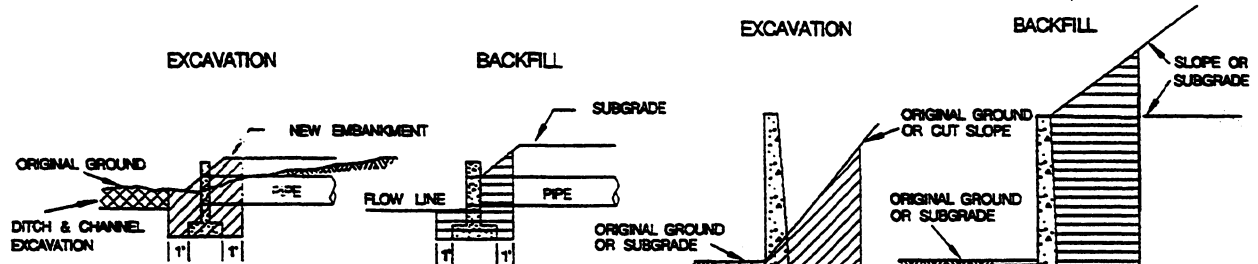
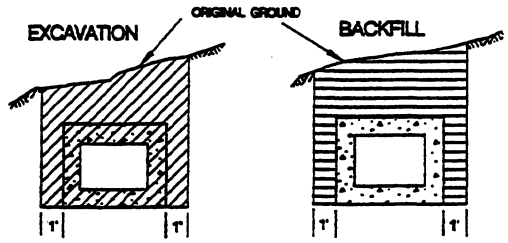


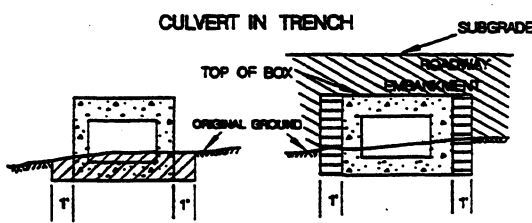
# CONCRETE STRUCTURES



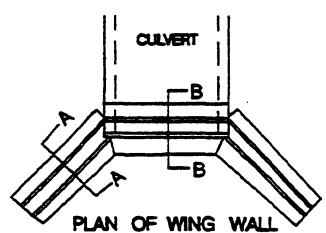
**PIPE HEADWALLS**



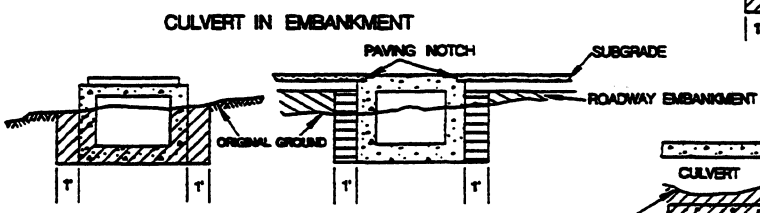
**RETAINING WALLS**



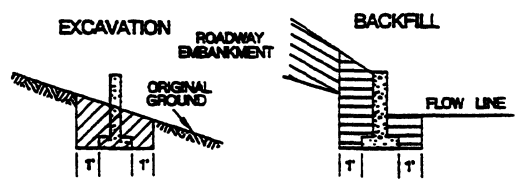
**CULVERT IN TRENCH**



**PLAN OF WING WALL**



**CULVERT IN EMBANKMENT**



**SECTION A-A**

**SECTION B-B**

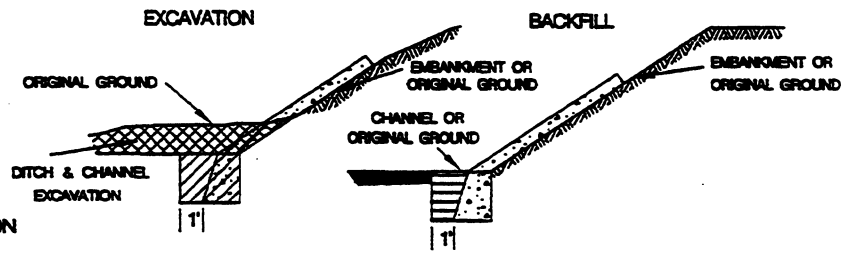


**GRADE TOP CULVERT**



**WING WALLS**

**BOX CULVERTS**



**MONOLITHIC CONCRETE SLOPE PAVING: RIPRAP**

**LEGEND**

- STRUCTURE EXCAVATION
- STRUCTURE BACKFILL
- DITCH & CHANNEL EXCAVATION
- ROADWAY EMBANKMENT
- ROADWAY EXCAVATION

NOTE: SUBGRADE SHALL BE LOWEST SUBGRADE AS DEFINED IN THE STANDARD SPECIFICATIONS

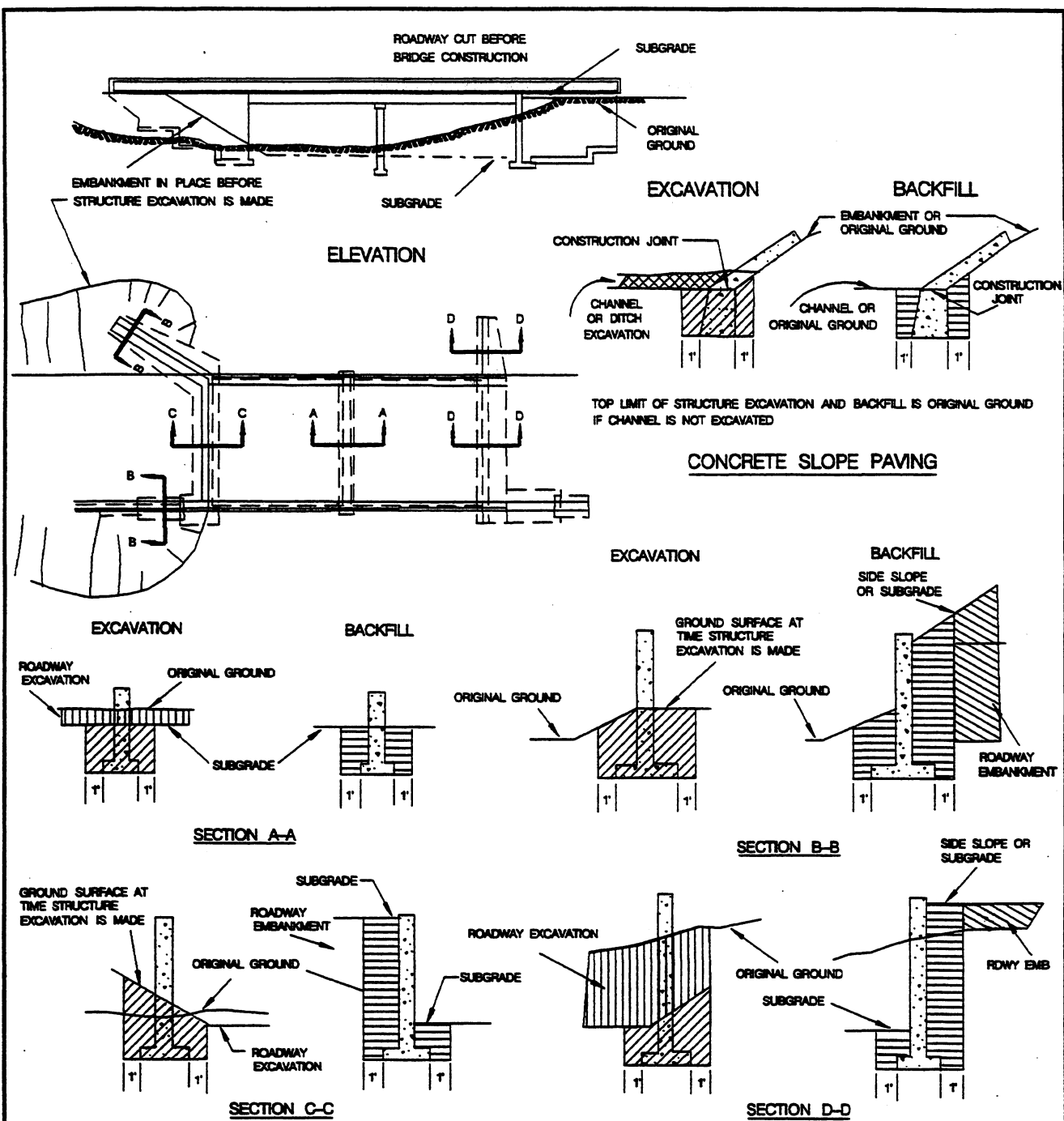
Revision	By	Approved	Date
ORIGINAL		J.P. Casey	6-3-83

**CITY OF SAN DIEGO - STANDARD DRAWING**

**STRUCTURE EXCAVATION & BACKFILL**

CITY OF SAN DIEGO STANDARDS COMMITTEE  
 2-7-85  
 COORDINATOR R.C.E. 25902 DATE

DRAWING NUMBER **SDC-103**



**BRIDGE ABUTMENTS & ADJOINING WING WALLS**

**LEGEND**

- STRUCTURE EXCAVATION
- STRUCTURE BACKFILL
- DITCH & CHANNEL EXCAVATION
- ROADWAY EXCAVATION
- ROADWAY EMBANKMENT

NOTE: SUBGRADE SHALL BE LOWEST SUBGRADE AS DEFINED IN THE STANDARD SPECIFICATIONS

SEE ALSO STD. DWG. SDC-403

Revision	By	Approved	Date
ORIGINAL		J.P. Casey	6-3-83

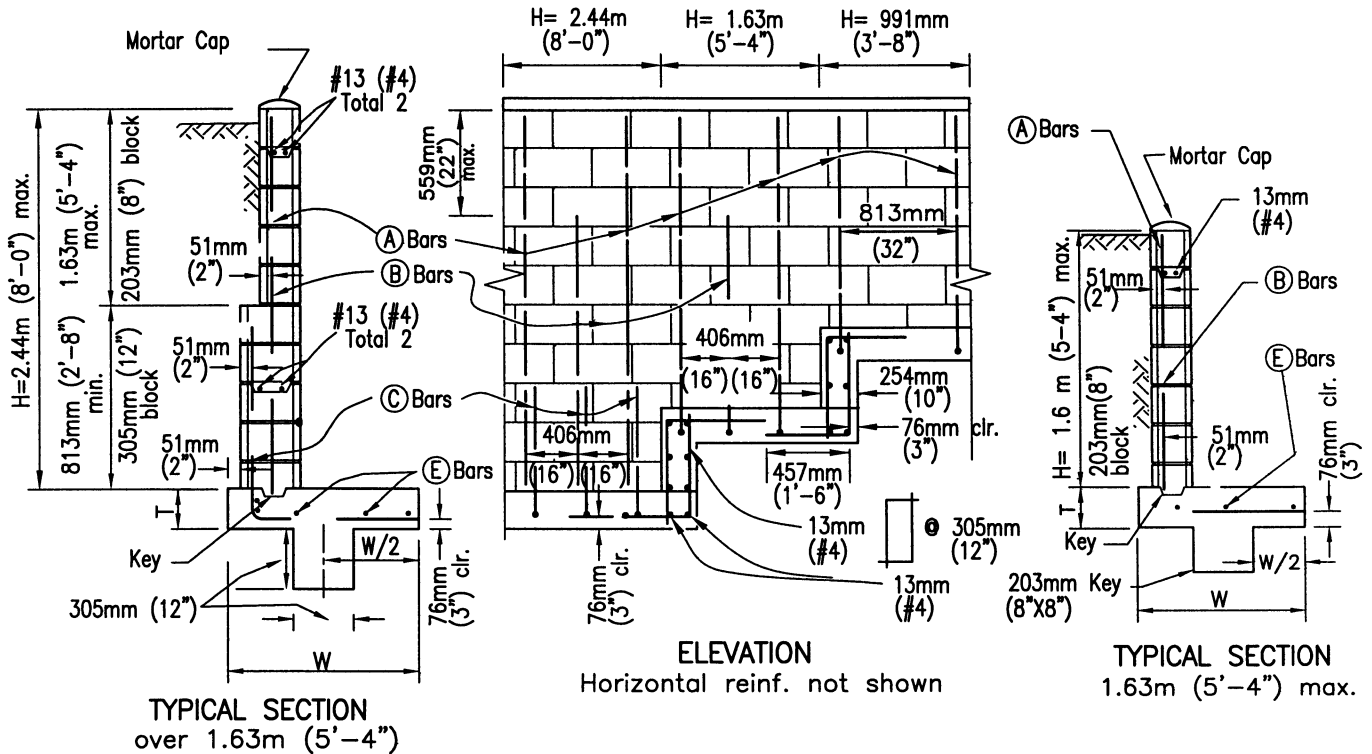
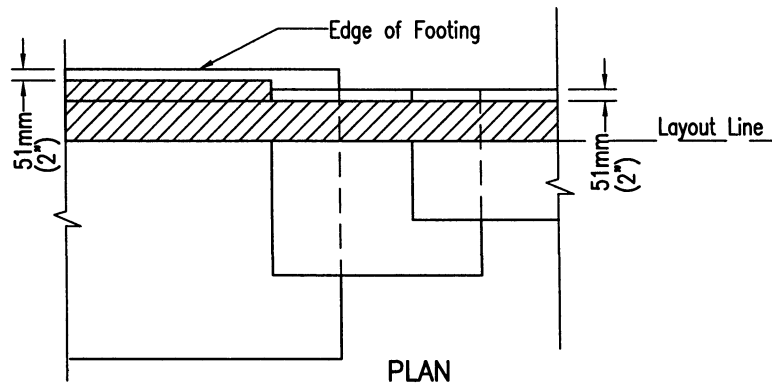
**CITY OF SAN DIEGO - STANDARD DRAWING**

**STRUCTURE EXCAVATION & BACKFILL**

CITY OF SAN DIEGO  
STANDARDS COMMITTEE


*[Signature]* 2-7-95  
COORDINATOR R.C.E. 25902 DATE

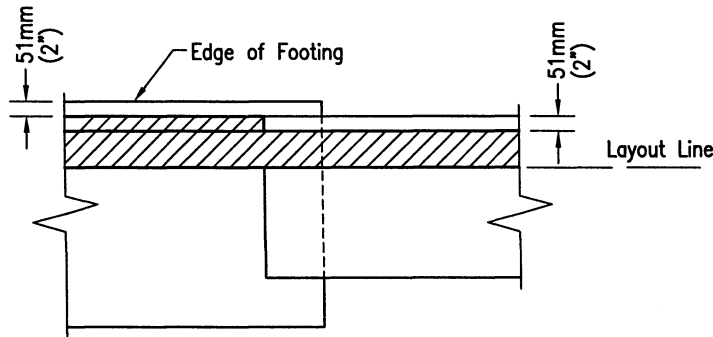
DRAWING NUMBER **SDC-104**



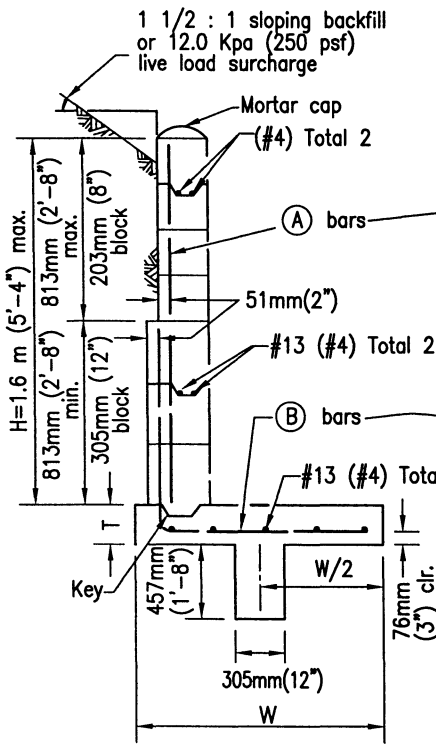
DIMENSIONS AND REINFORCING STEEL			
H (max.)	1.12m (3'-8")	1.63m (5'-4")	2.44m (8'-0")
T (min.)	203mm (0'-8")	254mm (0'-10")	305mm (1'-0")
W (min.)	762mm (2'-4")	1.12m (3'-6")	1.63m (5'-4")
(A) Bars	#13@813mm (#4@32")	#13@813mm (#4@32")	#13@813mm (#4@32")
(B) Bars	—	#13@813mm (#4@32")	#13@813mm (#4@32")
(C) Bars	—	—	406mm (#6@16")
(E) Bars	#13 (#4) Total 4	#13 (#4) Total 5	#13 (#4) Total 6
max soil press.	23.9 Kpa (500psf)	28.7 Kpa (600psf)	38.3 Kpa (800psf)

NOTES: 1. See Standard Drawings C-7 and C-8 for additional notes and details.  
 2. Fill all block cells with grout.

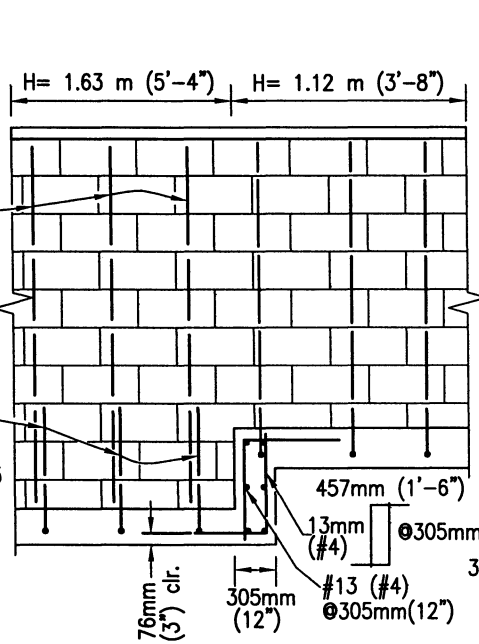
Revision	By	Approved	Date	<b>SAN DIEGO REGIONAL STANDARD DRAWING</b>	RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE
ORIGINAL		Kercheval	12/75		
Add Metric		T. Stanton	03/03		
<b>MASONRY RETAINING WALL TYPE 1 (LEVEL BACKFILL)</b>				 310112003 Chairperson R.C.E. 19246 Date	
				DRAWING NUMBER <b>C-1</b>	



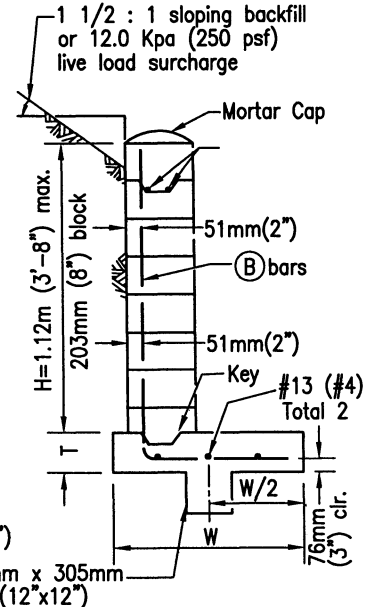
PLAN



TYPICAL SECTION  
over 1.12m (3'-8")



ELEVATION  
Horizontal reinf. not shown



TYPICAL SECTION  
1.12 m (3'-8") max.

DIMENSIONS AND REINFORCING STEEL		
H (max.)	1.63m (5'-4")	1.12m (3'-8")
T (min.)	254mm (0'-10")	254mm (0'-10")
W (min.)	1.52m (5'-0")	1.14m (3'-9")
(A) Bars	#13@406mm (#4@16")	—
(B) Bars	#19@406mm (#6@16")	#13@406mm (#4@16")
max. soil press.	33.5 Kpa (700psf)	26.3 Kpa (550psf)

NOTES:

1. See Standard Drawings C-7 and C-8 for additional notes and details.
2. Fill all block cells with grout.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

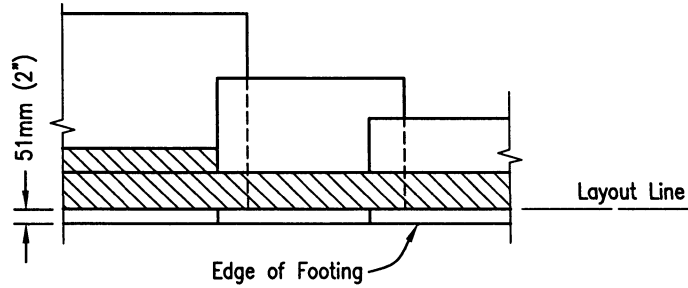
SAN DIEGO REGIONAL STANDARD DRAWING

**MASONRY RETAINING WALL TYPE 2**  
(LIVE LOAD SURCHARGE OR SLOPING BACKFILL)

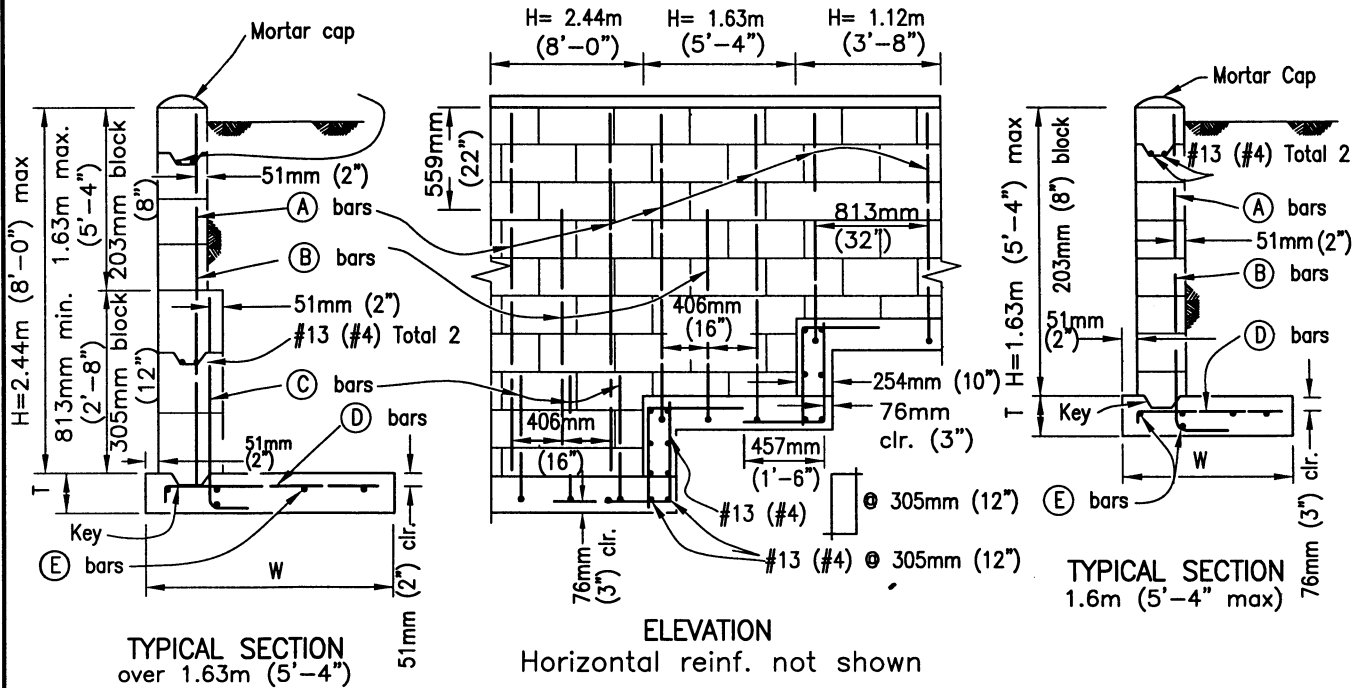
RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/10/2003  
Chairperson R.C.E. 19246 Date

DRAWING NUMBER **C-2**



PLAN



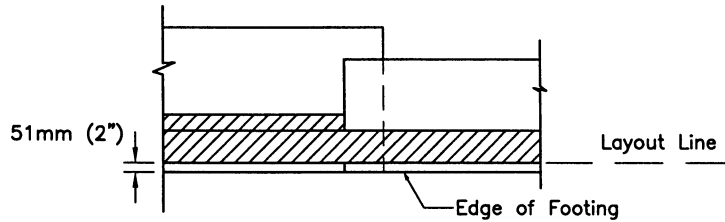
ELEVATION

Horizontal reinf. not shown

DIMENSIONS AND REINFORCING STEEL			
H (max)	1.12 m (3'-8")	1.63 m (5'-4")	2.44m (8'-0")
T (min)	203 mm (0'-8")	254 mm (0'-10")	305mm (1'-0")
W (min)	762 mm (2'-4")	965mm (3'-2")	1.45m (4'-9")
(A) Bars	#13@813mm (#4@32")	#13@813mm (#4@32")	13mm@813mm (#4@32")
(B) Bars	—	#13@813mm (#4@32")	13mm@813mm (#4@32")
(C) Bars	—	—	406mm (#6@16")
(D) Bars	#13@813mm (#4@32")	#13@406mm (#4@16")	406mm (#6@16")
(E) Bars	#13 (#4) total 4	#13 (#4) total 5	13mm (#4) total 6
max soil press. (psf)	7.6 MPa (1100psi)	11.0 MPa (1600psi)	15.2 MPa (2200psi)

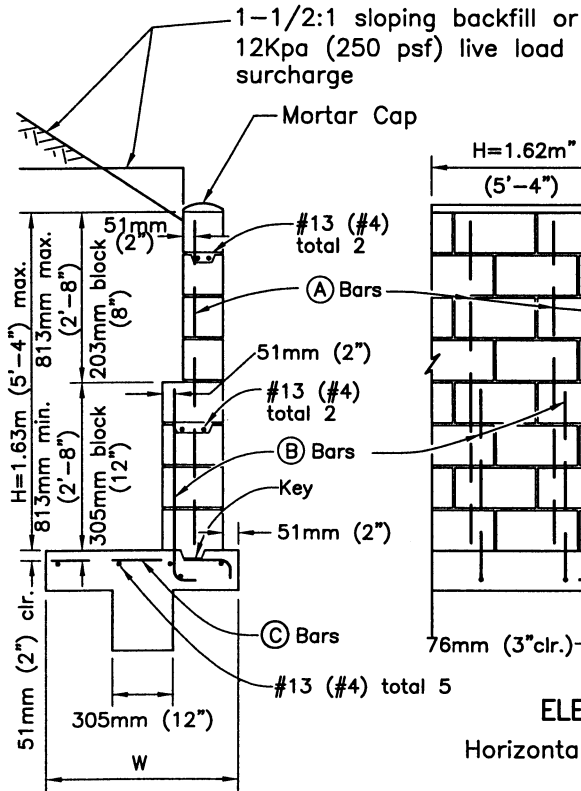
- NOTES: 1. See Standard Drawings C-7 and C-8 for additional notes and details.  
 2. Fill all block cells with grout.

Revision	By	Approved	Date	<b>SAN DIEGO REGIONAL STANDARD DRAWING</b>	<b>MASONRY RETAINING WALL TYPE 3 (LEVEL BACKFILL)</b>	RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE
ORIGINAL		Kercheval	12/75			<i>T. Stanton</i> 3/10/2003 Chairperson R.C.E. 19246 Date
Add Metric		T. Stanton	03/03			
						DRAWING NUMBER <b>C-3</b>

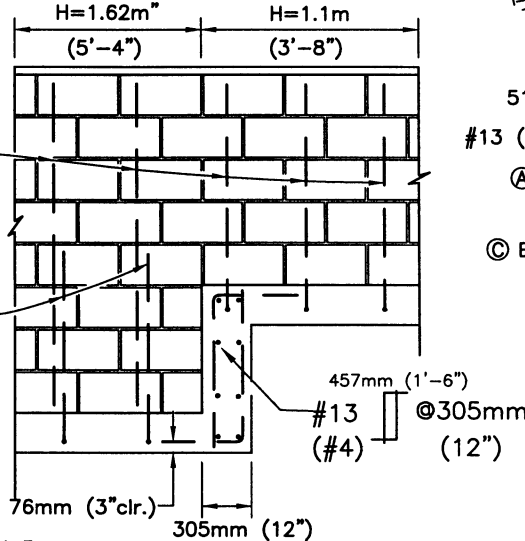


PLAN

1-1/2:1 sloping backfill or  
12Kpa (250 psf) live load  
surcharge

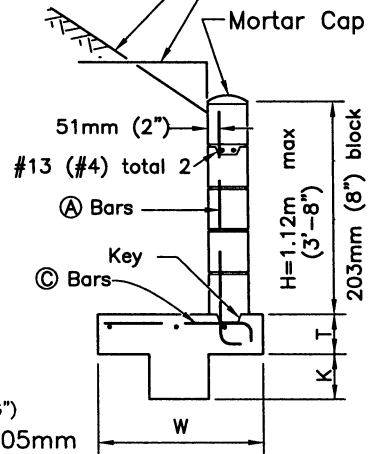


TYPICAL SECTION  
over 1.12m (3'-8")



ELEVATION

Horizontal reinf. not shown



TYPICAL SECTION  
1.12m (3'-8") max

DIMENSIONS AND REINFORCING STEEL				
H (max)	1.63m (5'-4")		1.12m (3'-8")	
T (min)	254mm (0'-10")		203mm (0'-8")	
W (min)	1.22m (4'-0")		914mm (3'-0")	
(A) Bars	#13(#4)@406mm(16")		#13 (#4)@406mm (16")	
(B) Bars	#19(#6)@406mm(16")		—	
Surcharge	sloping	live load	sloping	live load
(C) Bars	#19(#6)@203mm(8")	#19(#6)@406mm(16")	#19(#6)@406mm(16")	#19(#6)@403mm(16")
K (min)	305mm (1'-0")	203mm (0'-8")	305mm (1'-0")	203mm (0'-8")
Toe Press.	129.3 Kpa (2700 psf)	91 Kpa (1900 psf)	81.4 Kpa (1700 psf)	68.5 Kpa (1430 psf)

NOTES:

1. See Standard Drawings C-7 and C-8 for additional notes and details.
2. Fill all block cells with grout.

Revision	By	Approved	Date
ORIGINAL		Parkinson	02/95
Add Metric		T. Stanton	03/03
Reformatted		T. Stanton	04/06

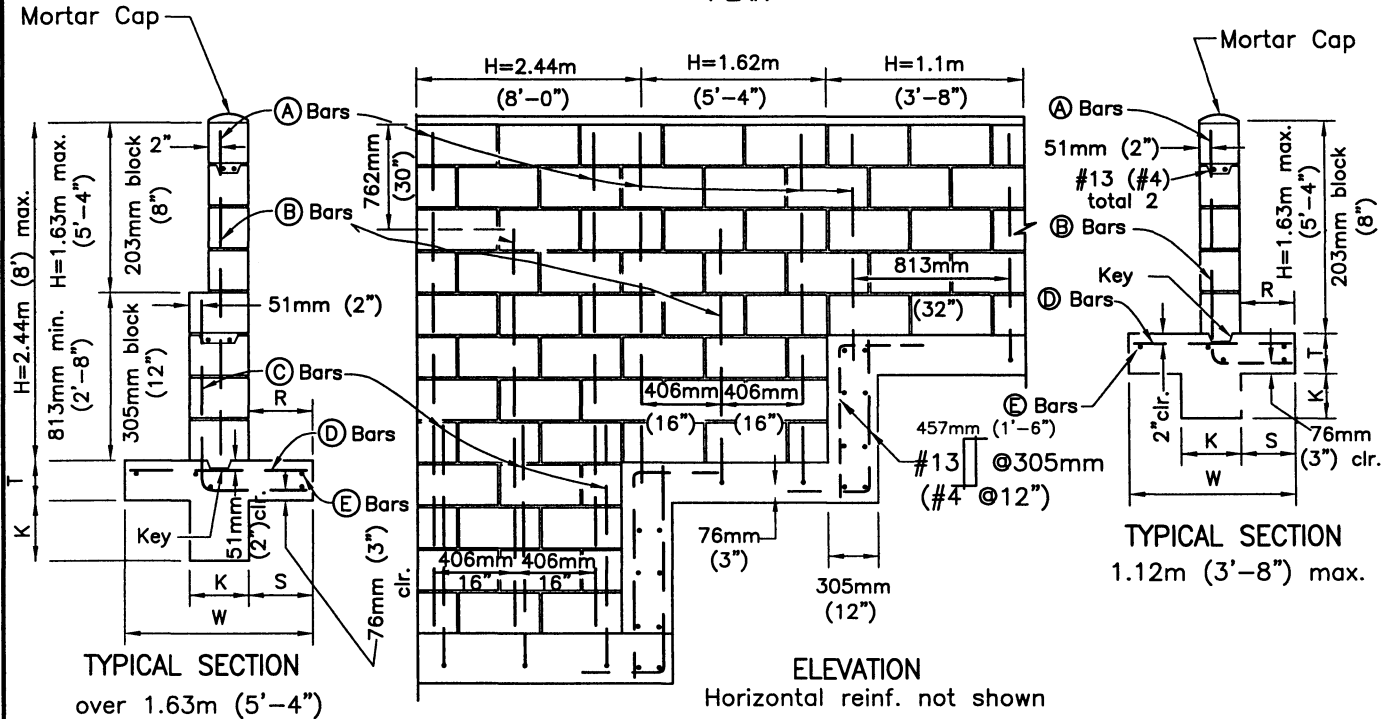
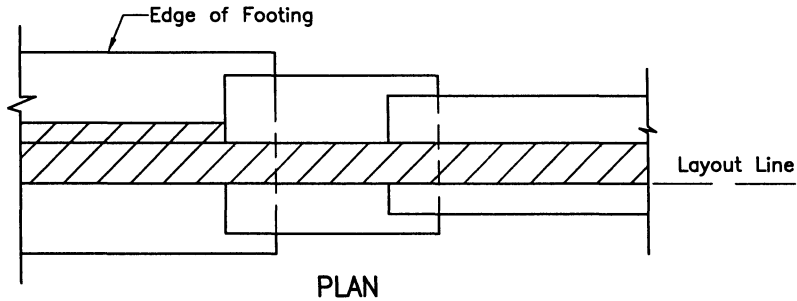
SAN DIEGO REGIONAL STANDARD DRAWING

**MASONRY RETAINING WALL TYPE 4**  
**(LIVE LOAD SURCHARGE OR SLOPING BACKFILL)**

RECOMMENDED BY THE SAN DIEGO  
REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/10/2003  
Chairperson R.C.E. 19246 Date

DRAWING  
NUMBER **C-4**



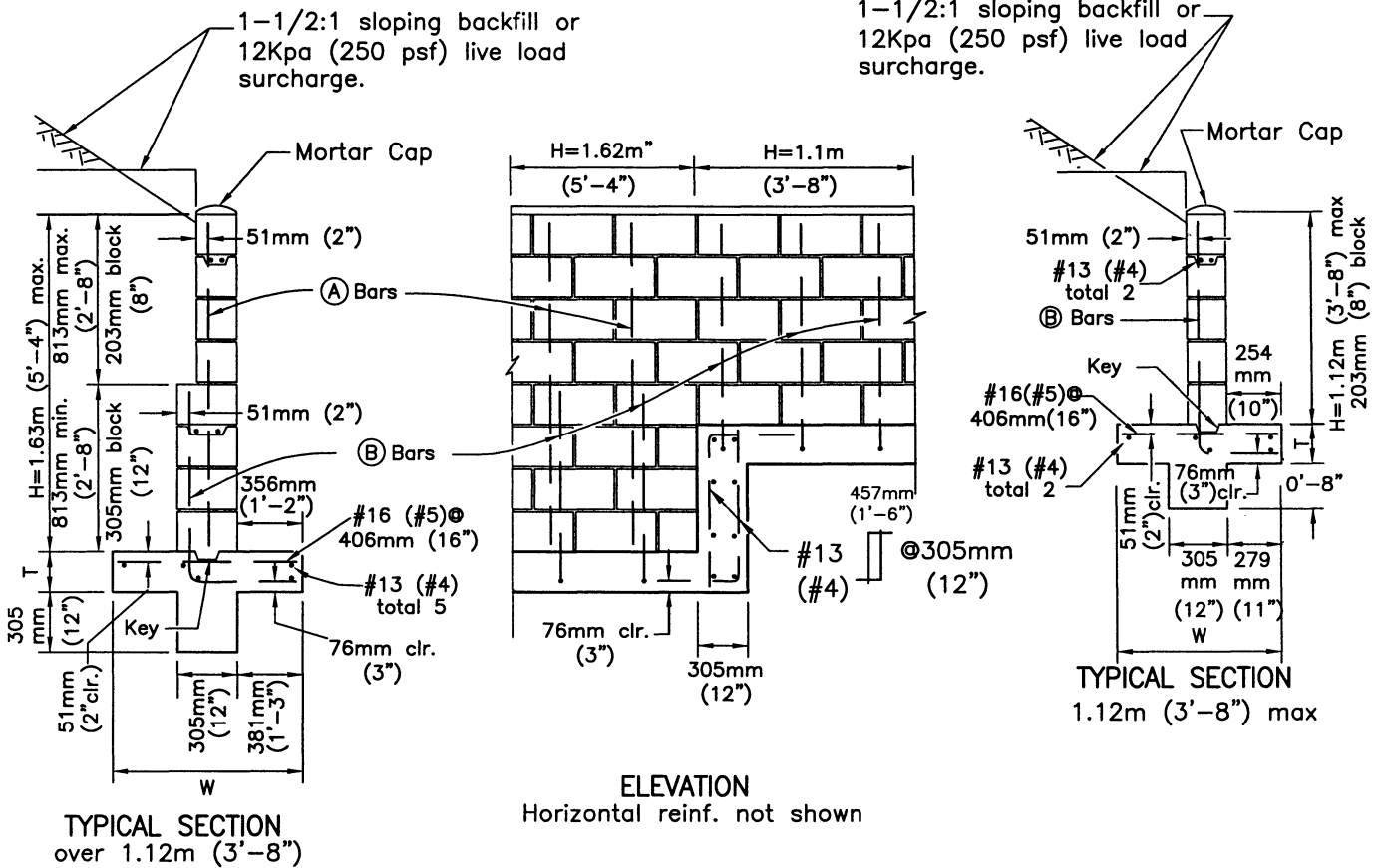
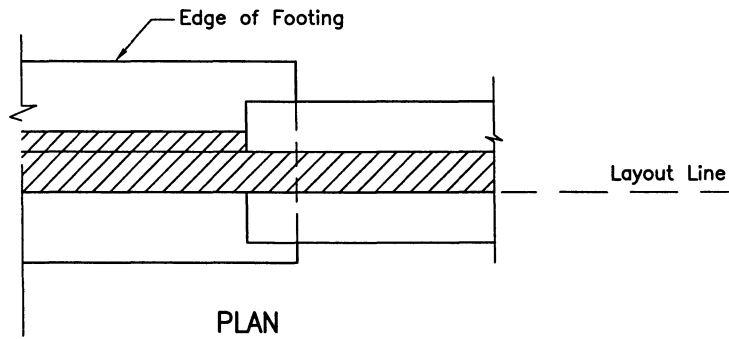
DIMENSIONS AND REINFORCING STEEL			
H (max)	1.12m (3'-8")	1.63m (5'-4")	2.44m (8'-0")
T (min)	203mm (0'-8")	254mm (0'-10")	305mm (1'-0")
W (min)	635mm (2'-1")	940mm (3'-1")	1.25m (4'-3")
R	229mm (0'-9")	356mm (1'-2")	432mm (1'-5")
S	216mm (0'-8 1/2")	318mm (1'-1 1/2")	495mm (1'-7 1/2")
K	203mm (0'-8")	203mm (0'-8")	305mm (1'-0")
(A) Bars	#13(#4)@813mm(32")	#13(#4)@813mm(32")	#13(#4)@813mm(32")
(B) Bars	—	#13(#4)@813mm(32")	#13(#4)@813mm(32")
(C) Bars	—	—	#22(#7)@406mm(16")
(D) Bars	#13(#4)@813mm(32")	#13(#4)@406mm(16")	#13(#4)@406mm(16")
(E) Bars	#13(#4) total 5	#13(#4) total 5	#13(#4) total 6
Max. Toe Press.	37.1 Kpa (774 psf)	49.3 Kpa (1,030 psf)	79.5 Kpa (1,660psf)

NOTES:

1. See Standard Drawings C-7 and C-8 for additional notes and details.
2. Fill all block cells with grout.

Revision	By	Approved	Date	SAN DIEGO REGIONAL STANDARD DRAWING	RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE
ORIGINAL		Parkinson	2/95		
Add Metric		T. Stanton	03/03		
				DRAWING NUMBER	<b>C-5</b>





DIMENSIONS AND REINFORCING STEEL		
H (max)	1.63m (5'-4")	1.12m (3'-8")
T (min)	254mm (0'-10")	203mm (0'-8")
W (min)	1.17m (3'-10")	838mm (2'-9")
(A) Bars	#13(#4)@406mm(16")	—
(B) Bars	#19(#6)@406mm(16")	#13(#4)@406mm(16")
Max. Toe Press.	95.8 Kpa (2,000 psf)	67.0 Kpa (1,400 psf)

**NOTES:**

- See Standard Drawings C-7 and C-8 for additional notes and details.
- Fill all block cells with grout.

Revision	By	Approved	Date
ORIGINAL		Parkinson	2/95
Add Metric		T. Stanton	03/03

**SAN DIEGO REGIONAL STANDARD DRAWING**

**MASONRY RETAINING WALL TYPE 6  
(LIVE LOAD SURCHARGE OR SLOPING BACKFILL)**

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/01/2003  
Chairperson R.C.E. 19246 Date

DRAWING NUMBER **C-6**

**DESIGN CONDITIONS:**

Walls are to be used for the loading conditions shown for each type wall. Design H shall not be exceeded. Footing key is required except as shown otherwise or when found unnecessary by the Engineer. Special footing design is required where foundation material is incapable of supporting toe pressure listed in table.

**DESIGN DATA:**

**Reinforced Concrete:**

F<sub>c</sub>=8.3 Mpa (1200 psi) F'<sub>c</sub>=20.7 Mpa (3000 psi)  
F<sub>s</sub>=138 Mpa (20,000 psi) n=10

**Reinforced Masonry:**

F'<sub>m</sub>=41.4 Mpa (600 psi) F<sub>m</sub>=1.4 Mpa (200 psi)  
F<sub>s</sub>=138 Mpa (20,000 psi) n=50  
Earth=1922 kg/cu m (120 pcf) and Equivalent Fluid Pressure=1.76 kg/sq m (36 psf) per 305mm (foot) of height.  
Walls shown for 1 1/2:1 unlimited sloping surcharge are designed in accordance with Rankline's formula for unlimited sloping surcharge with a  $\phi = 33^\circ 13m(42')$ .

**REINFORCEMENT:**

Intermediate grade, hard grade, or rail steel deformation shall conform ASTM A615, A616, A617. Bars shall lap 40 diameters, where spliced, unless otherwise shown on the plans. Bends shall conform to the Manual of Standard Practice, A.C.I. Backing for hooks is four diameters. All bar embedments are clear distances to outside of bar. Spacing for parallel bars is center to center bars.

**MASONRY:**

All reinforced masonry retaining walls be constructed of regular or light weight standard units conforming to the "Standard Specifications for Public Works Construction."

**JOINTS:**

Vertical control joints shall be placed at 9.75m (32') intervals maximum. Joints shall be designed to resist shear and other lateral forces while permitting longitudinal movement. Vertical expansion joints shall be placed at 29.3m (96') intervals maximum.

**CONCRETE:**

Footing concrete shall be 332 kg/M<sup>3</sup>-C-22Mpa (560-C-3250), using Type B aggregate when placing conditions permit.

**BACKFILL:**

No backfill material shall be placed against masonry retaining walls until grout has reached design strength or until grout has cured for a minimum of 28 days. Compaction of backfill material by jetting or ponding with water will not be permitted. Each layer of backfill shall be moistened as directed by the Engineer and thoroughly tamped, rolled or otherwise compacted until the relative compacting is not less than 90%.

**FENCING:**

Safety fencing shall be installed at the top of the wall as required by the agency.

**INSPECTIONS:**

Call for inspections as follows:

- A. When the footing has been formed, with the steel tied securely in final position, and is ready for the concrete to be placed.
- B. Where cleanout holes are not provided:
  - (1) After the blocks have been laid up to a height of 1.22m (4') or full height for walls up to 1.52m (5'), with steel in place but before the grout is poured, and.....
  - (2) After the first lift is properly grouted, the blocks have been laid up to the top of the wall with the steel tied securely in place but before the upper lift is grouted.
- Where cleanout holes are provided:
  - After the blocks have been laid up to the top of the wall, with the steel tied securely in place, but before grouting.
- C. After grouting is complete and after rock or rubble wall drains are in place but before earth backfill is placed.
- D. Final inspection when all work has been completed.

**CONCRETE GROUT AND MORTAR MIXES:**

Concrete grout shall attain a minimum compressive strength of 13.8 Mpa (2,000 psi) in 28 days and mortar shall attain 12.4 Mpa (1,800) psi in 28 days. All cells shall be filled with grout. Rod or vibrate consolidation. Bring grout within 10 minutes of pouring to insure grout to a point 51mm (2") from the top of masonry units when grouting of second lift is to be continued at another time.

**MORTAR KEY:**


To insure proper bonding between the footing and the first course of block, a mortar key shall be formed by embedding a flat 2 x 4 flush with and at the top of the freshly poured footing. The 2 x 4 should be removed after the concrete has started to harden (approximately 1 hour). A mortar key may be omitted if the first course of block is set into the fresh concrete when the footing is poured, and a good bond is obtained.

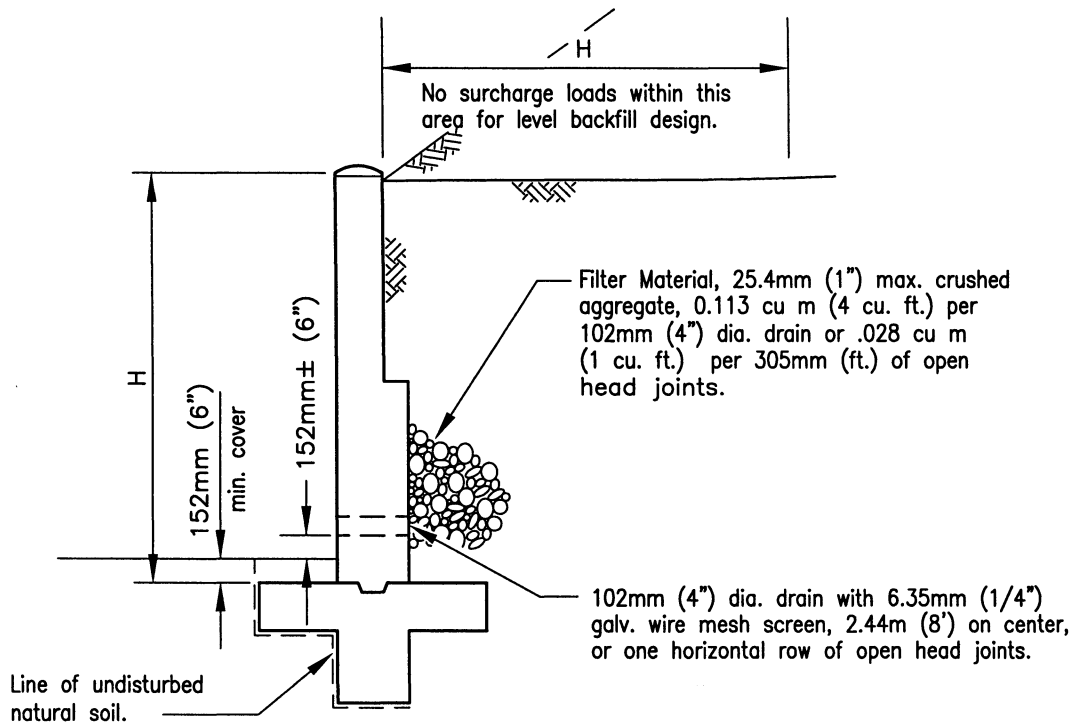
**WALL DRAINS:**

Wall drains shall be provided in accordance with Standard Drawing C-8.

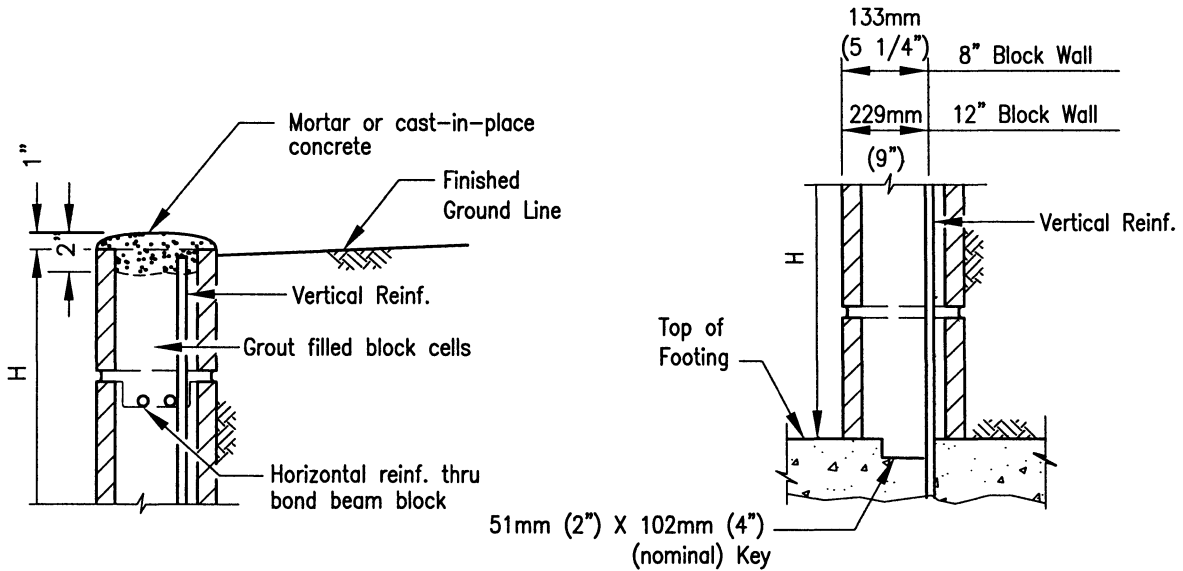
**SOIL:**

All footings shall extend at least 305mm (12") into undisturbed natural soil or approved compacted fill. Soil should be dampened prior to placing concrete in footings.

Revision	By	Approved	Date	<b>SAN DIEGO REGIONAL STANDARD DRAWING</b>	RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE
ORIGINAL		A. Kercheval	12/75		
Add Metric		T. Stanton	03/03		
<b>GENERAL NOTES FOR MASONRY RETAINING WALLS</b>				 3/01/2003 Chairperson R.C.E. 19246 Date	
				DRAWING NUMBER	<b>C-7</b>



TYPICAL SECTION



CAP DETAIL

KEY DETAIL

NOTES:

1. All masonry retaining walls shall be constructed with cap, key and drainage details as shown hereon.
2. 102mm (4 inch) diameter drain may be formed by placing a block on it's side.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

SAN DIEGO REGIONAL STANDARD DRAWING

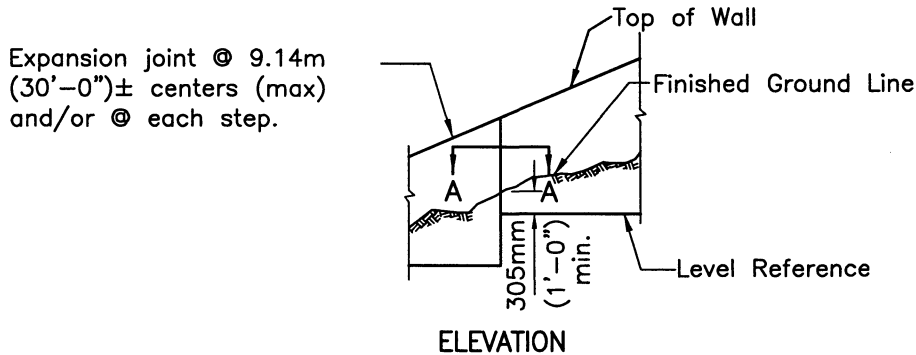
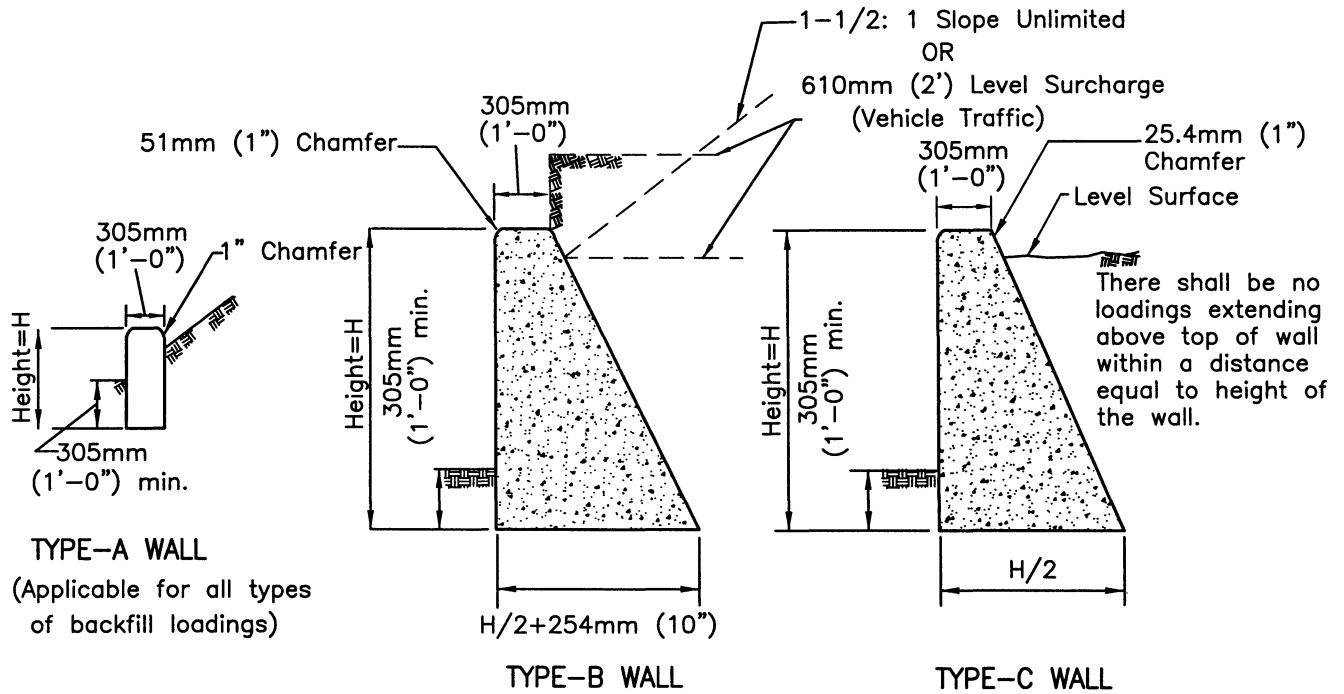
DETAILS FOR MASONRY RETAINING WALL

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/01/2003  
Chairperson R.C.E. 19246 Date

DRAWING NUMBER

C-8



WALL TYPE	HEIGHT	BASE	CONCRETE CU M - CF/FT
A	457mm (1'-6")	305mm (1'-0")	.042 cu m (1.50 cu ft.)
	610mm (2'-0")	305mm (1'-0")	.057 cu m (2.00 cu ft.)
B	914mm (3'-0")	711mm (2'-4")	1.41 cu m (4.99 cu ft.)
	1.22m (4'-0")	864mm (2'-10")	.217 cu m (7.66 cu ft.)
	1.52m (5'-0")	1.02m (3'-4")	.306 cu m (10.82 cu ft.)
C	1.83m (6'-0")	1.17m (3'-10")	.410 cu m (14.49 cu ft.)
	914mm (3'-0")	457mm (1'-6")	.106 cu m (3.75 cu ft.)
	1.22m (4'-0")	610mm (2'-0")	.170 cu m (6.00 cu ft.)
	1.52m (5'-0")	762mm (2'-6")	.248 cu m (8.75 cu ft.)
	1.83m (6'-0")	914mm (3'-0")	.340 cu m (12.00 cu ft.)

NOTE:  
See Standard Drawings C-10 for Section A-A, notes and details.

Revision	By	Approved	Date	SAN DIEGO REGIONAL STANDARD DRAWING	RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE	
ORIGINAL		Kercheval	12/75		<b>GRAVITY RETAINING WALLS</b>	<i>T. Stanton</i> 3/10/2003 Chairperson R.C.E. 19246 Date
Add Metric		T. Stanton	03/03			
				DRAWING NUMBER		<b>C-9</b>

**CONCRETE**

Concrete shall be 332 kg/M<sup>3</sup> -C-22Mpa (560-C-3250)

**DESIGN CONDITIONS**

Walls are to be used for the loading conditions shown for each type wall. Design H may be exceeded by six inches before going to next size.

**DESIGN DATA**

F<sub>c</sub> = 8.3 Mpa (1200 psi)  
 F'c = 20.7 Mpa (3000 psi)  
 Earth = 1922 kg/cu m (120 pcf)  
 and equivalent fluid pressure = 176 kg/sq m (36 psf) per 305mm (foot) of height

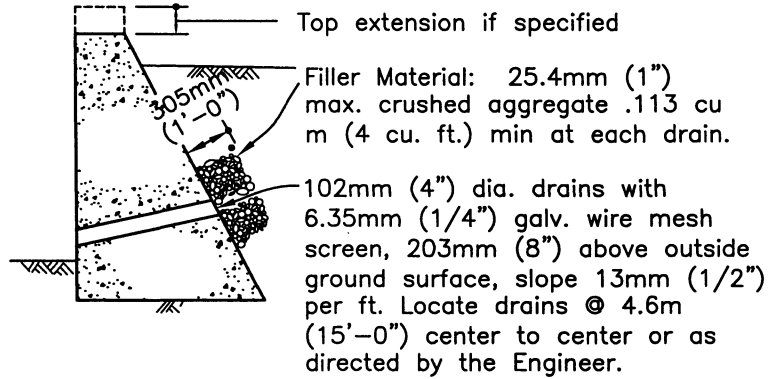
Walls shown for 1-1/2:1 unlimited sloping surcharge are designed in accordance with Rankine's Formula for unlimited sloping surcharge with  $\phi = 33^\circ$  13m (42').  
 Note: Maximum toe pressure under wall footing = 143.6 Kpa (1-1/2 tons/sq. ft.). Special design required where footing material is incapable of supporting this pressure.

**EXCAVATION AND BACKFILL**

Compaction of backfill material by jetting or ponding with water will not be permitted.

Each layer of backfill shall be moistened as directed by the Engineer and thoroughly tamped, rolled or otherwise compacted until the relative compaction is not less than 90 percent.

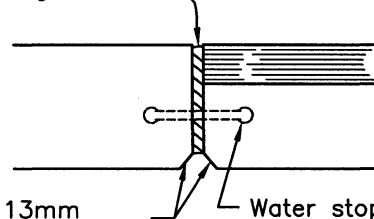
No backfill material shall be deposited against concrete retaining walls until the concrete has developed a strength of 17 Mpa (2,500 psi) in compression as determined by test cylinders, or until 28 days after wall has been placed.



**TYPICAL DRAINAGE**

WHEN H IS GREATER THAN 1.22m (4'-0")

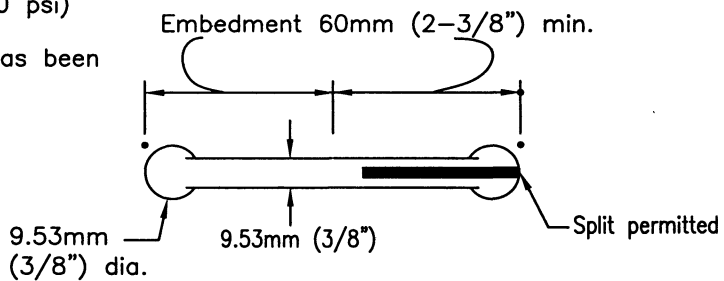
13mm (1/2") Expansion joint, fill with premolded expansion joint filler. Locate joints at approx. 9.14m (30'-0") centers or as directed by the Engineer.



13mm (1/2") chamfer

Water stop, use only when watertight joint is required, see water stop detail.

**SECTION A-A**



**RUBBER WATERSTOP**

Use only when watertight joint is required.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

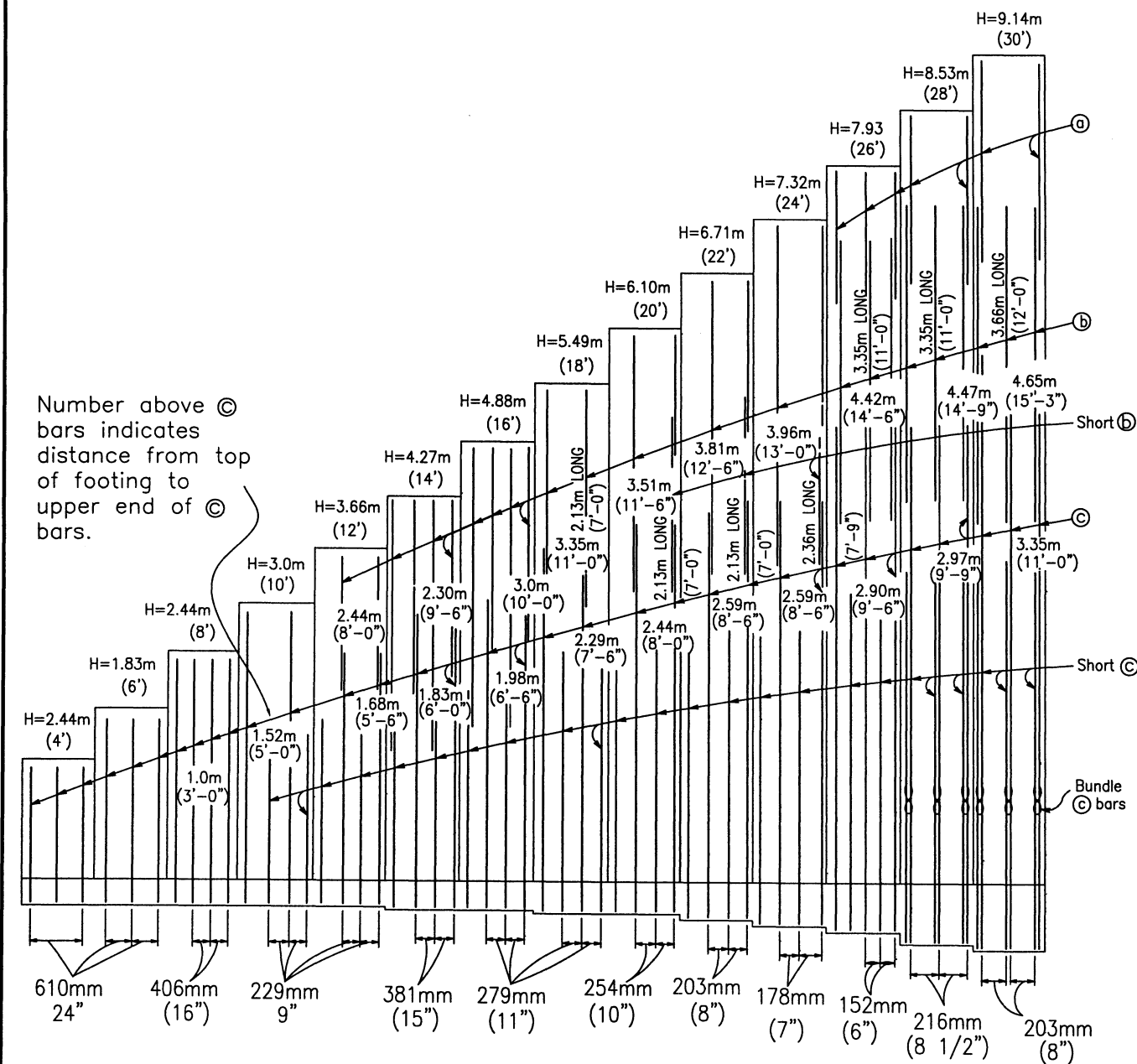
**SAN DIEGO REGIONAL STANDARD DRAWING**

**GENERAL NOTES AND DETAILS FOR GRAVITY RETAINING WALLS**

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/01/2003  
 Chairperson R.C.E. 19246 Date

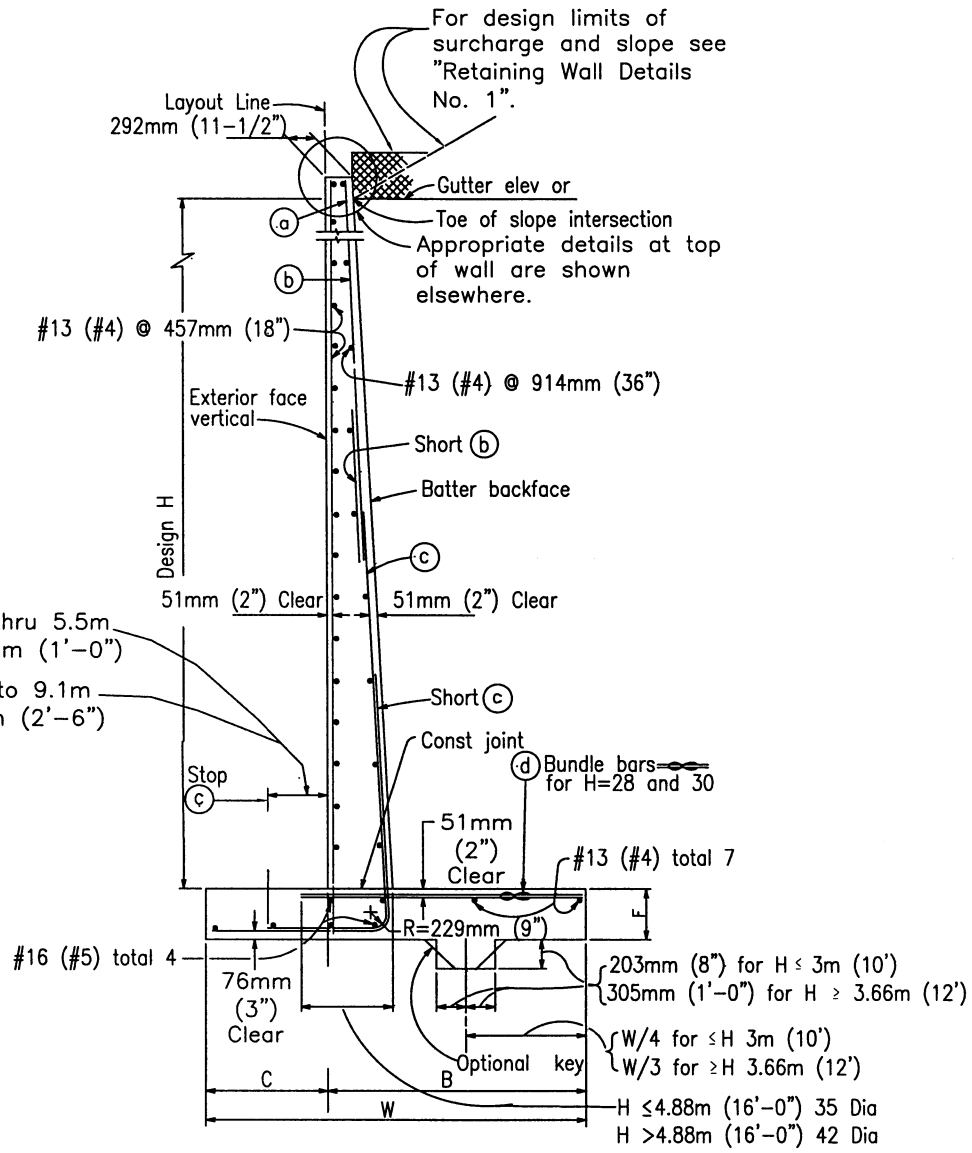
DRAWING NUMBER **C-10**



**ELEVATION**

- NOTES:
1. For SPREAD FOOTING SECTION see C-11B
  2. For TYPICAL LAYOUT EXAMPLE see C-11C
  3. For 45T PILE FOOTING SECTION see C-11C
  4. For TABLE OF REINFORCING STEEL DIMENSIONS AND DATA see C-11D

Revision	By	Approved	Date	<b>SAN DIEGO REGIONAL STANDARD DRAWING</b>	RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE
ORIGINAL		Kercheval	12/75		<b>REINFORCED CONCRETE RETAINING WALL TYPE 1</b>
Add Metric		T. Stanton	03/03	DRAWING NUMBER <b>C-11A</b>	



SPREAD FOOTING SECTION

NOTES:

- For details not shown and drainage notes see "Retaining Wall Details No.1." Standard Drawing C-13.
- Quantities apply to Design H portion and exclude the added portion above "Gutter Elevation".

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

**SAN DIEGO REGIONAL STANDARD DRAWING**

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**REINFORCED CONCRETE RETAINING WALL**

**TYPE 1**

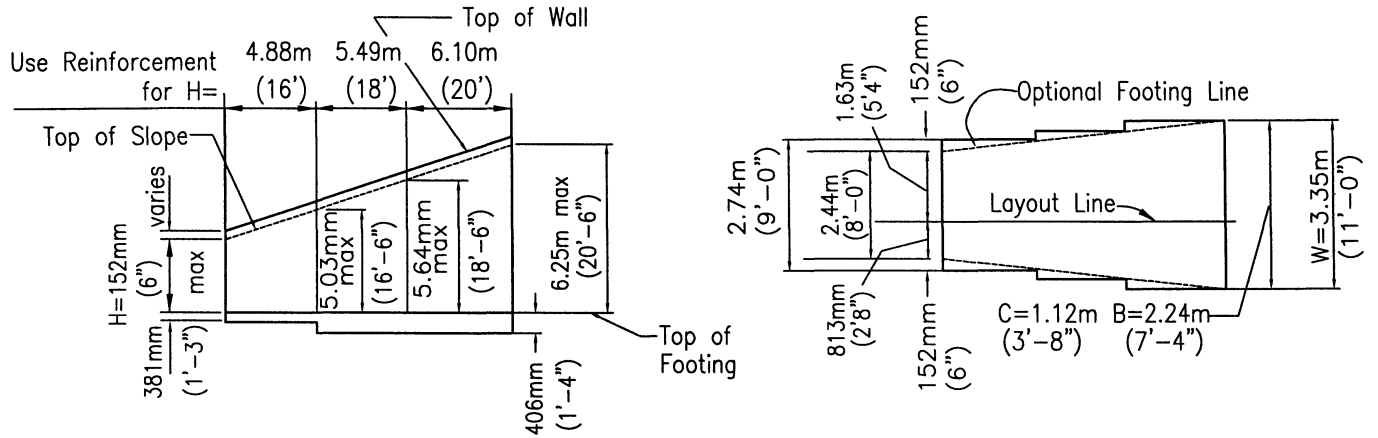
RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/01/2003

Chairperson R.C.E. 19246 Date

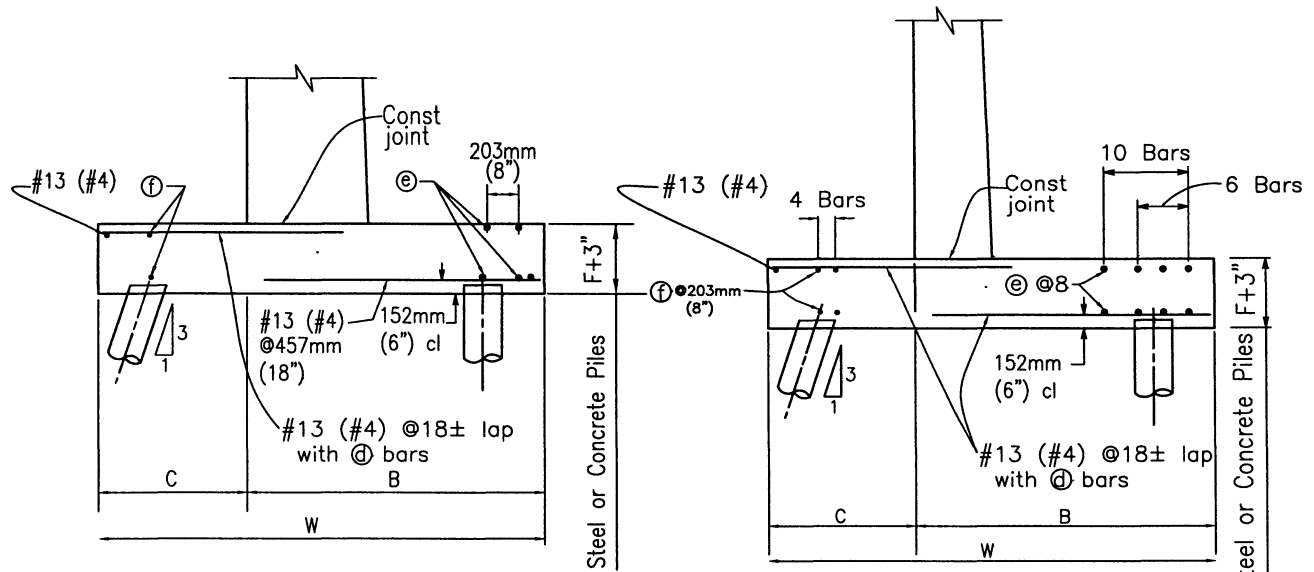
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DRAWING NUMBER **C-11B**



**TYPICAL LAYOUT EXAMPLE**

For joints required, see Details 3-3 and 3-4, drawing C-15



**45T PILE FOOTING SECTION**

H=7.32m (24') Thru H=9.14m (30')

**45T PILE FOOTING SECTION**

H=1.22m (4') Thru H=6.71m (22')

Revision	By	Approved	Date	SAN DIEGO REGIONAL STANDARD DRAWING		RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE
ORIGINAL		Kercheval	12/75	<b>REINFORCED CONCRETE RETAINING WALL</b>		<i>T. Stanton</i> 3/10/2003 Chairperson R.C.E. 19246 Date
Add Metric		T. Stanton	03/03			
				<b>TYPE 1</b>		<b>DRAWING NUMBER C-11C</b>



Revision	By	Date
ORIGINAL	Approved Kercheval	12/75
Add Metric	T. Stanton	03/03
<b>SAN DIEGO REGIONAL STANDARD DRAWING</b>		
<b>REINFORCED CONCRETE RETAINING WALL</b>		
<b>TYPE 1</b>		
DRAWING NUMBER <b>C-11D</b>		
RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE <i>John Peterson</i> 3/10/2003 Chairperson R.C.E. 19246 Date		

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA			4'	6'	8'	10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'
Design H			4'	6'	8'	10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'
W	Metric U.S.		965mm 3'-2"	1.27m 4'-2"	1.58m 5'-2"	1.88m 6'-2"	2.18m 7'-2"	2.44m 8'-0"	2.74m 9'-0"	3.0 m 10'-0"	3.35m 11'-0"	3.66m 12'-0"	4.04m 13'-3"	4.34m 14'-3"	4.65m 15'-3"	5.10m 16'-9"
C	Metric U.S.		305mm 1'-0"	406mm 1'-4"	508mm 1'-8"	610mm 2'-0"	711mm 2'-4"	813mm 2'-8"	1.0 m 3'-0"	1.02m 3'-4"	1.12m 3'-8"	1.22m 4'-0"	1.35m 4'-5"	1.45m 4'-9"	1.55m 5'-1"	1.65m 5'-5"
B	Metric U.S.		660mm 2'-2"	864mm 2'-10"	1.07m 3'-6"	1.27m 4'-2"	1.47m 4'-10"	1.63m 5'-4"	1.83m 6'-0"	2.03m 6'-8"	2.24m 7'-4"	2.44m 8'-0"	2.69m 8'-10"	2.90m 9'-6"	3.10m 10'-2"	3.45m 11'-4"
F Spread Ftg.	Metric U.S.		356mm 1'-2"	356mm 1'-2"	356mm 1'-2"	356mm 1'-2"	356mm 1'-2"	381mm 1'-3"	381mm 1'-3"	406mm 1'-4"	406mm 1'-4"	457mm 1'-6"	508mm 1'-8"	584mm 1'-11"	660mm 2'-2"	711mm 2'-4"
Batter			1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	5/8:12	3/4:12	3/4:12	7/8:12
ⓐ bars	Metric U.S.		—	—	—	—	—	—	—	—	—	—	—	#13ⓐ 610mm #6ⓐ24	#19ⓐ 432mm #6ⓐ17	#19ⓐ 406mm #6ⓐ16
ⓑ bars	Metric U.S.		—	—	—	—	#13ⓑ 457mm #4ⓑ18	#19ⓑ 762mm #6ⓑ30	#19ⓑ 559mm #6ⓑ22	#22ⓑ 559mm #7ⓑ22	#25ⓑ 508mm #8ⓑ20	#25ⓑ 406mm #8ⓑ16	#25ⓑ 356mm #8ⓑ14	#25ⓑ 305mm #8ⓑ12	#25ⓑ 13mm #8ⓑ8-1/2	#25ⓑ 203mm #8ⓑ8
ⓒ bars	Metric U.S.		#16ⓐ 610mm #5ⓐ24	#16ⓐ 610mm #5ⓐ24	#16ⓐ 406mm #5ⓐ16	#16ⓐ 229mm #5ⓐ9	#19ⓐ 229mm #6ⓐ9	#29ⓐ 381mm #9ⓐ15	#29ⓐ 279mm #9ⓐ11	#32ⓐ 279mm #10ⓐ11	#36ⓐ 254mm #11ⓐ10	#36ⓐ 203mm #11ⓐ8	#36ⓐ 176mm #11ⓐ7	#36ⓐ 152mm #11ⓐ6	#32ⓐ 216mm ♂ #10ⓐ8-1/2	#32ⓐ 203mm ♂ #10ⓐ8 ♂
ⓓ bars	Metric U.S.		#16ⓐ 610mm #5ⓐ24	#16ⓐ 610mm #5ⓐ24	#13ⓐ 406mm #4ⓐ16	#13ⓐ 229mm #4ⓐ9	#16ⓐ 229mm #5ⓐ9	#25ⓐ 381mm #8ⓐ15	#25ⓐ 279mm #8ⓐ11	#32ⓐ 279mm #10ⓐ11	#32ⓐ 279mm #10ⓐ11	#32ⓐ 203mm #10ⓐ8	#32ⓐ 178mm #10ⓐ7	#32ⓐ 152mm #10ⓐ6	#29ⓐ 216mm ♂ #9ⓐ8-1/2	#29ⓐ 203mm ♂ #9ⓐ8 ♂
Total ⓔ bars	Metric U.S.		6-#19 6-#6	6-#19 6-#6	10-#22 10-#7	10-#22 10-#7	10-#22 10-#7	10-#22 10-#7	6-#22 6-#7	6-#22 6-#7	6-#22 6-#7	6-#22 6-#7	4-#22 4-#7	4-#22 4-#7	4-#22 4-#7	4-#22 4-#7
Total ⓕ bars	Metric U.S.					4-#22 4-#7	4-#22 4-#7	4-#22 4-#7	4-#22 4-#7	4-#22 4-#7	4-#22 4-#7	4-#22 4-#7	2-#22 2-#7	2-#22 2-#7	2-#22 2-#7	2-#22 2-#7
2' Level surcharge	Toe Pressure	Metric U.S.	77Kpa 1.6k/sf	91Kpa 1.9k/sf	105Kpa 2.2k/sf	110Kpa 2.3k/sf	134Kpa 2.8k/sf	158Kpa 3.3k/sf	168Kpa 3.5k/sf	191Kpa 4.0k/sf	206Kpa 4.3k/sf	220Kpa 4.6k/sf	235Kpa 4.9k/sf	254Kpa 5.3k/sf	273Kpa 5.7k/sf	297Kpa 6.2k/sf
2:1 unlimited slope	Toe Pressure	Metric U.S.	53Kpa 1.1k/sf	72Kpa 1.5k/sf	96Kpa 2.0k/sf	120Kpa 2.5k/sf	129Kpa 2.7k/sf	158Kpa 3.3k/sf	172Kpa 3.6k/sf	201Kpa 4.2k/sf	225Kpa 4.7k/sf	263Kpa 5.5k/sf	282Kpa 5.9k/sf	311Kpa 6.5k/sf	340Kpa 7.1k/sf	359Kpa 7.5k/sf
1-1/2:1 limited slope	Toe Pressure	Metric U.S.	62Kpa 1.3k/sf	81Kpa 1.7k/sf	101Kpa 2.1k/sf	120Kpa 2.5k/sf	139Kpa 2.9k/sf	163Kpa 3.4k/sf	182Kpa 3.8k/sf	206Kpa 4.3k/sf	230Kpa 4.8k/sf	259Kpa 5.4k/sf	278Kpa 5.8k/sf	311Kpa 6.5k/sf	345Kpa 7.2k/sf	359Kpa 7.5k/sf
Spread Footing	Steel kg/ft.	Metric	7.7kg	9.1kg	12.7kg	16.8kg	23kg	36.3kg	47.6kg	66.7kg	84.8kg	112kg	137kg	185kg	204kg	230kg
	Steel lbs/ft.	U.S.	17lb.	20lb.	28lb.	37lb.	51lb.	80lb.	105lb.	147lb.	187lb.	246lb.	303lb.	407lb.	449lb.	507lb.
Pile ftg.	Conc cu m	Metric	26cu m	36cu m	47cu m	58cu m	72cu m	86cu m	1.0cu m	1.2cu m	1.3cu m	1.5cu m	1.8cu m	2.9cu m	2.5cu m	3.0cu m
	Conc cf/ft	U.S.	8.9cu ft	12.5cu ft	16.3cu ft	20.2cu ft	25.4cu ft	30.1cu ft	34.6cu ft	40.1cu ft	45.0cu ft	52.1cu ft	63.3cu ft	77.0cu ft	88.1cu ft	104.8cu ft
Pile ftg.	Steel kg/ft.	Metric	13.2kg	14.5kg	18.6kg	31.8kg	38.1kg	51.3kg	63.5kg	78.0kg	96.2kg	122kg	146kg	194kg	213kg	240kg
	Steel lbs/ft.	U.S.	29lb.	32lb.	41lb.	70lb.	84lb.	113lb.	140lb.	172lb.	212lb.	270lb.	322lb.	427lb.	469lb.	528lb.
Pile ftg.	Conc cu m	Metric	30cu m	34cu m	48cu m	59cu m	72cu m	86cu m	99cu m	1.1cu m	1.3cu m	1.2cu m	1.8cu m	2.3cu m	2.6cu m	3.0cu m
	Conc cf/ft	U.S.	10.2cu ft	12.7cu ft	16.7cu ft	20.8cu ft	25.2cu ft	30.1cu ft	34.8cu ft	40.6cu ft	45.7cu ft	53.1cu ft	64.7cu ft	78.6cu ft	89.9cu ft	107.0cu ft

Note: Reinforcement detailed is to be placed in addition to that shown for spread footing. All piles not shown, see Pile Layout on plans. For pile footing Design H=4' use same footing dimensions as Design H=6' ♂ Denotes a bundle of 2 bars

Revision	By	Approved	Date
ORIGINAL			12/75
Add Metric	T. Stanton		03/03

**SAN DIEGO REGIONAL STANDARD DRAWING**

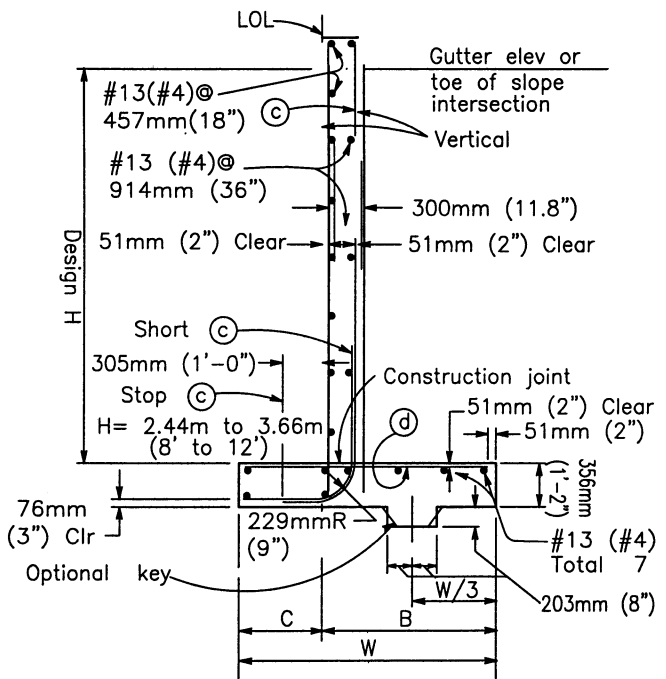
**REINFORCED CONCRETE RETAINING WALL**

**TYPE 1A**

DRAWING NUMBER **C-12A**

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

Christerson R.C.E. 19246 Date 3/01/2003



**SPREAD FOOTING SECTION**

Place concrete in toe against undisturbed material, except as permitted by the Engineer.

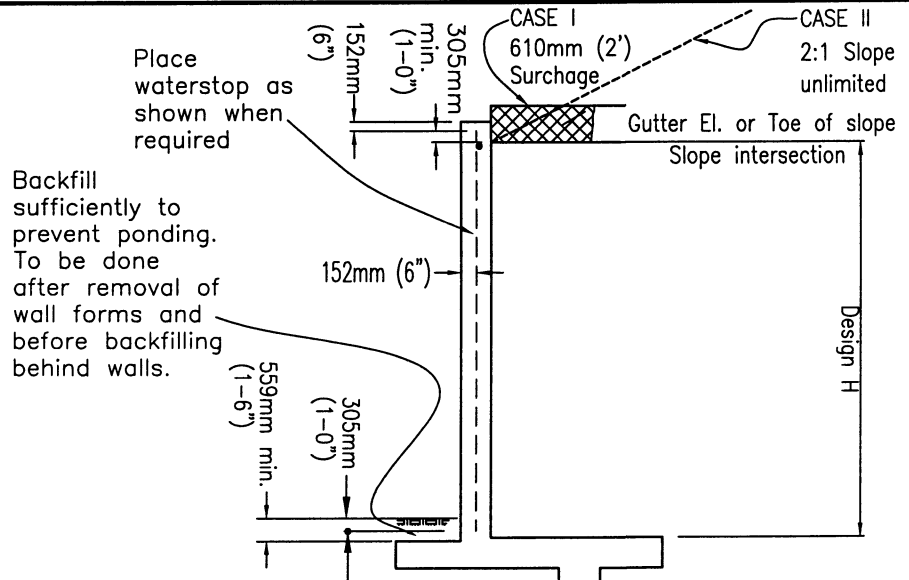
**NOTES:**  
 Design H may be exceeded by 152mm (6") before going to the next size. Footing key is required except when found unnecessary by Engineer. Special footing design is required where foundation material is incapable of supporting toe pressure loads listed in table.

**Design Data:**  
 $f_c = 8.96 \text{ Mpa (1300 psi)}$   $f'_c = 22.4 \text{ Mpa (3250 psi)}$   $f_s = 165 \text{ Mpa (24,000 psi)}$   $n = 10$  earth  $5.75 \text{ Kpa (120 pcf)}$

Case I - Equivalent fluid pressure = 1.7 Kpa (36 psf) max for determination of toe pressure. 1.3 Kpa (27) psf min for determination of heel pressure.

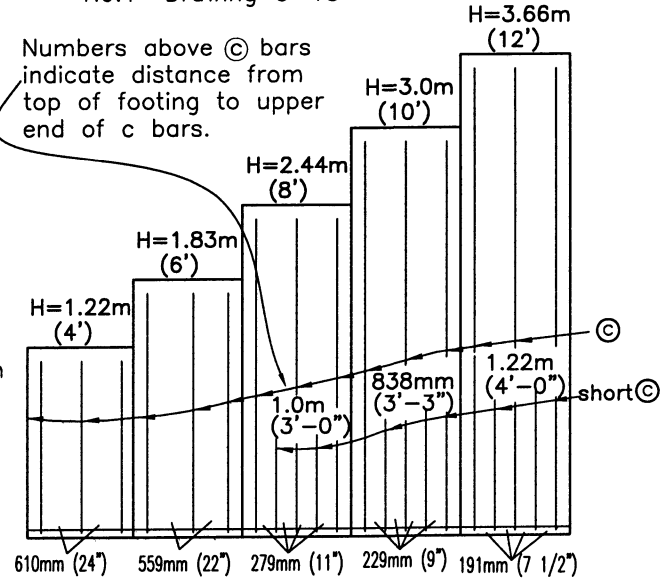
Case II - Earth pressure determined from Rankine's formula with  $\theta = 33^\circ - 12.8\text{m (42')}$ .

**NOTE:**  
 Reinforcement detailed is to be placed in addition to that shown for spread footing. All piles not shown. see Pile Layout on plans. \* For pile footing Design H=1.22m (4') use same footing dimensions as Design H=1.83m (6').



**DESIGN**

For drainage notes and other details, see "Retaining Wall Details No.1" Drawing C-13



**ELEVATION**

Revision	By	Approved	Date
ORIGINAL	Kerchengl		12/75
Add Metric	T. Stanton		03/03

**SAN DIEGO REGIONAL STANDARD DRAWING**

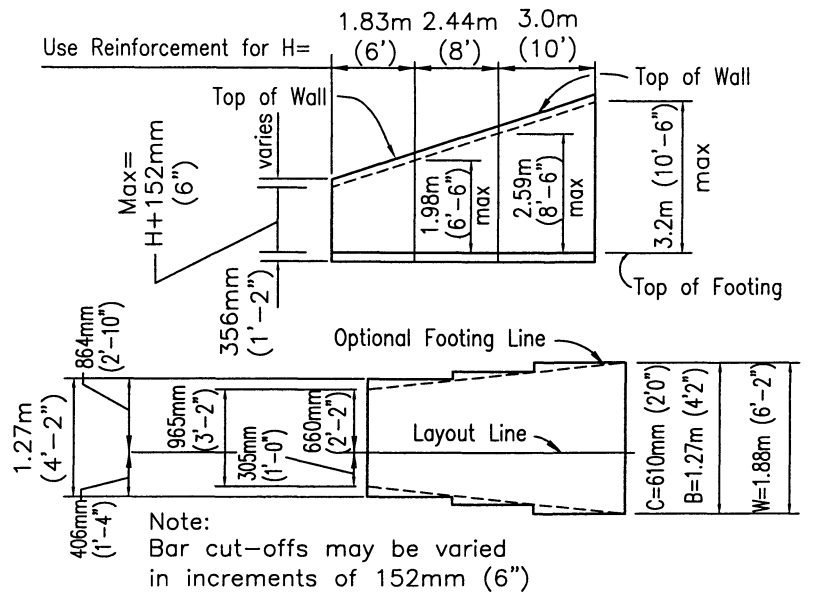
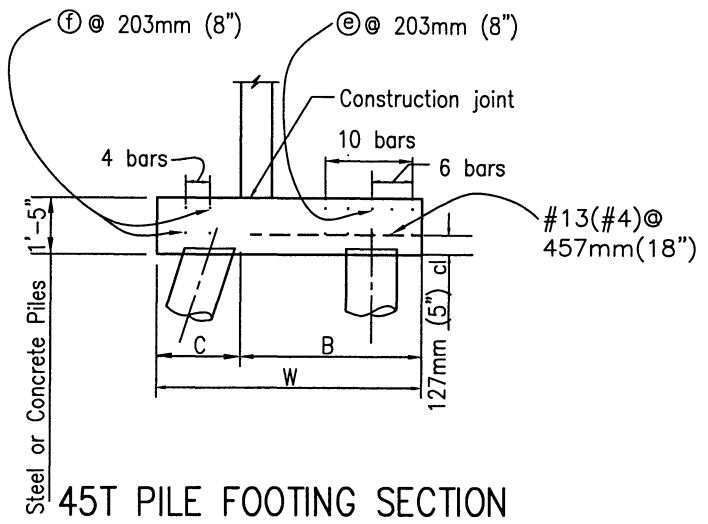
**REINFORCED CONCRETE RETAINING WALL**

**TYPE 1A**

**DRAWING NUMBER C-12B**

Checked by *[Signature]* 3/01/2003  
 Date  
 R.C.E. 19246

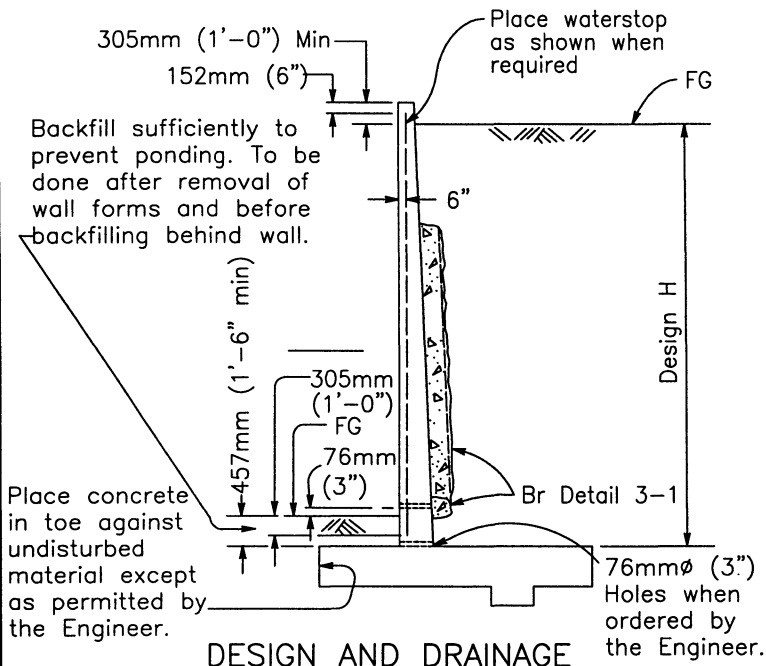
RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE



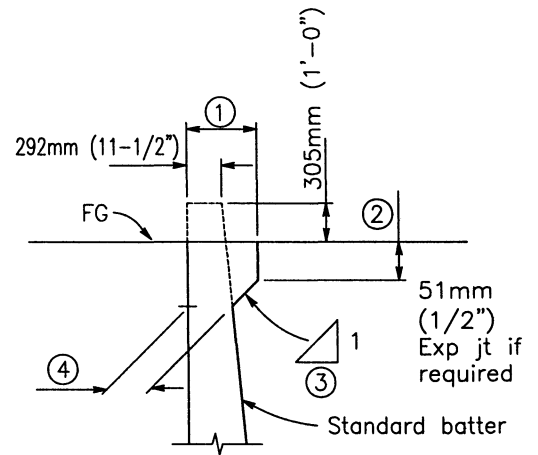
**TABLE OF REINFORCING STEEL DIMENSIONS AND DATA**

Design H	ⓐ1.22m (4')	1.83m (6')	2.44m (8')	3.0m (10')	3.66m (12')	
W	965mm (3'-2")	1.27m (4'-2")	1.57m (5'-2")	1.88m (6'-2")	2.18m (7'-2")	
C	305mm (1'-0")	406mm (1'-4")	508mm (1'-8")	610mm (2'-0")	711mm (2'-4")	
B	356mm (1'-2")	864mm (2'-10")	1.07m (3'-6")	1.27m (4'-2")	1.47m (4'-10")	
ⓐ bars	#16(#5)@610mm(24")	#16(#5)@559mm(22")	#16 (#5)@279mm (11")	#19(#6)@229mm(9")	#22(#7)@191mm(7-1/2")	
ⓑ bars	#16(#5)@610mm(24")	#16(#5)@559mm(22")	#16 (#5)@559mm (22")	#22(#7)@457mm(18")	#25 (#8)@15	
Total ⓐ bars	6-#19 (#6)	6-#19 (#6)	6-#19 (#6)	10-#22 (#7)	10-#22 (#7)	
Total ⓑ bars				4-#22 (#7)	4-#22 (#7)	
Case I - Toe Press.	76.1 kg/m <sup>2</sup> (1590psf)	92.4kg/m <sup>2</sup> (1930psf)	107kg/m <sup>2</sup> (2240psf)	122kg/m <sup>2</sup> (2550psf)	136kg/m <sup>2</sup> (2840psf)	
Case II - Toe Press.	50.8 kg/m <sup>2</sup> (1060psf)	69.9kg/m <sup>2</sup> (1460psf)	89.1kg/m <sup>2</sup> (1860psf)	109kg/m <sup>2</sup> (2280psf)	129kg/m <sup>2</sup> (2700psf)	
Spread	Steel lbs/ft	6.8kg (15lb)	9.52kg (21lb)	12.25kg (27lb)	21.3kg (46lb)	31.8kg (70lb)
	Conc CF/ft	3.9kg (8.6lb)	5.35kg (11.8lb)	6.76kg (14.9lb)	8.21kg (18.1lb)	9.66kg (21.3lb)
Pile Ftg	Steel lbs/ft	11.3kg (25lb)	14.51kg (32lb)	17.24kg (38lb)	34.0kg (75lb)	45.8kg (101lb)
	Conc CF/ft	4.5kg (9.9lb)	5.40kg (11.9lb)	6.94kg (15.3lb)	8.53kg (18.8lb)	10.1kg (22.2lb)

Note:  
 Quantities apply to Design H portion and exclude the added portion above "Gutter Elevation".



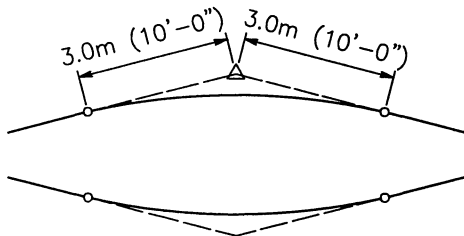
**DESIGN AND DRAINAGE**



Dimensions ①, ② and ③ to be as shown elsewhere in the Project Plans.

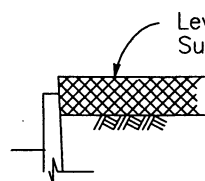
④ Stem width at base of haunch to be determined as shown.

**STEM WIDTH AT BASE OF HAUNCH**

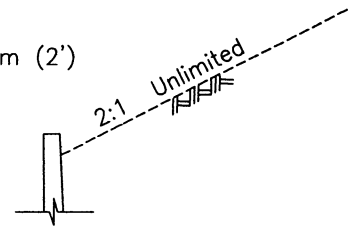


**6.1m (20') VC AT TOP OF WALL SLOPE CHANGE**

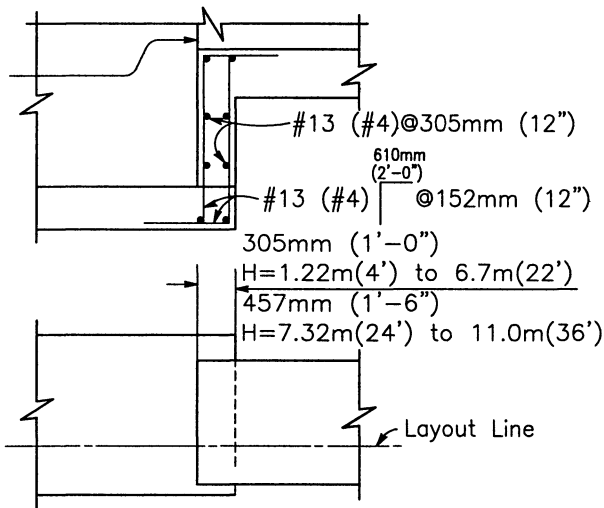
Where shown on the plans



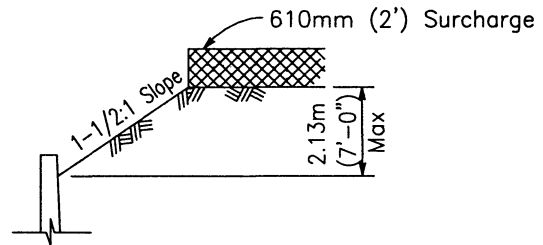
**CASE I**



**CASE II**



**FOOTING STEP**



**CASE III**

**DETAIL OF DESIGN LOADING CASES**

- CASE I Level + 610mm (2') Surcharge
- CASE II 2:1 Unlimited Slope
- CASE III 1-1/2:1 Limited Slope (2.13m (7'-0") Max height) + 610mm (2') Surcharge

NOTE: Surcharge Limits Shown Apply To Retaining Walls Type 1 and 3.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

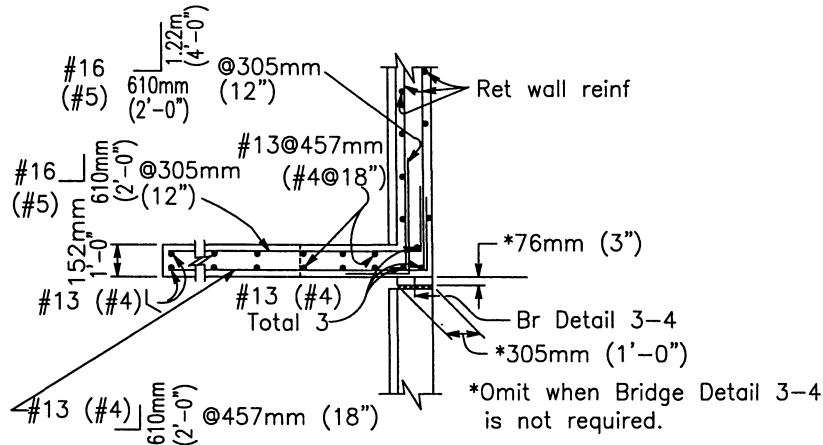
**SAN DIEGO REGIONAL STANDARD DRAWING**

**REINFORCED CONCRETE  
RETAINING WALL DETAILS No. 1**

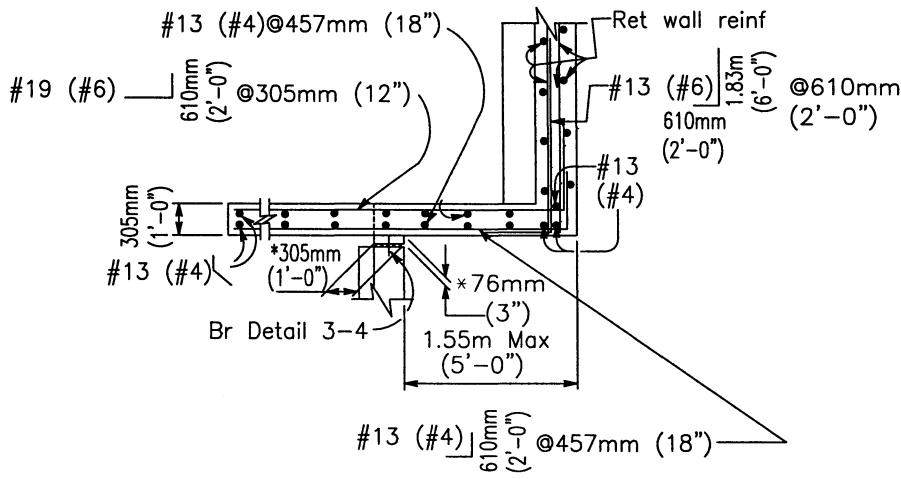
RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/10/2003  
Chairperson R.C.E. 19246 Date

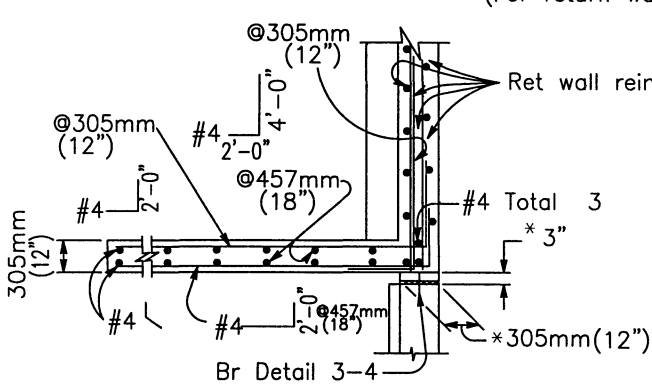
DRAWING NUMBER **C-13A**



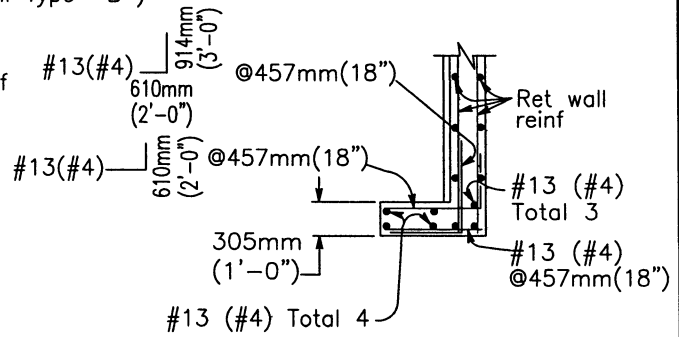
**PLAN**  
(For return wall Type "A")



**PLAN**  
(For return wall Type "B")



**PLAN**  
(For return wall Type "C")



**PLAN**  
(For return wall Type "D")

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

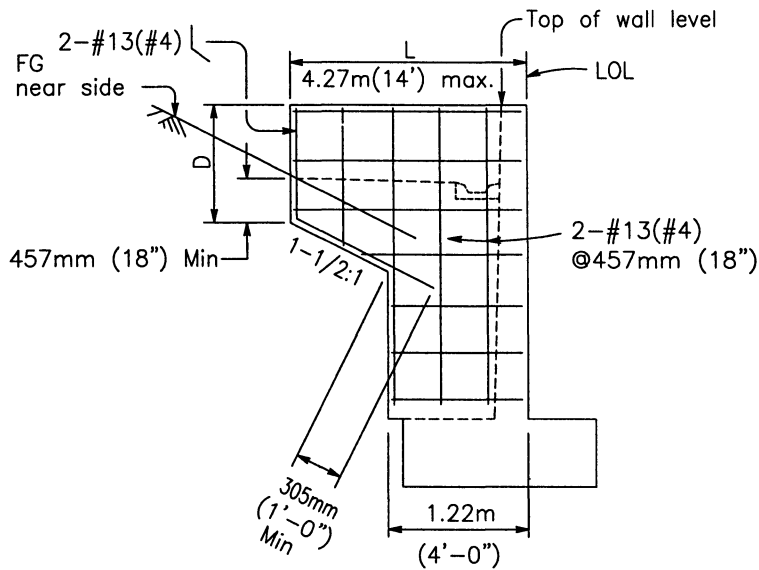
**SAN DIEGO REGIONAL STANDARD DRAWING**

**REINFORCED CONCRETE  
RETAINING WALL DETAILS No. 1**

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/10/2003  
Chairperson R.C.E. 19246 Date

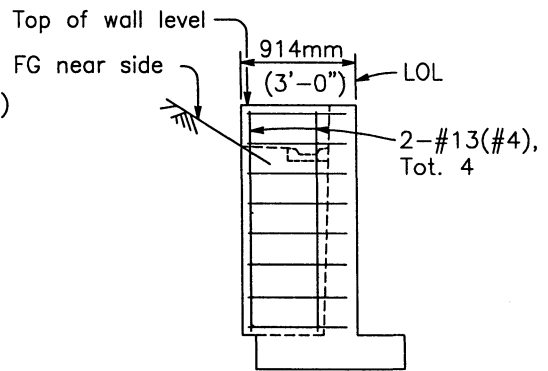
DRAWING NUMBER **C-13B**



ELEVATION

**RETURN WALL TYPE A**

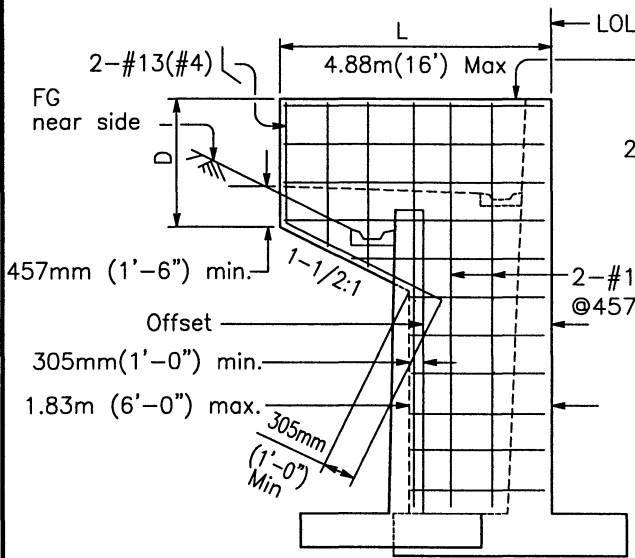
Use where H=2.44m (8') or less



ELEVATION

**RETURN WALL TYPE D**

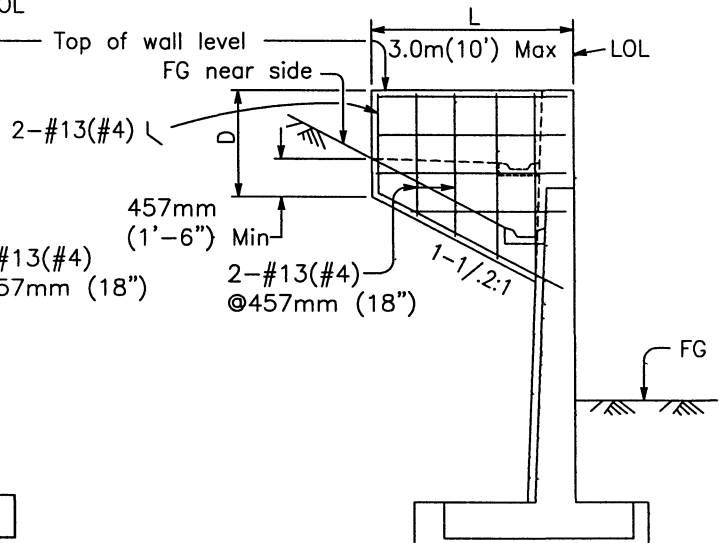
Use where H=1.83m (6') or less



ELEVATION

**RETURN WALL TYPE B**

Use where H=3.0m (10') or more on offset walls



ELEVATION

**RETURN WALL TYPE C**

Use where H=3.9m (10') or more on straight walls

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

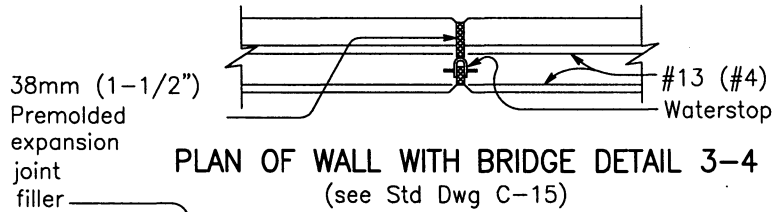
**SAN DIEGO REGIONAL STANDARD DRAWING**

**REINFORCED CONCRETE  
RETAINING WALL DETAILS No. 1**

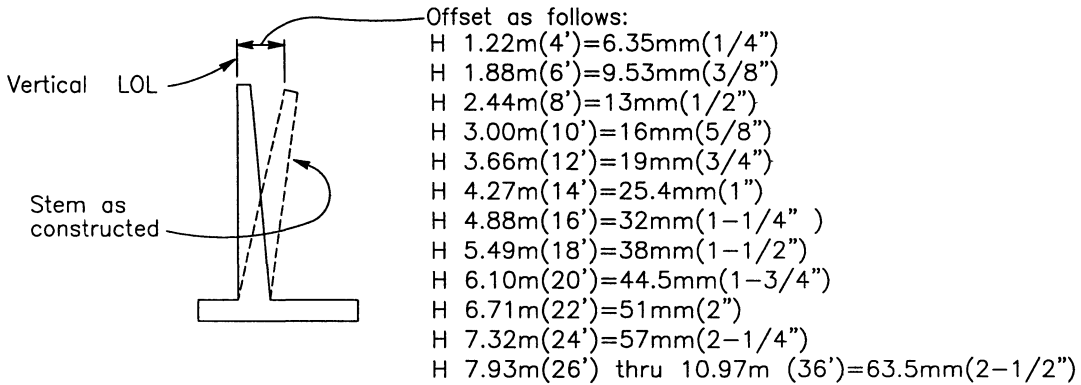
RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 3/10/2003  
Chairperson R.C.E. 19246 Date

DRAWING NUMBER **C-13C**



PLAN OF WALL WITH EXPANSION JOINT ONLY



**APPROX. WALL OFFSET VALUES**

Not required for wall Types 3 and 4.  
 Values for offsetting forms to be determined by the Engineer.

**NOTES**

Design Conditions:

Design H may be exceeded by 152mm (6") before going to the next size. Special footing design is required where foundation material is incapable of supporting toe pressure listed in table. Return wall not required unless shown elsewhere.

Design Data:

$f_c = 8.96\text{Mpa}$  (1300 psi)  $f'_c = 22.4\text{Mpa}$  (3250 psi)  $f_s = 166\text{Mpa}$  (24,000 psi)  
 $n = 10$  earth = 1922 kg/cu m (120 pcf)

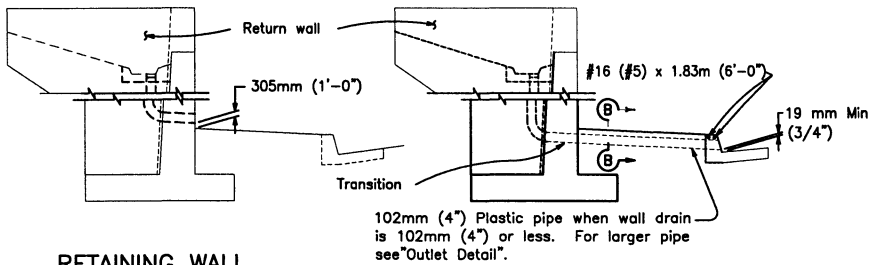
610mm (2') Surcharge:

Equivalent fluid pressure =

- 36 pcf maximum for determination of toe pressure.
- 27 pcf minimum for determination of heel pressure.

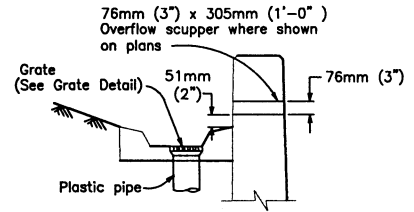
Earth pressures for 2:1 unlimited slope, 1-1/2:1 slope, and 1-1/2:1 unlimited slope, determined from Rankine's formula with  $\phi=33^\circ-12.8\text{m}(42')$ .

Revision	By	Approved	Date	<b>SAN DIEGO REGIONAL STANDARD DRAWING</b>	RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE
ORIGINAL		Kercheval	12/75		<b>REINFORCED CONCRETE RETAINING WALL DETAILS No. 1</b>
Add Metric		T. Stanton	03/03	Chairperson R.C.E. 19246	
					DRAWING NUMBER <b>C-13D</b>

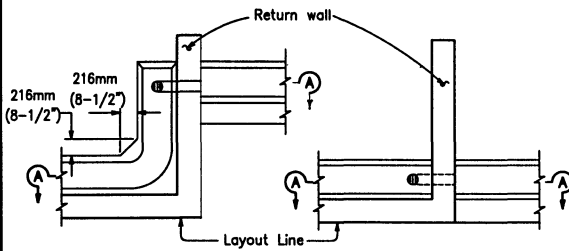


**RETAINING WALL,  
FACE OF WALL OUTLET**

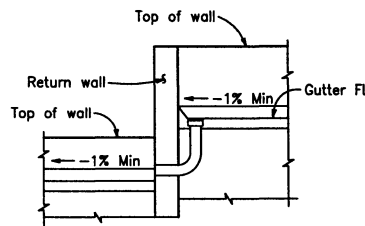
**RETAINING WALL, GUTTER OUTLET**



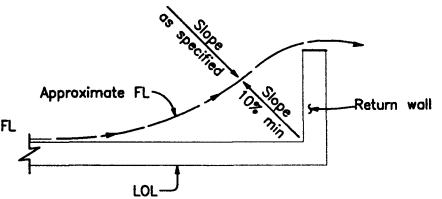
**WALL DRAIN DETAIL**



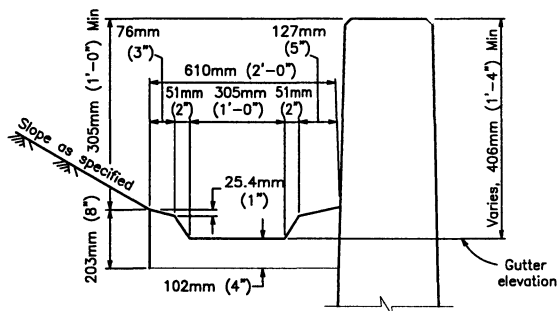
**PLAN-OFFSET WALL  
DRAIN THROUGH RETURN WALL**



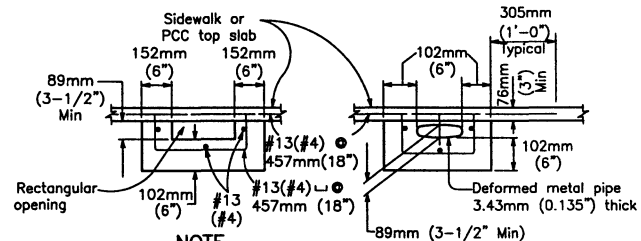
**SECTION A-A**



**WALL DRAINAGE  
WHERE GUTTER NOT REQUIRED**



**TYPICAL GUTTER DETAIL**



**NOTE**

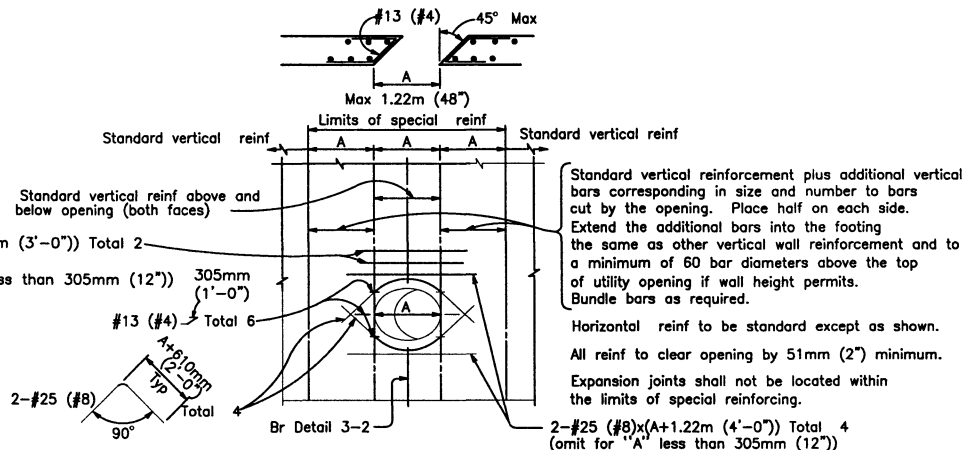
Area of opening to be not less than that of pipe from wall gutter. Make opening transition in wall. Edge opening in curb face to 19mm (3/4") minimum radius.

**OUTLET DETAIL - SECTION B-B**



**GRATE DETAIL**

Sizes to fit standard hubs



**RETAINING WALL UTILITY OPENING**

Max size of opening (A) = 1.22m (48") To be used in conjunction with Standard Drawing C-13.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

**SAN DIEGO REGIONAL STANDARD DRAWING**

**REINFORCED CONCRETE  
RETAINING WALL DETAILS No. 2**

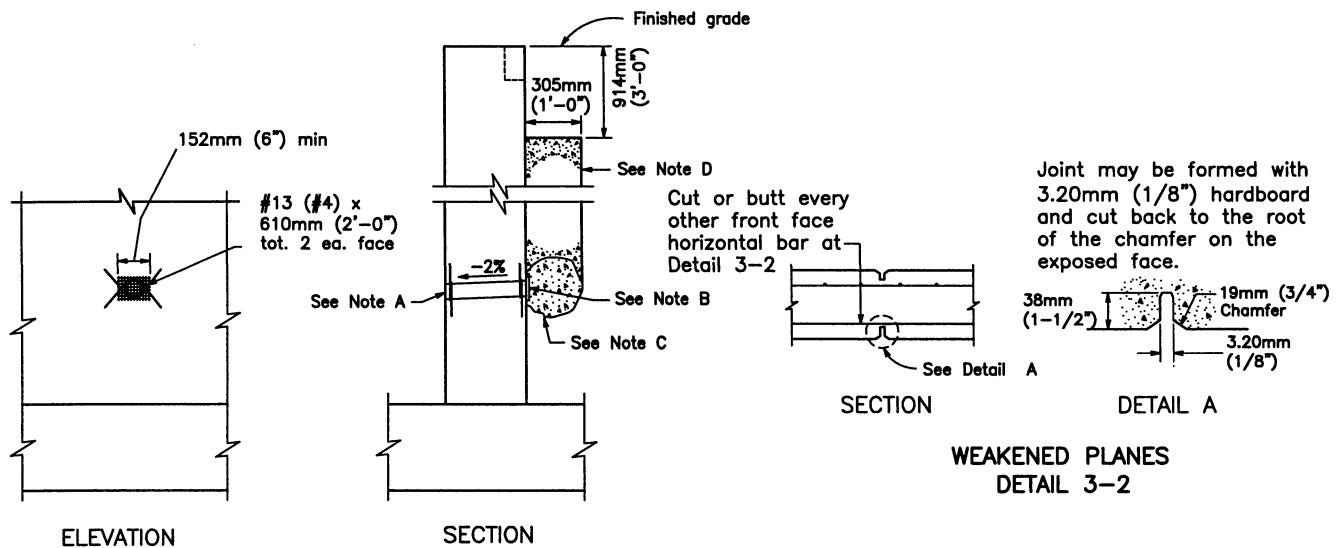
RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

*T. Stanton* 310112003

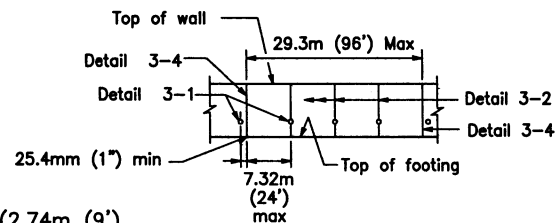
Chairperson R.C.E. 19246 Date

**DRAWING  
NUMBER C-14**





WEEP HOLE AND PERVIOUS BACKFILL  
DETAIL 3-1

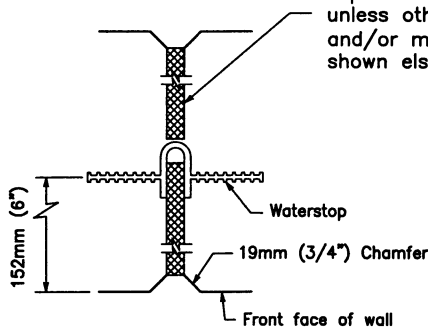


WALL EXPANSION JOINTS  
AND WEAKENED PLANES  
DETAIL 3-3

NOTES

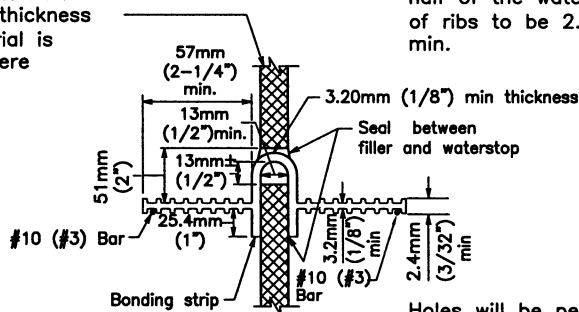
- A. 102mm (4") diameter drain @ 7.62m (25') max. center to center (2.74m (9') c-c for Type 3 and 2.82m (9'-3") c-c for Type 4 Retaining Walls). For walls adjacent to sidewalks or curbs, provide 102mm (4") cast iron or asbestos cement pipe under the sidewalk to discharge thru curb face. Exposed wall drains shall be located 76mm (3") ± above finished grade.
- B. 152mm (6") square aluminum or galvanized steel wire 4 mesh hardware cloth. (Min wire diameter .762mm (0.03")) Anchor firmly to backface.
- C. .028 Cubic Meter (One cubic foot) pervious backfill material in a burlap sack, securely tied.
- D. Pervious backfill material continuous behind retaining wall.

13mm (1/2") premolded expansion joint filler unless other thickness and/or material is shown elsewhere



WALL EXPANSION JOINT  
DETAIL 3-4

Waterstop to have 5 or more pairs of raised ribs to provide 64.5 sq mm (0.1 sq in) min. rib cross-section area on each half of the water stop. Height of ribs to be 2.38mm (3/32") min.



WATERSTOP  
DETAIL 3-6

Holes will be permitted in the outer 13mm (1/2") of the web for wire, rings etc. Tie web to #10 (#3) reinforcing bars @ 305mm (12") max intervals to support the waterstop in proper position during concrete placement. Alternative detail may be submitted for approval of the engineer.

Revision	By	Approved	Date
ORIGINAL		Kercheval	12/75
Add Metric		T. Stanton	03/03

SAN DIEGO REGIONAL STANDARD DRAWING

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

REINFORCED CONCRETE  
RETAINING WALL DETAILS No. 3

*T. Stanton* 3/10/2003  
Chairperson R.C.E. 19246 Date

DRAWING  
NUMBER C-15