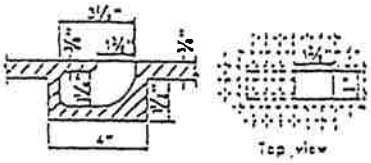
SECTION A - A



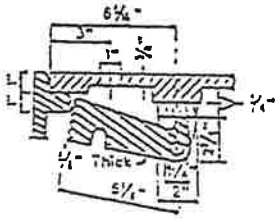
SECTION A - A



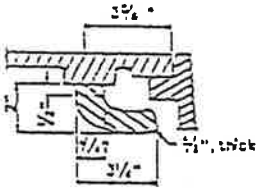
BOLT-DOWN WATERTIGHT DETAIL



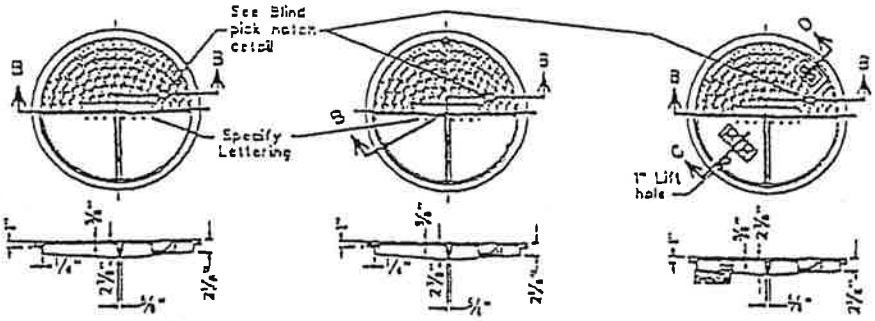
BLIND PICK NOTCH DETAIL



BOLT ON CAM TYPE LOCKING DEVICE-SECTION C



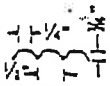
BOLT ON CAM TYPE LOCKING DEVICE-SECTION D



SECTION B - B
TYPE 1
STANDARD

SECTION B - B
TYPE 2
BOLT-DOWN/WATERTIGHT

SECTION B - B
TYPE 3
CAMLOCK



COVER SKID DESIGN DETAIL

DATE	REVISION	BY	APPR'D
3-6-90	Revised threads on bolt-down manhole	KJ	

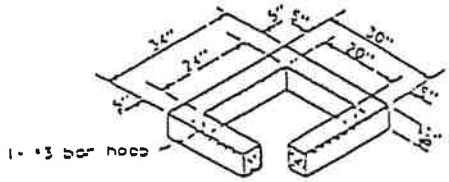
CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

MANHOLE RING AND COVER

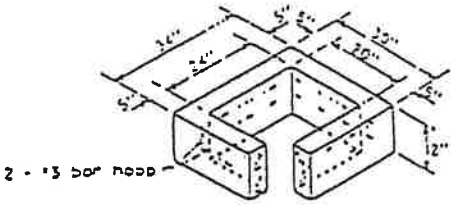
APPROVED BY
CITY ENGINEER _____ DATE _____

REF	DWN	CKD	DATE	FILE
WSDOT STANDARD PLAN			6/24/94	FIG 3-24

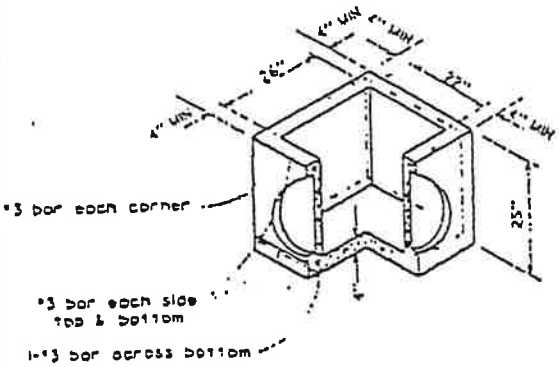
Frame and grate
(See Standard Plan for details)



6" Riser Section



12" Riser Section



Precast Base Section
(Measurement at the top of the base)

NOTES

Concrete inlet to be constructed in accordance with ASTM C 478 (AASHTO M 199) & ASTM C 890 unless otherwise shown on plans or noted in the Standard Specifications.

As an acceptable alternate to rebar, welded wire fabric having a minimum area of 0.12 square inches per foot may be used. Welded wire fabric shall comply to ASTM A 497 (AASHTO M 220). Wire fabric shall not be placed in the knockouts.

The bottom of the precast base section may be rounded.

Precast bases shall be furnished with cutouts or knockouts. Knockouts shall have a wall thickness of 2" minimum.

Knockout or cutout hole size is equal to pipe outer diameter plus concrete inlet wall thickness.

Knockouts may be on all 4 sides with maximum diameter of 17". Knockouts may be either round or "D" shape. Pipe to be installed in factory supplied knockouts.

Concrete inlet frame and grates shall be in accordance with Standard Specifications and meet the strength requirements of Federal Specification RR-F-621D. Mating surfaces shall be finished to assure non-rocking fit.

The taper on the sides of the precast base section and riser section shall not exceed ½"/ft.

Frame and grate may be installed with flange cast or cast into riser.

CITY OF AIRWAY HEIGHTS
DEPARTMENT OF PUBLIC WORKS

CONCRETE INLET

APPROVED BY
CITY ENGINEER _____ DATE _____

REF	DWN	CKD	DATE	FILE
WSDOT STANDARD PLAN			6/24/94	FIG. 3-