SAWREY
CONSULTING ENGINEERS LTD

Petone Recreation Ground Grandstand

Detailed Seismic Assessment

For Hutt City Council

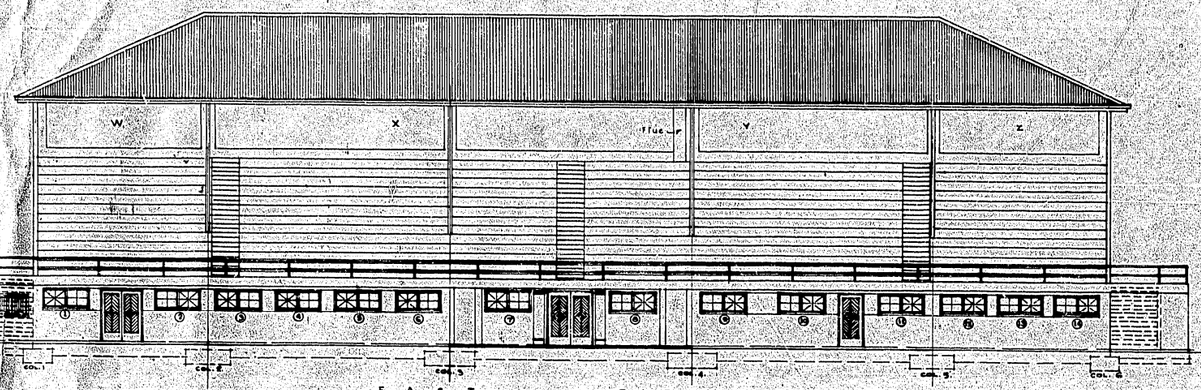
Volume 3: Appendices
Appendix E – 1939 Drawings
Appendix F – 1979 Drawings
Appendix G – 2014 Drawings
Appendix H – 2023 DSA Calculations



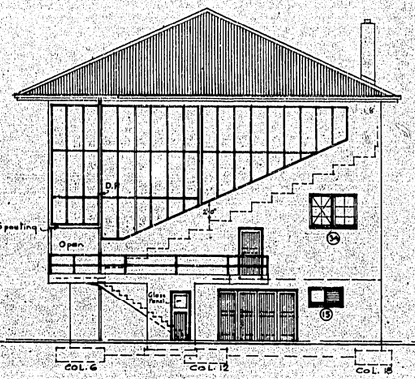
Project 10131

July 2023

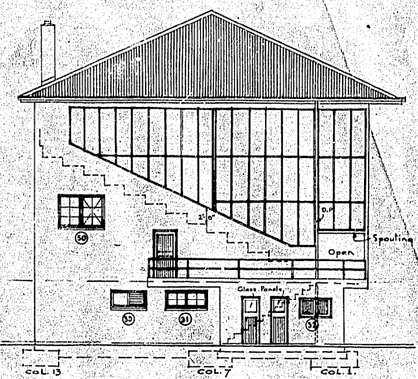
Appendix E –Drawings – 1939 Drawings



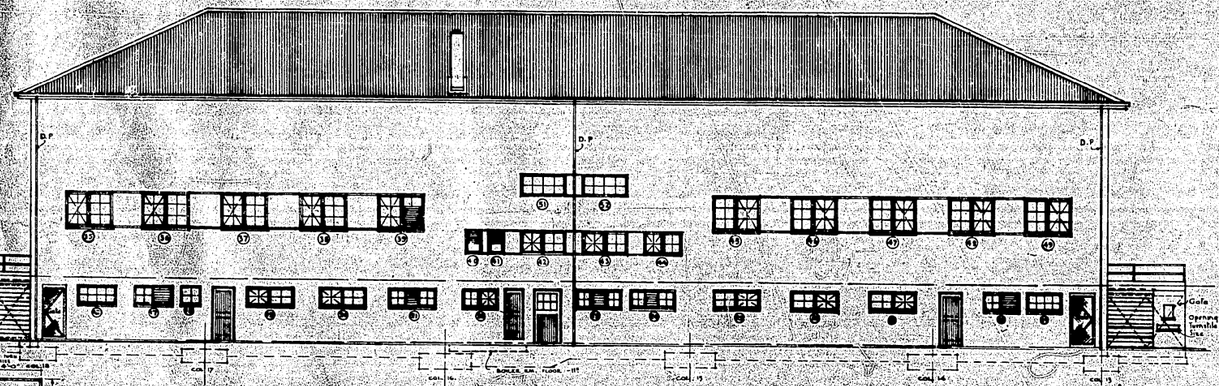
EAST ELEVATION



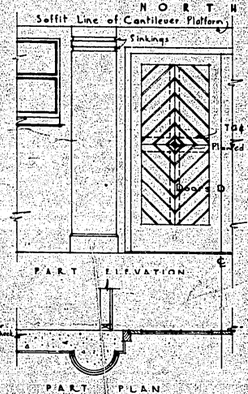
NORTH ELEVATION



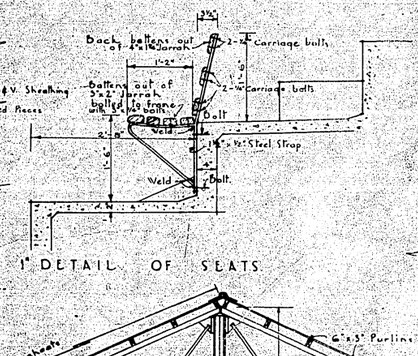
SOUTH ELEVATION



WEST ELEVATION



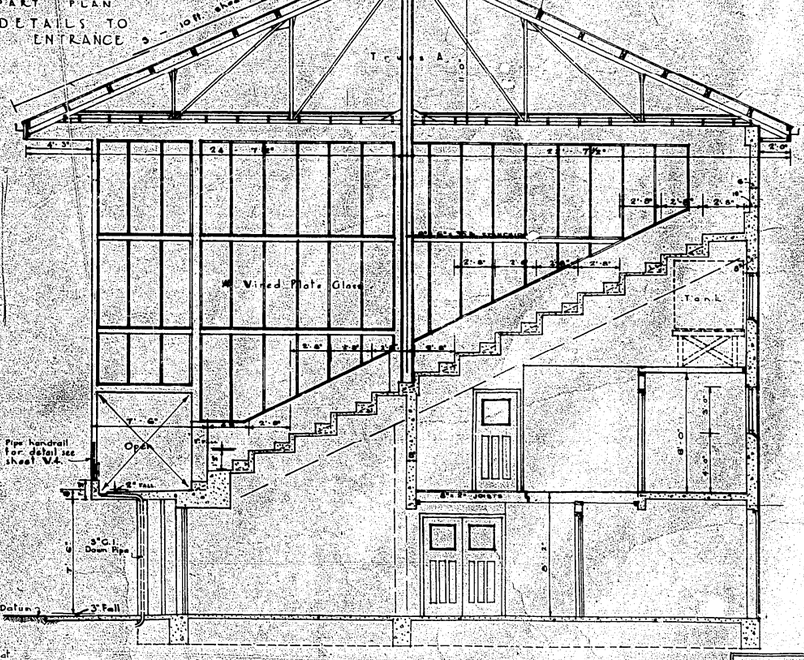
PART ELEVATION



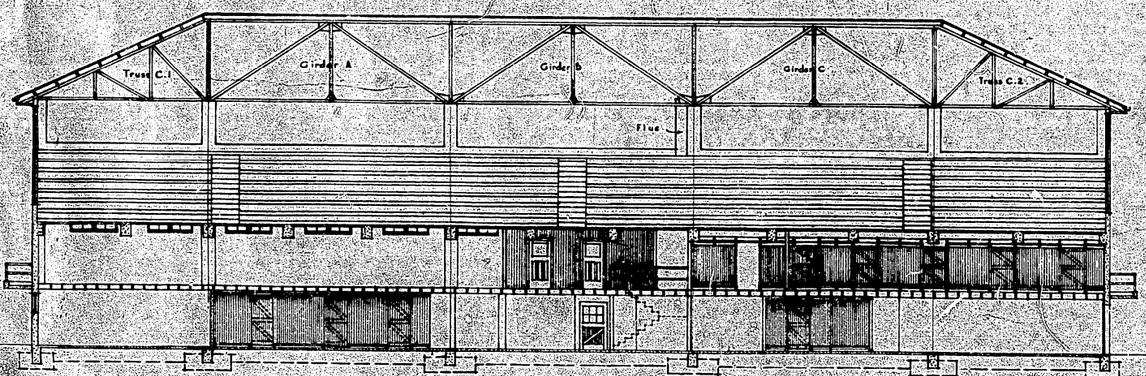
1" DETAIL OF SEATS

PART PLAN

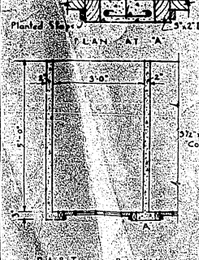
½" DETAILS TO MAIN ENTRANCE



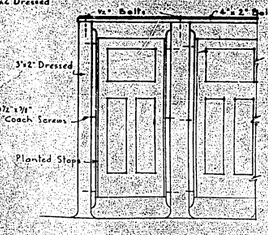
¼" SCALE SECTION B-B



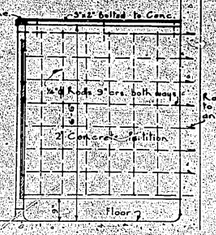
SECTION A-A



PART PLAN

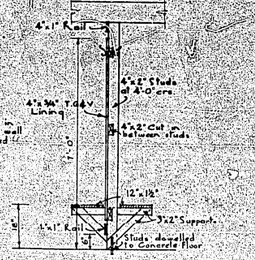


PART ELEVATION

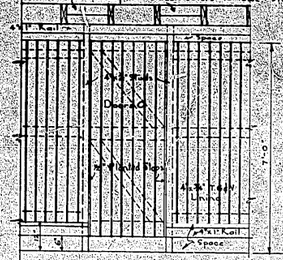


ELEVATION DIVIDING PARTITION

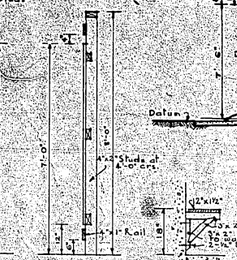
½" DETAILS WC PARTITIONS



REAR PARTITION GRD FLOOR



½" DETAILS DRESSING ROOM PARTITIONS



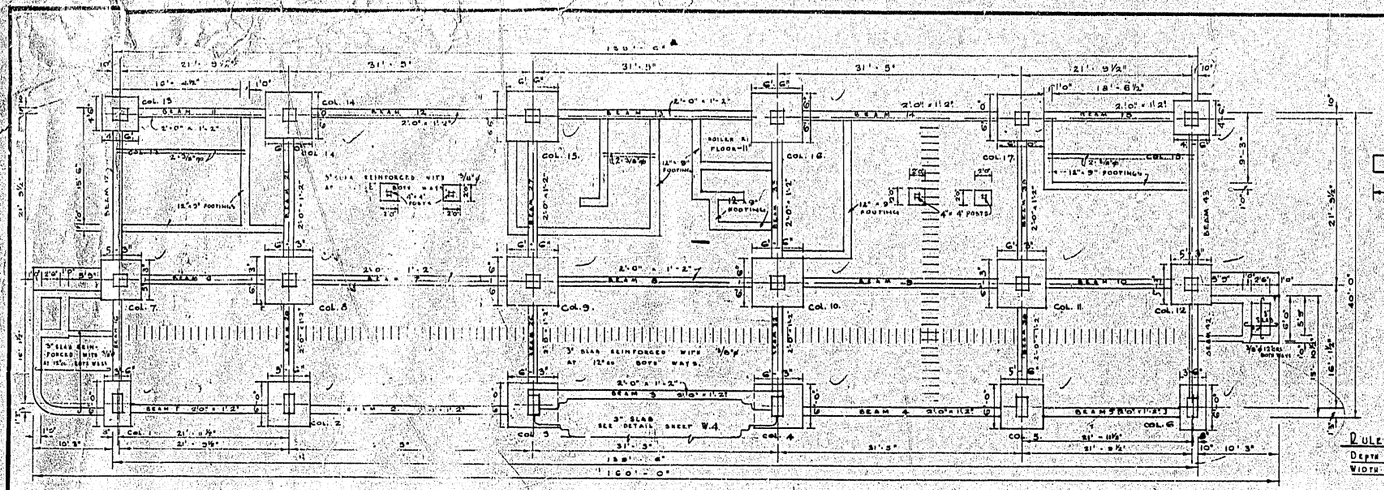
FRONT PARTITION GROUND FLOOR & FIRST FLOOR

PETONE · BOROUGH · COUNCIL

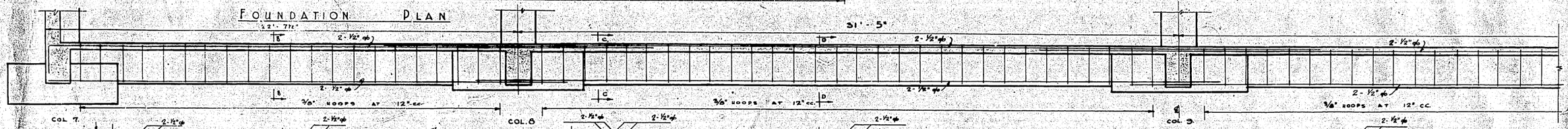
GRANDSTAND · PETONE

COMMISSION No. 426	SCALE: ⅛", ¼", ½", 1"	DATE: 16-2-39
DRAWING No. W-2	MADE BY: R.W.R. C.J.W.	
	TRACED BY: E.E.	
	CHECKED BY:	

JOHN S. SWAN & WM. DE LAVELLE
REGISTERED ARCHITECTS
A.R.A. BUILDING · 17 GREY ST. · WELLINGTON.



FOUNDATION PLAN



SECTION AA

SECTION BB

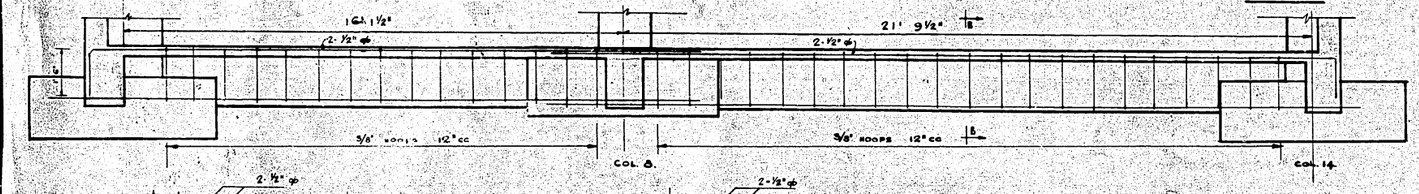
SECTION CC

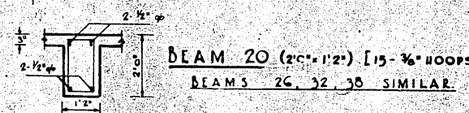
SECTION DD

BEAM 6 (2'0" x 1'2") [21 - 3/8" HOOPS] [BEAM NO. 10 SIMILAR]

BEAM 7 (2'0" x 1'2") [30 - 3/8" HOOPS] [BEAM NO. 9 SIMILAR]

BEAM 8 (2'0" x 1'4") [30 - 3/8" HOOPS]





SECTION AA

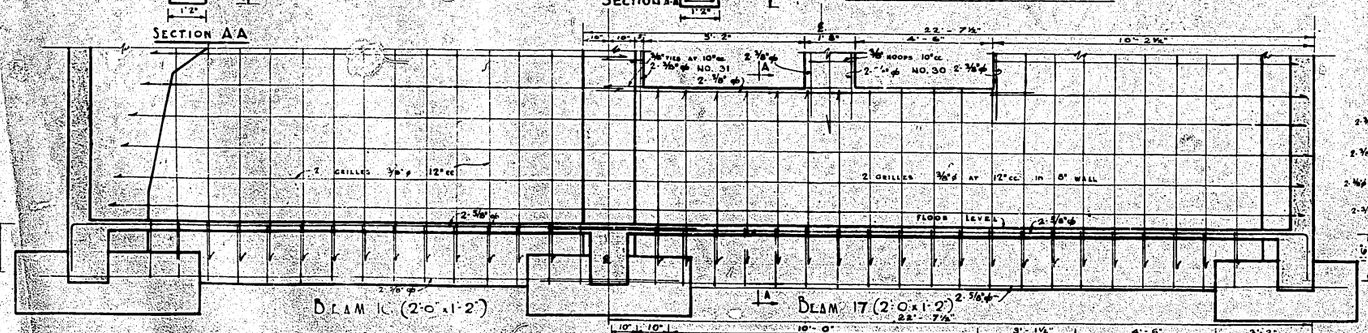
BEAM 20 (2'0" x 1'2") [15 - 3/8" HOOPS]

BEAMS 26, 32, 38 SIMILAR

SECTION AA

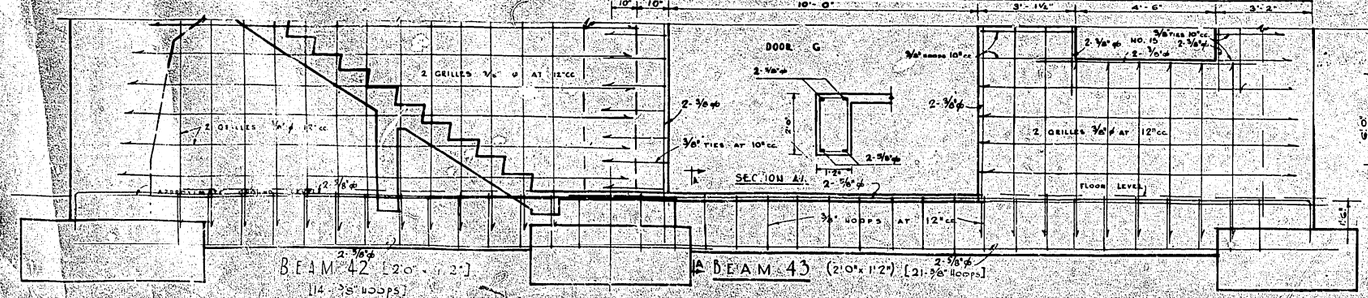
BEAM 21 (2'0" x 1'2") [21 - 3/8" HOOPS]

BEAMS 27, 33, 39 SIMILAR



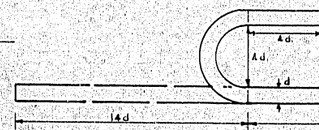
BEAM 1C (2'0" x 1'2")

BEAM 17 (2'0" x 1'2")

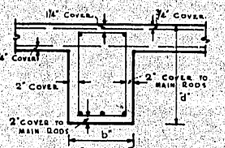


BEAM 42 [2'0" x 1'2"] [14 - 3/8" HOOPS]

BEAM 43 (2'0" x 1'2") [21 - 3/8" HOOPS]



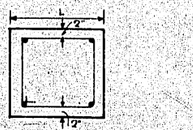
STANDARD HOOK & LAP



RULE FOR DETERMINING DENT SIZE OF STIRRUPS

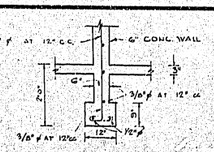
DEPTH OF STIRRUPS 'd' - 3 1/4" + 3/4" INSIDE.

WIDTH OF STIRRUPS 'b' - 4" + 3/4" INSIDE.



RULE FOR DETERMINING DENT SIZE OF HOOPS

LENGTH OF EACH SIDE: L - 4" + 3/4" INSIDE.



TYPICAL FOOTING UNDER 6" CONCRETE WALLS

NOTES

CONCRETE MIX 1 - 2 1/4 - 3 3/4

SLUMP OF CONCRETE

SLABS	6" MAXIMUM.
BEAMS	6" "
COLUMNS	3" "
FOOTINGS	2" "

CONCRETE COVER TO MAIN RODS.

BEAMS	2"
COLUMNS	2"
SLABS	3/4"
FOOTINGS	3"

LAP FOR ORDINARY RODS 40 DIA

LAP FOR ISTEG RODS

1/4" ø	12"
5/16" ø	14"
3/8" ø	17"
1/2" ø	23"
5/8" ø	28"
3/4" ø	34"

REINFORCEMENT LEGEND.

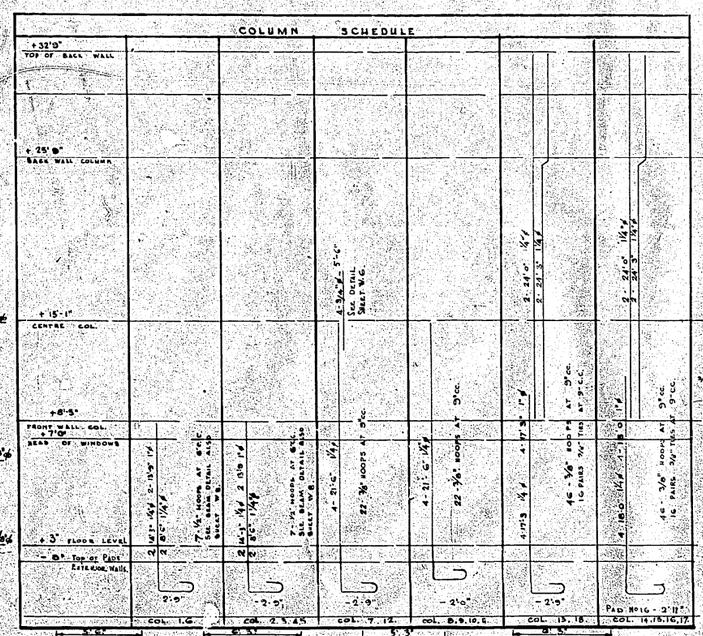
ORDINARY STEEL SHOWN ø

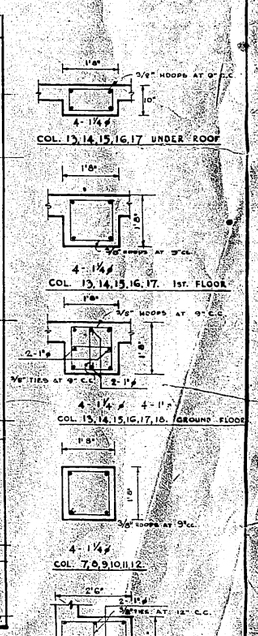
" " IN SECTION o

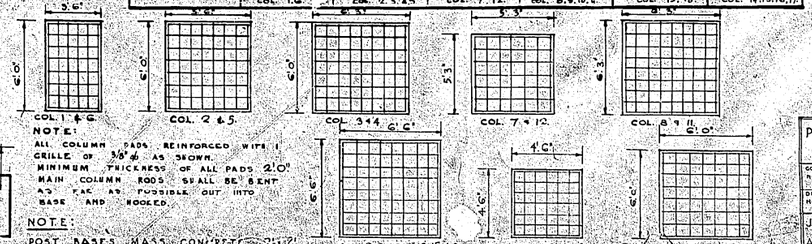
ISTEG STEEL SHOWN ø

" " IN SECTION ø

COLUMN SCHEDULE







NOTE:

ALL COLUMN PADS REINFORCED WITH 1 GRILLE OF 3/8" ø AS SHOWN.

MINIMUM THICKNESS OF ALL PADS 2'0"

MAIN COLUMN RODS SHALL BE BENT AS FAR AS POSSIBLE OUT INTO BASE AND HOOKED.

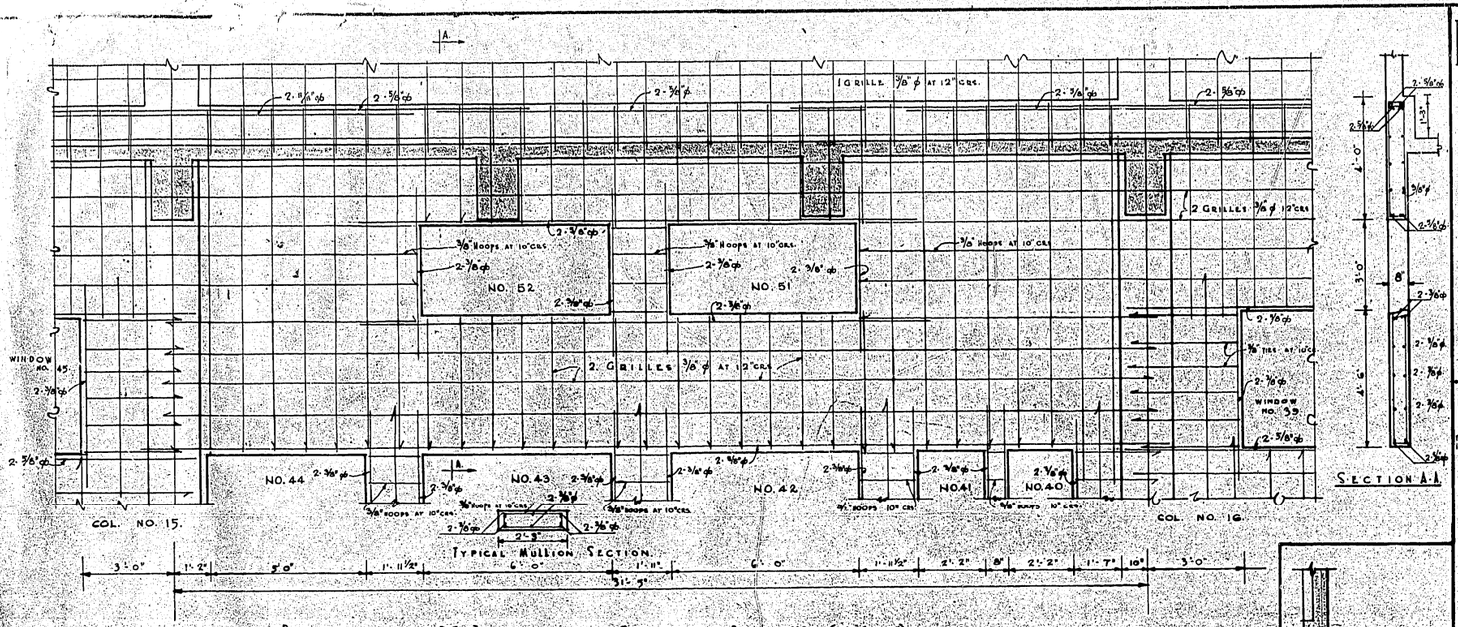
NOTE:

POST BASES MASS CONCRETE - 2'x 2'

PETONE BOROUGH COUNCIL
GRANDSTAND - PETONE

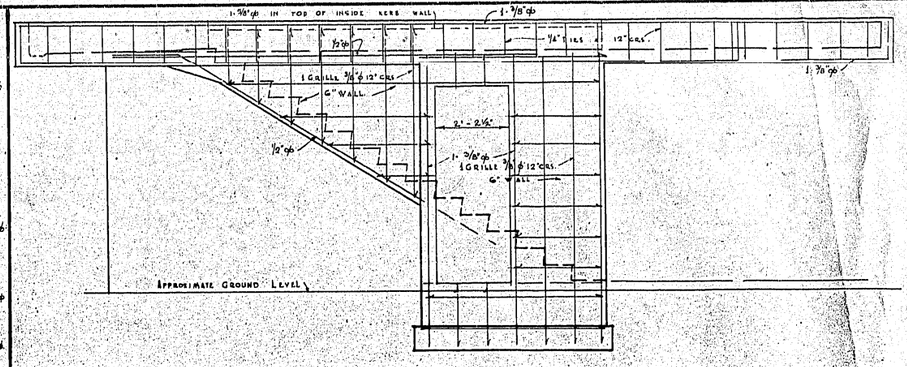
COMMISSION NO.	426	SCALE: 1/8" = 1'-0"	DATE: FEB., 1938
DRAWING NO.	W.3	TRACED BY: G.K.	
		CHECKED BY: G.K.	

JOHN S. SWAN & WM. P. LAVELLE
REGISTERED ARCHITECTS
A.N.A. BUILDING, 171 LAMBTON QUAY, WELLINGTON.

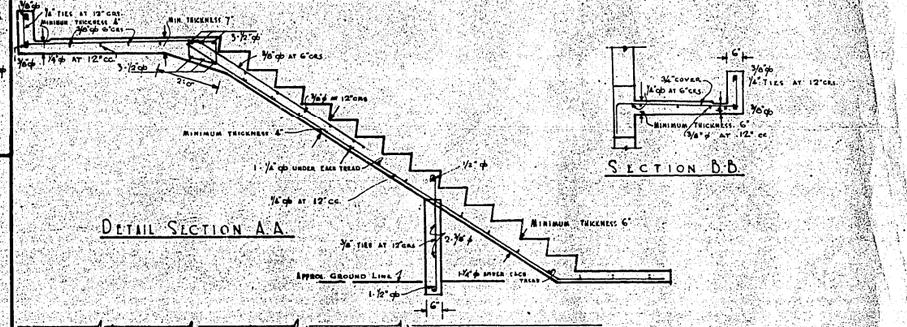


BEAM 113 (4'-0" x 10") [TOP]

SPANDREL BEAM 113B (4'-6" x 0")



DETAIL ELEVATION OF STAIRS NORTH END.



DETAIL SECTION A.A.

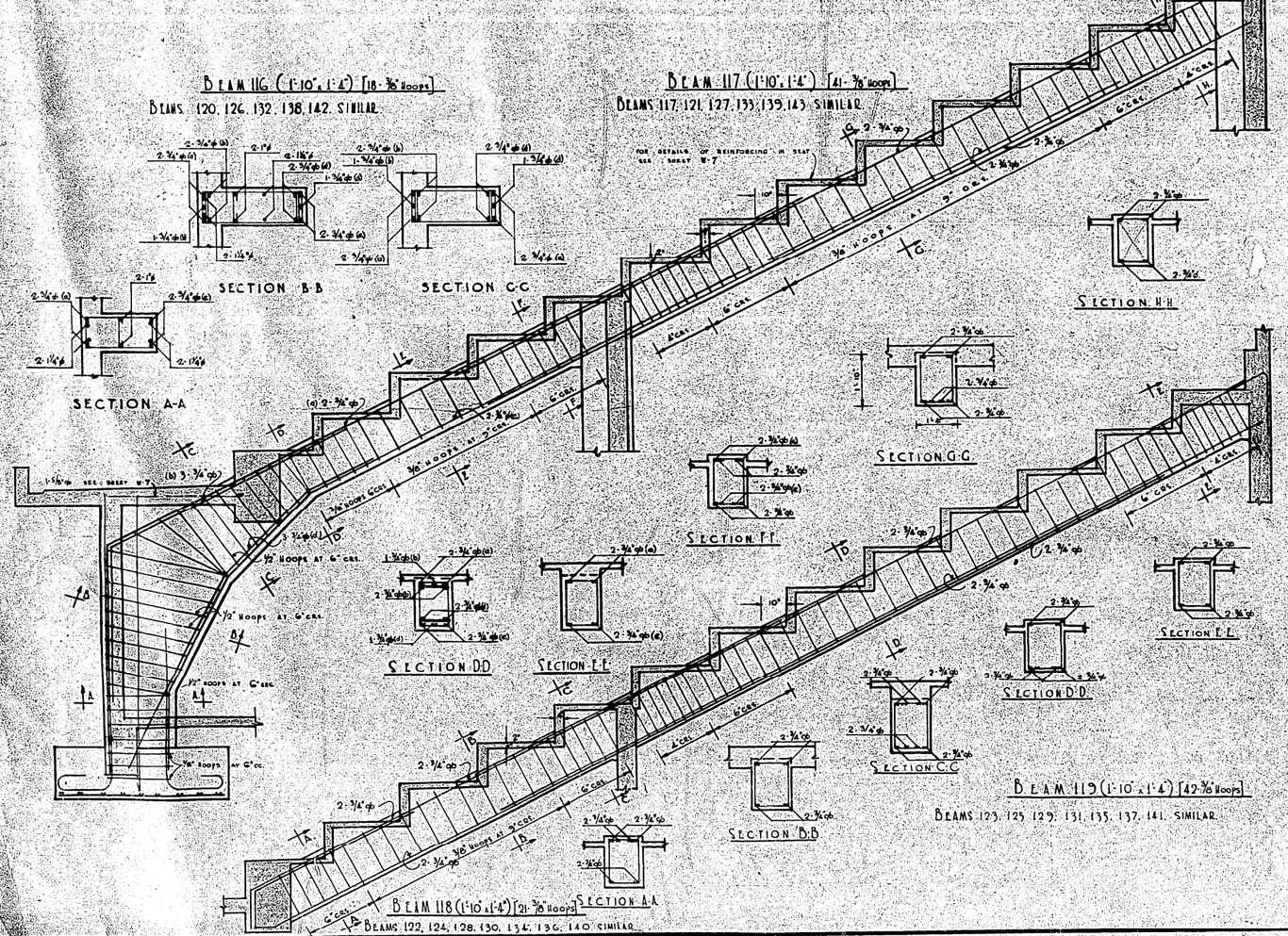
SECTION D.D.

BEAM 116 (1'-10" x 1'-4") [18-3/8" HOOPS]

BEAMS 120. 126. 132. 138. 142. SIMILAR.

BEAM 117 (1'-10" x 1'-4") [41-3/8" HOOPS]

BEAMS 117. 121. 127. 133. 139. 143 SIMILAR.

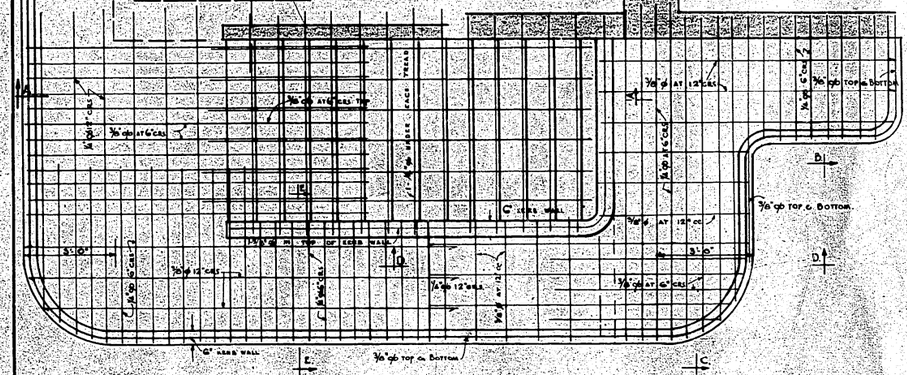


BEAM 118 (1'-10" x 1'-4") [21-3/8" Hoops]

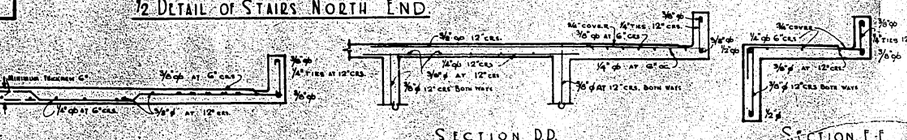
BEAMS. 122. 124. 128. 130. 134. 136. 140 SIMILAR.

BEAM 119 (1'-10" x 1'-4") [42-3/8" Hoops]

BEAMS 123. 125. 129. 131. 135. 137. 141. SIMILAR.



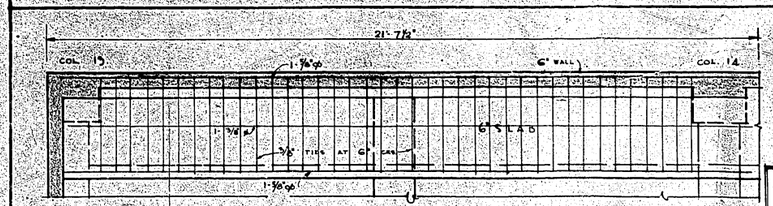
1/2" DETAIL OF STAIRS NORTH END.

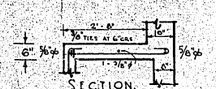


SECTION C-C

SECTION D.D.

SECTION E-E.

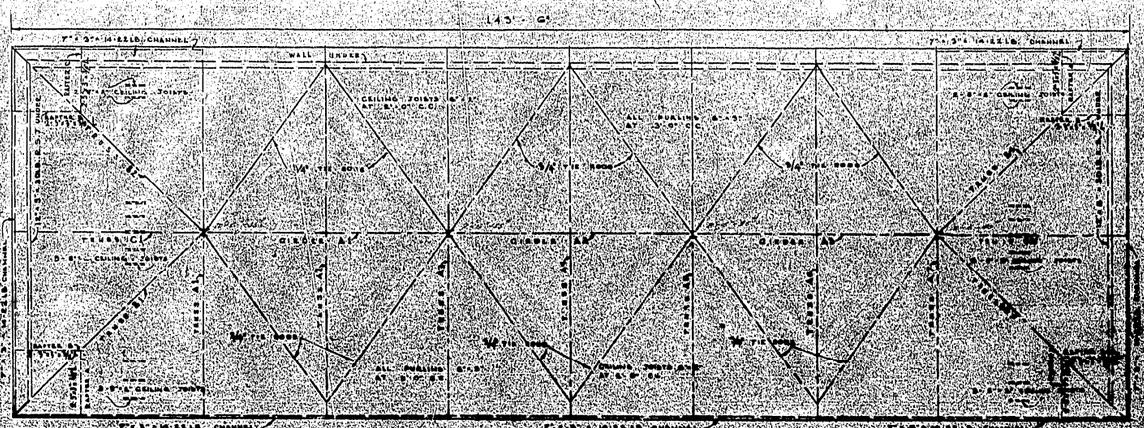




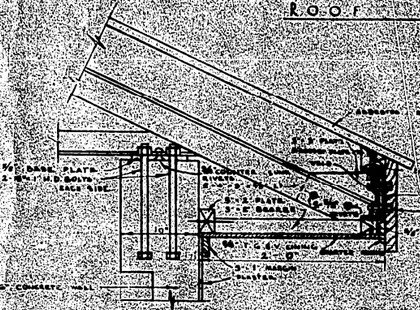
SECTION.

DETAIL OF REINFORCING IN BACK STEP OF DECK.

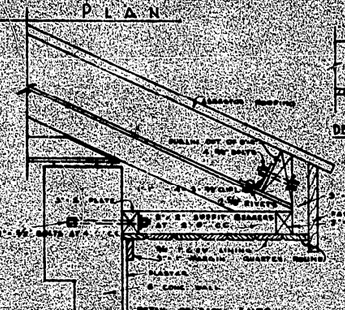
PETONE BOROUGH COUNCIL	
GRANDSTAND PETONE	
COMMISSION NO. 426	SCALE: 1/2" = 1 FT. DATE: FEB. 1939.
DRAWING NO. W 8	MAIN SET C.D.10. REVISED:
	TRACED BY: E.L.C.
	CHECKED BY:
JOHN J. SWAN & WM. E. LAVELLE. REGISTERED ARCHITECTS.	
A.P.A. BUILDING 17 GREY ST. WELLINGTON.	



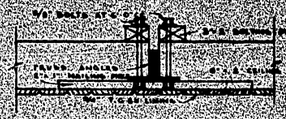
ROOF FRAMING PLAN



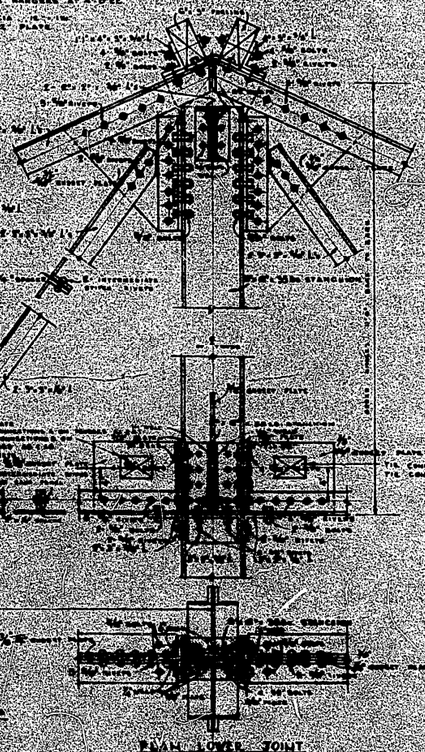
DETAIL OF JOINT OF TRUSS TO BACK WALL & END BAYS



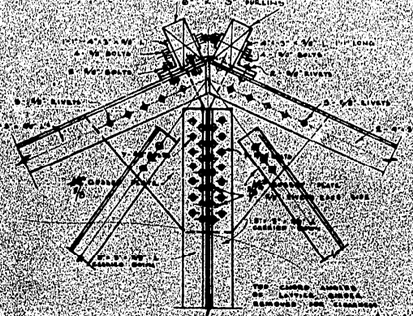
KERB OF BACK BAYS



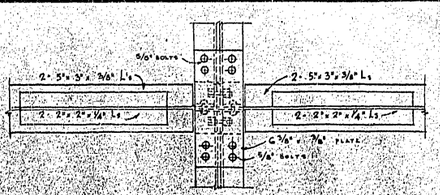
DETAIL OF CONNECTION OF CEILING JOISTS TO TRUSS



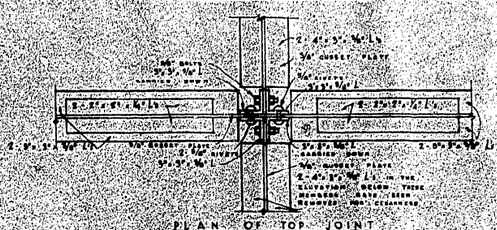
PLAN LOWER JOINT



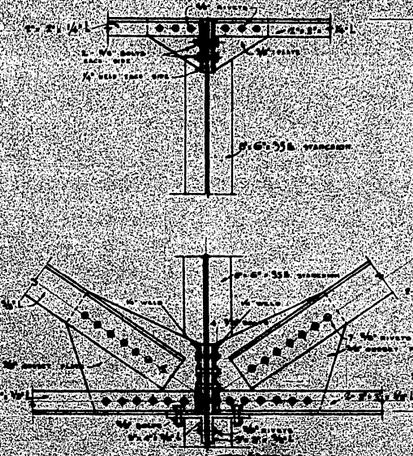
SIDE ELEVATION JOINT AT TOP OF TRUSSES A2, A4 & A6



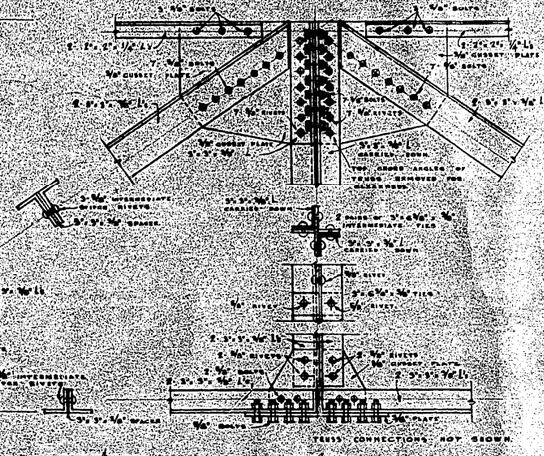
PLAN OF TOP JOINT



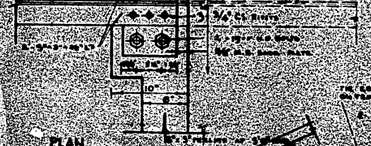
PLAN OF TOP JOINT PLATE REMOVED



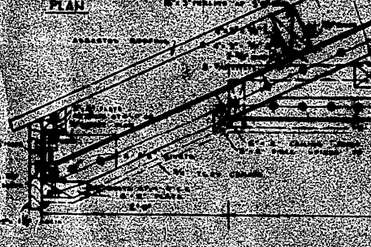
PLAN



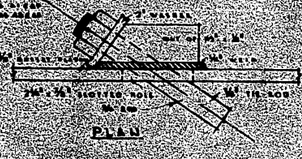
TRUSS CONNECTIONS NOT SHOWN



PLAN OF PURLIN



PLAN



PLAN

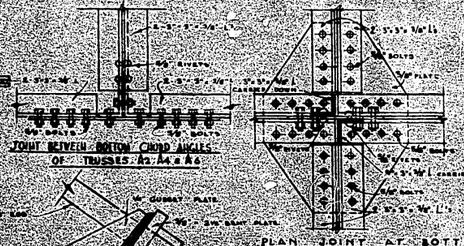
DETAILS OF GIRDER A



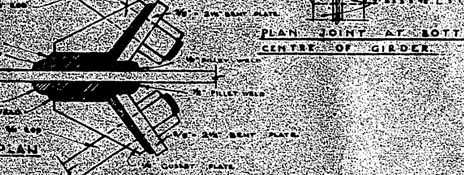
ELEVATION

½ ELEVATION OF CONNECTION OF TIE ROD TO TRUSSES A & A7

CONNECTION A



JOINT BETWEEN BOTTOM CHORD ANGLES OF TRUSSES A2, A4 & A6



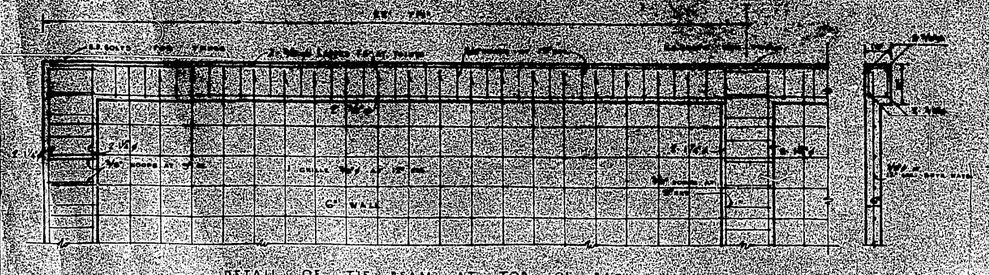
PLAN



ELEVATION

W.P.'S DETAIL OF CONNECTION OF TIE ROD TO TRUSSES A2, A4, A6 & GIRDERS A1, A2, A5.

CONNECTION B



DETAIL OF TIE BEAM AT TOP OF BACK WALL

NOTES

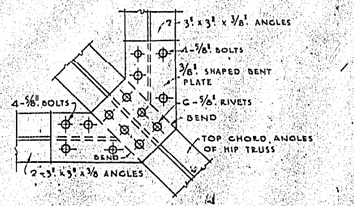
ALL BOLTS ¾"ø
ALL BOLTS ¾"ø
MINIMUM PITCH 3"
MINIMUM EDGE DISTANCE 1½"

PETONE BOROUGH COUNCIL
GRANDSTAND PETONE

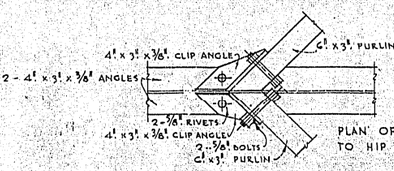
DRAWING NO. 426	SCALE: 1/8", 1", 1½", ½"	DATE: FEB 1935
	MADE BY: C.J.V.	REVISED:
JOB NO. W-9	TRACED BY: H.L.C.	
	CHECKED BY:	

JOHN S. SWAN & WM. E. LAVELLE
REGISTERED ARCHITECTS
A.R.A. BUILDING, 17 GREY ST. WELLINGTON.

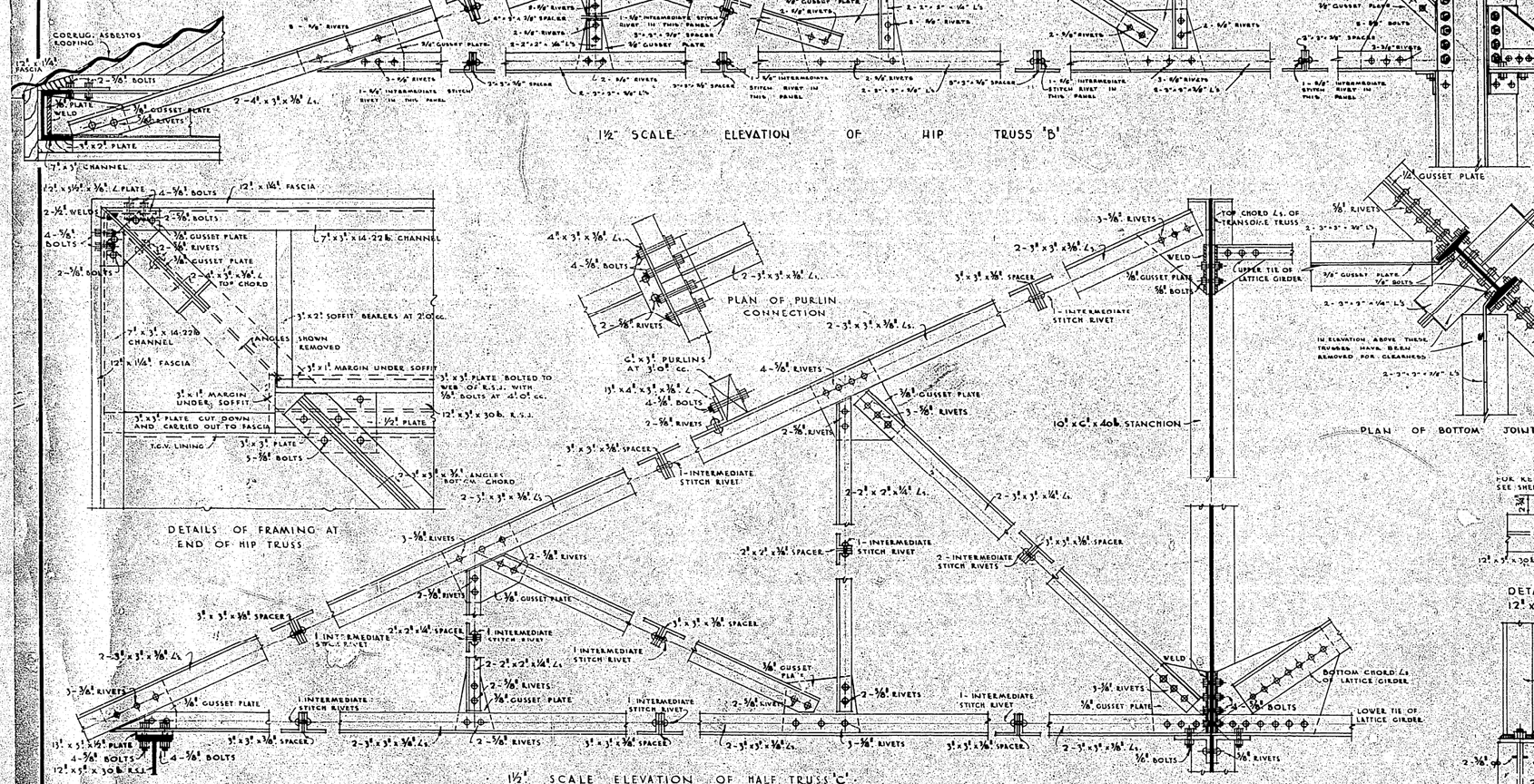
DETAILS OF TRUSSES A & GIRDER A



DETAIL OF CONNECTION OF 3" x 3" x 3/8" RAFTERS TO HIP TRUSS : CONNECTION OF RAFTERS AT EAVES SHALL BE SIMILAR TO TRUSS CONNECTION



PLAN OF PURLIN CONNECTION TO HIP TRUSS 'B'


PURLINS KNOTCHED OVER REAR SIDE TOP CHORD L.
C! x 3" PURLIN
4" x 3" x 3/8" SHAPED ANGLE CLIPS TO SUIT PURLINS AT 3'0" cc.
2-5/8" RIVETS
2-5/8" BOLTS
CORRUG. ASBESTOS ROOFING
12" x 1 1/4" FASCIA
2-5/8" BOLTS
3/8" PLATE WELD
3/8" GUSSET PLATE
5/8" RIVETS
3" x 3" PLATE
7" x 3" CHANNEL
2 - 4" x 3" x 3/8" L's
3-5/8" RIVETS
1 - 5/8" INTERMEDIATE STITCH RIVET IN THIS PANEL
40" @ 3'-4" SPACERS
3/8" GUSSET PLATE
2 - 3" x 3" x 3/8" L's
2 - 4" x 3" x 3/8" SPACER
2-5/8" RIVETS
2 - 3" x 2" x 3/8" L's
2" x 3" x 3/8" SPACER
3'0" @ 3'-3" SPACERS
2 - 3" x 3" x 3/8" L's
2-5/8" RIVETS
1 - 5/8" INTERMEDIATE STITCH RIVET IN THIS PANEL
2 - 3" x 3" x 3/8" L's
3-5/8" RIVETS
2 - 3" x 3" x 3/8" L's
2-5/8" RIVETS
2 - 3" x 3" x 3/8" L's
3-5/8" RIVETS
2 - 3" x 3" x 3/8" L's
2-5/8" RIVETS
2 - 4" x 3" x 3/8" SPACER PLATES
3-5/8" RIVETS
2 - 4" x 3" x 3/8" L's
1 - 5/8" INTERMEDIATE STITCH RIVET IN THIS PANEL
3/8" GUSSET PLATE
3-5/8" RIVETS
2 - 3" x 3" x 3/8" L's
6 1/8" x 3/8" PLATE
TOP CHORD ANGLES OF TRUSS
4 1/2" BUTT WELD
1/4" FILLET ALL ROUND
3/8" GUSSET
10" x 8" STANCHION
HALF TRUSS TO HIP & HIP TRUSS REMOVED FOR CLEARNESS
2-5/8" RIVETS
2 - 3" x 3" x 3/8" L's
2-5/8" RIVETS
2 - 3" x 3" x 3/8" L's
2-5/8" RIVETS
2 - 3" x 3" x 3/8" L's
3

BEAM 1 (2'-0" x 1'-2") [21-⅜" ϕ loops]

BEAM 2 (2'-0" x 1'-2") [30-⅜" ϕ loops]

BEAM 3 (2'-0" x 1'-2") [20-⅜" ϕ loops]
CONTINUED BELOW

SECTION A-A

SECTION B-B

SECTION C-C

TYPICAL MULLION SECTION

TYPICAL COLUMN NIB SECTION

TYPICAL DETAIL SHOWING BENDING OF ⅜" VERTICAL STEEL

SECTION D-D

½" SCALE DETAIL PLAN OF FRONT ENTRANCE

BEAM 3 [2'-0" x 1'-2"] (30-⅜" ϕ loops)

BEAM 4 [2'-0" x 1'-2"] (30-⅜" ϕ loops)

BEAM 5 [2'-0" x 1'-2"] (20-⅜" ϕ loops)

SECTION G-G

SECTION H-H

SECTION I-I

SECTION J-J

SECTION K-K

TYPICAL MULLION SECTION

TYPICAL DETAIL AT DOOR OPENINGS

DETAIL OF SETTING OF PIPE STANDARDS AND OF RAILING

DETAIL OF PIPE CONNECTIONS TO 5" x 4½" x 20 LB. STANCHION

DETAILS OF PIPE RAILING

STANDARD HOOK & LAP

NOTES.

CONCRETE MIX 1 - 2¼ - 3¼

SLUMP OF CONCRETE

SLABS	6" MAXIMUM
BEAMS	6" "
COLUMNS	5" "
FOOTINGS	2" "

CONCRETE COVER TO MAIN RODS

BEAMS	2"
COLUMNS	2"
SLABS	¾"
FOOTINGS	3"

LAP FOR ORDINARY RODS - 40 DIA.

LAP FOR ISTEG RODS

¼" ϕ	12"
⅜" ϕ	14"
⅝" ϕ	17"
½" ϕ	23"
⅝" ϕ	28"
¾" ϕ	34"

REINFORCEMENT LEGEND

ORDINARY STEEL SHOWN ϕ

" " IN SECTION ●

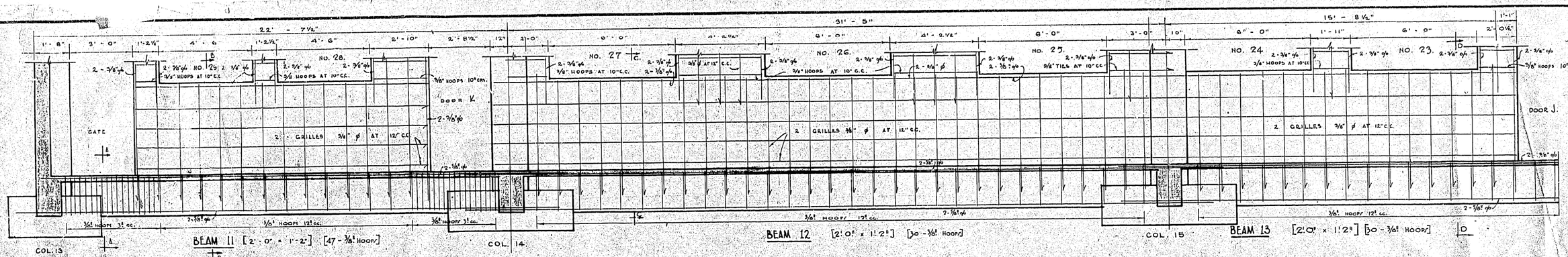
ISTEG STEEL SHOWN ϕϕ

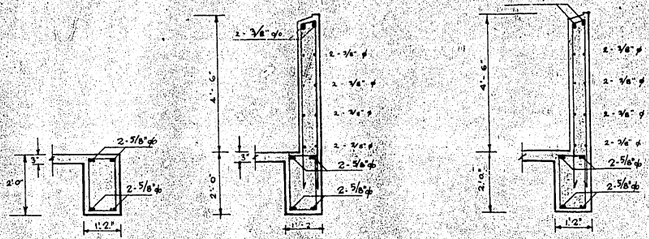
" " IN SECTION ⊙

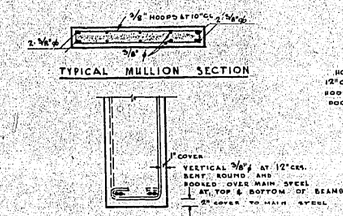
PETONE BOROUGH COUNCIL
GRANDSTAND PETONE

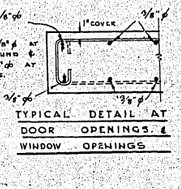
COMMISSION NO. 426	SCALE - ½ ½" = 1'0"	DATE - FEB. 1939	
DRAWING NO. W.4	MADE BY - C.J.W	REVISED	
	TRACED BY - IBR		
	CHECKED BY - WSL		

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REGISTERED ARCHITECTS
A.P.& BUILDING 17 GREY ST. W'GTON. C.1.



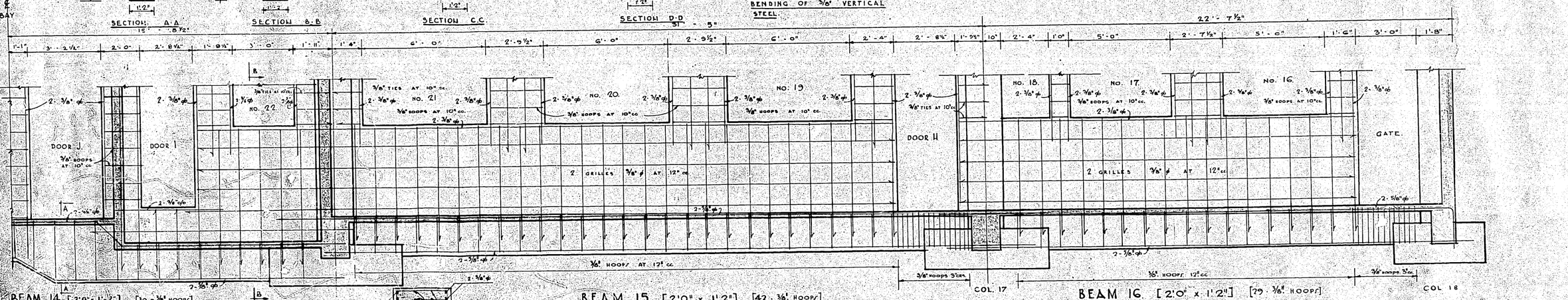


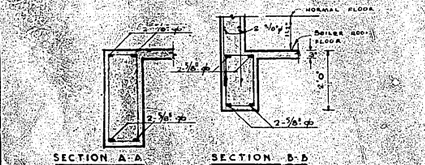


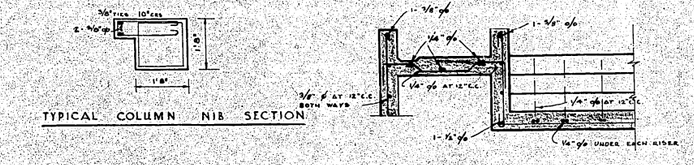


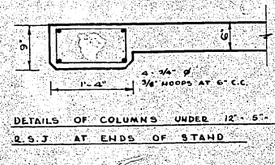
NOTES

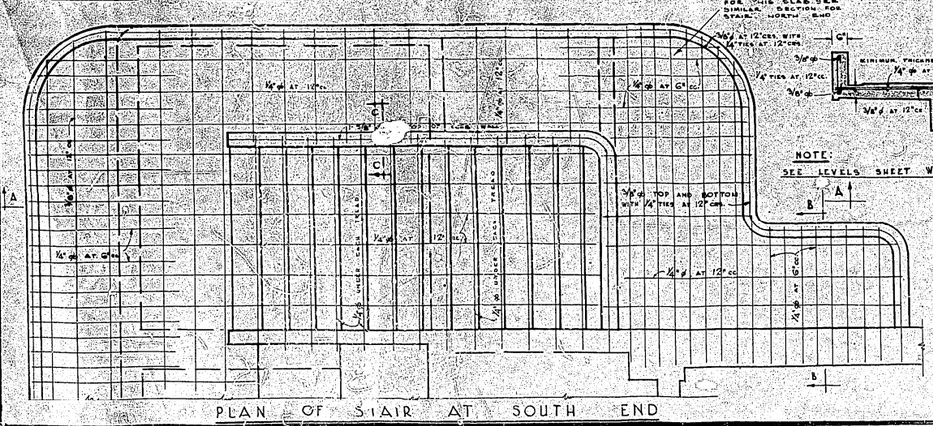
CONCRETE MIX 1 - 2 ½ - 3¾	LAP FOR ORDINARY RODS 40 DIA.
SLUMP OF CONCRETE	LAP FOR ISTEG RODS
SLABS 6" MAXIMUM	¼" o/o 12"
BEAMS 6" "	5/16" o/o 14"
COLUMNS 5" "	3/8" o/o 17"
FOOTINGS 2" "	½" o/o 23"
CONCRETE COVER TO MAIN RODS	5/8" o/o 28"
BEAMS 2"	¾" o/o 34"
COLUMNS 2"	
SLABS ¾"	REINFORCEMENT LEGEND
FOOTINGS 3"	ORDINARY STEEL SHOWN ϕ
	" " IN SECTION +
	ISTEG STEEL SHOWN ϕϕ
	" " IN SECTION ++

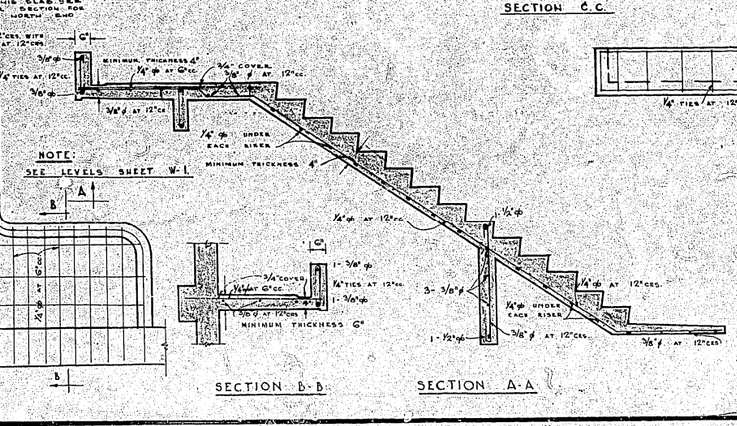


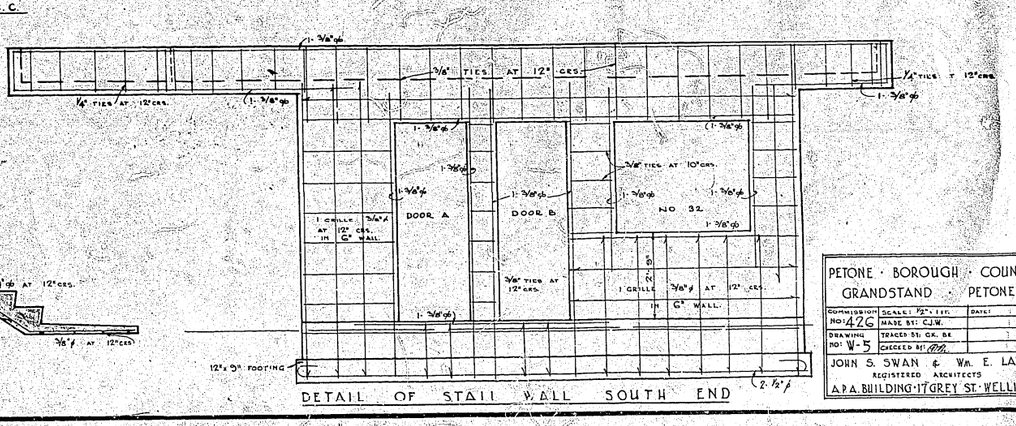








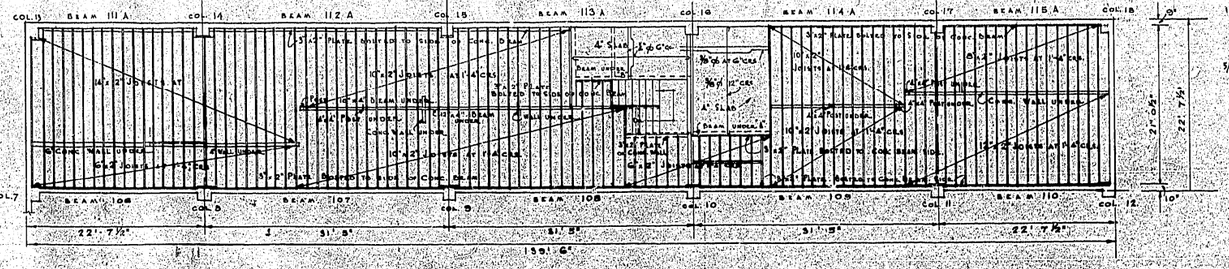




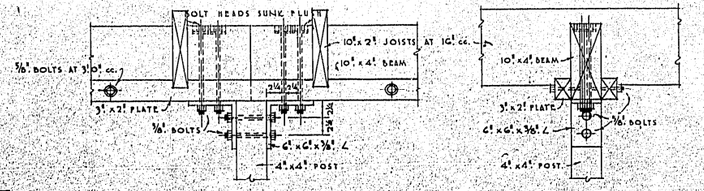
PETONE · BOROUGH · COUNCIL
GRANDSTAND · PETONE

COMMISSION NO: 426	SCALE: 1/2" = 1'-0"	DATE:
DRAWING NO: W-5	MADE BY: C.J.W.	
	TRACED BY: G.K. B.E.	
	CHECKED BY:	

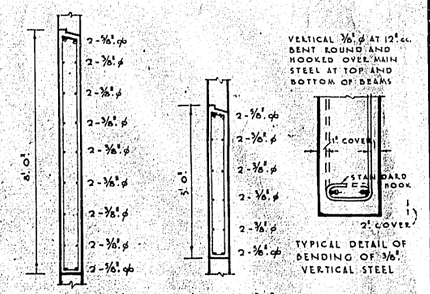
JOHN S. SWAN & Wm. E. LAVELLE
REGISTERED ARCHITECTS
A.P.A. BUILDING · 17 GREY ST · WELLINGTON



FIRST FLOOR FRAMING PLAN

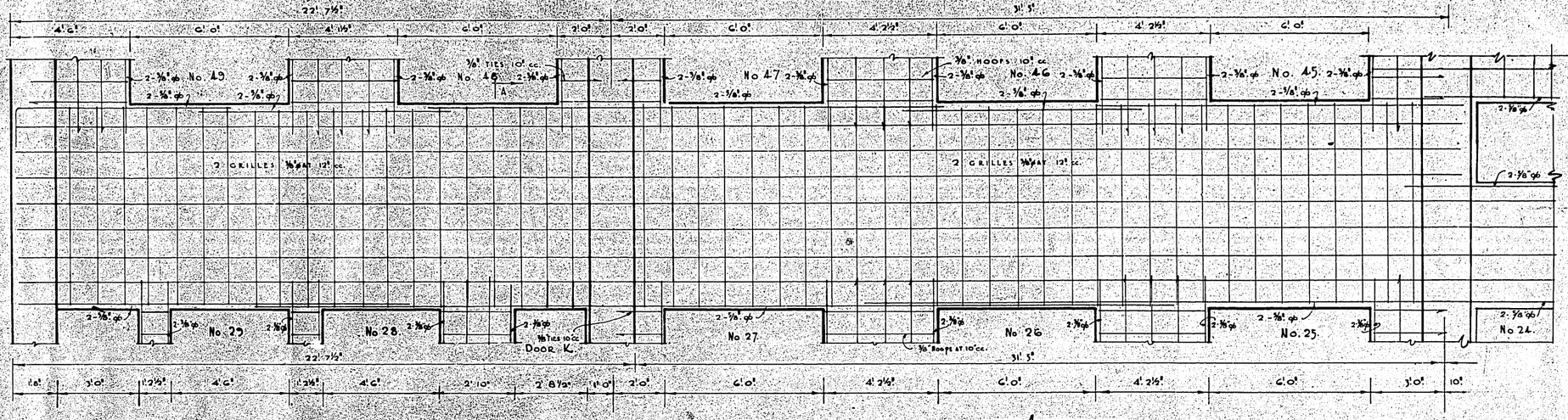


1½" DETAILS OF CONNECTION OF POSTS AND BEAM



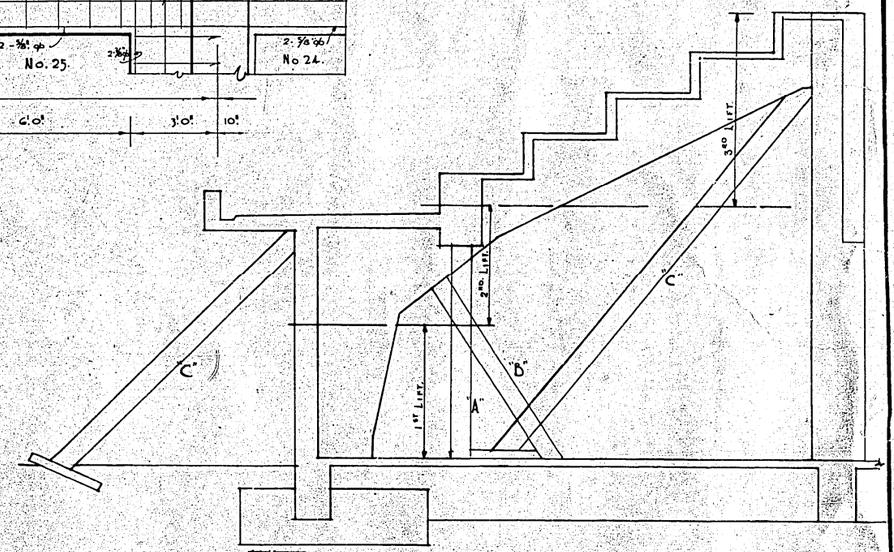
· SECTION A-A · SECTION B-B ·

TYPICAL DETAIL OF BENDING OF ⅜" VERTICAL STEEL



NOTES ON PROCEDURE

POUR 1ST LIFT AS SHOWN.
ERECT BOXING FOR 2ND LIFT SHORING WELL AS SHOWN AT 'A' AND 'B'.
POUR 2ND LIFT.
ALLOW 2ND LIFT AS LONG AS POSSIBLE TO HARDEN.
ERECT BOXING FOR 3RD LIFT.
SHORE BOXING WELL AT 'C' AND 'D' BEFORE POURING 3RD LIFT.



NOTES.

CONCRETE MIX. 1 - 2¼ - 3¾

SLUMP OF CONCRETE

SLABS	6" MAXIMUM
BEAMS	6"
COLUMNS	5"
FOOTINGS	2"

CONCRETE COVER TO MAIN RODS

BEAMS	2"
COLUMNS	2"
SLABS	¾"
FOOTINGS	3"

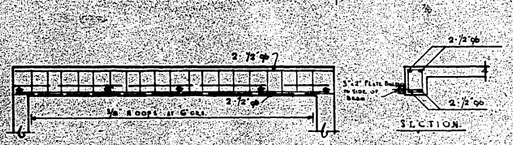
LAP FOR ORDINARY RODS 40 DIA

LAP FOR TSTEG RODS

¼" ϕ	12"
5/16" ϕ	14"
⅜" ϕ	17"
½" ϕ	23"
⅝" ϕ	28"
¾" ϕ	34"

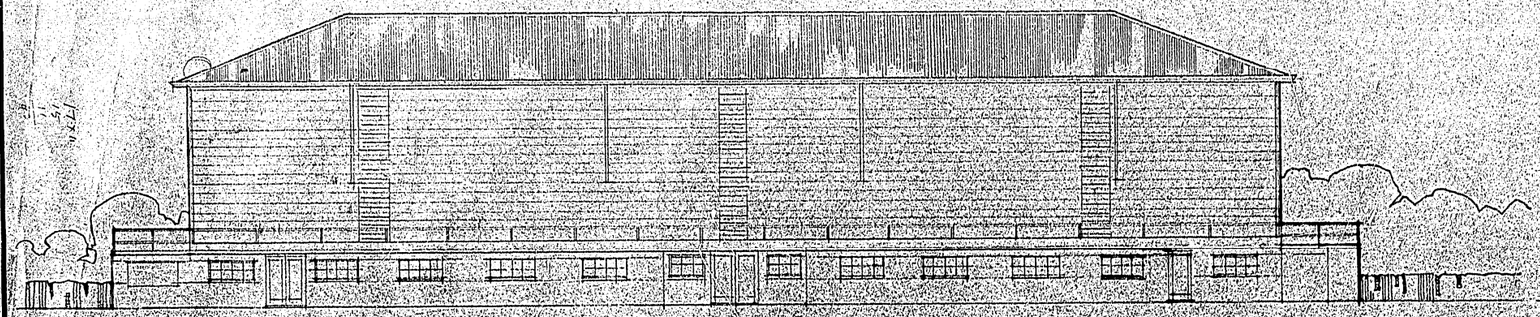
REINFORCEMENT LEGEND

ORDINARY STEEL SHOWN ϕ
" " IN SECTION ●
TSTEG STEEL SHOWN ϕ
" " IN SECTION ⊙

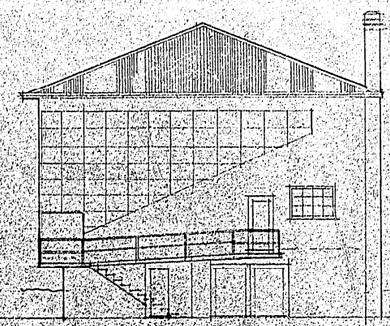


BEAM AT TOP OF CONCRETE SLAB AT 'A' BEAM AT 'B' SIMILAR

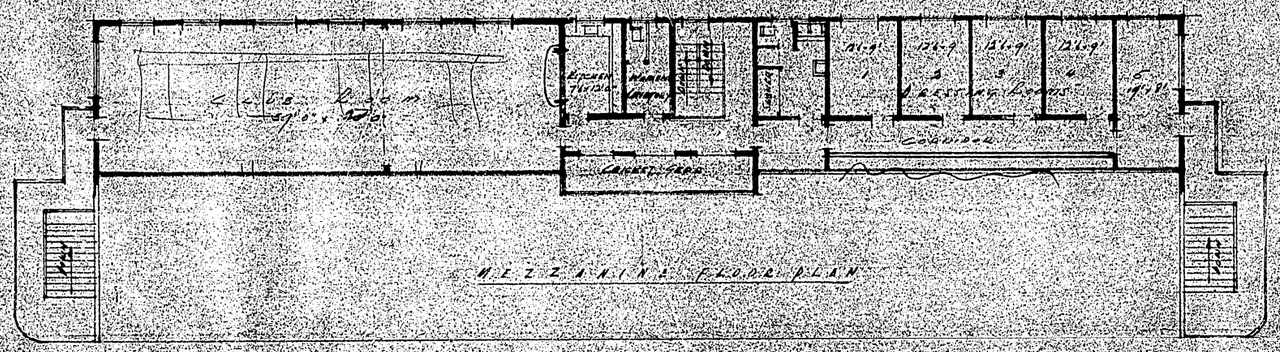
FOR DETAILS OF END WINDOWS SEE SHEET W.10
1'4½" COL. SEE SHEET W.15
6" WALL
1 GRILLE ⅜" ϕ 12" cc. BOTH WAYS
⅜" HOOPS AT 6" cc.
2-⅜" ϕ
⅜" TIES AT 10" cc.
2-¾" ϕ
2-⅜" ϕ
2-⅜" ϕ
2-⅜



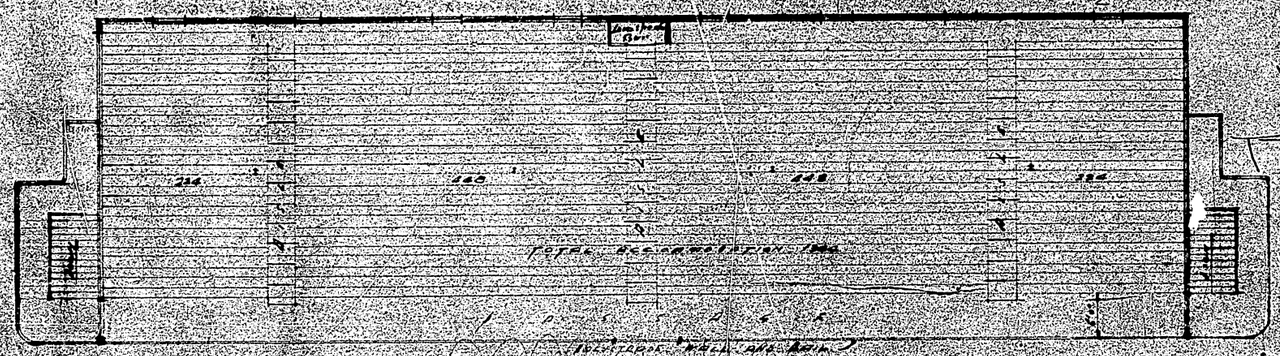
FRONT ELEVATION



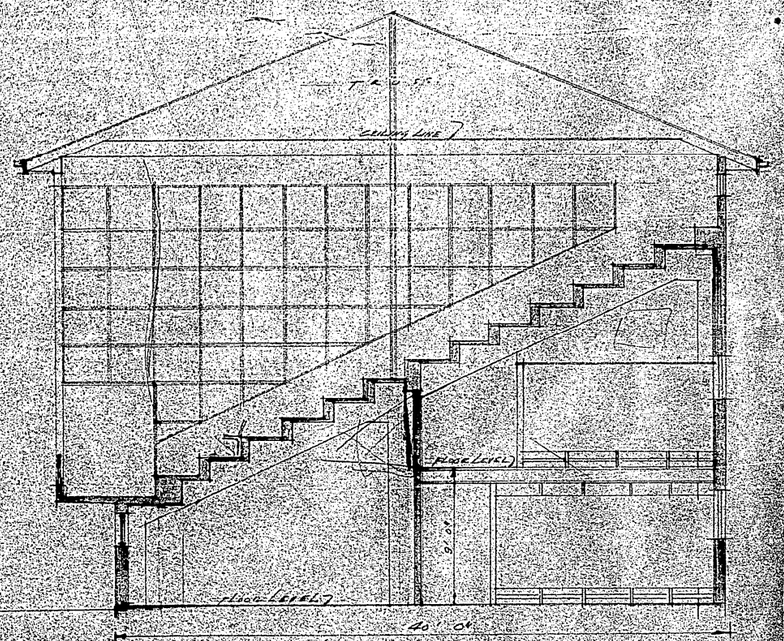
SIDE ELEVATION



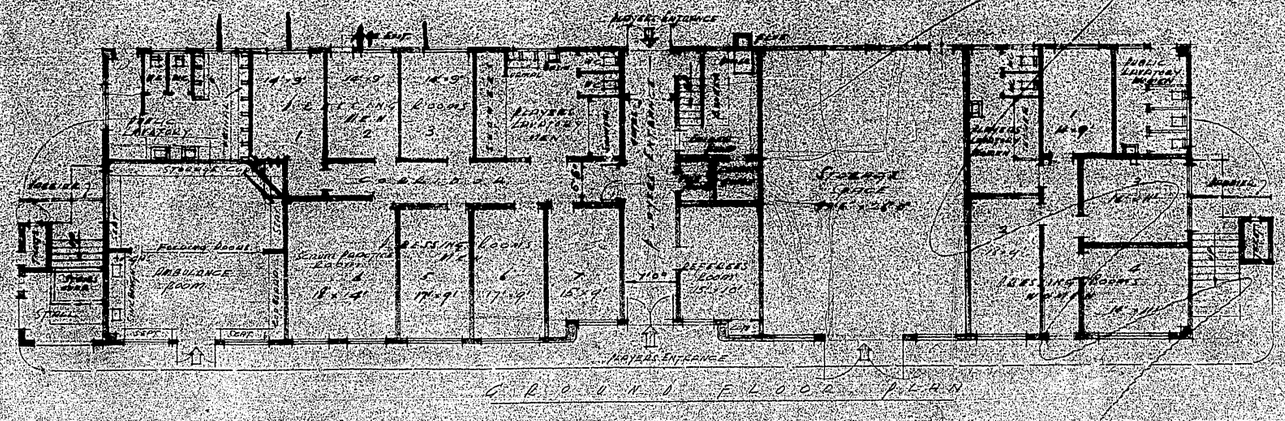
MEZZANINE FLOOR PLAN



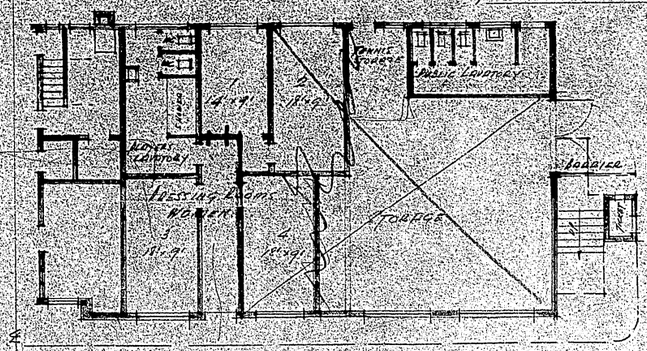
SEATING PLAN



1/4" SCALE SECTION



GROUND FLOOR PLAN

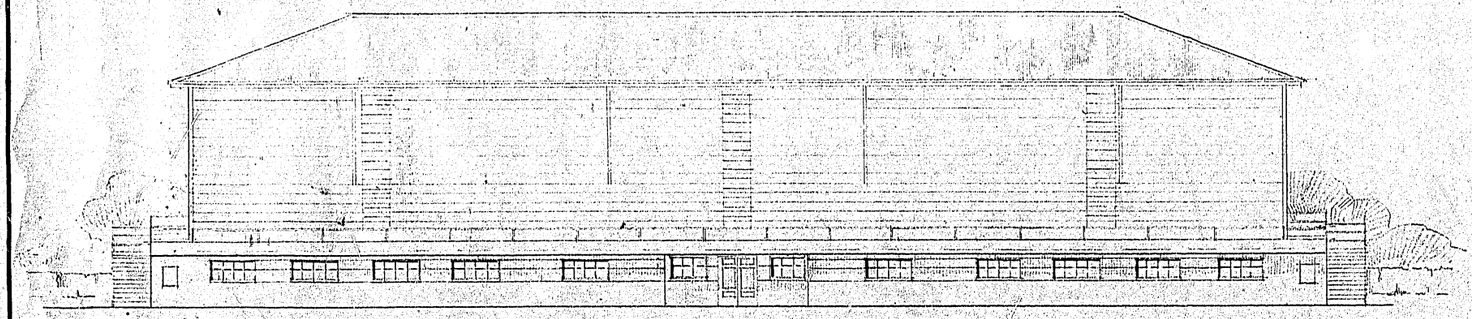


ALTERNATIVE PLAN

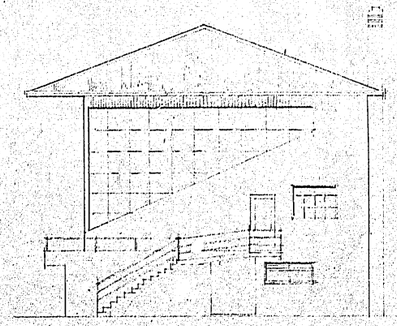
PETONE BOROUGH COUNCIL
ARCHITECTS

COMMISSION No. 426	SCALE: 1/8 1/4	DATE: 7 MAY 41
DRAWING No. 1/5	TRACED BY:	CHECKED:
	CHECKED BY:	

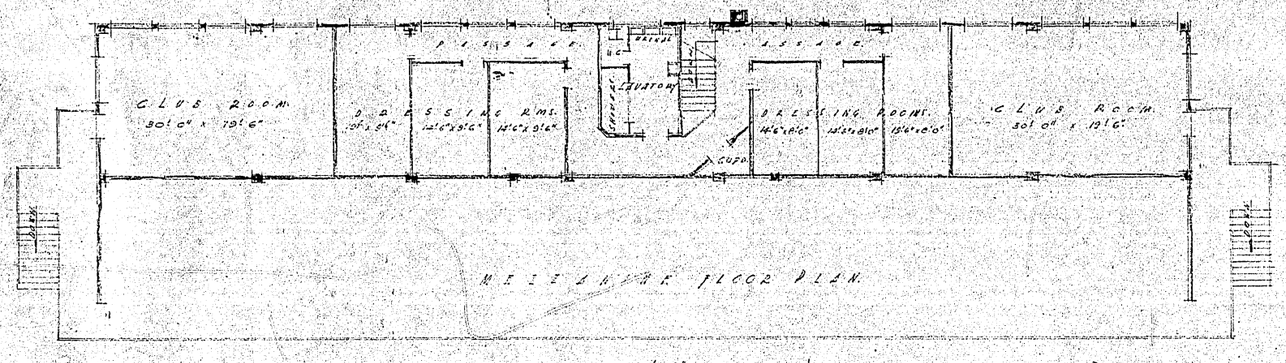
JOHN C. SWAN & WM. E. LAVELLE
REGISTERED ARCHITECTS
A.P.A. BUILDING 17 GREY ST. WELLINGTON



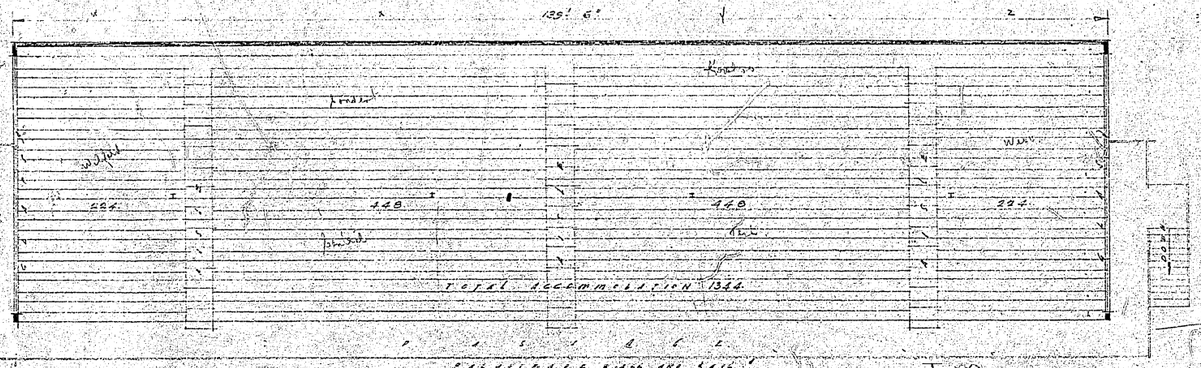
ELEVATION TO PLAYING FIELD

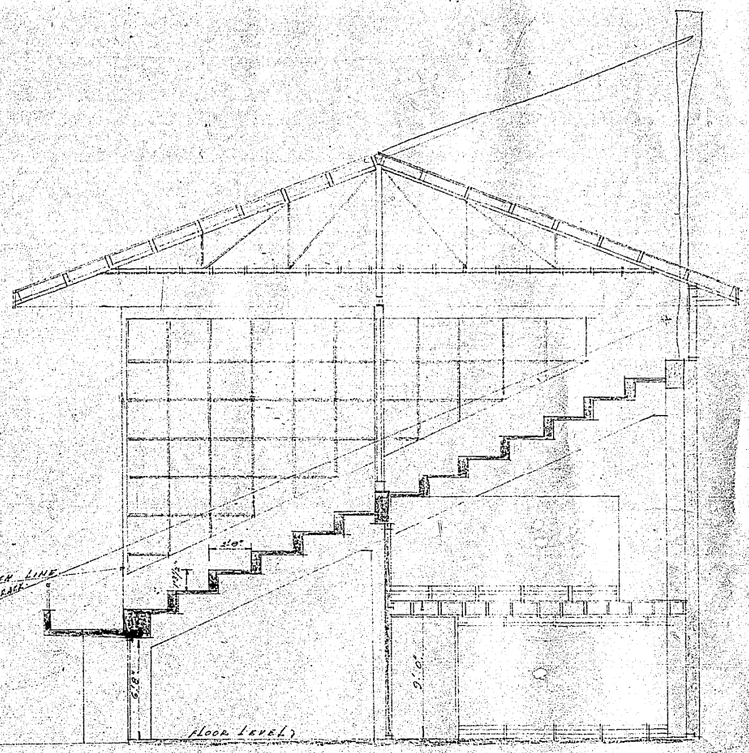


SIDE ELEVATION

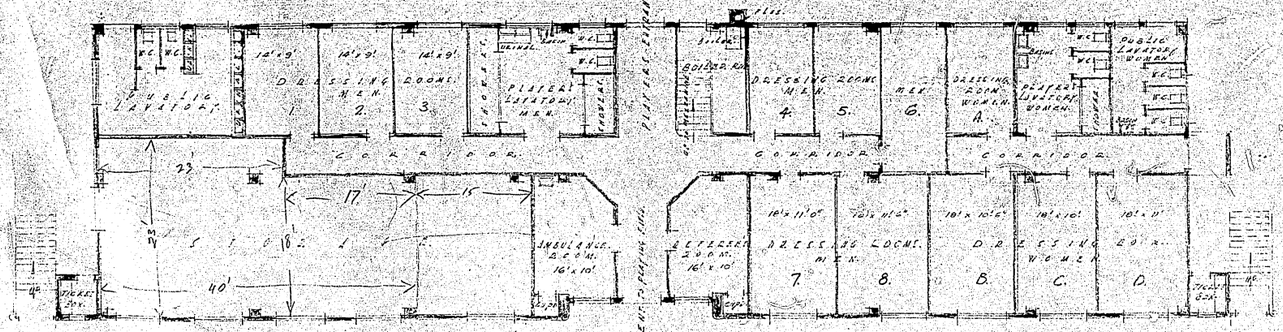


MEZZANINE FLOOR PLAN.





SECTION ¼" SCALE.



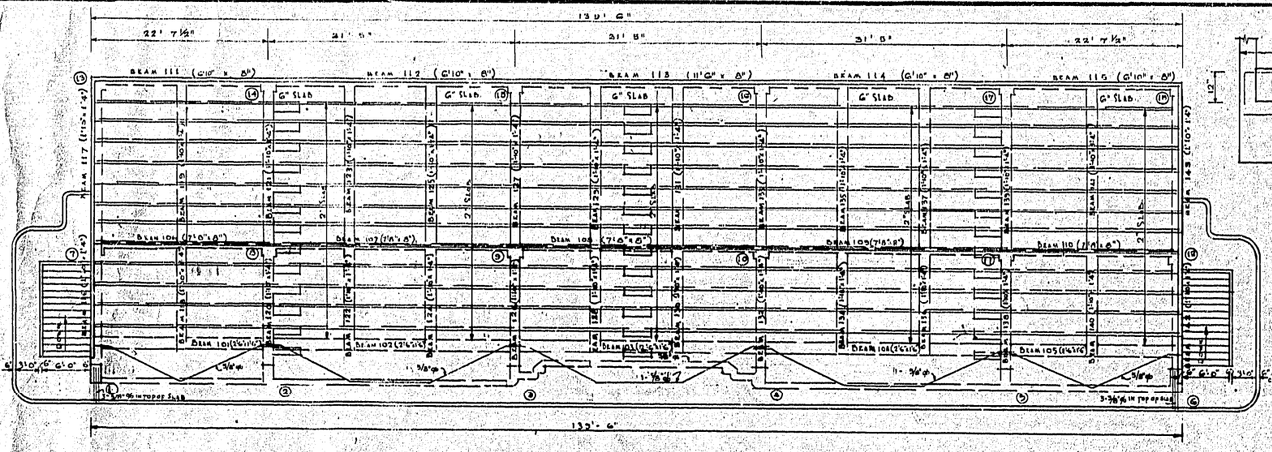
GROUND FLOOR PLAN.

PRELIMINARY DRAWINGS ONLY.

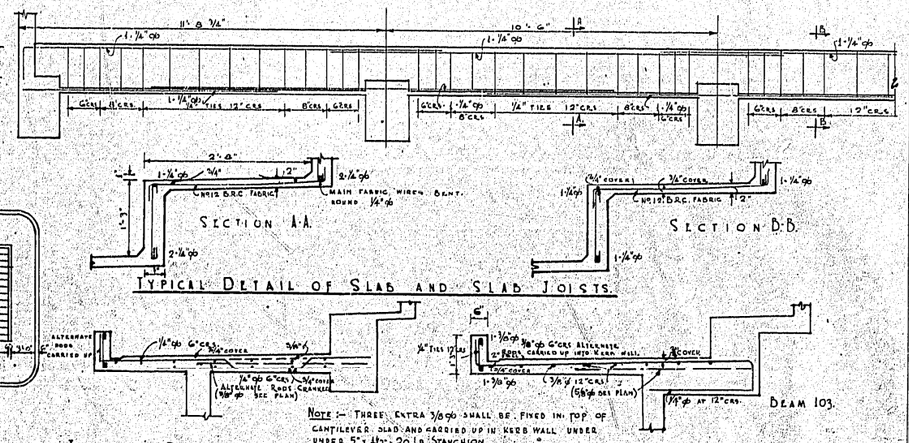
PETONE BOROUGH COUNCIL
GRANDSTAND.

COMMISSION No 126	SCALE 1/8 FULL SIZE	DATE 2nd June 39	
DRAWING No P.4	TRACED BY:		
	CHECKED BY:		

JOHN S. SWAN & WM. E. LAVELLE
REGISTERED ARCHITECTS.
A.R.A. BUILDING - 17 GREY ST - WGTON.



DECK FRAMING PLAN



TYPICAL DETAILS OF REINFORCING IN CANTILEVERED PLATFORM

NOTES—

CONCRETE MIX 1 - 2¼ - 3¼

SLUMP OF CONCRETE

SLABS	6" MAXIMUM
BEAMS	6" "
COLUMNS	3" "
FOOTINGS	2" "

CONCRETE COVER TO MAIN RODS

BEAMS	2"
COLUMNS	2"
SLABS	¾"
FOOTINGS	3"

LAP FOR ORDINARY RODS 40 DIA.

LAP FOR ISTEG BARS

¼" ϕ	12"
5/16 ϕ	14"
⅜" ϕ	17"
½" ϕ	23"
⅝" ϕ	28"
¾" ϕ	34"

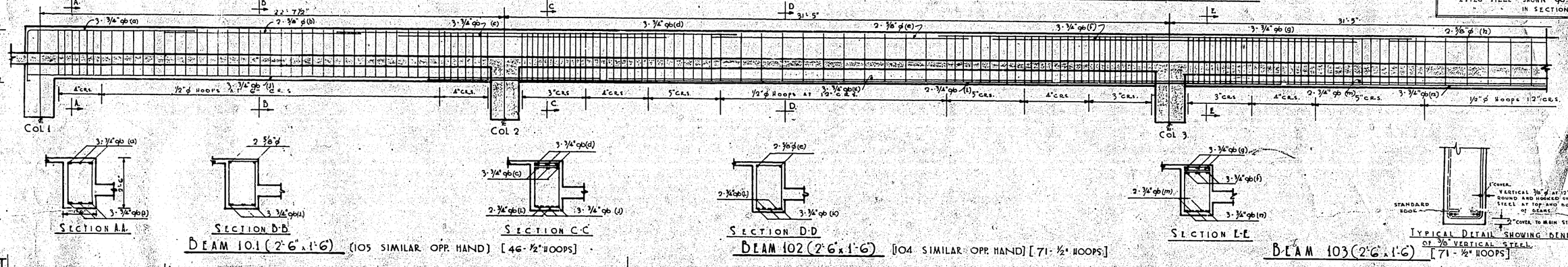
REINFORCEMENT LEGEND.

ORDINARY STEEL SHOWN ϕ

" " IN SECTION ●

ISTEG STEEL SHOWN ϕ

" " IN SECTION ●●



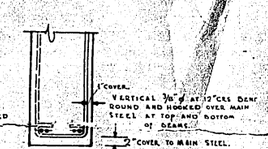
SECTION A-A.

SECTION D-B

SECTION C-C

SECTION D-D

SECTION E-E

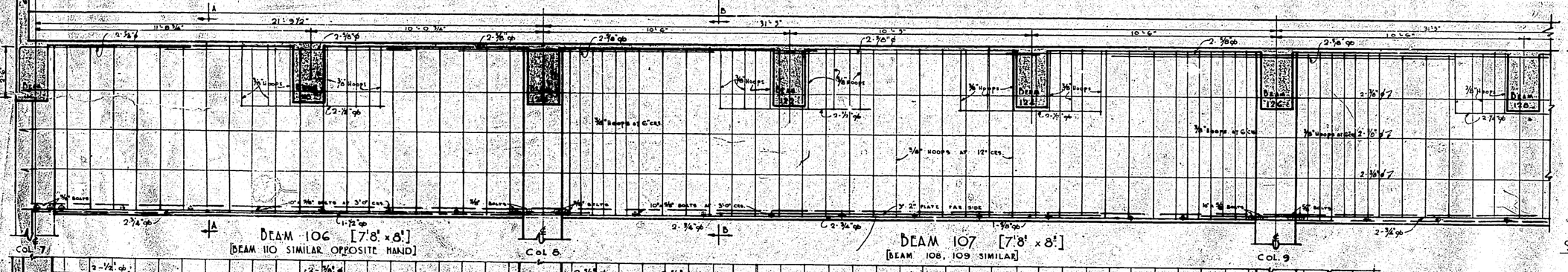


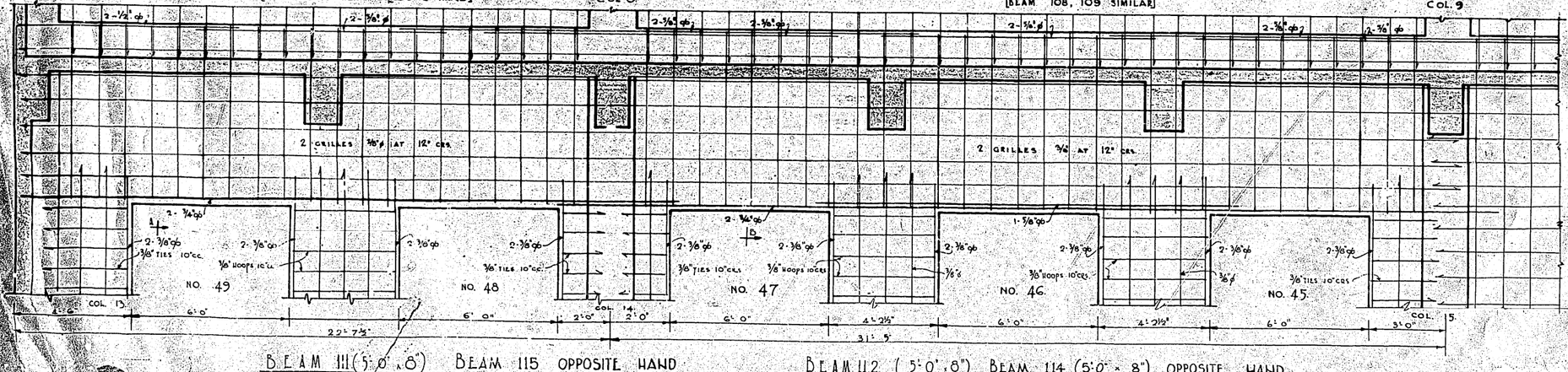
TYPICAL DETAIL SHOWING BENDING OF ⅜ VERTICAL STEEL.

BEAM 101 (2'6" x 1'6") (105 SIMILAR OPP. HAND) [46 - ½" HOOPS]

BEAM 102 (2'6" x 1'6") [104 SIMILAR OPP. HAND] [71 - ½" HOOPS]

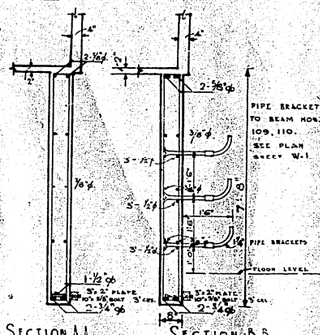
BEAM 103 (2'6" x 1'6") [71 - ½" HOOPS]





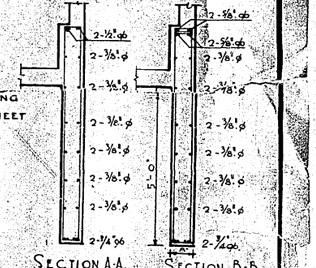
BEAM 111 (5'0" x 8") BEAM 115 OPPOSITE HAND

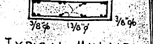
BEAM 112 (5'0" x 8") BEAM 114 (5'0" x 8") OPPOSITE HAND



SEE DETAIL OF REINFORCING IN BACK 6" SLAB ON SHEET W-8.

FOR CONTINUATION OF THIS BEAM SEE SHEET W-8



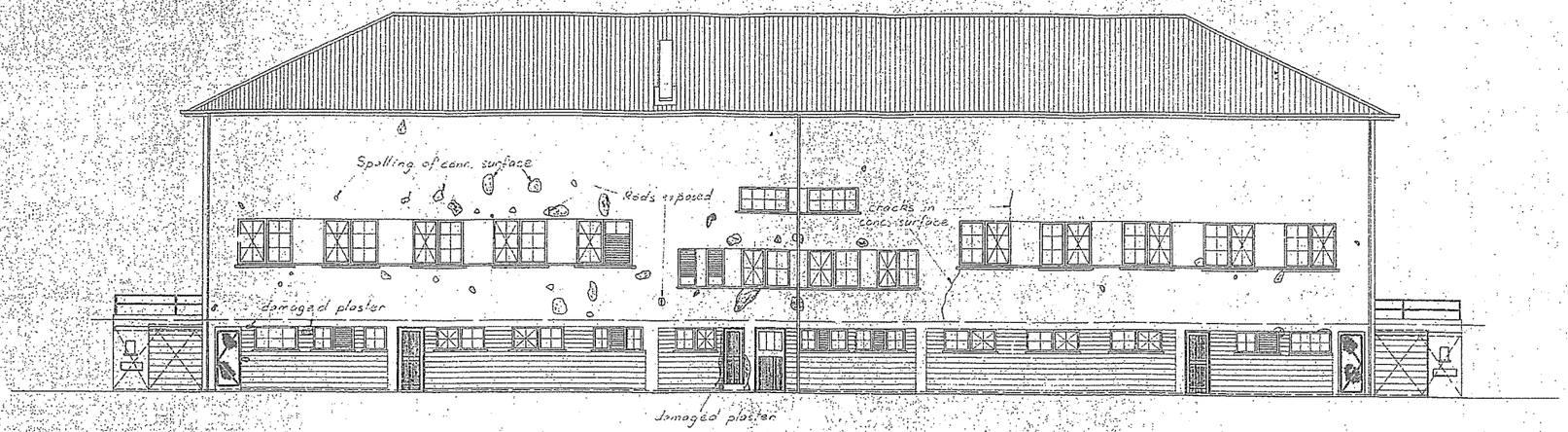

TYPICAL MULLION SECTION.

PETONE BOROUGH COUNCIL
GRANDSTAND — PETONE.

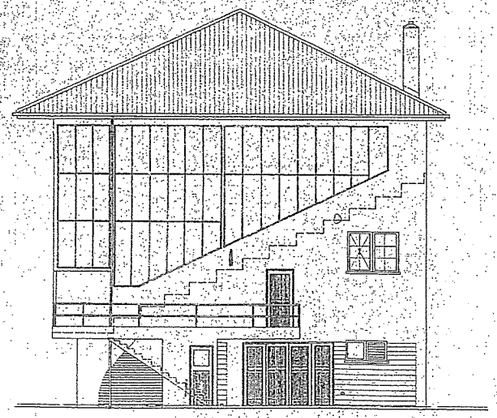
JOB No. 426	DRAWN BY: C.J.W.	SCALE: ½"=1'-0" DATE: Feb. 1935
DRAWING No. W-7	TRACED BY: E.L.C.	REVISED:
	CHECKED BY:	

JOHN S. OWAN & WM. E. LAVELLE REGISTERED ARCHITECTS
A.P.A. BUILDING 17 GREY ST. WELLINGTON

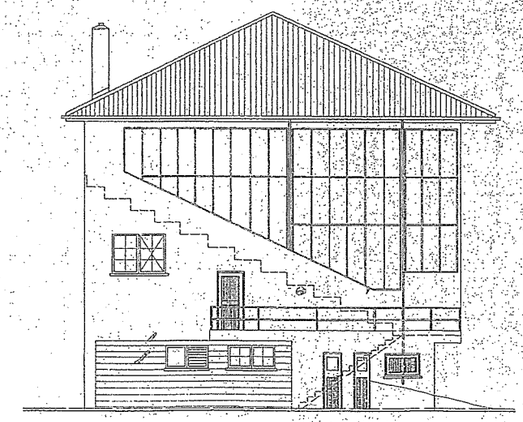
Appendix F –Drawings – 1979 Drawings



WEST ELEVATION
Scale ~ 1:100



NORTH ELEVATION
Scale ~ 1:100



SOUTH ELEVATION
Scale ~ 1:100

MICROFILMED
ANY AMENDMENTS TO THIS PLAN MUST BE NOTIFIED TO CHIEF DRAUGHTSMAN FOR REFILMING

468

No	AMENDMENT			SCALE:
				DESIGN SURVEY
				DRAWN
				CHECKED
				DATE

GRANDSTAND RENOVATION

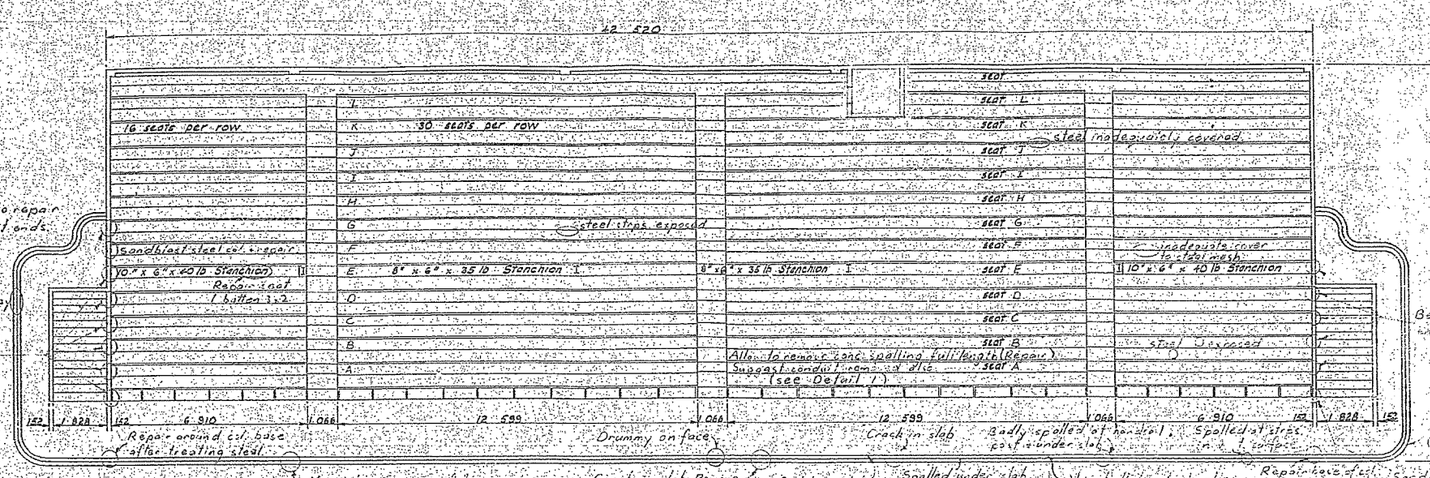
FOR PETONE BOROUGH COUNCIL

CLIMIE, SPENCER & HOLMES MILLER
CIVIL - STRUCTURAL - SURVEYING
A.M.P. CHAMBERS, P.O. BOX 588 — WELLINGTON 1, N.Z. TELEPHONE 722-261

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE

C/1923

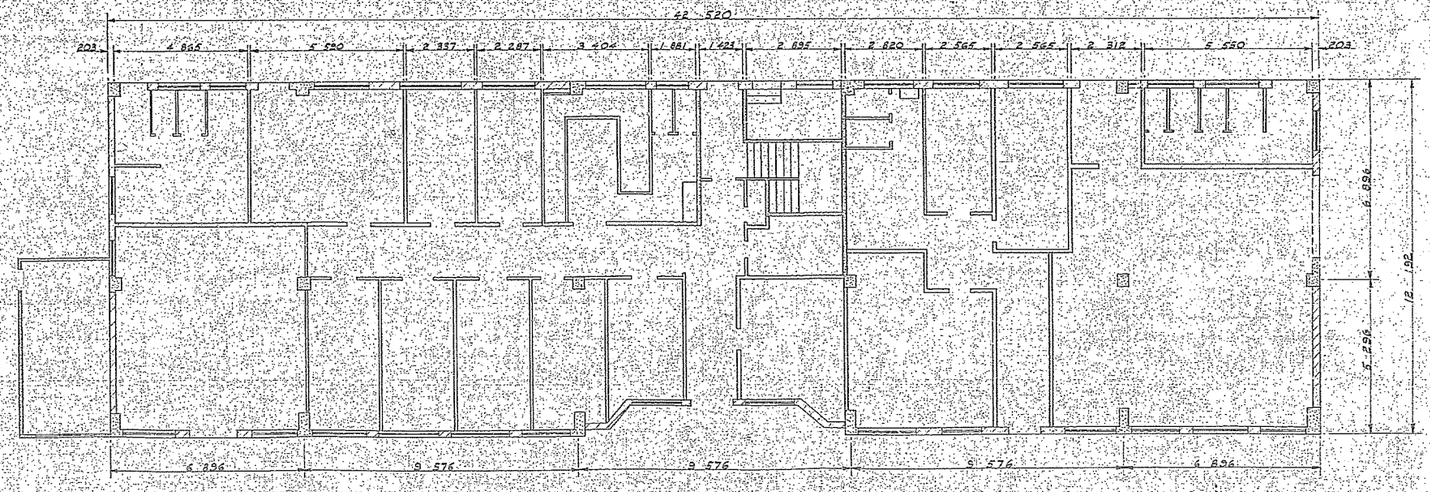
1



PLAN OF DECK LEVEL
Scale ~ 1 : 100

SECTION THRU CONC. UNDER SEATING
N.T.S.

N.B. - All steel to be sandblasted & painted



GROUND FLOOR PLAN
Scale ~ 1 : 100

EXISTING

MICROFILMED
ANY AMENDMENTS TO THIS PLAN MUST BE NOTIFIED TO CHIEF DRAUGHTSMAN FOR REFILMING.

468

No.	AMENDMENT			SCALE
				DESIGN
				SURVEY
				DRAWN
				CHECKED
				DATE

GRANDSTAND RENOVATION

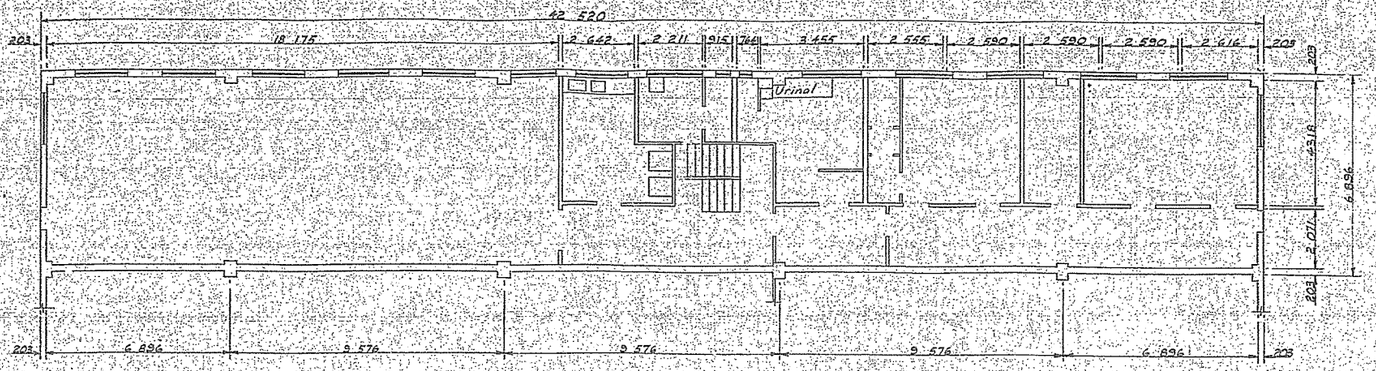
FOR PETONE BOROUGH COUNCIL

CLIMIE, SPENCER & HOLMES MILLER
CIVIL STRUCTURAL SURVEYING
A.M.P. CHAMBERS, P.O. BOX 588
WELLINGTON 1, N.Z.
TELEPHONE 722-261

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE

C/1923

2



FIRST FLOOR PLAN - EXISTING

Scale ~ 1 : 100

MICROFILMED

ANY AMENDMENTS TO THIS PLAN MUST BE NOTIFIED TO CHIEF DRAUGHTSMAN FOR REFILMING.

468

No.	AMENDMENT			
				SCALE
				DESIGN / SURVEY
				DRAWN
				CHECKED
				DATE

GRANDSTAND RENOVATION

FOR PETONE BOROUGH COUNCIL

CLIMIE, SPENCER & HOLMES MILLER

CIVIL STRUCTURAL SURVEYING

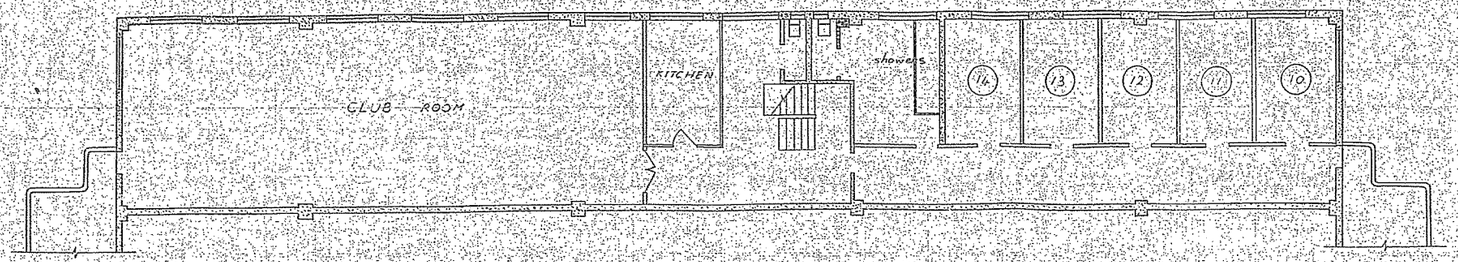
A.M.P. CHAMBERS, WELLINGTON 1, N.Z.

P.O. BOX 588, TELEPHONE 722-261

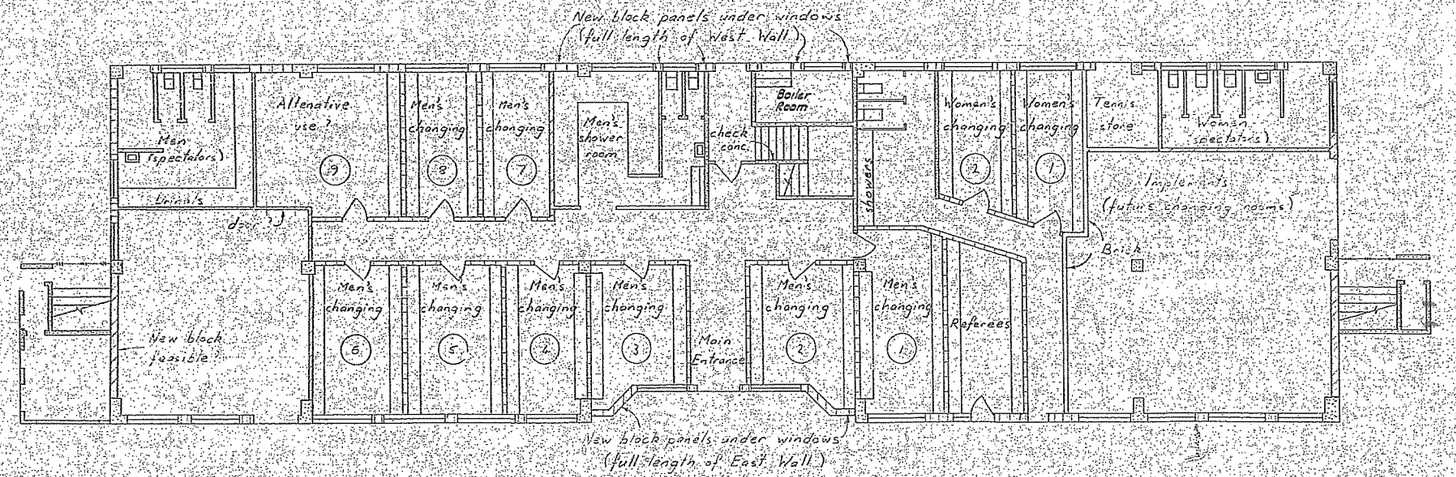
THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE

C/1923

3



NEW FIRST FLOOR PLAN
Scale - 1:100



NEW GROUND FLOOR PLAN
Scale - 1:100

LEGEND

Existing	Concrete
New	Concrete
Existing	Brick
New	Block

MICROFILMED
ANY AMENDMENTS TO THIS PLAN MUST BE NOTIFIED TO CHIEF DRAUGHTSMAN FOR REFILMING.

468

No	AMENDMENT			SCALE	
				DESIGN	
				SURVEY	
				DRAWN	
				CHECKED	
				DATE	

GRANDSTAND RENOVATION

FOR PETONE BOROUGH COUNCIL

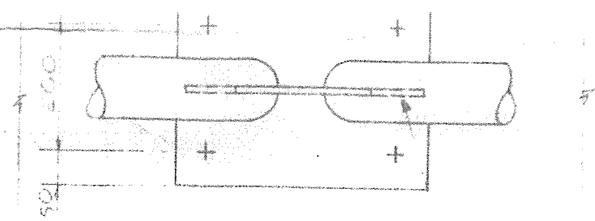
CLIMIE, SPENCER & HOLMES MILLER
CIVIL — STRUCTURAL — SURVEYING
AMP CHAMBERS
P.O. BOX 588
WELLINGTON 1, N.Z.
TELEPHONE 722-261

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE.

ACENZ

C/1923

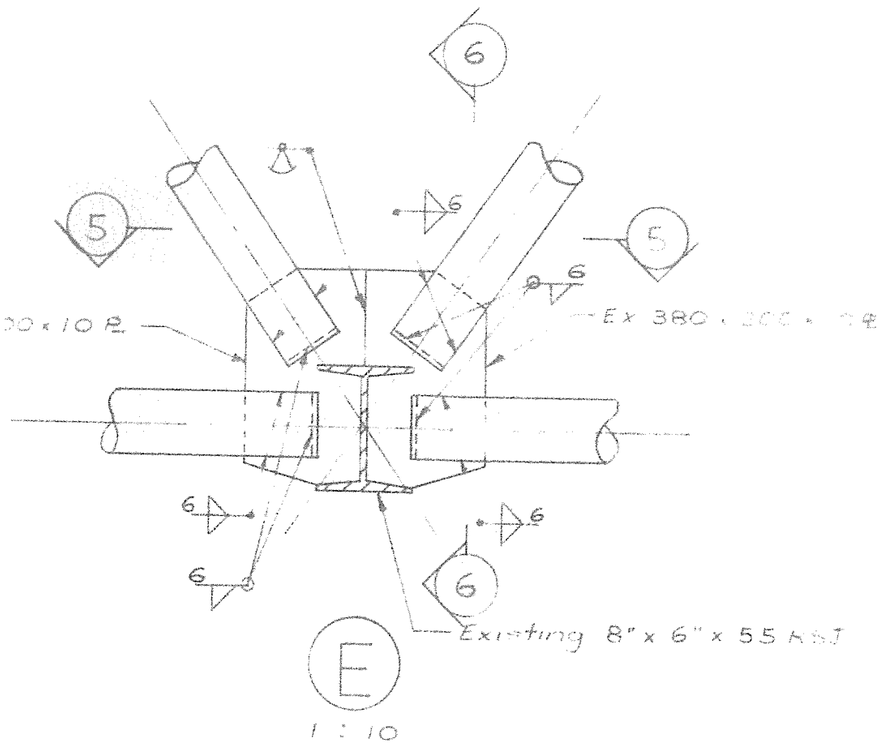
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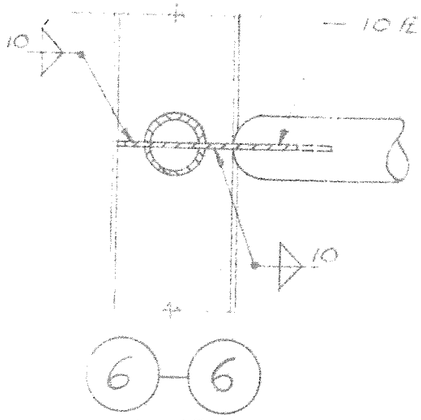
4 — 4
1 : 10



5 — 5
1 : 10



E
1 : 10



1 : 10

These are the Plans/~~Special Conditions and Specifications~~ referred to in the annexed Agreement signed by us.

Witness

Witness

FISHER & PAYKEL STEEL LIMITED,

Contractor

Principal

ORIGINAL

GH COUNCIL GRANDSTAND
RREATION GROUND
OF RACING

SPENCER, HOLMES MILLER & JACKSON
CIVIL - STRUCTURAL - SURVEYING
A.M.P. CHAMBERS. WELLINGTON 1., N.Z
P.O. BOX 588 TELEPHONE 722-261

THE CONTRACTOR SHALL VERIFY

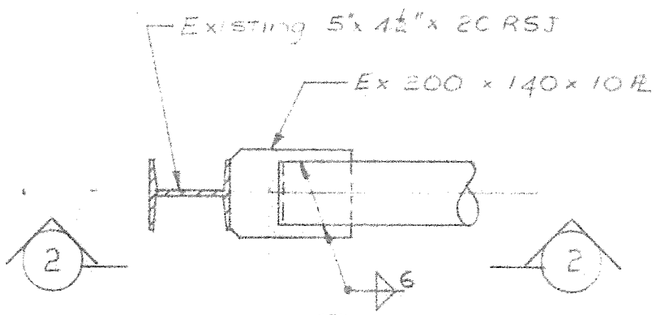
2782

1

A

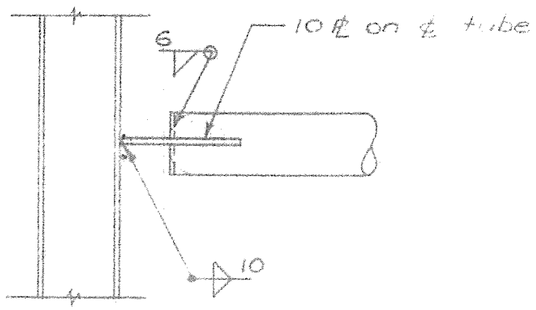
1 : 10

1 : 10



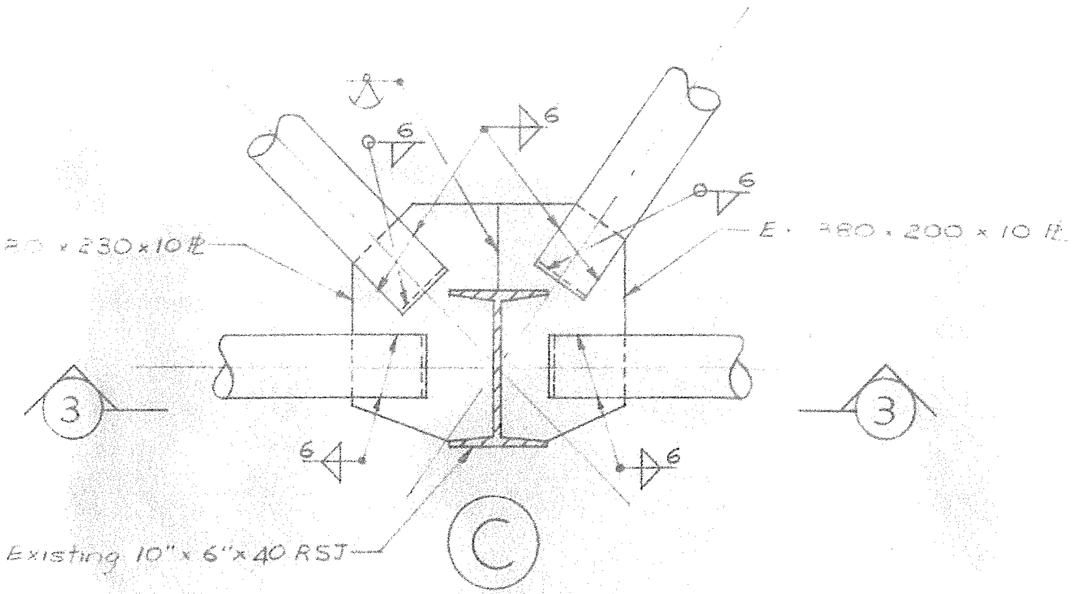
B

1 : 10



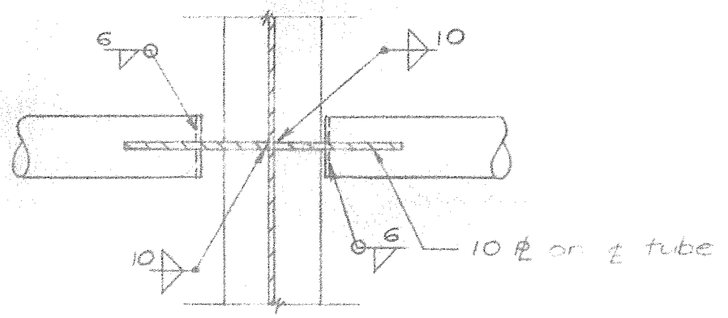
2 — 2

1 : 10



C

1 : 10



3 — 3

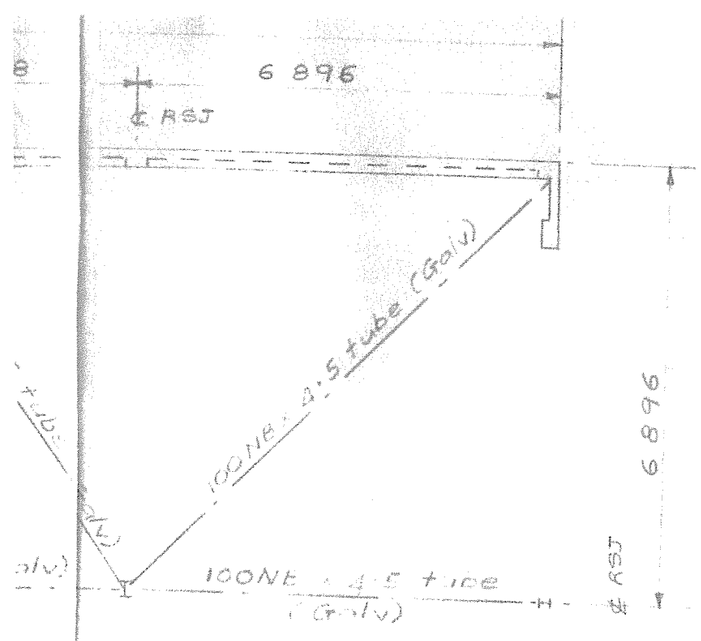
1 : 10

No	AMENDMENT		

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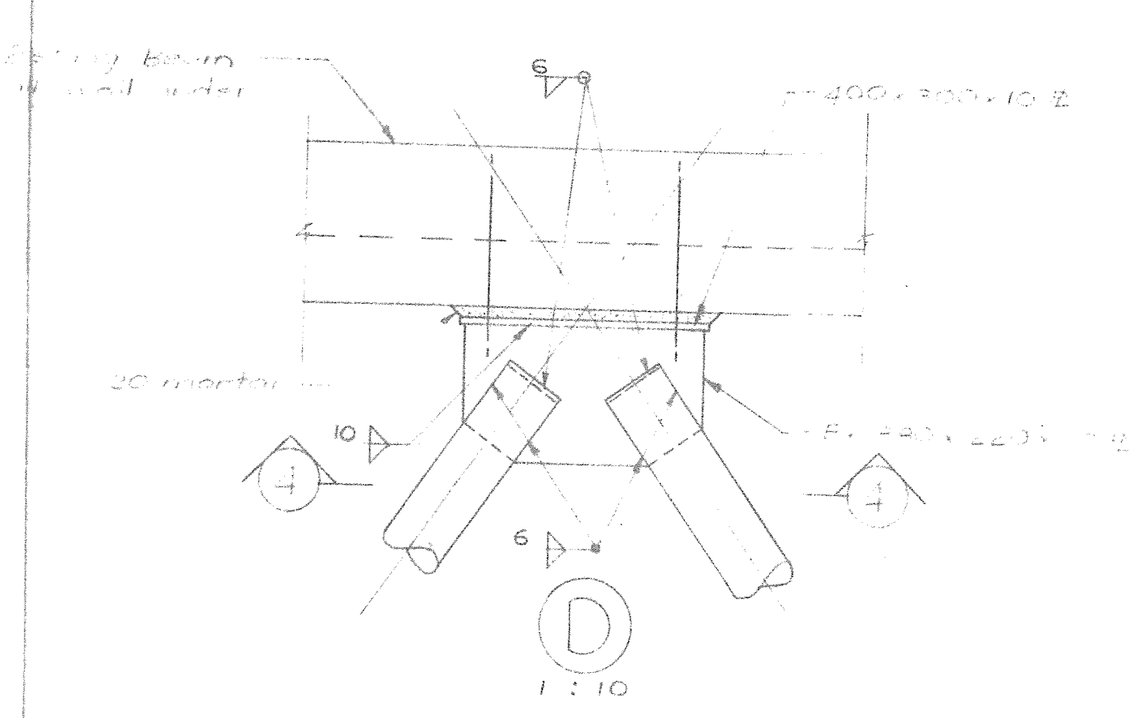
SCALE	As Shown
DESIGN ~~SURVEY~~	PCS
DRAWN	ANG
CHECKED	PCS
DATE	Dec 1979

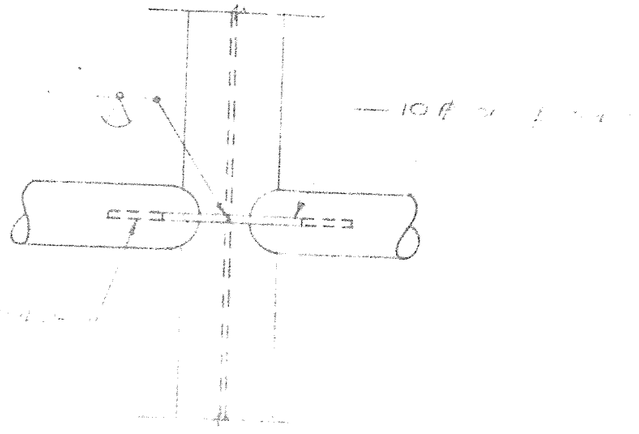
PETONE BOROUGH COUNCIL
AT PETONE RECREATION
ROOF RACING

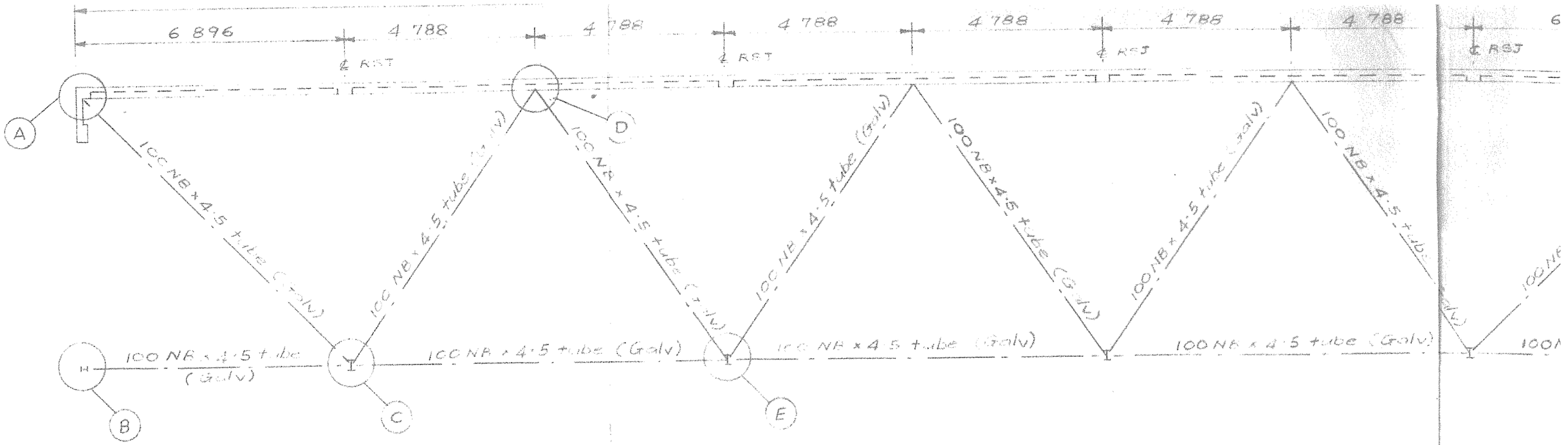


NOTES

All structural steelwork to be hot dipped galvanised.
All dimensions on layout plan to be checked on site.
Provide 6mm capping plate to all tubes.






6 896
4 788
4 788
4 788
4 788
4 788
4 788
6
℄ RST
℄ RST
℄ RSJ
℄ RSJ
A
B
C
D
E
H
100 NB × 4·5 tube (Galv)
100 NB × 4·5 tube (Galv)
100 NB × 4·5 tube (Galv)

Appendix G –Drawings – 2014 Drawings

PETONE RECREATION GROUND GRANDSTAND
16N UDY STREET, PETONE.

Seismic strengthening to 34%NBS

Project Number: 8757

Drawing Issue for: e.g. Building Consent [O]

Date of Current Issue: **19 December 2014**

Issued for:

Owner	[1]
Builder	[x]
Council	[2]
Subcontractor	[x]
Other	[x]

Drawing Number	Current Amendment	Title	O	A	B	C
S000	O	Drawing Issue	19.12.14			
S101	O	Existing Plan	19.12.14			
S102	O	Proposed Plan	19.12.14			
S201	O	Elevation	19.12.14			
S202	O	Section	19.12.14			
S301	O	Details	19.12.14			
S302	O	Details	19.12.14			
S303	O	Details	19.12.14			
S304	O	Details	19.12.14			
S401	O	Notes	19.12.14			
S402	O	Notes	19.12.14			
S403	O	Notes	19.12.14			
S404	O	Notes	19.12.14			
S405	O	Notes	19.12.14			
S406	O	Notes & PS3 Form	19.12.14			



Site Location Plan

Engineer's Inspections:

Check all is complete then phone (04) 566-1483 for an inspection. One days notice please. Refer also to monitoring and inspection notes.

- Following scabbling of existing columns prior to reinforcing and boxing.
- During drilling of columns prior to epoxy fixing of U bars.
- Reinforcement prior to completion of boxing for concrete strengthening to columns and nib at timber framed wall.
- Structural steelwork on completion and while suitable safe access is available.
- Epoxy anchors are to be inspected and may be subject to load testing.
- Timber framing to wall at equipment room prior to lining.
- Prior to saw cutting opening in wall between SW changing room and public toilet.
- Following preparation at repair of column 14.
- On completion of all work.

27693-1

SAWREY
CONSULTING ENGINEERS
CIVIL ▲ STRUCTURAL ▲ FOUNDATIONS
92 Queens Drive PO Box 30-444 Lower Hutt
Telephone Bus (04)566 1483 Fax (04)566 9118
Email info@sawrey.co.nz

CLIENT:

Hutt City Council

REVISIONS:

REV No.	DATE.
O	19.12.43 (Original)

CHECK ALL DIMENSIONS ON SITE

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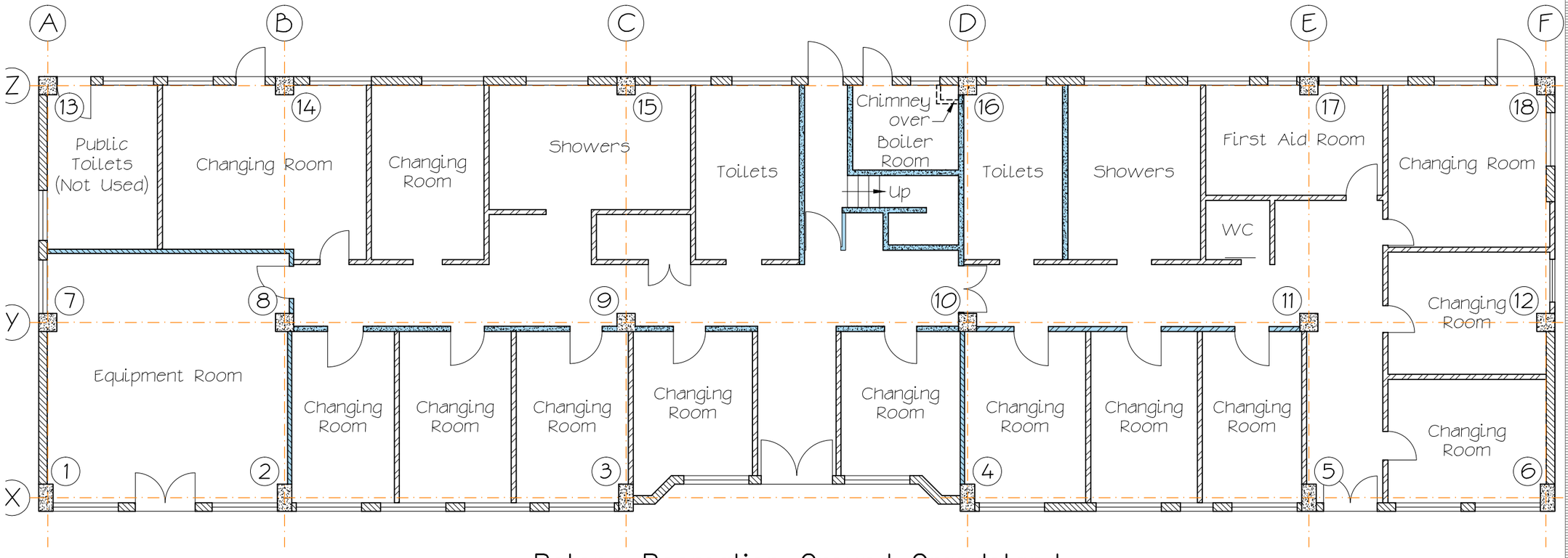
Petone Recreation Ground Grandstand

Seismic Strengthening to 34%NBS
Drawing Issue

DRAWN:	D.M.S.
CHECKED:	G.R.S.
APPROVED:	G.R.S.
DATE:	19.12.14
SCALE:	N/A
JOB NO:	8757

DWG.NO. **8757**

SHEET NO. **S000** IN SET OF **O**



Petone Recreation Ground Grandstand
Ground Floor Plan (Existing)

1:125

KEY

- 240mm Brick
- 120mm Brick
- 140mm Block
- 150mm Concrete
- 100mm Timber
- (1) Column Numbers
- Interior walls that extend to underside of structure above. Others terminate approx. 200mm below ceiling.

SAWREY
CONSULTING ENGINEERS
CIVIL ▲ STRUCTURAL ▲ FOUNDATIONS
92 Queens Drive PO Box 30-444 Lower Hutt
Telephone Bus (04)566 1483 Fax (04)566 9118
Email info@sawrey.co.nz

CLIENT:

Hutt City Council

REVISIONS:

REV No.	DATE.	
0	19.12.14	(Original) For Building Consent

CHECK ALL DIMENSIONS ON SITE

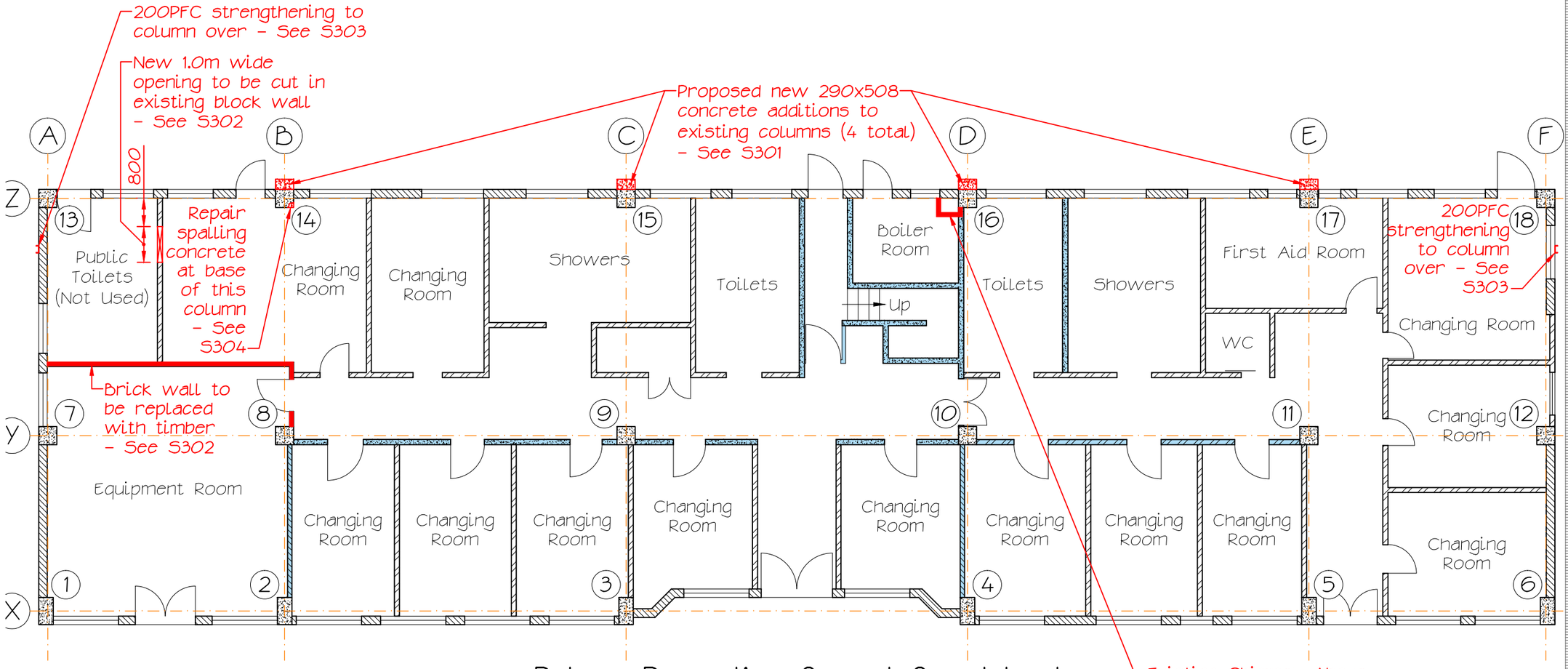
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Petone Recreation Ground Grandstand
34% NBS Seismic Strengthening
Ground Floor Plan (Existing)

DRAWN:	D.M.S.
CHECKED:	G.R.S.
APPROVED:	
DATE:	19:12:14
SCALE:	1:125
JOB NO:	8757

DWG.NO. 8757

SHEET NO. S101 IN SET OF



Petone Recreation Ground Grandstand
Ground Floor Plan (Proposed)

1:125

KEY

240mm Brick	150mm Concrete
120mm Brick	100mm Timber
140mm Block	(1) Column Numbers

Interior walls that extend to underside of structure above. Others terminate approx. 200mm below ceiling.

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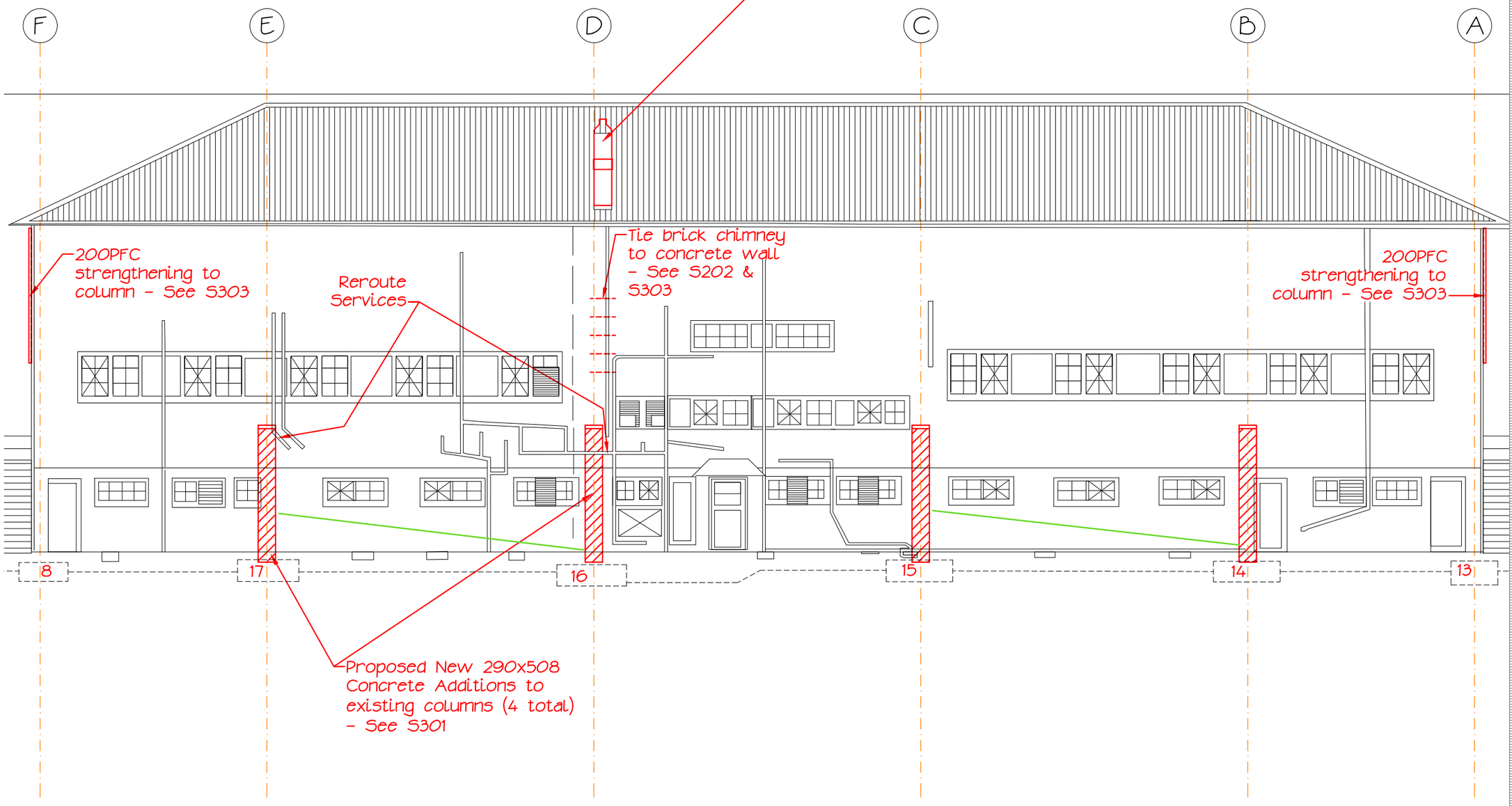
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Petone Recreation Ground Grandstand
34% NBS Seismic Strengthening
Ground Floor Plan (Proposed)

DRAWN:	D.M.S.
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APPROVED:	
DATE:	19:12:14
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JOB NO:	8757

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SHEET NO. S102 IN SET OF



Back (West) Wall Elevation

Approx. 1:125

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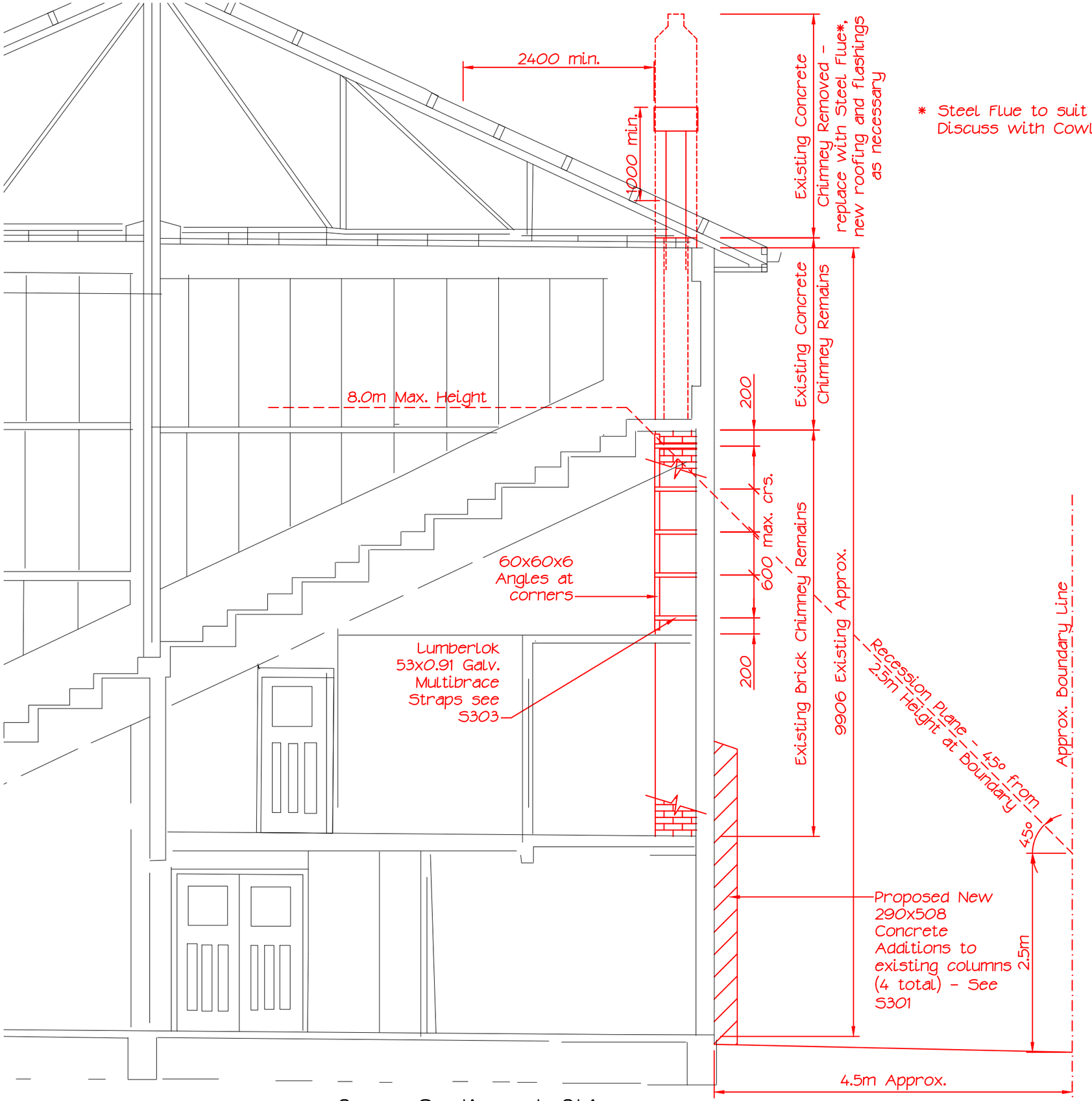
Petone Recreation Ground Grandstand 34% NBS Seismic Strengthening

Elevations

DRAWN:	D.M.S.
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APPROVED:	
DATE:	19:12:14
SCALE:	Approx. 1:125
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DWG.NO. 8757

SHEET NO. S201 IN SET OF



Cross Section at Chimney
Approx. 1:50

* Steel Flue to suit boiler requirements. Discuss with Cowley Services Ltd.

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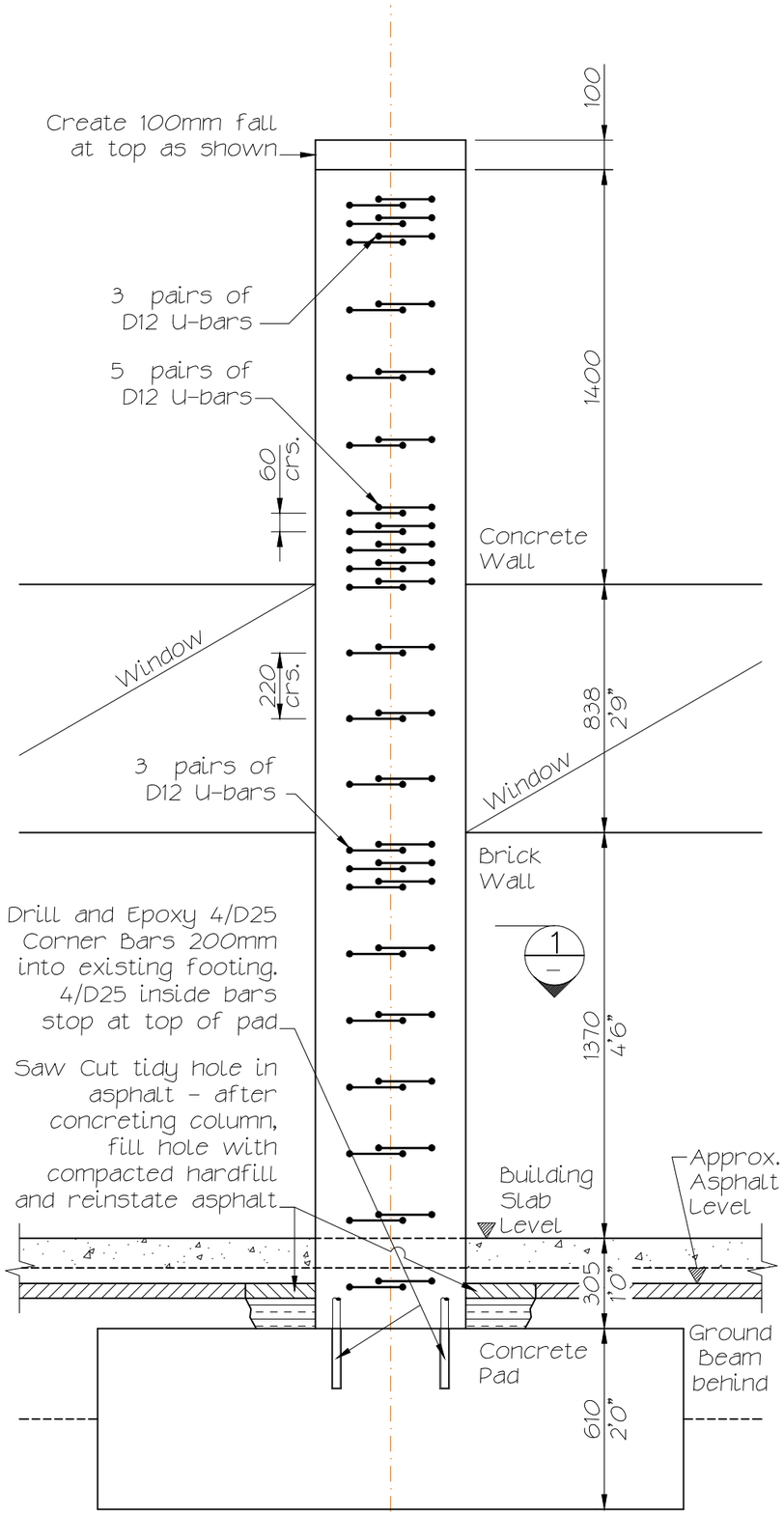
Petone Recreation Ground Grandstand 34% NBS Seismic Strengthening

Cross-Sections

DRAWN:	D.M.S.
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APPROVED:	
DATE:	19:12:14
SCALE:	Approx. 1:50
JOB NO:	8757

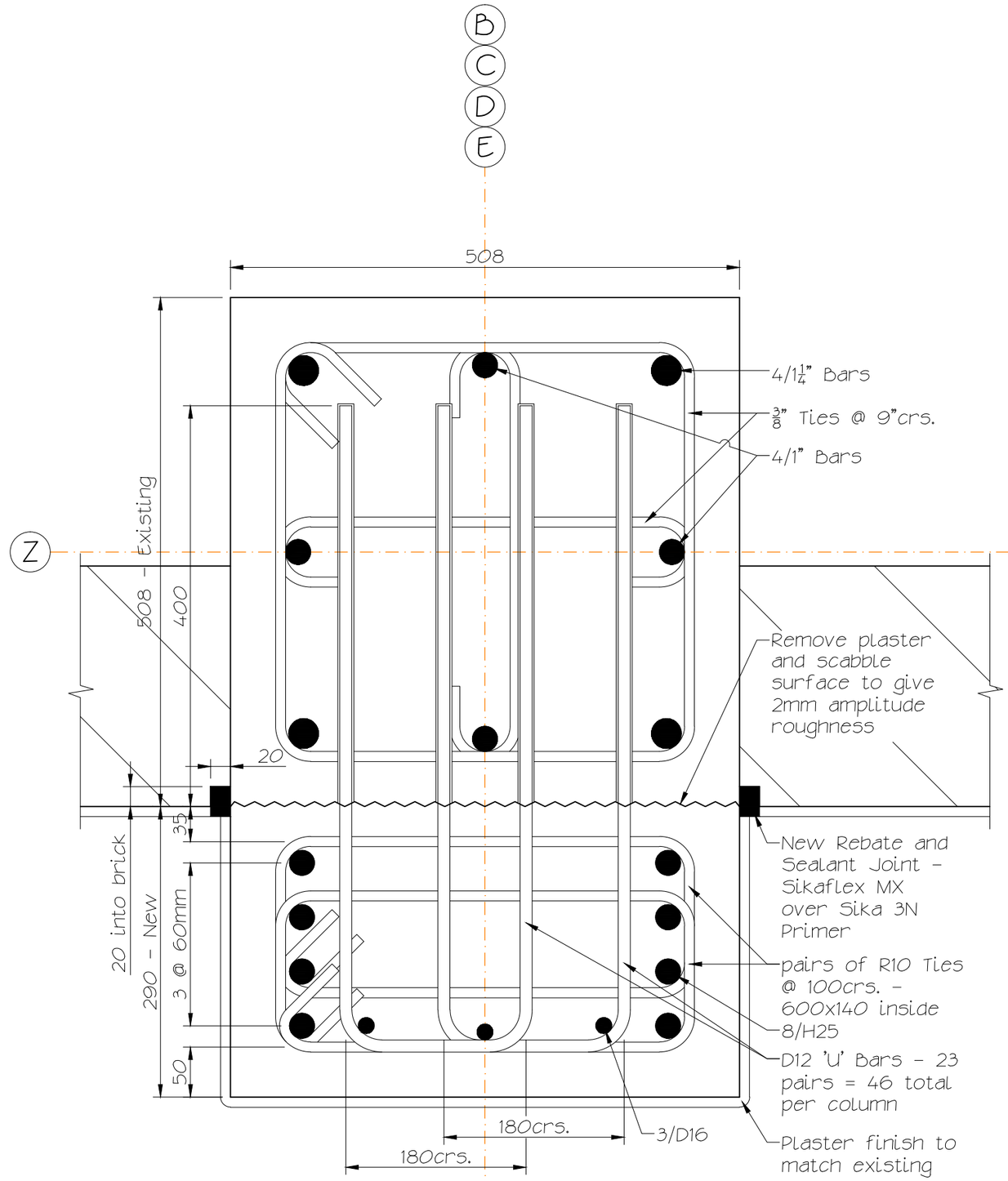
DWG.NO. 8757

SHEET NO. S202 IN SET OF



Elevation of Addition to Existing Columns Along Back (West) Wall (4 Total – Columns 14, 15, 16 & 17)

1:20



Section 1/— 1:5

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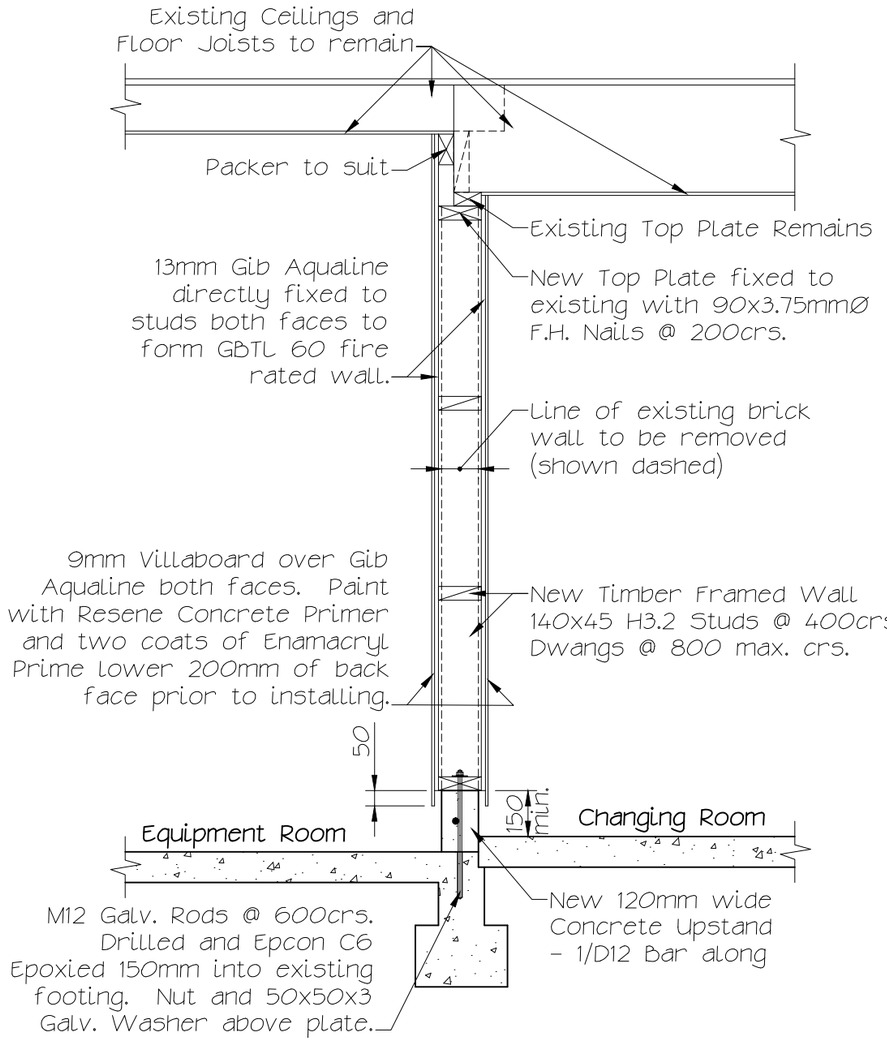
Petone Recreation Ground Grandstand 34% NBS Seismic Strengthening

Structural Details

DRAWN:	D.M.S.
CHECKED:	G.R.S.
APPROVED:	
DATE:	19:12:14
SCALE:	as shown (A3)
JOB NO:	8757

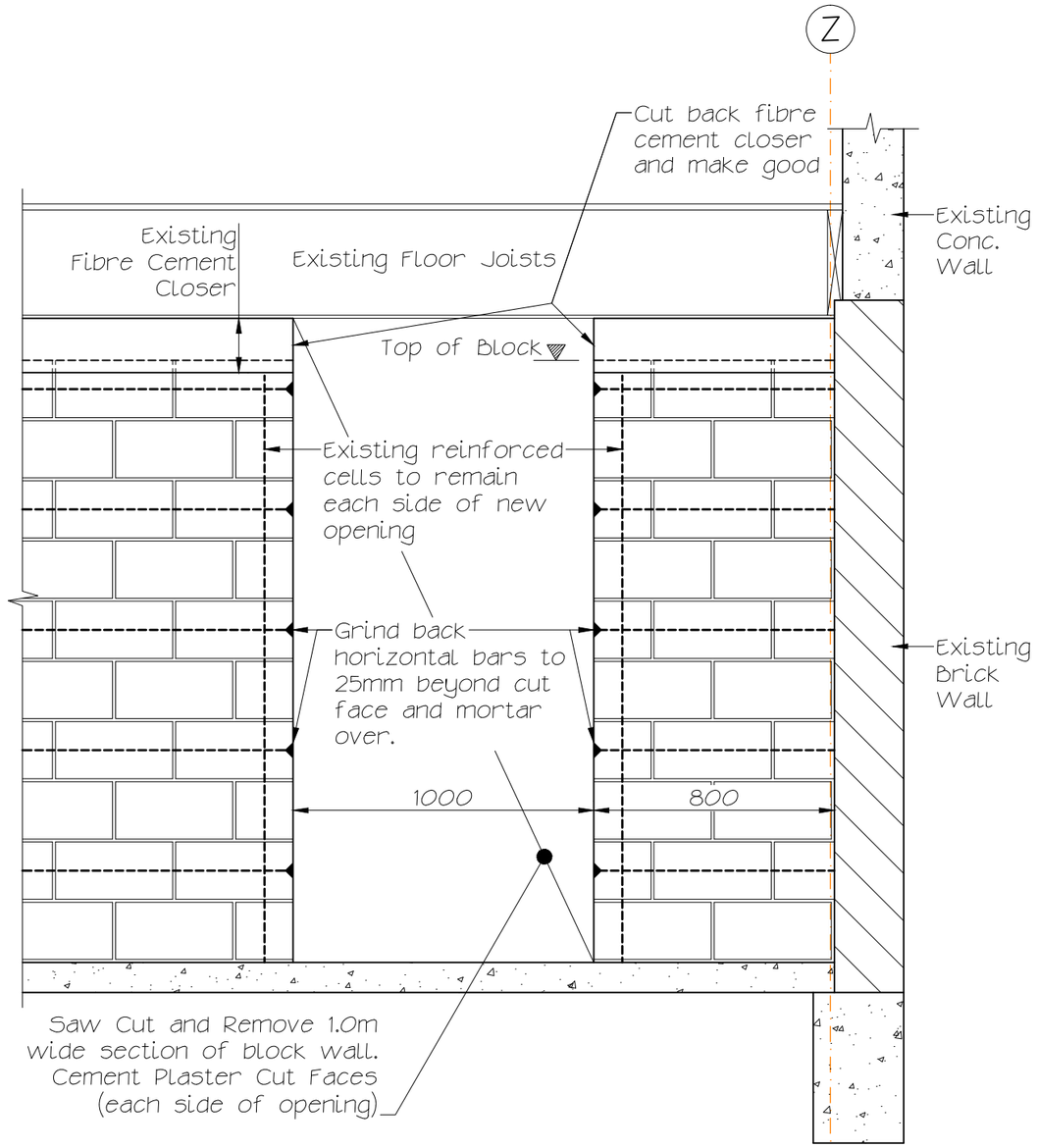
DWG.NO. 8757

SHEET NO. S301 IN SET OF



Detail of Proposed New Wall Where Brick Wall Removed Between Equipment Room and S.W. Changing Room

1:20



Elevation of Proposed New Opening Between S.W Public Toilets and S.W. Changing Room

1:20

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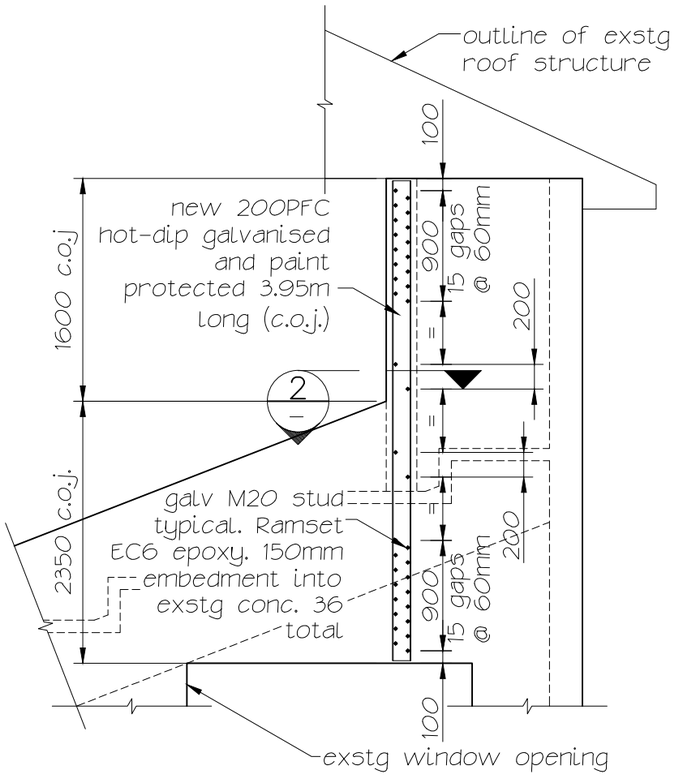
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Structural Details

DRAWN:	D.M.S.
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APPROVED:	
DATE:	19:12:14
SCALE:	1:20
JOB NO:	8757

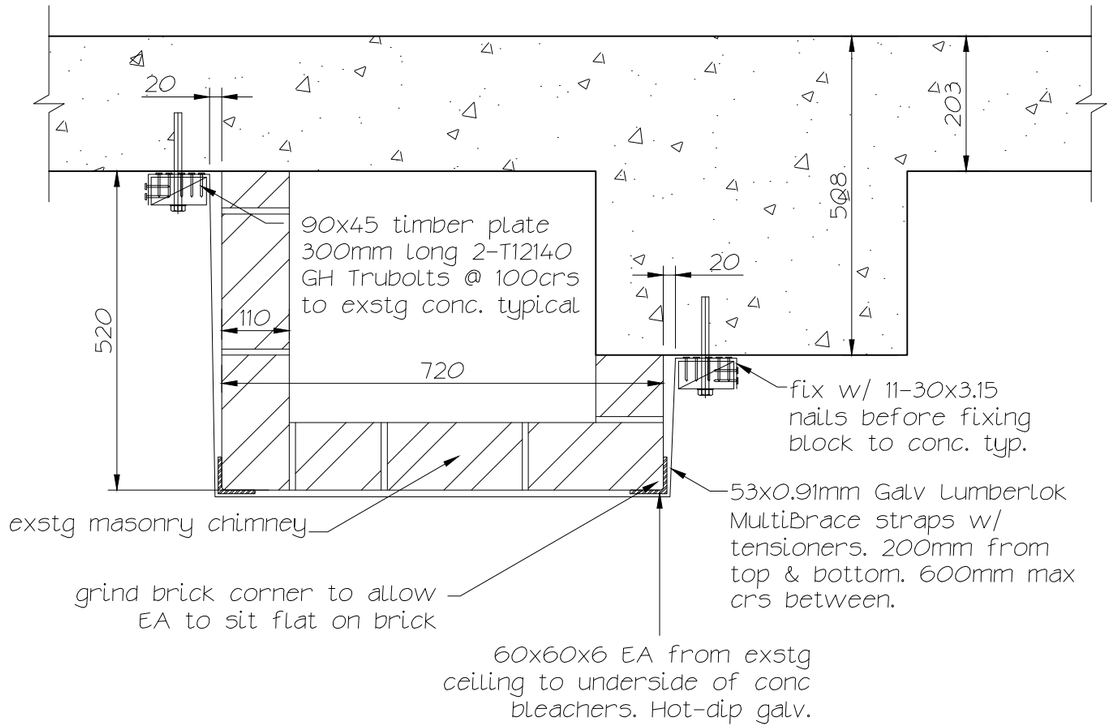
DWG.NO. 8757

SHEET NO. S302 IN SET OF



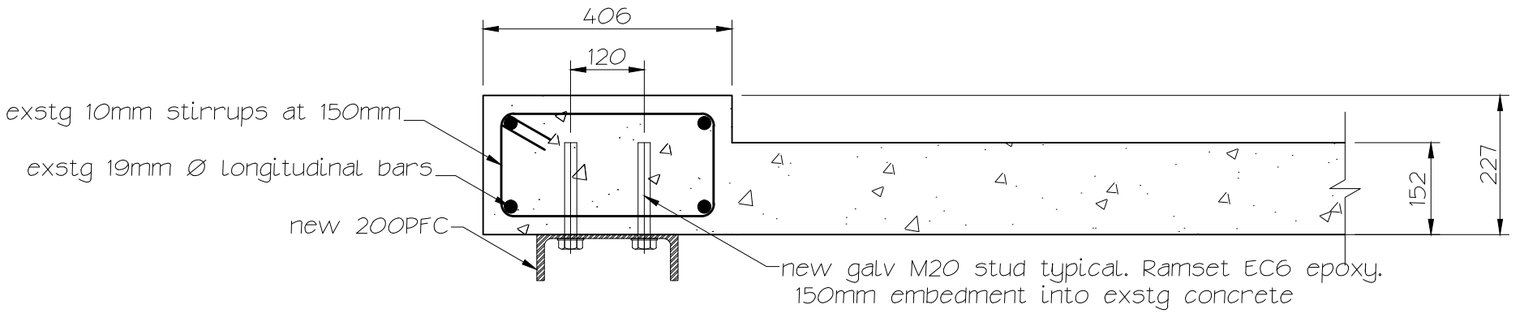
Part North Wall Elevation

1:50



Brick Chimney Detail Between First Floor Ceiling and Underside of Concrete Bleachers

1:10



Section 2 — 2

1:10

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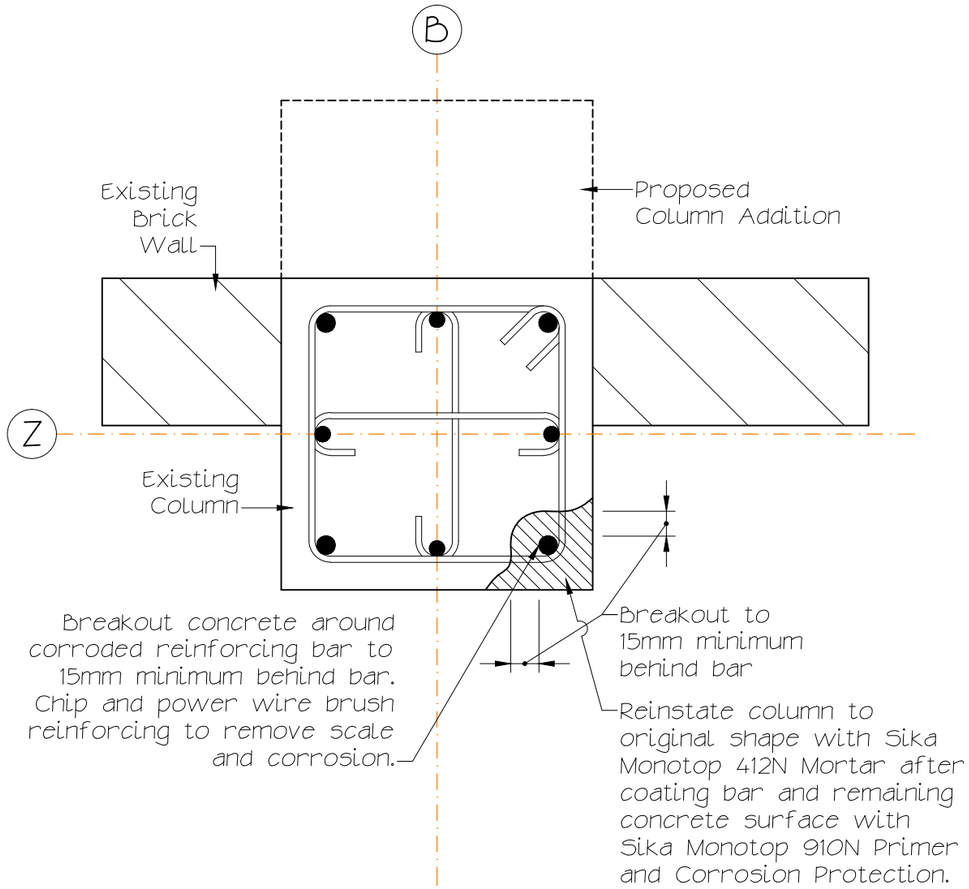
Petone Recreation Ground Grandstand 34% NBS Seismic Strengthening

Structural Details

DRAWN:	D.M.S.
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DATE:	19:12:14
SCALE:	as shown (A3)
JOB NO:	8757

DWG.NO. 8757

SHEET NO. S303 IN SET OF



Repair to Concrete at Base of Column 14

1:10

South West Changing Room - Ground Floor

Expected area of repair will extend from ground floor slab to approx. 800mm above slab.

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Petone Recreation Ground Grandstand 34% NBS Seismic Strengthening

Structural Details

DRAWN:	D.M.S.
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APPROVED:	
DATE:	19:12:14
SCALE:	1:10
JOB NO:	8757

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SHEET NO. S304 IN SET OF

PETONE RECREATION GROUND GRANDSTAND **Project 8757**
16N UDY STREET, PETONE.

Seismic strengthening to 34%NBS

Structural Notes

General

G1 Structural Drawings:

G1.1 Read these drawings in conjunction with all consultants' drawings and specifications and with other written instructions. Any discrepancy shall be referred to the Engineer and be resolved before work proceeds.

G1.2 Sawrey Consulting Engineers Ltd has designed these structural items in accordance with Section B1, (excluding B1.3.3(i), (k), (r), B1.3.5, B1.3.6, & B1.3.7) of the Building Regulations 1992, using B1VM1 of the NZ Building Code Handbook. This design excludes the effects of liquefaction, ground rupture & similar effects. Where moisture barrier membranes or systems are shown on these SCE drawings, they are indicative and are intended to be supplementary to specific design details supplied by others.

G1.3 All materials and workmanship shall be in accordance with the New Zealand Building Code.

G1.4 This engineering design is specific to this project. It is supplied on the proviso that all construction on this project shall be carried out, or fully supervised and checked, by experienced, qualified tradespersons whose qualifications are current.

G1.5 Unless noted otherwise, all levels are in metres and all dimensions are in millimetres

G1.6 The Engineer's drawings shall not be scaled for dimensions.

G1.7 Unless specifically noted, compliance of the drawings to non-specific codes such as NZS 3604 and NZS 4229 has not been checked by Sawrey Consulting Engineers Ltd.

G1.8 This structural design does not cover stability or suitability of the site, nor does it cover temporary works or propping.

G2 Shop Drawings

G2.1 The contractor shall measure the site and shall supply any shop drawings he requires.

G2.2 Shop drawings are to be prepared based on the most current structural drawings.

G2.3 If during this site measure, or for any reason, an anomaly is found, the contractor shall advise the Engineer of the detail, before commencing shop drawings. No extras will be paid for reworking of shop drawings as a result of discrepancies between structural drawings site measurements.

G2.4 All dimensions shown shall be verified by the Builder on site.

G3 Temporary Support

G3.1 During construction, maintain a safe and stable structure and neighbouring structures. Overstress no element. Provide temporary bracing and temporary propping, to keep the works and excavations stable at all times. Temporary bracing and propping is the sole responsibility of the contractor. Propping of adequate strength and stiffness shall be provided to ensure that the propped element remains plum and level during construction.

G4 Design Loads:

G4.1 The structural components detailed on these drawings have been designed in accordance with the New Zealand Building Code and AS/NZS1170.

G4.2 The unfactored design ultimate limit state wind speed is **44m/s**.

G4.3 Supply structural calculations, shop drawings and producer statement(s) PS1, PS3 & PS4 for items such as proprietary roof trusses, windows and nominated structural components, to the New Zealand Building Code and AS/NZS1170.

G4.4 In addition to code requirements, the maximum calculated mid-span deflection of a proprietary member subject to design in G4.3, in any serviceability limit state shall be L/400, where L is the span (or a shorter line crossing the member, between fixed building elements).

G4.5 Ensure that lintels & beams shown on the structural/architectural drawings are appropriate to support proprietary systems. The shop drawings shall show imposed loads, by the proprietary system on the supporting structure and all fixings.

Monitoring and Inspecting Construction

MS1 Sawrey Consulting Engineers has been engaged by the applicant or the owner to carry out construction monitoring of the items that it has designed. Construction monitoring by the engineer is intended as CM2 as given in "Briefing and Engagement of Consultants (IPENZ/ACENZ) for structural items shown on this drawing set.

MS2 First, provide the engineer with a copy of the Building Consent prior to engineer's inspections. Supply other consents as required.

MS3 The builder shall provide adequate, safe access to allow full inspection and shall check his own work. Then the Engineer (and other relevant authorities) shall be called to inspect the following items for approval before covering over. Tel (04) 566-1483 (One days notice please)

- **Following scabbling of existing columns prior to reinforcing and boxing.**
- **During drilling of columns prior to epoxy fixing of U bars.**
- **Reinforcement prior to completion of boxing for concrete strengthening to columns and nib at timber framed wall.**
- **Structural steelwork on completion and while suitable safe access is available.**
- **Epoxy anchors are to be inspected and may be subject to load testing.**
- **Timber framing to wall at equipment room prior to lining.**
- **Prior to saw cutting opening in wall between SW changing room and public toilet.**
- **Following preparation at repair of column 14.**
- **On completion of all work.**

MS4 The Engineer is available to provide technical interpretation of the plans and specifications. If in doubt, ask.

MS5 The council should be invited to inspect and approve all items associated with the building consent before covering over.

MS6 Items such as tanking and the dpm are not part of the structural design. Call the building inspector / designer to inspect.

MS7 After completion of the construction, the builder shall provide to the Engineer, a producer statement (PS3), certifying he has completed all of the building works shown on these engineering drawings and the specification. The sixth schedule of NZS 3910:2003 is an approved PS3 format.

Concrete

C1 Concrete Standards

C1.0 All workmanship and material shall be in accordance with the New Zealand Building Code and:

NZS 3101: 2006	Concrete Structures Standard	Pts 1 & 2
NZS 3104 :2003	Concrete production	
NZS 3105 :1986	Concrete mixers (batch type and truck type).	
NZS 3109 :1997	Concrete construction.	
NZS 3112 :1986	Methods of test for concrete.	
NZS 3113 :1979	Chemical admixtures for concrete.	
NZS 3114 :1987	Concrete surface finishes.	
NZS 3121 :1986	Water and aggregate for concrete.	
NZS 3122 :1995	Portland and blended cements (General and special purpose).	
ASTM C 171-2003	Sheet materials for curing concrete.	
NZQA unit standard 12019 – Carry out routine tests on concrete.		

C2 Concrete Materials

C2.1 Concrete quality and strengths shall be as below and shall be from a plant with a current 'Certificate of Audit'.

C2.2 Refer to the table for concrete strengths, f'c = 25 MPA.

C2.3 Unless noted otherwise the maximum aggregate size shall be 19mm

C2.4 Slump during placing shall be consistent and within the tolerances specified in Table 9 of NZS 3109.

C2.5 Water may be added to the delivered concrete only by the concrete supplier within the restriction provided in 2.9.3.1 of NZS 3104.

C2.6 No admixtures shall be used in concrete unless approved in writing. Chemical admixtures shall comply with AS 1478.

C2.7 The selection, proportioning and mixing of the concrete materials shall be such as to produce a mix which works readily into corners and angles of the forms, and around reinforcement, bur without permitting the material to segregate or excess free water to collect on the surface.

C2.8 In addition to testing in accordance with NZS 3104, representative samples of fresh concrete shall be taken on site in accordance with NZS 3112: Part 1 for compression strength testing and slump for every $50m^3$ of concrete. Each compression test shall comprise four samples, one tested at 7 days and three tested at 28 days.

C2.9 Personnel conducting tests shall have satisfied the requirements of NZQA unit standard 12019 or testing shall be done by an INZ accredited laboratory.

C3 Concrete Construction

C3.1 The workmanship shall conform to the best modern trade practice and shall conform in every respect with NZS 3109.

C3.2 The concrete work shall be under the control of a responsible foreman (suitably qualified contractor's representative) who shall be on the site whenever concrete is being mixed, transported or placed. The concrete shall be produced, placed, compacted, finished and cured by experienced and competent concrete workers who shall produce quality work that conforms with the specified standard of surface finish and which has a surface that is plumb and true and within the specified tolerances.

C3.3 The finished concrete shall be a dense homogenous mass, completely filling the formwork, thoroughly embedding the reinforcement and free of stone pockets.

C3.4 All concrete, including slabs on ground and footings, shall be compacted with mechanical vibrators.

C3.5 Concrete shall not be placed when the ambient temperature exceeds $27^{O}C$. For ambient temperatures above $25^{O}C$, reinforcement shall be cooled in water.

C3.6 Maximum area of floor to be poured at any one time shall have a 21m diagonal.

C3.7 Take care to control cracking of concrete slabs with: diagonal bars across un-jointed re-entrant corners; place sawn joints at 5 m max crs; 19 mm aggregate size; cure by keeping constantly wet & protected from sun and drying winds for 7 days; do not pour concrete when frost or severe temperature drops are expected.

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Petone Recreation Ground Grandstand

Seismic Strengthening to 34%NBS
Notes

DRAWN:	D.M.S.
CHECKED:	G.R.S.
APPROVED:	G.R.S.
DATE:	19.12.14
SCALE:	N/A
JOB NO:	8757

DWG.NO. **8757**

SHEET NO. **S401** IN SET OF O

C3.8 Cure slabs by keeping them constantly wet & protected from sun and drying winds for 7 days; keep damp for another 7 days. Refer also to clause 3.6 of NZS 3101: Part 1: 2006.
C3.9 Sawn joints 3mm–5mm wide by T/4 deep, are to be constructed as early as possible before random cracking can occur, but after the concrete has hardened sufficiently to prevent ravelling or tearing of the surface under the action of the saw, with 24 hours being the latest time after placement for sawing.
3.10 Early entry saw cuts may be adjusted if authorised. These shall be created within 2-5 hrs after finishing . The saw cutting equipment shall be on site prior to completion of concreting. Advise Engineer. The depth of the cut shall be the greater of 25mm or one eighth of the slab thickness.
C3.11 Co-ordinate and insure the correct positioning and sizing of penetrations through concrete and blockwork for stormwater, sewerage, mechanical ventilation, water supply, electrical supply and telecoms.
C3.12 Clean and scabble concrete surfaces prior to next pour.
C3.13 Unless noted otherwise, cover to reinforcing steel to be 50mm formed sides and top, 75mm cover at bottom and sides poured against earth. Refer to the table:

Exposure Classification	Concrete Grade	Cast Against Ground	Cast in Forms and Exposed	Cast in Forms Not Exposed	Clear Cover to Beams and Columns
Internally (A1)	20 to 25	75mm	50mm	30mm	40mm
Externally (B1)	30	75mm	50mm		40mm

C3.14 All reinforcement shall be firmly supported on plastic chairs or concrete chairs at not greater than 1m centres both ways.
C3.15 Bars shall be tied at alternate intersections.
C3.16 Concrete sizes shown do not include thickness of applied finishes.
C3.17 For chamfers, drip grooves, reglets, etc refer to Architects details. Maintain cover to reinforcement at these details.
C3.18 Holes, chases or embedment of pipes shall not be made in concrete members without the prior written approval of the Engineer.
C3.19 Construction joints, where not shown, shall be located to the approval of the Engineer.
C3.20 Conduits, pipes etc, shall only be located in the middle one third of slab depth and spaced at not less than 3 diameters.
C3.21 All exposed corners of concrete shall be chamfered 20mm UNO.
C3.22 For surface finishes refer to NZS3114:1987 and the following table.

Class	Description	
F1	Surfaces where roughness is not objectionable. No surface treatment is required other than filling tie holes and repair of defective concrete. Colour variations and certain physical irregularities permitted.	
F2	Surfaces which provide a key for plaster and other thick surfaces.	
F3	All permanently exposed surfaces smooth or textures which are not prominent or subject to close or frequent scrutiny.	
Class	**Finish**	**Technique**
U1	Screeded	Hand saw motion with straightedge or mechanical vibrating screed.
U2	Floated	Wood or bull float, or both. Generally manual but power driven equipment may be used.
U3	Trowelled	Manual or mechanical steel trowelling of floated finish after the concrete is sufficiently hardened, to prevent excess fine material and water being worked to the surface, may be done in one or two stages.
U4	Shallow Textured	Hard or soft bristled brooms.

C4 Monitoring Concrete Construction
C4.1 Advise the Engineer in writing the name of the Contractor's suitably qualified representative responsible for quality control.
C4.2 Store quality control records on site for inspection at any time.
C4.3 Upon works' completion, provide the Engineer with a PS3 statement that work has been conducted by suitably qualified persons, and in accordance with the drawings, specification and contract instructions. Refer to note MS7.
C4.4 In terms of NZS 3109 the Construction Reviewer is the Engineer, who shall be given at least 24 hours notice for reinforcement inspection and concrete shall not be delivered until final approval has been obtained for the reinforcement.

C5 Repairs to concrete column (Column 14)
C5.0 All workmanship and material shall be in accordance with the New Zealand Building Code:
C5.1 Repairs to the concrete column are to be done in accordance with the drawings
C5.2 Repair products to be used are:
Sika Monotop – 910 N Bonding Primer & Reinforcement Corrosion Protection
Sika Monotop – 412N Structural Repair Mortar
C5.3 These products are to be used in accordance with the Sika Product Data Sheets.
C5.4 Work is to be carried out by personal experienced in concrete repair.
C5.5 Engineer to inspect as outlined in section MS3 above.

Reinforcing Steel

R1 Reinforcing Steel Standards
R1.1 All reinforcing is to comply with:
AS/NZS 3679.1:2010 Hot rolled structural steel bars and sections.
AS/NZS 4671: 2001 Steel reinforcing materials
AS/NZS 4680: 1999 Hot-dip galvanised (zinc) coatings on fabricated ferrous articles

R2 Reinforcing Steel Materials
R2.1 Reinforcing steel shall be seismic grade "Seismic" 300E unless noted otherwise, sourced from Pacific Steel.

300E Grade reinforcing marks



R2.2 Grade "Seismic" E500 steel shall be marked micro-alloy and sourced from Pacific Steel.



Figure 1. A Pacific Steel Grade 500, Ductility Class E, Micro-Alloyed Reinforcing Bar.



Figure 2. A Pacific Steel Grade 500, Ductility Class E, Quench and Tempered Reinforcing Bar.


Figure 3. A Pacific Steel Grade 500, Ductility Class E, Plain Bar. (All Pacific Steel Plain Bar is Micro-Alloyed. More explicit markings cannot be rolled into the bar without detrimentally affecting the forming characteristics of the bar.

Bars marked "500E MA" in fig. 1 may be accepted. Bars marked "500E QTR" in fig. 2 will be rejected, unless authorised in writing by the engineer for non-seismic applications such as most slabs on ground. Plain 500E bars marked as in fig 3 will be accepted.
R2.3 The contractor will be required to provide evidence that the reinforcing being used meets the above gradings. Where evidence is not provided the bars may be rejected.
R2.4 D12 denotes deformed reinforcement grade 300E.
H12 denotes deformed reinforcement grade 500E.
HR12 denotes round reinforcement grade 500E.
R2.5 Reinforcing bars are designated thus: 12 H16 -150 T&B
All reinforcing steel shall comply with NZS3402 Grade 300E
Prefix H denotes high yield deformed bars (grade 500E)
Prefix D denotes deformed bars (grade 300E)
Prefix R denotes plain bars (grade 300E)
Thus:
12 = Number of bars
H = Round (R or D, H, HR)
16 = Bar diameter in millimetres
150 = Spacing of bars in millimetres
T&B = Top and bottom steel (T&B or B, T, EF, NF, FF, EW)
R2.6 Where wire mesh is shown on the drawings it shall be Ductile 500E. Acceptable alternatives are:
(i) Wireplus SE62 Plus, SE73DE Plus, or SE73LDE Plus, "Ductile Plus 500E Mesh" or
(ii) Hurricane SE62 or SE 62 res "Seismic SE mesh", or
(iii) Eurosteel 500E SE 615 500 "Xtra-Ductile mesh".

R3 Reinforcing Steel Construction
R3.1 The reinforcement shall be fabricated and placed by experienced and competent workers who shall produce quality work in which the reinforcement conforms with the shapes and sizes shown on the drawings and is fixed within the specified tolerances.

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Petone Recreation Ground Grandstand
Seismic Strengthening to 34%NBS
Notes

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Reinforcing Laps

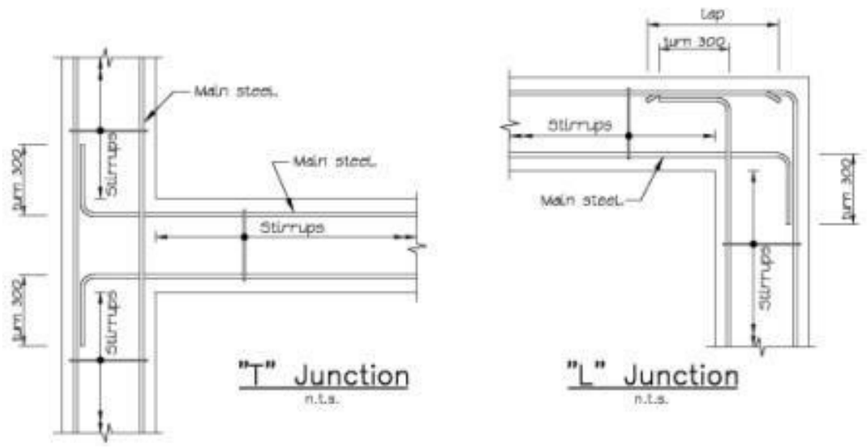
R3.2 Lap all edge beam reinforcing at all corners, intersections and as required on the drawings. See tables of standard laps in concrete and separate table of laps in masonry.

R3.3 For laps in concrete refer to the table UNO.

Lap Lengths for Deformed Steel in Concrete			Lap Lengths if more that 300mm of fresh concrete is cast below bar, for Deformed Steel		
Bar Dia.	Grade Seismic 300E Lap Length 35D	Grade Seismic 500E Lap Length 60D	Bar Dia.	Grade Seismic 300E Lap Length 45D	Grade Seismic 500E Lap Length 80D
10	350	600	10	450	800
12	420	720	12	540	960
16	560	960	16	720	1280
20	700	1200	20	900	1600

R3.4 Laps for plain round bars in concrete shall be twice those listed above.

R3.5 Corner steel to extend 52 bar diameters away from the corner. UNO corner reinforcement shall be as shown:



R3.6 The following types of lap are to be used.

R3.7 Parallel lap – typical for walls and slabs unless detailed otherwise.

R3.8 Offset lap – typical for beams and columns unless detailed otherwise.

R3.9 Lap all mesh sheets 350mm at sides and edges. H.R.C mesh is to be lapped as follows:

R3.10 Lapped circular or spiral reinforcing.
Circular hoops or spirals shall not be lap spliced but laps may be achieved by either welding on to the previous turn, refer to "welding of reinforcement" or alternatively by an extra half turn of spiral and a standard 135 deg. hook.

R3.11 Masonry lap lengths:

Masonry Lap Lengths Seismic 300E Steel		Masonry Lap Lengths Seismic 500E Steel	
Bar Dia, 300	Lap Length, 40d	Bar Dia, 500E	Lap Length, 70d
D 10	400	H 10	700
D 12	480	H 12	840
D 16	640	H 16	1120
D 20	800	H 20	1400
D 25	1000	H 25	1750

Note: Horizontal laps increase by x1.3 if there is no expansive admixture in the grout.

Reinforcing Bend Diameters

R3.12 Minimum diameters of bend shall be 50 mm for 10 mm rods, 60 mm for 12 mm rods, 80 mm for 16 mm rods and 100mm for 20 mm rods – refer to the table.

R3.13 Standard Reinforcing Hooks and Bends

R3.14 The following are the minimum former pin diameter "PD" for bending reinforcing bars, refer diagram above.

	MINIMUM RECOMMENDED BEND (PIN) DIAMETER								
	Bar Diameter								
Rebar Type	**6**	**10**	**12**	**16**	**20**	**25**	**28**	**32**	**40**
Plain bars	30	50	60	80	100	150	170	200	240
Deformed Bars	30	50	60	80	100	150	170	200	240
Plain bars (Stirrups and ties)	20	20	30	40	40	80	-	-	-
Deformed Bars (Stirrups and Ties)	30	40	50	70	80	150	-	-	-

R3.15 Note: In the case of stirrups and ties
(i) Minimum bend diameters for deformed bars are twice those for plain round bars.
(ii) Where the main bar size is greater then the minimum former pin diameter the main bar size will govern.

Trimmer Bars Around Wall And Slab Openings, Ducts and Penetrations.

R3.16 Unless detailed otherwise the following reinforcing is to be used for all penetrations greater than 200mm in size.

Wall or Slab Thickness	Trimmer Reinforcing
100 or 125	1-D16 central
150	1-D20 central
200	2-D16
250	2-D20

Reinforcing Spacing

R3.17 Except in columns minimum bar spacing shall be the greater of bar diameter or 25mm.

R3.18 In reinforced columns the clear space between longitudinal bars shall be not less than 1.5 bar diameters nor 40mm.

R3.19 The clear distance between horizontal layers shall be maintained by using spacer bars of the same diameter as the largest beam bar and spaced not further than 1500 apart.

Welding of Reinforcing

R3.20 The welding of Seismic 300E Grade steel reinforcement may permitted only with the engineer's approval. The welding of Seismic 500E grade steel is not permitted.

R4 Monitoring Reinforcing Steel Construction

R4.1 The Engineer shall be given at least 24 hours notice for reinforcement inspection and concrete shall not be delivered until final approval has been obtained for the reinforcement.

Structural Steelwork

S1 Structural Steelwork Standards

S1.1 All work must comply with the NZ Building Code and:

AS/NZS 3679.1: 1996	Structural steel - Hot-rolled bars and sections.
NZS 3404: 1997	Steel structures standard.
NZS 4711: 1984	Qualification tests for metal-arc welders
NZS 4781: 1973	Safety in welding and cutting.
AS/NZS 1554	Structural steel welding
AS/NZS 1554.1: 2004	Part 1: Welding of steel structures
AS/NZS 1554.2	Part 2: Stud Welding (steel studs to steel)
AS/NZS 1554.4	Part 4: Welding of high strength quenched and tempered steels
AS/NZS 1554.5	Part 5: Welding of steel structures subject to high levels of fatigue loading
AS/NZS 1594: 2002	Hot-rolled steel flat products
AS/NZS 1595: 1998	Cold-rolled, unalloyed, steel sheet and strip.
AS 1627.4: 2002	Abrasive blast cleaning
AS/NZS 2312:2002	Protection of structural steel against atmospheric corrosion by the use of protective coatings
AS/NZS 3679.1: 1996	Structural steel - Hot-rolled bars and sections.
AS/NZS 3750.15: 1998	Paints for steel structures - Inorganic zinc silicate paint
AS/NZS 4600: 1996	Cold-formed steel structures.
AS/NZS 4680: 1999	Hot-dip galvanized coatings
AWS C2 18-93	Protection of steel with thermal sprayed coatings of aluminium and zinc.

S2 Structural Steelwork Materials

S2.1 All materials shall be the best of their respective types and shall be free from all defects. The materials shall conform in every respect with the above specified standards.

S2.2 Steel and sections shall conform to NZS 3401 Hot-rolled Sections. Cold rolled steel sections shall conform to AS/NZS 4600 Cold-formed Steel Structures. All other components such as nuts, bolts,

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Petone Recreation Ground Grandstand

Seismic Strengthening to 34%NBS
Drawing Issue

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washers and screws shall conform to the requirements of NZS 3404 Steel Structures Standard.

S2.3 If asked, provide in writing of the country of origin, the name of the manufacturer, and the specification to which the materials conform, and when requested, provide test certificates that prove that the materials conform to the specified standards.

S3 Structural Steel Construction

S3.1 The work quality, fabrication, erection and tolerances shall conform to the best modern practice and shall conform in every respect with the NZS 3404 Steel Structures Standard.

S3.2 The work shall be performed by experienced, competent and certificated tradeworkers, who shall produce quality work that when completed is free from all defects and is plumb and true.

S3.3 Shop drawings are to be supplied by the contractor for approval by the Engineer, prior to the fabrication of steelwork. Refer to Note G2.

S3.4 The approval by the Engineer shall not remove the responsibility from the contractor for the accuracy of his shop drawings. The contractor shall accurately measure the project as it proceeds to confirm dimensions for the fabrication of steelwork. If during this site measure, or for any reason, an anomaly is found, the contractor shall advise the Engineer of the details.

S3.5 The structural steel worker shall attend a meeting organised by the Contractor prior to erection.

S3.6 Check all dimensions on site prior to fabrication of steelwork

S3.7 The erected tolerances of all structural steelwork shall conform to NZS 3404 clause 15.3 Tolerances.

S3.8 In addition to the above requirements the standard of tolerance on dimensions shall be such that components can be joined without straining and attachments, finishes, and equipment can be installed accurately as specified and as shown on the drawings.

S3.8 All steelwork is to be hot dip galvanised as specified below**.**

S3.9 Refer to notes on bolting and welding.

S3.10 Not all implied details are shown on the drawings. Eg. - Timber shall be bolted to steel with M12 bolts at 600 mm crs UNO.

S4 Structural Steel Monitoring

S4.1 The Engineer shall be called to inspect structural steelwork edge preparation to butt welds before welding and structural steelwork before enclosure.

S4.2 Shop fabricated steel shall be subject to a non-destructive testing programme in accordance with the standard, for which records may be required by the engineer.

S4.3 The Engineer shall have the right to reject at any stage of fabrication, any steel showing defects such as laminations, cracks, surface flaws or severe surface pitting which, in his opinion, would render the steel unsuitable for welding, fabrication or service.

PC Protective Coatings to Steelwork

Either 1 Hot-dip Galvanizing. The steelwork shall be abrasive blast cleaned to a Class 2 finish to conform with the requirements of AS 1627 part 4 and then hot-dip galvanized to produce a galvanized coating to conform with the weight and thickness requirements in Table 1 of AS/NZS 4680. System designation HDG600.
Reprotect hot dip galv steel with multi layer epoxy paint system nominated below.

Or 2 Thermal Zinc Arc Spray. Where thermal zinc arc spraying is specified or shown on the drawings the steelwork shall be abrasive blast cleaned to a Class 2.5 finish to conform with the requirements of AS 1627 Part 4.
Before there is any deterioration of the cleaned surface, apply by thermal zinc arc spray a coating of 99.99% pure zinc to produce a coating thickness of 150 microns as determined by AS 3894.3 Site Testing of Protective Coatings - Determination of Dry Film Thickness. System designation TSZ150.
Validate the adhesion of the sprayed metal by using the band test as defined in AWS C2 18-93.
Apply a seal coat of aluminium vinyl within 24 hours of metal spraying or reprotect to Resene recommendation eg given below.
All defects and damage shall be made good immediately.
Reprotect thermal zinc arc spray steel with multi layer epoxy paint system nominated below.

Reprotection of Hot dip galvanizing and thermal zinc arc sprayed steel.

Apply 175µm dry film thickness of Resene Alumastic high build epoxy to galvanized steel. DRY FILM THICKNESS SHALL BE MEASURED AND CONFIRMED by Resene paint supplier or laboratory prior to steel being delivered to site.

B Bolting

B1 Contact surfaces at bolted connections shall match accurately and shall be free from dirt, loose scale, burrs, pits and other defects.

B2 Unless otherwise shown on the drawings, the maximum size of the holes for bolts shall be the diameter of the bolt shank plus 2 mm. All bolts shall be fully tightened.

B3 Bolt threads shall not lie within the thickness of the parts being bolted together and the length of the bolt shall be adjusted accordingly to conform with this requirement.

B4 All bolts shall be galvanised Grade 4.6 unless noted otherwise. Check bolt heads and nuts comply with those specified on drawings. Bolts marked 8.8 on the head are not to be used UNO.

B5 All bolts shall be fitted with appropriate washers.

B6 Hot dip galvanize 85µm DFT all steel hardware and in exposed locations. Re-protect as described below.

B7 Apply 100µm dry film thickness epoxy powder coating of the entire galvanized bolt and nut system or B8, B9 as applicable.

B8 Typical exposures. For small areas, a brush applied galv protection coating system is: - (i) Apply 125µm dry film thickness of Resene Alumastic high build epoxy to galvanized steel shafts and internal surfaces, (ii) Bolt the timbers together, (iii) Brush apply on site as per (i) above, all exposed galvanized and scuffed surfaces.

B9 Severe exposures. For small areas, a brush applied galv protection coating system is: - (i) Apply 175µm dry film thickness of Resene Alumastic high build epoxy to galvanized steel shafts and internal surfaces, (ii) Bolt the timbers together, (iii) Brush apply on site as per (i) above, all exposed galvanized and scuffed surfaces.

W Welding

W1 Before commencement of any welding, the qualifications Certificates for the operators in the relevant positions shall be supplied to the Engineer as per NZS 4711:1984.

W2 All weld quality shall be SP (structural purpose) in accordance with NZS 3404: Pt 1, 9.7.1.4.

W3 The nominal tensile strength of the weld metal shall be f_{uw} = 410 MPa u.n.o.

W4 Welding shall be in accordance with AS/NZS 1554.1: 1995.

W5 All welding symbols are in accordance with NZS/AS 1102.3:1987.

W6 All fillet welds to be 5mm minimum, all butt welds are to be complete penetration (full strength), continuous around the connected pieces.

W7 All site welds to be wire brushed immediately after welding and painted with 2 coats of lead free one pack zinc rich paint or a lead free two pack zinc epoxy primer.

W8 All SHS, RHS, and hollow sections are to be capped and all joints sealed.

W9 Seal welds shall be made on all joints unless noted otherwise.

W10 The Engineer shall be called to inspect structural steelwork edge preparation to butt welds before welding and completion before closing in.

W11 Shop fabricated steel shall be subject to a non-destructive testing programme in accordance with the standard, for which records may be required by the engineer.

Timber

T1 Timber Standards

T1.1 All work must comply with the NZ Building Code and:

AS/NZS 1491: 1996	Finger jointed structural timber
AS/NZS 1860.1: 2002	Particleboard
AS/NZS 2098.1-10	Methods of test for veneer and plywood
AS/NZS 2270: 1999	Plywood and blockboard for interior use
AS/NZS 2271: 2004	Plywood and blockboard for exterior use
AS/NZS 2312:2002	Protection of structural steel against atmospheric corrosion by the use of protective coatings
NZS 3601: 1973	Metric dimensions for timber
NZS 3602: 2003	Timber and wood-based products for use in building
NZS 3603: 1993	Timber structures standard
NZS 3604: 2011	Timber framed buildings
NZS3605: 2001	Timber Piles and Poles
AS/NZS 1328.1:1998	Glue Laminated Structural Timber – Performance requirements and minimum production requirements
AS/NZS 1328.2:1998	Glued laminated structural timber – Guidelines for AS/NZS 1328.1:1998
NZS 3631: 1988	New Zealand national timber grading rules
NZS 3622: 2004	Verification of Timber Properties
AS/NZS 4364:1996	Adhesives, phenolic and aminoplastic, for load-bearing timber structures
NZMP 3640: 2003	Specification of the minimum requirements of the New Zealand Timber Preservation Council Inc.

T2 Timber Materials

T2.1 Pole timber and piles shall comply to NZS 3605: 2001, Timber Piles and Poles for Use in Building, H5 treated.

T2.2 Dry timber shall be SG 8 to meet the properties specified for MSG 8 or VSG 8; or SG 10 to meet the properties specified for VSG 10. Wet (or green) timber shall be SG 8 (Wet) meeting the properties specified for G 8. (Refer NZS3603.)

T2.3 Subfloor framing timber shall be H3.2 treated and at 20% moisture content. (H4 treated if within 300mm of the ground.)

T2.4 All timber shall be seasoned, having an average moisture content range of 15% and not exceeding 18% at 17.5c deg.

T2.5 All nuts, bolts and washers to be 85µm Hot Dipped Galvanised and re-protected according to the notes below.

T2.6 Apply 100µm dry film thickness epoxy powder coating of the entire galvanized bolt and nut system or

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Petone Recreation Ground Grandstand

Seismic Strengthening to 34%NBS

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T2.7, T2.8 as applicable.

T2.7 Typical exposures. For small areas, a brush applied galv protection coating system is: - (i) Apply 125µm dry film thickness of Resene Alumastic high build epoxy to galvanized steel shafts etc that are in contact with the timber, (ii) Bolt the timbers together, (iii) Brush apply on site as per (i) above, all exposed galvanized and scuffed surfaces.

T2.8 Severe exposures. For small areas, a brush applied galv protection coating system is: - (i) Apply 175µm dry film thickness of Resene Alumastic high build epoxy to galvanized steel shafts etc that are in contact with the timber, (ii) Bolt the timbers together, (iii) Brush apply on site as per (i) above, all exposed galvanized and scuffed surfaces.

T2.9 Isolate dissimilar metals to minimize the risk of galvanic corrosion.

T3 Timber Construction

T3.1 Timber shall be handled and stored so as not to overstress the members at any time. Timber delivered to the site shall be stored level not less than 150mm off the ground, evenly supported, well ventilated and protected from the elements.

T3.2 All cut ends, rebates and bored holes in timber to be liberally brush coated with Metalex or similar approved "Tributylin Oxide (TBTO), Tributylin Napthenate (TBTN) or Copper Napthenate (CuN). Reprotected areas are not to be placed within 300 mm of the ground.

T3.3 Coat shaft and internal surfaces of holes with multi-purpose grease.

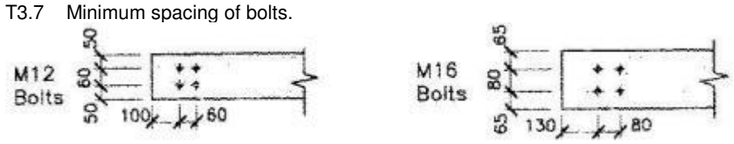
T3.4 Re-protection of hot dip galvanized steel shall comply with AS/NZS 2312:2002 tables 5.2 and 5.3, system designation HDG600P7.

T3.5 Epoxy paint steel and galv steel in contact with CCA treated timber – eg one 75µm layer of epoxy primer Resene Armourcote 221 or with Resene Alumastic high build epoxy paint.

T3.6 Re-protect threads etc on completion after final tightening of nuts with all paint coats.

Bolted Timber Connections

T3.7 Minimum spacing of bolts.



T3.8 The following washers are to be used on all timber faces (head & nut)

M12	-	50 x 50 x 3mm
M16	-	50 x 50 x 6mm
M20	-	60 x 60 x 6mm

T4 Timber Monitoring

T4.1 After installation of all fixings and before covering over, call the engineer and the building inspector for the required monitoring of timber construction.

Solid Plaster

SP1. Scope

SP1.1 Solid Plaster finish is to be applied to the additions to existing four columns on west wall and cut ends to opening in block wall between south west changing room and toilet area.

SP2 Qualifications

SP2.1 Carry out solid plaster work using competent, experienced plasterers.

SP2.2 Work to be carried out by or supervised by the appropriate LBP.

SP3 Solid Plaster Materials

SP3.1 Materials

Sand:	To NZS 4251.1, clause 2.2.2.4 Sand
Cement:	Portland cement to NZS 4251.1, clause 2.2.2.3 Cement
Lime putty:	To NZS 4251.1.clause 2.2.3.2 Lime
Admixtures:	To admixture manufacturer's requirements

SP3.2 Plaster Mix

(C =cement; L = lime; S = sand)

On concrete/concrete masonry

Finish	Mix	Thickness
Bond coat	1 : 1.5 CS	Combined bond and flanking coats, 15mm (minimum) 12mm on concrete masonry
Flanking coat	1 : 1 : 6 CLS	
Finish coat - sponge	1 : 1 : 6 CLS	Finish coat 3mm (maximum)

SP4 Solid Plaster Construction

SP4.1 Store materials on site in conditions ensuring protection from contamination and deterioration.

SP4.2 Ensure that substrates and adjoining surfaces are (with the preparation called for) of a standard required for plastering. Protect existing adjoining work and surrounding areas with boards, dust sheets and protective panels. Completely mask metals, joinery, glass and other adjoining finished surfaces. Ensure flashings and penetrations are in place, and work liable to damage the plaster complete before commencing laying up.

SP4.3 Cut off projections and fill voids. Remove oils, retarders, loose material and leave surfaces dust free. Roughen concrete to provide a mechanical bond, rake out concrete masonry joints and dampen surface if necessary before applying the bond coat.

SP4.4 Lay up all coats to the requirements of NZS 4251.1 under atmospheric conditions that will not adversely affect the finished work. Scratch the initial coats of plaster to provide a mechanical key for following coats. Complete any coat in sufficient time to enable subsequent coats to be applied under conditions that give full bond. Cut out damaged and faulty work in any coat and make good before proceeding.

SP4.5 For trowelled surfaces no deviation more than 3mm from a 1200mm long straight edge. For textured surfaces no deviation more than 3mm from a 900mm long straight edge.

SP4.6 When not detailed, provide control joints at 4 metre centres maximum vertically and horizontally; vertically at all openings and horizontally at inter-storey level at the underside of the floor construction.

SP4.7 Wet cure unmodified plaster by continuous mist spray or protect with wet hessian for 4 days and then slowly dry for 3 days. Wet cure acrylic-modified plaster for 1 day and shade for another 4 days. Protect finished work from the weather and from damage by building operations or other causes.

Interior Linings & Trim

IL1 Scope

IL1.1 The timber framed wall that replaces the existing brick wall between the equipment room and the south west changing room and adjoining toilets are to be lined with 13mm Gib Aqualine both faces to form a GBTL 60 fire rated wall and then over lined on both faces with James Hardie 9mm Villaboard to achieve a finished surface suitable for regular washing down. Refer to drawings for details.

IL1.2 Scotias and trim to the above wall and the wall over the new opening in the block wall are to match existing.

IL1.3 Refit existing door between corridor and equipment room.

IL1.4 Provide and fit architraves and trim to above door.

IL2 Qualifications

IL2.1 Interior linings are to be installed by competent, experienced tradesmen.

IL2.2 Work to be carried out by or supervised by the appropriate LBP.

IL3 Interior Lining Materials

IL3.1 13mm Gib Aqualine with fixings and stopping in accordance with the Gib Site Guide"

IL3.2 9mm Hardies Villaboard with fixings and stopping in accordance with the James Hardie Villaboard Linings Installation Manual.. All fixings to be stainless steel.

IL3.3 Surface finish fire performance is to satisfy Group Number G2S requirements to NZBC C/AS2-AS7, 4.17.1. This is satisfied with Fibre Cement board more than 6mm think with paint coatings less than 0.4mm thick as table A1 of NZBC C/AS2-AS7.

IL3.4 Scotia and trim timber selection to NZS 3602, table 3 Requirements for wood-based building component. Profile as selected or to match existing. Jointer profiles to suit location.

IL4 Interior Lining Installation

IL4.1 Protect joinery, fittings and finishes already in place from water staining or damage from lining installation. Ensure building is weatherproof before lining work commences.

IL4.2 Ensure substrate is suitable for the lining material and trim and meets the, standard required by the lining manufacturer's literature. Ensure moisture content of timber framing is at the levels specified in section T2.4.

IL4.3 Provide levels of finish to standards laid down by AS/NZS 2589 as follows:
Level 4: For thin coating finishes (paint) and surfaces receiving light texture or wall covering finishes

IL4.4 Install 13mm Gib Aqualine with fixings and stopping in accordance with the Gib Site Guide"

IL4.5 Paint bottom 200mm of the Villaboard lining back face with 1 coat of Resene Concrete Primer before installation.

IL4.6 Install 9mm Hardies Villaboard with fixings and stopping in accordance with the James Hardie Villaboard Linings Installation Manual.. All fixings to be stainless steel.

IL4.7 Scribe and fit, architraves to interior joinery, scotias to walls and timber beads and trim as necessary to match existing.

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Petone Recreation Ground Grandstand

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Painting

P1 Scope

P1.1 Exterior painting to 4 south wall concrete column additions including any areas of adjoining wall damaged during installation.

P1.2 Interior painting of new wall between equipment room and south west changing room/toilet including making good any adjoining walls and ceilings damaged during the construction works.

P1.3 Interior painting of column 14 following repair and where the opening has been cut in the block wall between the south west changing room and the toilet.

P2 Qualifications

P2.1 Carry out work using competent and experienced painters.

P3 Health and Safety

P3.1 Refer to the requirements of the Health and Safety in Employment Act 1992 and if elimination or isolation is not possible, then minimise the hazards in this work. Refer to WorkSafe NZ publication, Repainting lead based paints, for the required procedures and precautions when treating or removing lead based paint, burning or sanding off paint, or using solvent based paint removers.

P4 Paint Materials

P4.1 Exterior paint system to be Resene Spec no. 1e1.1 Waterborne Gloss - Surface prep – Limelock, 1st coat Concrete Primerl, 2nd & 3rd coats – Hi-Glo

P4.2 interior paint system to be Resene Spec no. 1i1.1 Waterborne Gloss - Surface prep – Limelock,(not required on Villaboard) 1st coat Concrete Primer, 2nd & 3rd coats – Enamacryl

P4.3 Colours to match existing.

P4.4 Gap fillers to be linseed oil putty, plastic wood, wood filler or plastic filler, to suit and to match the surface being prepared.

P5 Painting Workmanship

P5.1 Inspect surfaces being painted and report to the builder and engineer any that will not, after the preparatory work laid down by the paint manufacturer, allow work of the required standard. Confirm that all areas have adequate lighting and are sufficiently free of other construction activities to enable painting work to proceed.

P5.2 protect and cover up adjoining surfaces and areas liable to damage or over-painting.

P5.3 Remove hardware and door/window furniture and replace on completion. Do not paint over permanently attached hinges, or any hardware items which cannot be removed.

P5.4 Ensure that priming and sealing work needed before or during construction is carried out when required. This includes coating the bottom 200mm of the back face of the Villaboard linings with concrete primer prior to it being installed.

P5.5 Carry out work within acceptable temperature and humidity limits, with timber dry, all to the requirements of the paint manufacturer.

P5.6 Fill sand and repair sharp edges, cracks and holes as required by the paint manufacturer to achieve suitable finishes.

5.7 Prepare surfaces as required by the paint manufacturer. Make good all damage and defects.

5.8 Apply paint by brush and/or roller to suit the location of the coating and to the paint manufacturer's requirements. Do not spray on site without express permission.

5.9 Refer to the paint manufacturers' manuals and follow their preparation, sequence and application requirements applying to each system. Ensure all paint coats in any system are supplied by the same manufacturer.

5.10 Scuff between all coats to remove any dust pick-up, protruding fibres and coarse particles.

5.11 Finished paint surfaces are to show uniformity of gloss and colour, with the correct thickness for each coat, and freedom from painting defects. Ensure finished work is clean and free of any disfigurement.

5.12 Clean adjoining surfaces, glass and fittings of any paint contamination.

5.13 Refit hardware without damage to the hardware or the adjoining surfaces.

FORM OF PRODUCER STATEMENT PS3 – CONSTRUCTION

At project completion, this form shall be completed by the building contractor and supplied to the Engineer.

ISSUED BY:.....
(Building Contractor)

TO: .....
(Owner/Principal)

IN RESPECT OF:.....
(Description of Contract Works)

AT:.....
(Address)

T/A:..... **BUILDING CONSENT No:**.....
(Territorial Authority / Building Consent Authority)

The above Building Contractor has contracted to the above Owner/Principal to carry out and complete certain building works in accordance with the contract, titled

..... (“the contract”)
(Title of building contract)

I ..... a duly authorised representative
(Builder’s Authorised Agent)

of the above building contractor, believe on reasonable grounds that the above building contractor has carried out and completed

☐All ☐Part only as specified in the attached particulars

of the building works in accordance with the contract.

.....
(Signature of Authorised Agent on behalf of the Building Contractor)

.....
(Date)

.....

.....
(Address)

This producer statement is confirmation by the builder(s) that they have carried out the building work in accordance with the drawings, specifications (and site amendments) that are part of the contract / building consent documents.

Work covered by this statement should have been supervised and checked by suitably qualified trades-persons.

The Engineer requires this producer statement and a copy of the T/A’s building consent conditions, to confirm that items of the contract that he has not personally examined, have in fact been built according to the documents, so that the Engineer may issue appropriate documents to the T/A for it to release the Code Compliance Certificate.

SAWREY
CONSULTING ENGINEERS
CIVIL ▲ STRUCTURAL ▲ FOUNDATIONS
92 Queens Drive PO Box 30-444 Lower Hutt
Telephone Bus (04)566 1483 Fax (04)566 9118
Email info@sawrey.co.nz

CLIENT:

Hutt City Council

REVISIONS:

REV No.	DATE.
O	19.12.43 (Original)

CHECK ALL DIMENSIONS ON SITE

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IT REMAINS THE PROPERTY OF
SAWREY CONSULTING ENGINEERS LTD
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WITHOUT PERMISSION.

Petone Recreation Ground Grandstand

Seismic Strengthening to 34%NBS

Notes & PS3 Form

DRAWN:	D.M.S.
CHECKED:	G.R.S.
APPROVED:	G.R.S.
DATE:	19.12.14
SCALE:	N/A
JOB NO:	8757

DWG.NO. **8757**

SHEET NO. **S406** IN SET OF O

Appendix H – Calculations – 2023 DSA Calculations

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT TABLE OF CONTENTS ASSUMPTIONS & FURTHER ASSESSMENT	SAWREY CONSULTING ENGINEERS LTD			
		Date	Project No.	By	Page No.
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1.0 Stiffness Model
2.0 Loading
3.0 Mass Model
4.0 Material Properties
5.0 Infill URM Walls
6.0 URM Walls
7.0 Concrete & Block Walls - Including End Wall Above the Bleachers
8.0 Foundations
9.0 End Wall Above the Bleachers - Steel Post & Glazing
10.0 Results
11.0 Concrete Raking Beams & Vertical Seismic

Subject to further investigation

1 reinforcing steel in block walls
2 cold joints in concrete walls at ground floor along gird Y
3 subsoil modulus
4 concrete cover survey

Subject to further ASSESSMENT

1 Cantilever walkway along grid X at Level 1
2 Bleachers modelled as strut & tie. In-plane displacement capacity & strength
3 Foundations modelled as springs for differential vertical displacement
4 Slab in-plane resistence to lateral differential displacements.
5 Roof connection/load path to the end concrete wall above the bleachers

Assumptions

1 all concrete is original concrete structure cast in situ without cold joints
2 all concrete block masonry is reinforced with 9.5mm dia bars at 400 crs each way

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT RESULTS SUMMARY	Date	Project No.	By	Page No.
		7/07/23	10131	ULM	NA

SAWREY CONSULTING ENGINEERS LTD

	Staad.Pro	Member Type	Height	Column Number	Notes	ϕNn NBS(IL3)	ϕVn NBS(IL3)	ϕMn NBS(IL3)
Compare Previous DSA	583	truss	roof	col 13 to 8	bottom chord	40%		
	591	truss	roof	col 13 to 8	top chord	45%		
	887	brace	roof	col 13 to 8	pipe	50%		
	121	wall	G to L1	col 8 to 9	concrete		60%	
	145	wall	G to L1	col 10 to 11	block		30%	
	1370	wall	L3 to roof	Col 13	improved		40%	20%
	471	column	L3 to roof	col 14	0		100%	70%
	1412	stairs	G to L1	col 6 to 12	0	100%		
	1776	beam	L1	col 10	lintel	20%		
Back Wall	290	wall	L1 to L2	15	strut & tie		60%	
	1667	wall	L1 to L2	16	strut & tie		50%	
	1469	column	G to L1	14	improved		60%	30%
	241	column	G to L1	15	improved		55%	30%
	1466	column	G to L1	16	improved		60%	34%
	1455	column	G to L1	17	improved		55%	30%
	1470	wall	G to L1	16 to 17	URM**		40%	
	1810	wall	G to L1	14 to 15	URM**		34%	
Transverse - Bleacher Beams	461	Column	G	col 1	Grid A		100%	100%
	465	beam	L1	col 1	Grid A		100%	95%
	476	Column	G	col 2	Grid B		60%	90%
	479	beam	L1	col 2	Grid B		100%	100%
	897	Column	G	col 3	Grid C		35%	60%
	493	beam	L1	col 3	Grid C		45%	25%
	939	Column	G	col 4	Grid D		60%	95%
	507	beam	L1	col 4	Grid D		100%	80%
	940	Column	G	col 5	Grid E		60%	55%
	521	beam	L1	col 5	Grid E		70%	100%
	533	Column	G	col 6	Grid F		75%	100%
	536	beam	L1	col 6	Grid F		100%	100%
Transverse - URM Infill walls	1411	wall	G to L2	col 1 to 7	240 brick		100%	
	1477	wall	G to L2	col 2 to 8	120 brick		45%	
	1773	wall	G to L2	col 3 to 9	140 block		55%	
	1774	wall	G to L2	col 4 to 10	120 brick		60%	
	1786	wall	G to L2	col 5 to 11	140 block		80%	
	1801	wall	G to L2	col 6 to 12	240 brick		100%	

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT RESULTS SUMMARY	Date	Project No.	By	Page No.
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SAWREY CONSULTING ENGINEERS LTD

Parts and Vertical Seismic

Staad.Pro	Member Type	Height	Column Number	Notes	Actions	ϕVn NBS(IL3)
1470	wall	G to L1	16 to 17	URM**	OOP	25%
1810	wall	G to L1	14 to 15	URM**	OOP	25%
674	truss	roof	col 9	bot chord	Eu vertical	100%
668	truss	roof	col 9	top chord	Eu vertical	60%
end wall	mullions	L1 to roof	col6 to 18	timber	OOP	< 33%
end wall	posts	L1 to roof	col 6	steel	OOP	< 33%
end wall	mullions	L1 to roof	col 1 to 13	timber	OOP	< 33%
end wall	posts	L1 to roof	col 1	steel	OOP	< 33%
East to West	foundations	ground	NA	stability	overturning	50%
North - South	foundations	Ground	all	passive & slide	base shear	10%*
East - West	foundations	Ground	all	passive & slide	base shear	20%*

** URM has two %NBS one for out of plane capacity and one for in-plane capacity.

* Redundancy. Load redistributuion. Not expected to cause a local or global collapse.

Reactions at supports

Staad.Pro Refrence	member type	height	column number	notes	Rx NBS(IL3)	Ry NBS(IL3)	Rz NBS(IL3)
1	foundation	Ground	col 14	pad		100%	
2	foundation	Ground	15	pad		100%	
3	foundation	Ground	16	pad		100%	
4	foundation	Ground	17	pad		100%	
8	foundation	Ground	8	pad		100%	
9	foundation	Ground	col 13	pad		90%	
11	foundation	Ground	1	pad		100%	
12	foundation	Ground	18	pad		100%	
13	foundation	Ground	6	pad		100%	
15	foundation	Ground	2	pad		100%	
16	foundation	Ground	3	pad		100%	
17	foundation	Ground	4	pad		100%	
18	foundation	Ground	5	pad		100%	

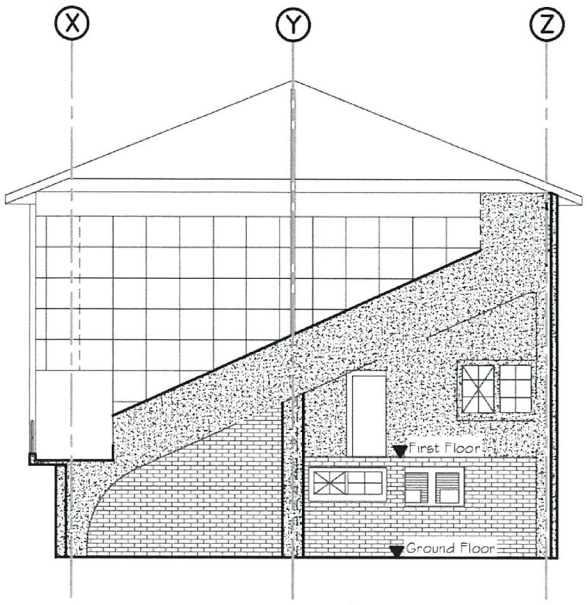
Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT RESULTS SUMMARY	Date	Project No.	By	Page No.
		7/07/23	10131	ULM	NA

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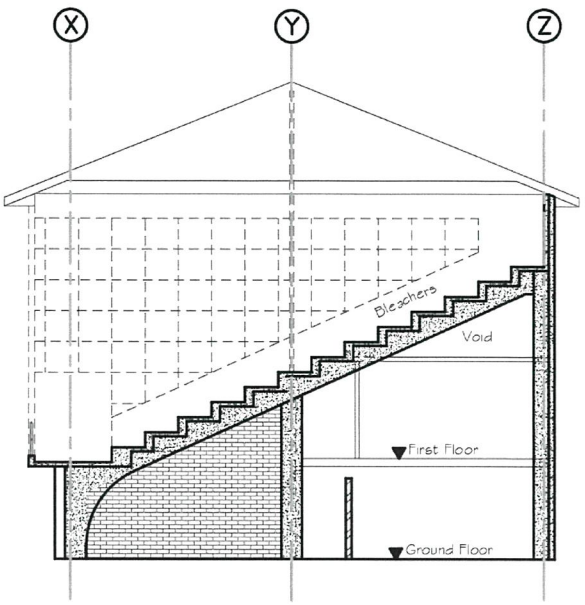
Summary of Earthquake Prone Elements

Staad.Pro	Member Type	Height	Column Number	Notes	ϕNn NBS(IL3)	ϕVn NBS(IL3)	ϕMn NBS(IL3)
145	wall	G to L1	col 10 to 11	block		30%	
1370	wall	L3 to roof	Col 13	improved		40%	20%
1776	beam	L1	col 10	lintel	20%		
1469	column	G to L1	14	improved		60%	30%
241	column	G to L1	15	improved		55%	30%
1455	column	G to L1	17	improved		55%	30%
493	beam	L1	col 3	Grid C		45%	25%
end wall	mullions	L1 to roof	col6 to 18	timber OOP			< 33%
end wall	posts	L1 to roof	col 6	steel OOP			< 33%

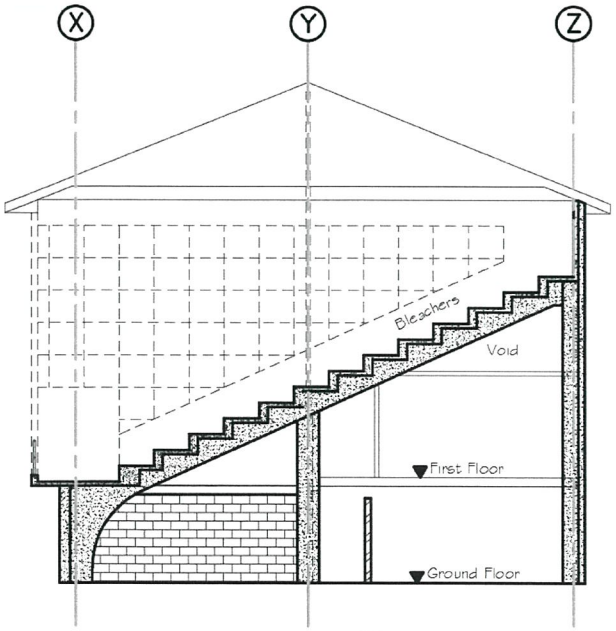
Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 1.0 STIFFNESS MODEL TRANSVERSE STRUCTURE	SAWREY CONSULTING ENGINEERS LTD			
		Date	Project No.	By	Page No.
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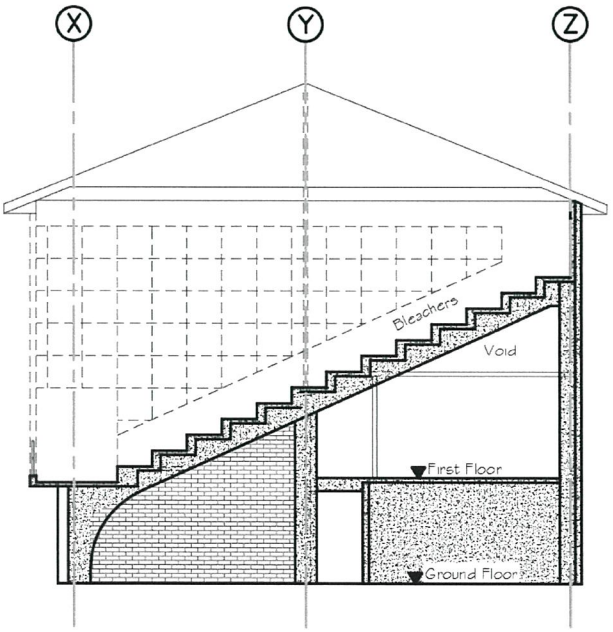
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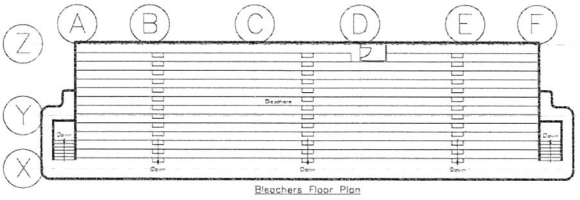
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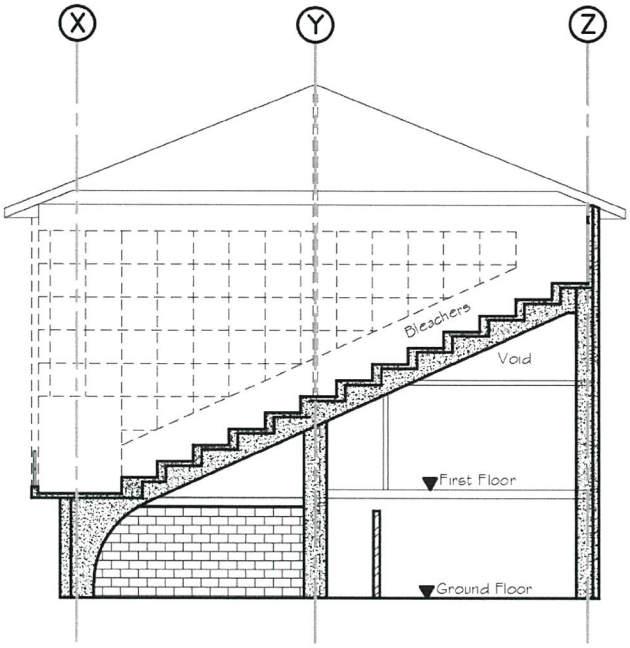
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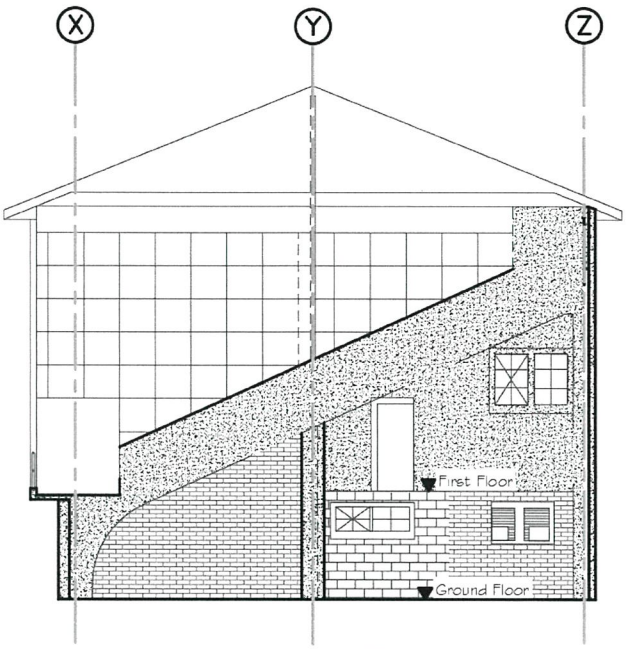
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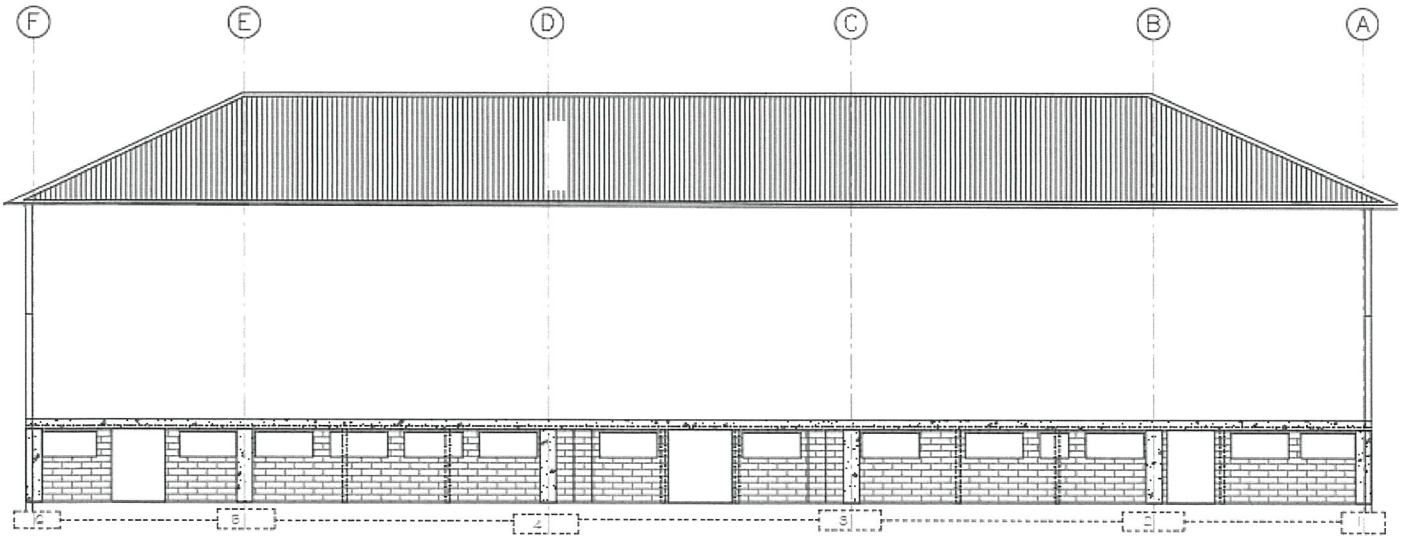
Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 1.0 STIFFNESS MODEL TRANSVERSE & LONGITUDINAL STRUCTURE	SAWREY CONSULTING ENGINEERS LTD			
		Date	Project No.	By	Page No.
		Jul-23	10131	ULM	1. 2



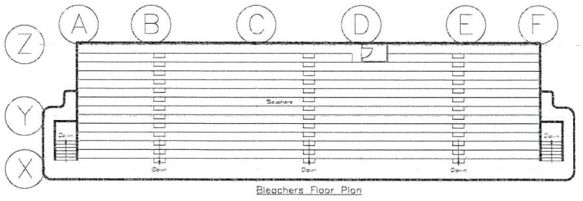
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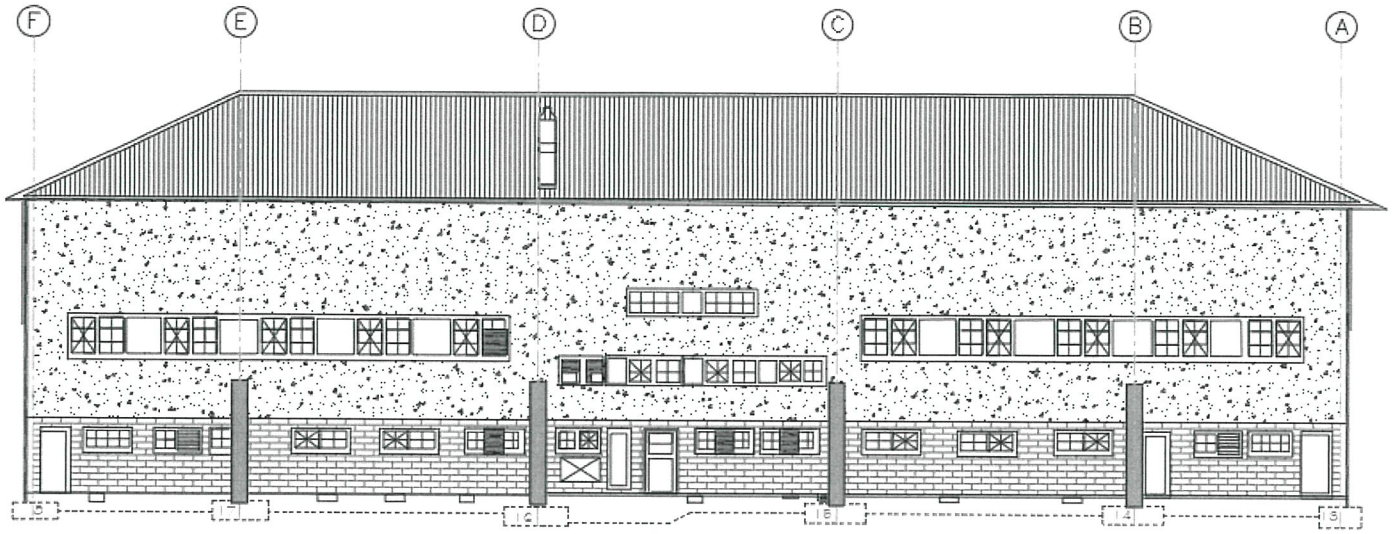
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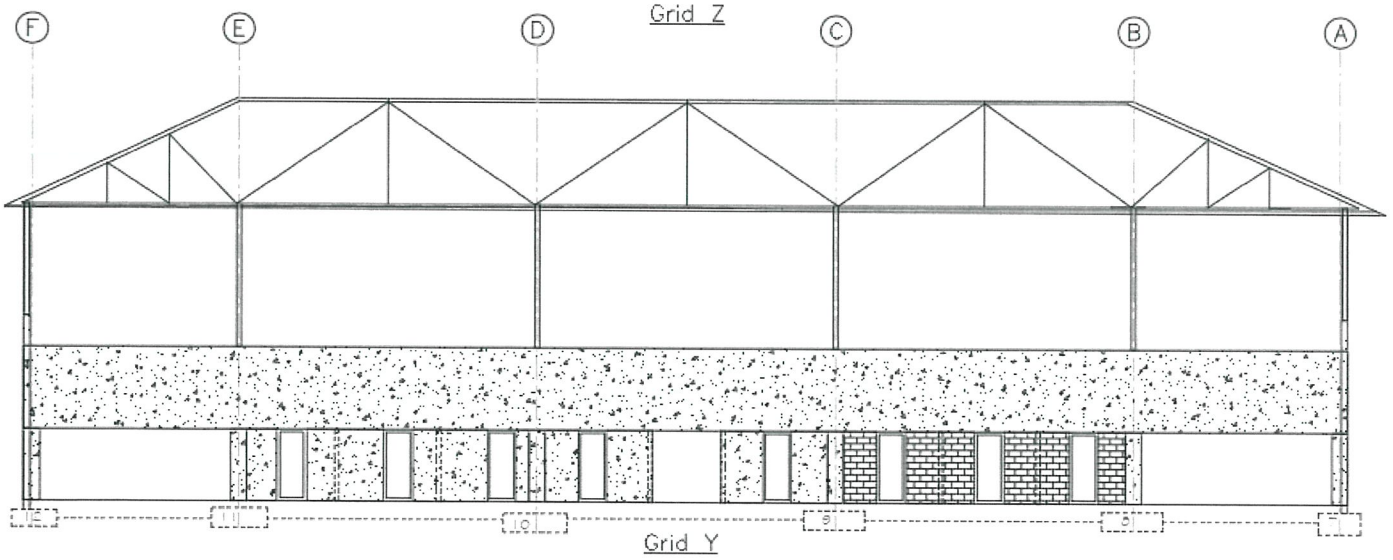


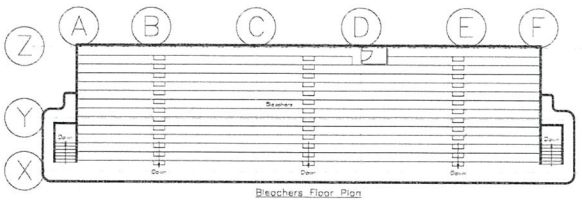
Grid X



Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 1.0 STIFFNESS MODEL LONGITUDINAL STRUCTURE	SAWREY CONSULTING ENGINEERS LTD			
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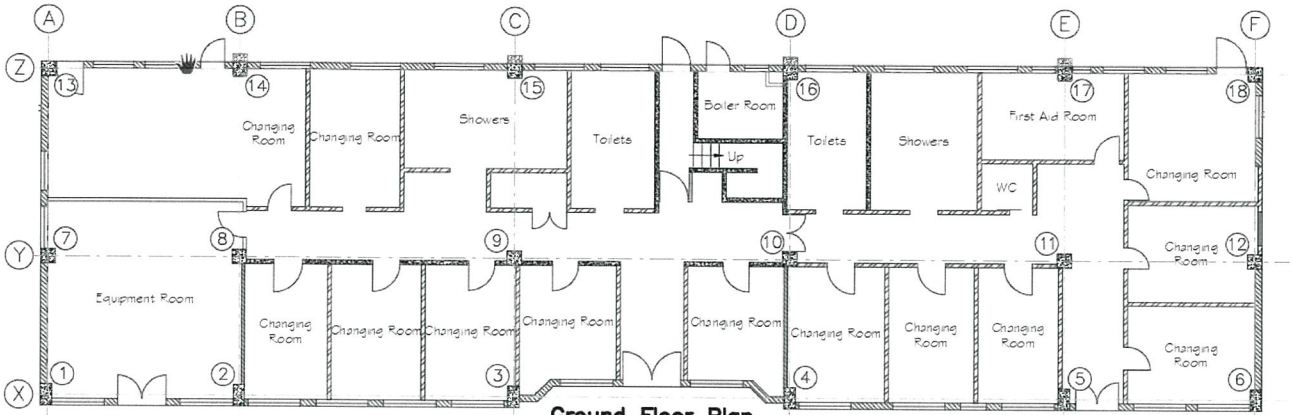


Psudeo Non-linear

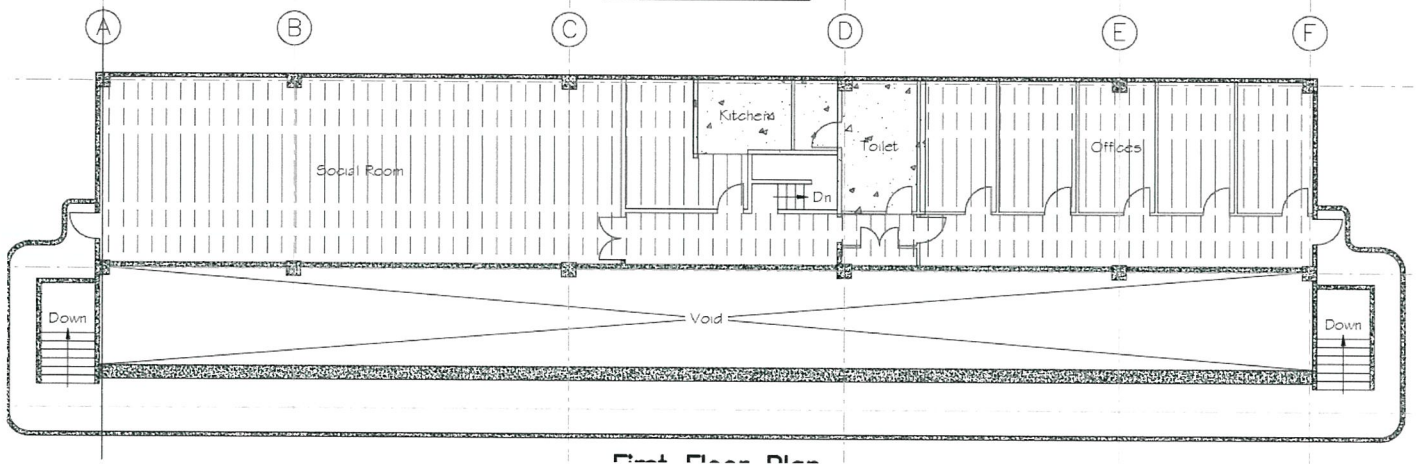
1 URM mullards have failed in-plane due to toe-crushing

2 Timber joists have let-go but still have positive seating.

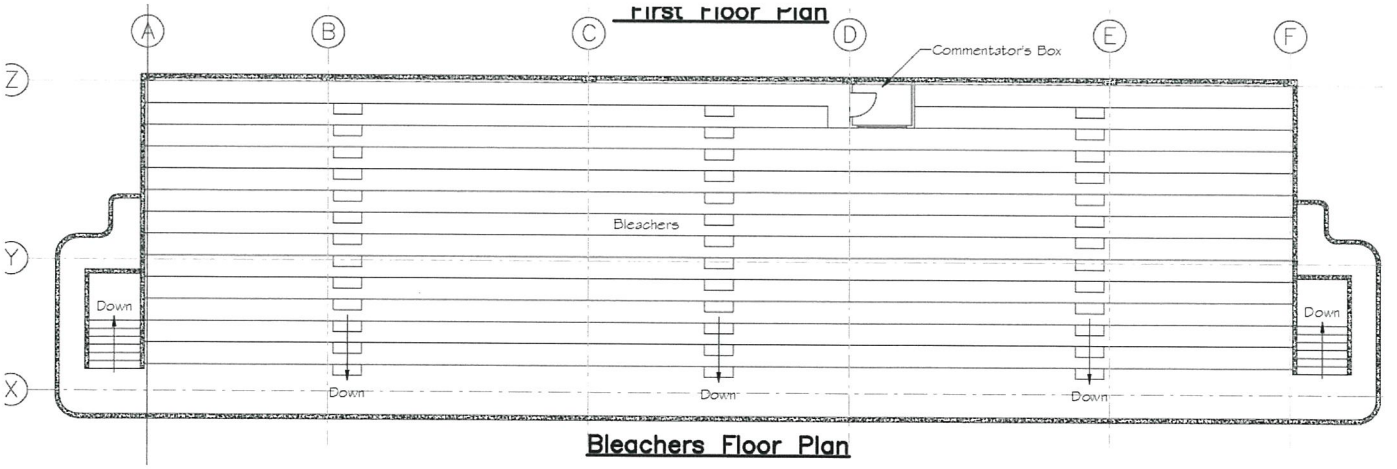
Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 1.0 STIFFNESS MODEL FLOOR PLANS & ROOF PLAN	SAWREY CONSULTING ENGINEERS LTD			
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Ground Floor Plan



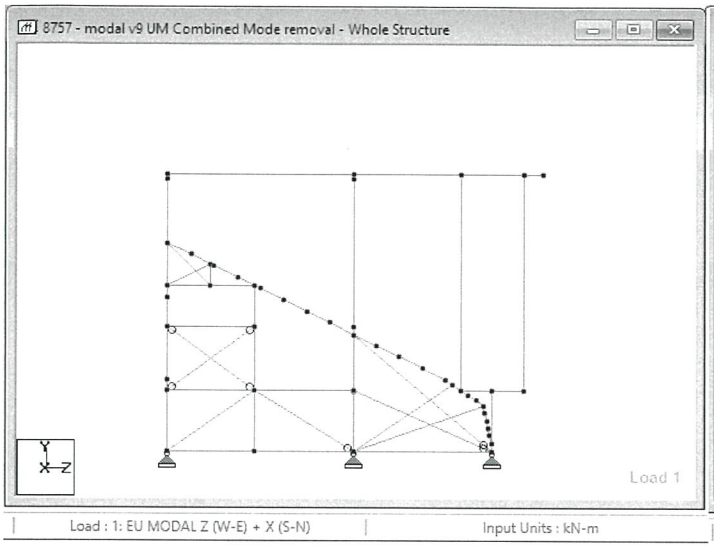
First Floor Plan



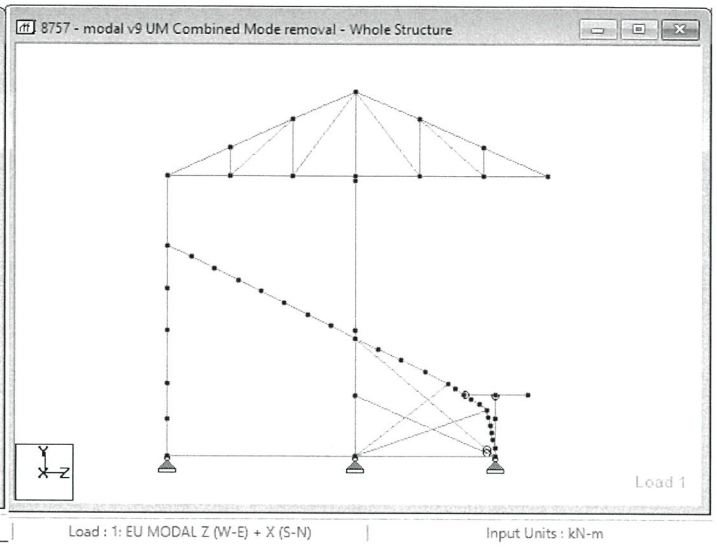
Bleachers Floor Plan

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 1.0 STIFFNESS MODEL STAAD.PRO 3D MODEL - TRANSVERSE FRAMES	SAWREY CONSULTING ENGINEERS LTD			
		Date	Project No.	By	Page No.
		Jul-23	10131	ULM	1. **5**

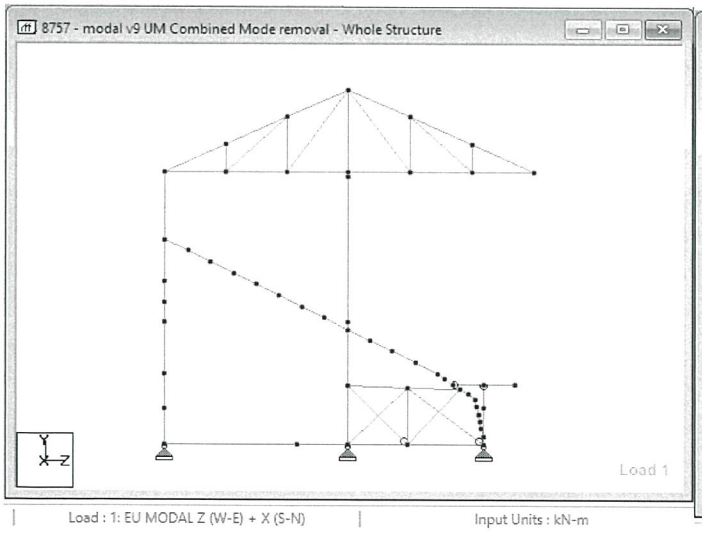
The blue cirldes indicate - axial release,
such that the oposite brace is similar to a compression only member in a static analysis.



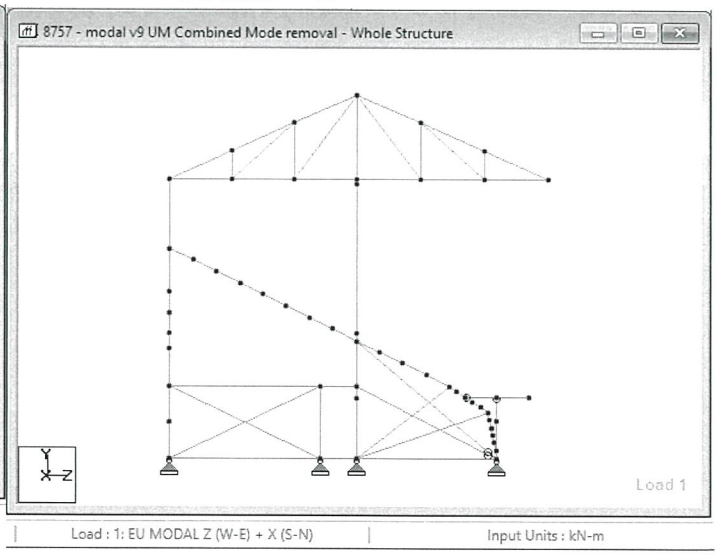
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Secion B

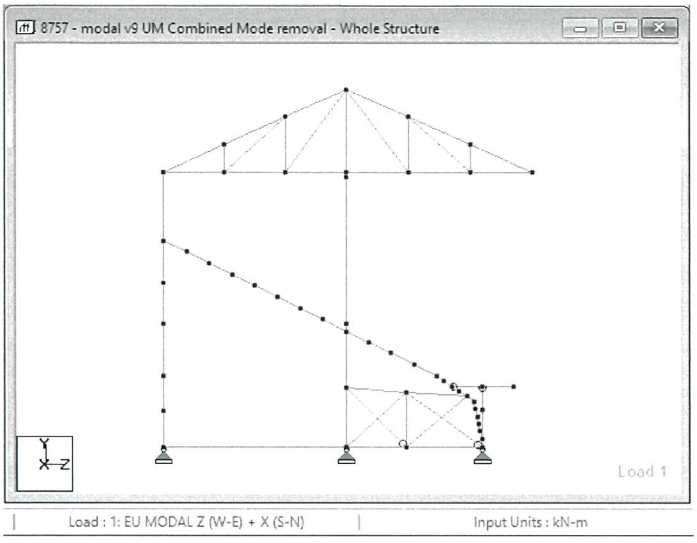


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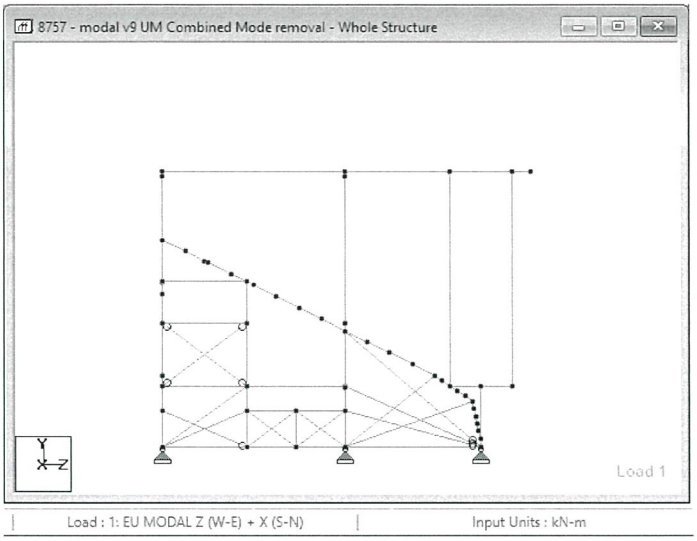


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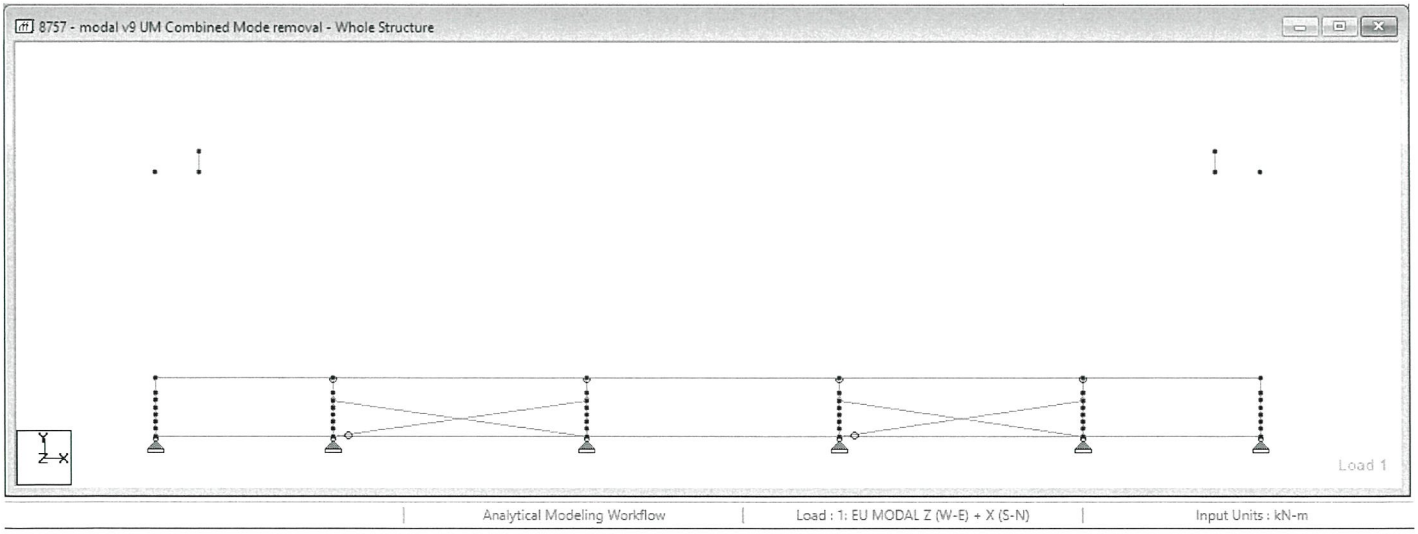
The blue cirldes indicate - axial release,
such that the oposite brace is similar to a compression only member in a static analysis.



Secion E



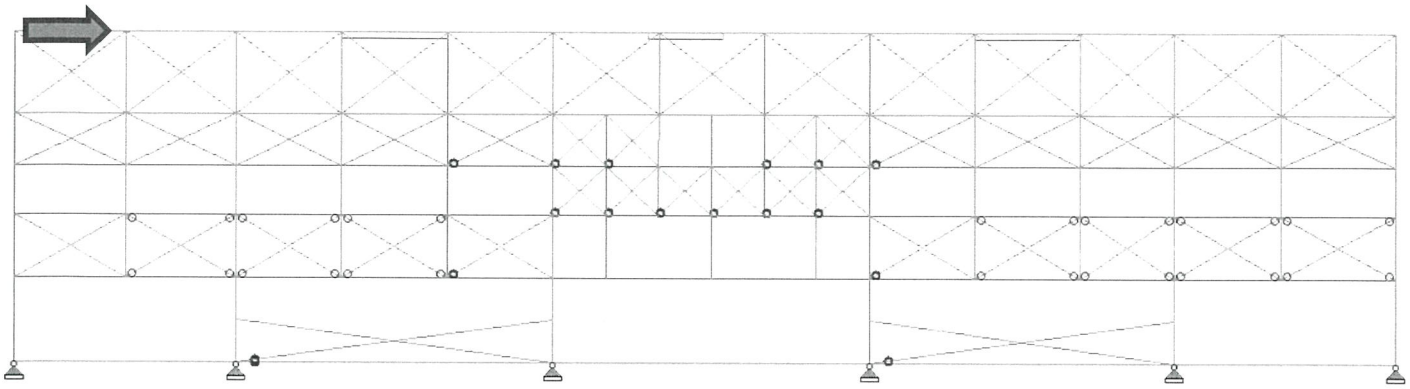
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Grid X

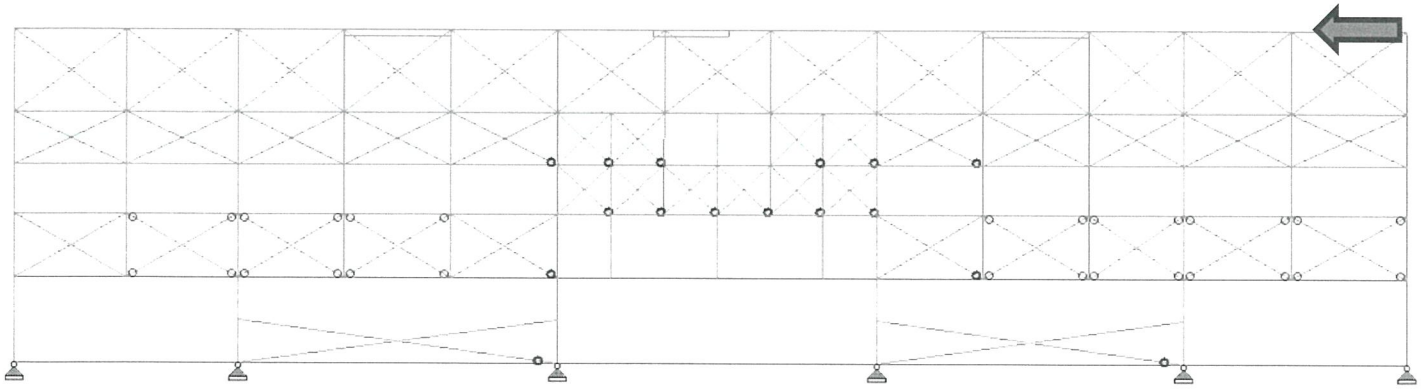
Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 1.0 STIFFNESS MODEL STAAD.PRO 3D MODEL - LONGITUDINAL FRAMES	SAWREY CONSULTING ENGINEERS LTD			
		Date	Project No.	By	Page No.
		Jul-23	10131	ULM	1. 7

The blue cirldes indicate - axial release,
such that the oposite brace is similar to a compression only member in a static analysis.



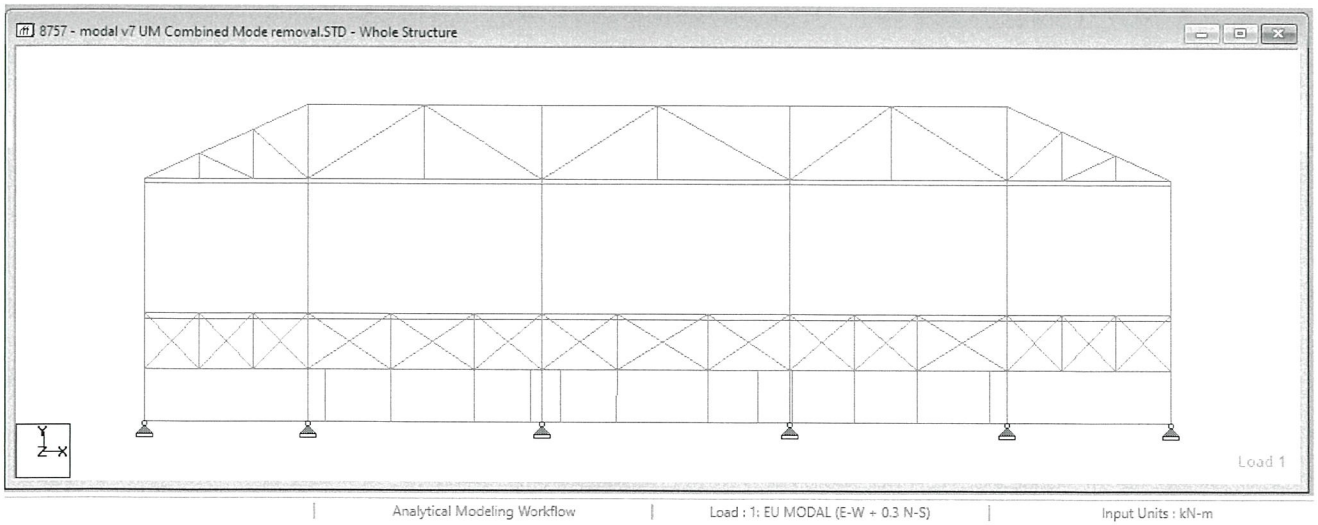
X= +ve (S-N) Releases -
View from front to back

Grid Z



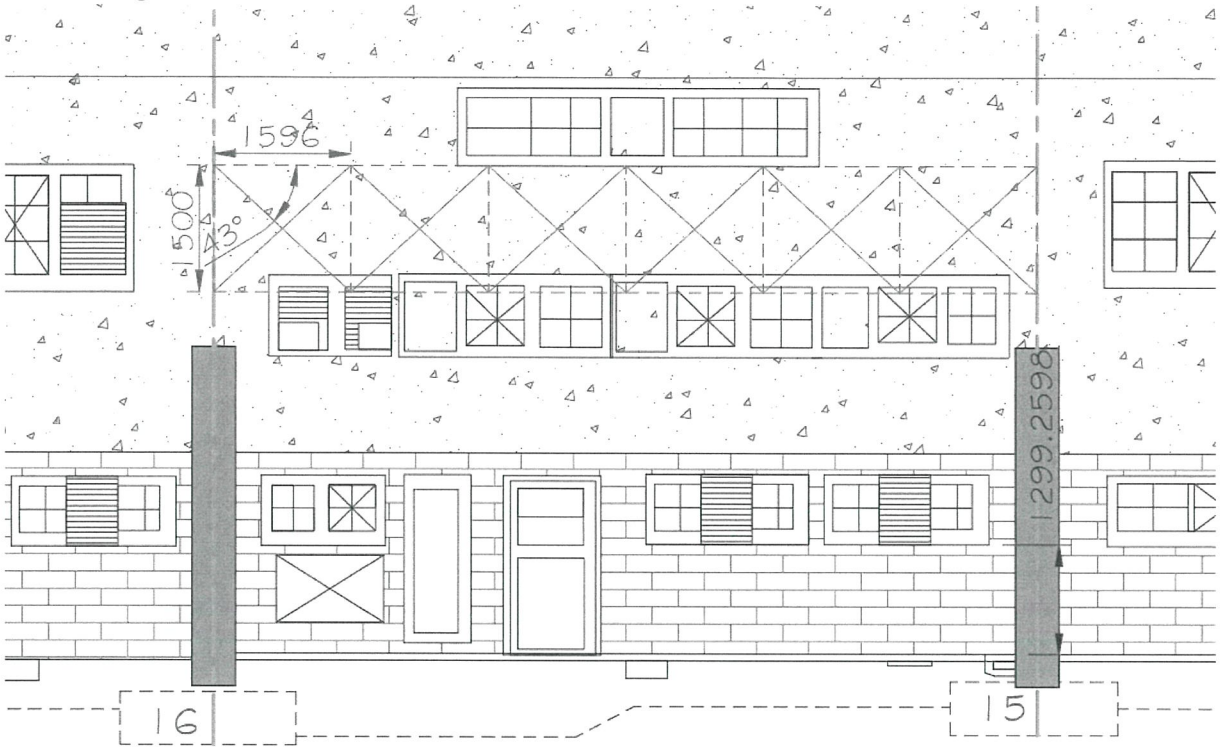
X= -ve (N-S) Releases -
View from front to back

Grid Z



Grid Y

Stut and Tie
Wall between columns 15 and 16 along grid Z
mid-height



Grid Z

D C

t =	200 mm	A =	0.75 Sgrid	B=	0.53 Sgrid
Sgrid =	1596 mm	=	1197 mm	=	845.88 mm

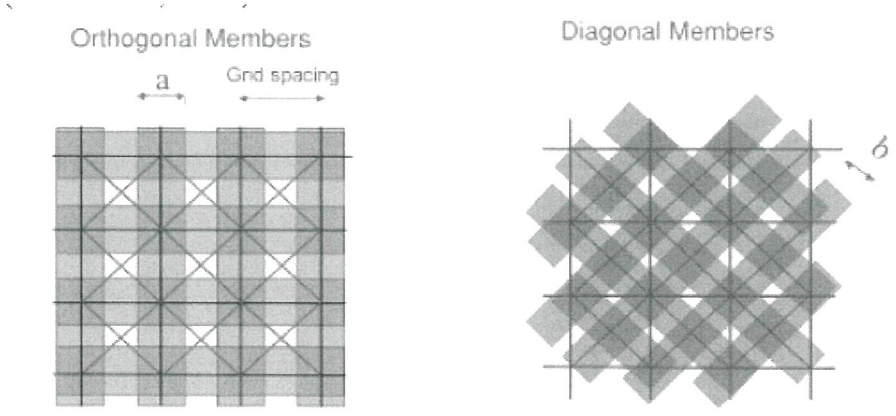


Figure C5D.2: Grillage beam dimensions for the square grillage (Hrennikoff, 1941)

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 2.0 LOADING GRAVITY

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LOADINGS

To AS / NZS 1170

	G+Q	SERVICEABILITY G+Q Short Term	SERVICEABILITY G+Q Long Term	ULTIMATE 1.35G	ULTIMATE 1.2G+1.5Q
ROOF					
Corr Iron	0.10				
Trusses & Timber	0.40				
Ceiling	0.10				
	0.60 kPa				
25 degree slope	1.10				
Dead Load G=	0.66 kPa	0.66	0.66	0.89	0.79
Live Load Q=	0.25 kPa	0.25	0.25	0.00	0.38
Load factor	1.00	0.70	0.00	1.00	1.00
	0.91 kPa	**0.84 kPa**	**0.66 kPa**	**0.89 kPa**	**1.17 kPa**
TIMBER FLOOR					
Flooring	0.12				
Timber	0.20				
Ceiling	0.12				
Dead Load G=	0.44 kPa	0.44	0.44	0.59	0.53
Live Load Q= **	5.00 kPa	5.00	5.00	0.00	7.50
Load factor ψc	1.00	0.70	0.40	1.00	1.00
** C5 Areas susceptable to overcrowding					
	5.44 kPa	**3.94 kPa**	**2.44 kPa**	**0.59 kPa**	**8.03 kPa**
BLEACHERS					
Slab 51 mm	1.22				
Risers 51*457 @ 810 crs	0.69				
Seats	0.15				
Dead Load G=	2.06 kPa	2.06	2.06	2.79	2.48
Live Load Q= **	5.00 kPa	5.00	5.00	0.00	7.50
Load factor ψc	1.00	0.70	0.40	1.00	1.00
** C5 Areas susceptable to overcrowding					
	7.06 kPa	**5.56 kPa**	**4.06 kPa**	**2.79 kPa**	**9.98 kPa**
KITCHEN FLOOR SLAB					
Slab 102 mm	2.45				
Plaster etc	0.50				
Dead Load G=	2.95 kPa	2.95	2.95	3.98	3.54
Live Load Q= *	5.00 kPa	5.00	5.00	0.00	7.50
Load factor	1.00	0.70	0.40	1.00	1.00
'* B Commercial kitchens					
	7.95 kPa	**6.45 kPa**	**4.95 kPa**	**3.98 kPa**	**11.04 kPa**
GLAZED WALLS					
Framing	0.14				
Glass 10 mm	0.26				
Steel Hori 15.2kg/m @ 2.0	0.08				
	0.33 kPa	**0.33 kPa**	**0.33 kPa**	**0.45 kPa**	**0.40 kPa**

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 2.0 LOADING GRAVITY

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LOADINGS

To AS / NZS 1170

		G+Q	SERVICEABILITY G+Q Short Term	SERVICEABILITY G+Q Long Term	ULTIMATE 1.35G	ULTIMATE 1.2G+1.5Q
152mm SLAB AT TOP & BOTTOM OF BLEACHERS						
Slab	152 mm	3.65				
Plaster etc		0.50				
Dead Load G=		4.15 kPa	4.15	4.15	5.60	4.98
Live Load Q=	**	5.00 kPa	5.00	5.00	0.00	7.50
Load factor		1.00	0.70	0.40	1.00	1.00
** C5 Areas susceptable to overcrowding						
		9.15 kPa	**7.65 kPa**	**6.15 kPa**	**5.60 kPa**	**12.48 kPa**
TIMBER FRAMED WALLS						
Framing		0.14				
Lining		0.24				
		0.38 kPa	**0.38 kPa**	**0.38 kPa**	**0.51 kPa**	**0.46 kPa**
203mm CONCRETE WALLS						
Conc	203 mm	4.87				
Plaster finish	2 at10mm	0.48				
		5.35 kPa	**5.35 kPa**	**5.35 kPa**	**7.23 kPa**	**6.42 kPa**
152mm CONCRETE WALLS						
Conc	152 mm	3.65				
Plaster finish		0.48				
		4.13 kPa	**4.13 kPa**	**4.13 kPa**	**5.57 kPa**	**4.95 kPa**
102mm CONCRETE WALLS						
Conc	102 mm	2.45				
Plaster finish	2 at10mm	0.48				
		2.93 kPa	**2.93 kPa**	**2.93 kPa**	**3.95 kPa**	**3.51 kPa**
140mm CONCRETE BLOCK WALLS						
Block	140 mm	3.22				
Plaster finish		0.00				
		3.22 kPa	**3.22 kPa**	**3.22 kPa**	**4.35 kPa**	**3.86 kPa**
230mm BRICK WALLS						
Brick	230 mm	4.37				
Plaster finish	1 at10mm	0.24				
		4.61 kPa	**4.61 kPa**	**4.61 kPa**	**6.22 kPa**	**5.53 kPa**
110mm BRICK WALLS						
Brick	110 mm	2.09				
Plaster finish	0 at10mm	0.00				
		2.09 kPa	**2.09 kPa**	**2.09 kPa**	**2.82 kPa**	**2.51 kPa**
220mm CONCRETE WALLS						
Conc	220 mm	5.28				
Plaster finish	0 at10mm	0.00				
		5.28 kPa	**5.28 kPa**	**5.28 kPa**	**7.13 kPa**	**6.34 kPa**

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 2.0 LOADING WEIGHT

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DETERMINATION SEISMIC LATERAL LOADING - Seismic Weights

Roof Level	Number		Length		Height/Width			Mass/m^2			
Roof	1.0	*	43.7	*	15.01 m	=		656.1	*	0.66	= 434.3
Top Beam Each End	2.0	*	13.5	*	1.00 m	=		27.0	*	0.45	= 12.2
Eaves Beam	2.0	*	58.7	*	1.00 m	=		117.5	*	0.21	= 24.7
Glazed Walls Each End	2.0	*	12.0	*	1.00 m	=		24.0	*	0.33	= 7.9
Conc Wall Each End	2.0	*	2.0	*	1.11 m	=		4.4	*	4.13	= 18.3
Conc Beam West Side	1.0	*	42.5	*	1.00 m	=		42.5	*	2.50	= 106.1
Conc Wall West Side	1.0	*	42.5	*	1.00 m	=		42.5	*	4.13	= 175.4
Conc Columns	6.0	*	0.8	*	1.00 m	=		4.5	*	0.96	= 4.3
Steel Posts End Walls	2.0	*	2.0	*	2.70 m	=		10.8	*	0.30	= 3.2
Steel Posts Internal	4.0	*	1.0	*	6.00 m	=		24.0	*	0.60	= 14.3
							wi				= 800.8 kN

Top of Bleachers											
6 inch Slab	1.0	*	42.5	*	0.81 m	=		34.4	*	2.95	= 101.5
Bleachers	1.0	*	42.2	*	1.62 m	=		68.4	*	2.06	= 141.1
Bleacher Beams	12.0	*	2.0	*	1.00 m	=		24.0	*	5.45	= 130.7
West Wall	1.0	*	42.5	*	2.10 m	=		89.3	*	5.35	= 477.7
Columns	6.0	*	1.0	*	2.10 m	=		12.6	*	0.96	= 12.1
North & South Wall Conc	2.0	*	2.0	*	2.10 m	=		8.4	*	5.35	= 45.0
North & South Wall Glaze	2.0	*	11.2	*	2.10 m	=		47.0	*	0.33	= 15.6
Live on Bleachers	1.0	*	42.5	*	2.43 m	=		103.3	*	1.50	= 154.9
$\psi\varepsilon$ = 0.3											
ψa = 1.00											
Seismic Live Load $\psi e^*\psi a^*Q$ = 1.5 kPa							wi				= 1078.6 kN

Middle of Bleachers / 1st Floor Ceiling											
Bleachers	1.0	*	42.2	*	5.80 m	=		244.8	*	2.06	= 505.3
Bleacher Beams	12.0	*	6.9		1.00 m	=		82.2	*	5.45	= 447.7
West Wall	1.0	*	42.5		3.00 m	=		127.5	*	5.35	= 682.4
Columns	6.0	*	1.0		3.00 m	=		18.0	*	0.96	= 17.3
North & South Wall Conc	2.0	*	7.4		3.00 m	=		44.4	*	5.35	= 237.6
North & South Wall Glaze	2.0	*	5.8		3.00 m	=		34.8	*	0.33	= 11.5
Central Beam/Wall	1.0	*	42.2		0.75 m	=		31.7	*	5.35	= 169.4
Walls around Central Stai	3.0	*	4.7		1.20 m	=		16.9	*	4.13	= 69.8
Timber Ceiling	1.0	*	42.2		4.50 m	=		189.9	*	0.38	= 72.2
Timber walls below floor	2.0		21.1		1.20	=		50.6	*	0.38	= 19.2
Steel Posts End Walls	2.0	*	2.0	*	3.00 m	=		12.0	*	0.30	= 3.6
Steel Posts Internal	4.0	*	1.0	*	2.60 m	=		10.4	*	0.60	= 6.2
Live on Bleachers	1.0	*	42.2	*	5.80 m	=		244.8	*	1.50	= 367.1
$\psi\varepsilon$ = 0.3											
ψa = 1.00											
Seismic Live Load $\psi e^*\psi a^*Q$ = 1.5 kPa							wi				= 2609.4 kN

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 2.0 LOADING WEIGHT

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DETERMINATION SEISMIC LATERAL LOADING - Seismic Weights Continued

Bottom of Bleachers / 1st Floor Level

6 inch Slab	1.0	*	42.2	*	2.20	m	=	92.8	* 4.15	= 385.1
Bleachers	1.0	*	42.2	*	2.50	m	=	105.5	* 2.06	= 217.8
Bleacher Beams	12.0	*	1.0		2.20	m	=	26.4	* 5.45	= 143.8
West Wall 200 conc	1.0	*	42.5		1.35	m	=	57.4	* 5.35	= 307.1
West Wall 230 brick	1.0	*	40.1		0.60	m	=	24.1	* 4.61	= 110.9
Columns in W conc wall	6.0	*	1.0		1.50	m	=	9.0	* 0.96	= 8.6
Columns in W brick wall	6.0	*	1.0		1.00	m	=	6.0	* 3.84	= 23.0
North & South Wall Conc	2.0	*	11.2		1.50	m	=	33.6	* 5.35	= 179.8
North & South Wall Brick	2.0	*	11.2		1.00	m	=	22.4	* 4.61	= 103.3
Central Beam/Wall/Col	1.0	*	42.2		2.30	m	=	96.8	* 5.35	= 518.3
Beam along base of bleac	1.0	*	42.2		1.00		=	42.2	* 7.46	= 314.7
East Wall 230 brick	1.0	*	40.1		0.60	m	=	24.1	* 4.61	= 110.9
Columns in East wall	6.0	*	1.0		1.20	m	=	7.2	* 8.64	= 62.2
Walls around Central Stai	4.0	*	4.7		2.45	m	=	46.1	* 4.13	= 190.1
Internal brick walls	3.0	*	4.5		1.20	m	=	16.2	* 2.09	= 33.9
Concrete Floor	1.0	*	6.0		4.50	m	=	27.0	* 2.95	= 79.6
Timber Floor	1.0		38.2		6.40	m	=	244.5	* 0.44	= 107.6
Ceiling over changing roo	1.0	*	37.7		4.50	m	=	169.7	* 0.24	= 40.7
Timber walls above floor	2.0		42.2		1.20	m	=	101.3	* 0.38	= 38.5
End slabs around steps	2.0		7.2		3.00	m	=	43.2	* 4.15	= 179.2
Nib at handrail	1.0		68.0		1.00		=	68.0	* 1.12	= 75.9
Live on Interior floors	1.0	*	42.2	*	6.40	m	=	270.1	* 1.50	= 405.1
Live on Bleachers	1.0	*	48.2	*	4.70	m	=	226.5	* 1.50	= 339.8

$\psi\varepsilon$ = 0.3

ψa = 1.00

Seismic Live Load $\psi e * \psi a * Q$ = 1.5 kPa wi = 3976.0 kN

	L4 Roof	L3 Top of Bleachers	L2 Middle of Bleachers	L1 Bottom of Bleac
West Wall	801	1079	1235	796
Centre			1375	973
East wall				1937
Slab at Stair				270
Total	801 kN	1079 kN	2609 kN	3976 kN

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 2.0 LOADING SEISMIC FACTOR

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DETERMINATION OF SEISMIC FACTOR TO NZS 1170.5:2004

Period T =	0.4	
Soil class =	D	From GNS Report
Ch(T) =	3.00	Table 3.1
Z =	0.4	Wellington
R =	1.3	Importance Factor 3 building 50 year life
N(T,D) =	1.0	T<1.5 sec

C(T) = Ch(T) Z R N(T,D) = 1.560

μ	=	1.00	Elastic
$k\mu$	= $(\mu-1)T1/0.7+1$	=	1.00
Sp	= $1.3-0.3\mu$	=	1.000

Cd (*T*) = C(T) * Sp/$k\mu$ = 1.560

C = seismic factor = 1.560

DISTRIBUTION OF SEISMIC LOADS for 100%NBS If using Equivalent Static Method and distribution as clause 6.2

with 0.08V at roof	wi kN	h m	hi m	wi*hi	wi*hi Σwi*hi	Fi kN	Vi kN	ESM scale
Roof	800.8	2.256	9.906	7933	0.268	3537.6	3537.6	4.418
Top of Bleachers	1078.6	2.700	7.650	8251	0.195	2580.7	6118.3	2.393
Middle of Bleachers	2609.4	2.500	4.950	12917	0.306	4040.0	10158.3	1.548
Bottom of Bleachers	3976.0	2.450	2.450	9741	0.231	3046.8	13205.1	0.766
Total	8464.8			38842	1.000	13205.1		

Total Horizontal Seismic Shear V = Cd(T_1)*Wt = 13205 kN

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 2.0 LOADING PERIOD - RAYLEIGH FORMULA

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Vb = 13205 kN

Level	Height (m)	Weight (kN)	wi x hi	Lat Forc	Defl di(m)	di^2	Fi di	wi di^2
4	9.906	272.272	2697.1	272.27	0.034	0.001	9.370	0.32248
3	7.4295	366.724	2724.6	366.72	0.026	0.001	9.461	0.24411
2	4.953	887.06	4393.6	887.06	0.017	0.000	15.264	0.26264
1	2.4765	1351.84	3347.8	1351.8	0.009	0.000	11.631	0.10008
	SUM =	2877.9	13163.1	2877.9			45.727	0.9293

Estimate of Period from Rayleigh Formula

T1 = 0.28598 sec

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 3.0 Mass Model TRIBUTARY AREAS	Date	Project No.	By	Page No.
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Tributary Widths (m)

	A	B	C	D	E	F
A as datum	0	6.636	9.567	9.567	9.567	6.636
Trib width	3.318	8.1015	9.567	9.567	8.1015	3.318

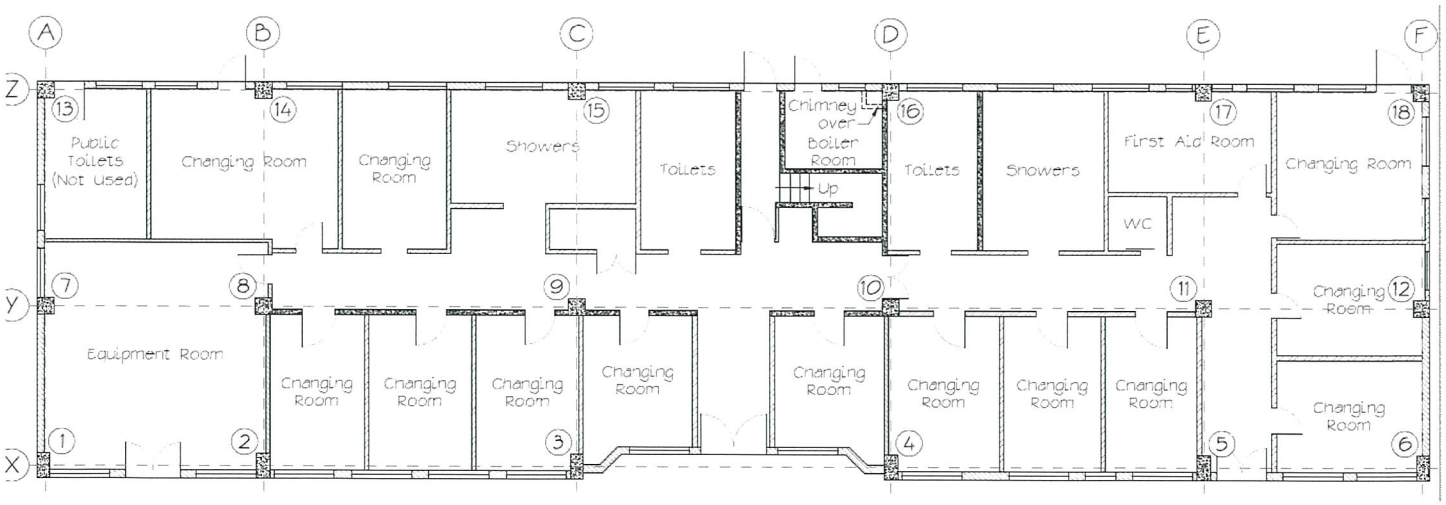
	X datum	W trib
Z	6.636	3.318
Y	4.91	5.773
X	0	2.455

Foundations A tot = 484.62026 m2 at centreline of foundations

Grid	A	B	C	D	E	F
Z	11.009124	26.880777	31.743306	31.743306	26.880777	11.009124
Y	19.154814	46.76996	55.230291	55.230291	46.76996	19.154814
X	8.14569	19.889183	23.486985	23.486985	19.889183	8.14569

Column Numbers

Grid	A	B	C	D	E	F
Z	13	14	15	16	17	18
Y	7	8	9	10	11	12
X	1	2	3	4	5	6



L4 - roof A tot = 484.62026 m2 at centreline of foundations

Grid	A	B	C	D	E	F
Z	11.009124	26.880777	31.743306	31.743306	26.880777	11.009124
Y	19.154814	46.76996	55.230291	55.230291	46.76996	19.154814
X	8.14569	19.889183	23.486985	23.486985	19.889183	8.14569

L3 - top of bleachers A tot = 139.26641 m2 at centreline of foundations

Grid	A	B	C	D	E	F
Z	11.009124	26.880777	31.743306	31.743306	26.880777	11.009124
Y						
X						

L2 - middle of bleachers A tot = 381.57654 m2 at centreline of foundations

Grid	A	B	C	D	E	F
Z	11.009124	26.880777	31.743306	31.743306	26.880777	11.009124
Y	19.154814	46.76996	55.230291	55.230291	46.76996	19.154814
X						

L1 - bottom of bleachers A tot = 484.62026 m2 assumed distribution of loads

Grid	A	B	C	D	E	F
Z	11.009124	26.880777	31.743306	31.743306	26.880777	11.009124
Y	19.154814	46.76996	55.230291	55.230291	46.76996	19.154814
X	8.14569	19.889183	23.486985	23.486985	19.889183	8.14569
Atot (m2)	38.309628	93.539919	110.46058	110.46058	93.539919	38.309628
Dead Load (kN)	255.41977	623.65378	736.46803	736.46803	623.65378	255.41977

Transverse Bleacher Beam on Gridlines - removed point load and added as UDL

L = 11.733 m

Gudl bleacher = 6.5/2 x 2.06 + 5.45

= 12.145 kN/m

= 142.49729 kN

DEADLOAD, G (KN) Transverse Bleacher Beam on Gridlines - removed point load and added as UDL

L 4 -Roof Level G = 800.8 kN

Grid	A	B	C	D	E	F
Z	18.191783	44.418544	52.453522	52.453522	44.418544	18.191783
Y	31.651948	77.283983	91.26407	91.26407	77.283983	31.651948
X	13.460165	32.865439	38.810548	38.810548	32.865439	13.460165

L3 - Top of Bleachers G = 923.6 kN

Dead Load, G (kN)

Grid	A	B	C	D	E	F
Z	73.014675	130.7795	163.02875	163.02875	130.7795	73.014675
Y						
X						

L2 -Middle of Bleachers/ timber celing G = 2242.3 kN

Dead Load, G (kN)

Grid	A	B	C	D	E	F
Z	64.69437	157.96306	186.53738	186.53738	157.96306	64.69437
Y	112.56196	227.3414	277.05796	277.05796	227.3414	112.56196
X						

L1 -Bottom of Bleachers/ timber floor G = 3231.1 kN

Assumed distrbution at each node

Grid	A	B	C	D	E	F
Z	20%	20%	20%	20%	20%	20%
Y	50%	50%	50%	50%	50%	50%
X	30%	30%	30%	30%	30%	30%
sum	100%	100%	100%	100%	100%	100%

Dead Load, G (kN)

Grid	A	B	C	D	E	F
Z	51.08	124.73	147.29	147.29	124.73	51.08
Y	127.71	311.83	368.23	368.23	311.83	127.71
X	76.63	139.60	173.44	173.44	139.60	76.63

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 3.0 Mass Model LIVE LOAD	Date	Project No.	By	Page No.
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LIVE LOAD, Q (KN)

L 4 -Roof Level

Q tot = 121.2 kN
Q = 0.25 kPa

Live Load, Q (kN)

Grid	A	B	C	D	E	F
Z	2.752281	6.7201943	7.9358265	7.9358265	6.7201943	2.752281
Y	4.7887035	11.69249	13.807573	13.807573	11.69249	4.7887035
X	2.0364225	4.9722956	5.8717463	5.8717463	4.9722956	2.0364225

L3 - Top of Bleachers

Q tot = 516.4 kN
Q = 5 kPa

Live Load, Q (kN)

Grid	A	B	C	D	E	F
Z	40.819866	36.115372	54.144762	54.144762	36.115372	40.819866
Y	0	0	0	0	0	0
X	0	0	0	0	0	0

L2 -Middle of Bleachers/ timber celing

Q tot = 1223.8 kN
Q = 5 kPa

Live Load, Q (kN)

Grid	A	B	C	D	E	F
Z	35.308685	86.212571	101.80777	101.80777	86.212571	35.308685
Y	61.433707	86.447809	113.58196	113.58196	86.447809	61.433707
X	0	0	0	0	0	0

L1 -Bottom of Bleachers/ timber floor

Q internal = 1350.4 kN
Q bleachers = 1132.7 kN
Qtotal = 2483.1 kN
Q = 5 kPa

Live Load, Q (kN)

Grid	A	B	C	D	E	F
Z	38.96	95.13	112.34	112.34	95.13	38.96
Y	67.79	165.52	195.46	195.46	165.52	67.79
X	89.54	155.08	194.63	194.63	155.08	89.54

Transverse Bleacher Beam on Gridlines - removed point load and added as UDL

L = 11.733 m
Qudl bleacher = 6.5/2 x 5
= 16.25 kN/m
= 190.66125 kN

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 3.0 Mass Model Weights ye*ya*Q + G	Date	Project No.	By	Page No.
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Seismic Weight, Wi (kN)

Wi = G + ye ya Q

ye = 0.3 except roof

ya = 1

L 4 -Roof Level

w4 = 800.8 kN

ye = 0

Seismic Weight, W4 (kN)

Grid	A	B	C	D	E	F
Z	18.191783	44.418544	52.453522	52.453522	44.418544	18.191783
Y	31.651948	77.283983	91.26407	91.26407	77.283983	31.651948
X	13.460165	32.865439	38.810548	38.810548	32.865439	13.460165

L3 - Top of Bleachers

Q tot = 812.3 kN

Seismic Weight, W3 (kN)

Grid	A	B	C	D	E	F
Z	85.260635	141.61411	179.27218	179.27218	141.61411	85.260635
Y	0	0	0	0	0	0
X	0	0	0	0	0	0

L2 -Middle of Bleachers/ timber celing

Q tot = 2343.2 kN

Seismic Weight, W2 (kN)

Grid	A	B	C	D	E	F
Z	75.286976	183.82683	217.07972	217.07972	183.82683	75.286976
Y	130.99208	253.27574	311.13255	311.13255	253.27574	130.99208
X	0	0	0	0	0	0

L1 -Bottom of Bleachers/ timber floor

W1 = 3709.8 kN

Seismic Weight, W1 (kN)

Grid	A	B	C	D	E	F
Z	62.77	153.27	181.00	181.00	153.27	62.77
Y	148.05	361.48	426.87	426.87	361.48	148.05
X	103.49	186.12	231.83	231.83	186.12	103.49

Seismic Weight, W4 (kN)

Grid	A	B	C	D	E	F
Z	18.191783	44.418544	52.453522	52.453522	44.418544	18.191783
Y	31.651948	77.283983	91.26407	91.26407	77.283983	31.651948
X	13.460165	32.865439	38.810548	38.810548	32.865439	13.460165

L3 - Top of Bleachers Q tot = 812.3 kN

Seismic Weight, W3 (kN)

Grid	A	B	C	D	E	F
Z	85.260635	141.61411	179.27218	179.27218	141.61411	85.260635
Y	0	0	0	0	0	0
X	0	0	0	0	0	0

L2 -Middle of Bleachers/ timber celing Q tot = 2343.2 kN

Seismic Weight, W2 (kN)

Grid	A	B	C	D	E	F
Z	75.286976	183.82683	217.07972	217.07972	183.82683	75.286976
Y	130.99208	253.27574	311.13255	311.13255	253.27574	130.99208
X	0	0	0	0	0	0

L1 -Bottom of Bleachers/ timber floor W1 = 3709.8 kN

Seismic Weight, W1 (kN)

Grid	A	B	C	D	E	F
Z	62.77	153.27	181.00	181.00	153.27	62.77
Y	148.05	361.48	426.87	426.87	361.48	148.05
X	103.49	186.12	231.83	231.83	186.12	103.49

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Node numbers

L4 - roof

Grid	A	B	C	D	E	F
Z	108	103	322	135	106	107
Y	264	265	323	347	370	381
X	291	292	329	353	376	382

L3 - top of bleachers

Grid	A	B	C	D	E	F
Z	191	203	162	166	242	255
Y						
X						

L2 - middle of bleachers

Grid	A	B	C	D	E	F
Z	114	132	133	147	123	115
Y	192	204	217	230	243	256
X						

L1 - bottom of bleachers

Grid	A	B	C	D	E	F
Z	653	113	112	138	111	663
Y	652	33	34	670	36	662
X	194	206	219	232	245	258

Transverse Bleacher Beams on Gridlines

473 474 477 478 488 491 492 501 502 505 506 515 516 519 520 1072 To 1084 1086 To 1095 1097

Modal Response Spectra

Vb ESM = 13205 kN

Model	Vx (kN)	Vz (kN)	mode @ 90% X	mode @ 90% Z	scale factor X	scale factor Z
X,Z	7911.95	5399.72	14	25	1.67	2.45
X,-Z	7738.86	5327.53	15	25	1.71	2.48
-X,Z	7846.81	5400.35	14	25	1.68	2.45
-X,-Z	7669.7	5362.35	15	26	1.72	2.46

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 4.0 MATERIAL & SECTION PROPERTIES Concrete, Brick and Block	SAWREY CONSULTING ENGINEERS LTD			
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Cracked Section Properties

for walls:

Icr =	0.32	Ig (ULS)	Table C6.5
or Ecr =	0.32	E	NZS3101
Icr =	1	Ig (SLS)	

for beams:

Icr =	0.43	Ig (ULS)	Table C6.5
or Ecr =	0.43	E	NZS3101
Icr =	1	Ig (SLS)	

Existing Concrete

for walls: 1 : 2.25 : 3.75 concrete mix drawings

f'c spec =	2000	PSI (assumption based on mix)	
=	13.8	Mpa	
f'c prob =	1.5 x f'c spec		
=	20.7	MPa	
Econc =	4700 x sqrt (f'c)		C5.4
=	21	GPa	
Ecr =	6.9	GPa	

for beams: 1 : 2.25 : 3.75 concrete mix drawings

f'c spec =	2000	PSI (assumption based on mix)	
=	13.8	Mpa	
f'c prob =	1.5 x f'c spec		
=	20.7	MPa	
Econc =	4700 x sqrt (f'c)		C5.4
=	21	GPa	
Ecr =	9.2	GPa	

New Concrete

for walls:

ρ=	24	kN/m3	
=	2400	kg/m3	
f'c =	30	Mpa	
f'c for E =	f'c + 10	MPa	
=	40	MPa	
Econc =	$[4700\sqrt{f'c}]*(r/2300)^{1.5}$		
=	32	GPa	Eq 5-1 NZS3101
Ecr =	10.1	GPa	

for beams:

ρ=	24	kN/m3	
=	2400	kg/m3	
f'c =	30	Mpa	
f'c for E =	f'c + 10	MPa	
=	40	MPa	
Econc =	$[4700\sqrt{f'c}]*(r/2300)^{1.5}$		
=	32	GPa	Eq 5-1 NZS3101
Ecr =	13.6	GPa	

Shear Modulus

Gconc = Gmasonry =

G= 0.4Ec (C5E.5.5.5)

= 8.6 GPa

Existing Masonry

For: Clay Brick Masonry

C8.7.2 Clay bricks and mortars

Observation: Brick scratches with a 10c copper coin

f'b=f'cb = 26 MPa Table C8.3

Observation: mortar Scratches with finger nails

f'j =f'g = 3 MPa

Masonry probably Compressive Strength (C8.7.3)

f'mp = 0.75*f'b^0.75*f'j^0.3

= 12.0 Mpa

E masonry = 700 f'm (equation C7.1)

= 8404.8 Mpa

= 8.4 GPa

G masonry = 0.4 Em (eq C8.5)

= 3.4 Gpa

For: Concrete Block Masonry

f'm =	12	Mpa	NZS 4230:2004 section CB2
f'mp =	1.5 x f'm		
=	18	Mpa	
υ=	0.2	(2017, NZS3101 5.2.7)	
G =	E/((2*(1+u)	(UCAN Mar 2009, Sefano Pampanin)	
=	13.2	Gpa	
E masonry =	900 f'm	(C7.2)	
=	16200	Mpa	
Ecr =	5.2	GPa	for walls

For: Stand alone clay brick masonry wall

E masonry =	300	f'm	(eq C8.4)
=	3602.0	Mpa	
=	3.6	Gpa	
G masonry =	0.4	Em	(eq C8.5)
=	1.4	Gpa	

June 17 1935, Journal of the American Concrete Institute - Proceedings, Isteg Steel for Concrete Reinfrocement, D. B. Steinman
Conducted at the Civil Engineering Testing Laboratories of Columbia University, from September 1934 to March 1935.

pitch = 12.5 db

Tension Tests

Table 2 - relative strength of plain and twisted bars
(Average Values in Pounds per Square Inch)

bar size	round bar		ISTEG		ISTEG / round bar	
inches	fy	fu	fy	fu	fy	fu
	(PSI)	(PSI)	(PSI)	(PSI)	%	%
0.375	39900	57900	56330	66300	141%	115%
0.5	36700	56700	55730	66000	152%	116%
0.625	34800	53900	51400	62070	148%	115%
0.75	34000	53400	50470	58420	148%	109%

This yield strength is for cold worked materials (Isteg bars) and for hot rolled rods (plain and deformed bars).
The yeild point is for hot rolled rods (plain and deformed bars) only and is tested using "drop of the beam" method.

The test for yield strength is at permanent elongation of 0.2% or a total elongation of 0.4% (under load).
This is because cold worked matieral (Isteg bars) have a smooth stress-strain curve with no definite "yield point".

Average Value for Elastic Modulus, E

E rods	30124000
E isteg	22854000
Eisteg/E rods	76%

Conditions of Beams at Failure

	max load	max observed steel stress	Factor of Safety based on design stresses of: Plain (18000)	Plain (18000) Isteg (27000)
1.25 deformed	52180	36700	2.2	2.2
1.25 deformed	55000	36900	2.29	2.2
0.75 Isteg	55000	53450	3.28	2.18
0.75 Isteg	57600	53400	3.3	2.21

Beams with plain round bars & deformed bars had a few main cracks near the centre (0.2 to 0.3 inches)
Beams with Isteg steel developed finer cracks which were more uniformely distributed (0.1 to 0.15 inches)

Conclusion: Beams designed with Isteg steel at 27,000 p.s.i. and with a 15 percent increase in concrete stress will have a higher factor of safety than beams designed with plain or deformed bars at 18,000 p.s.i and with the usually specificed concrete stress.

db	round bar	ISTEG
mm	fu/fy	fu/fy
9.525	1.45	1.18
12.7	1.54	1.18
15.875	1.55	1.21
19.05	1.57	1.16

Seismic Assessment Guidelines -

Table C5.4 note 3. states that Cold drawn mesh does not exhibit a defined yield plateau.
The value shown is an approximate 0.2% offset proof stress.

Section C5.4.3 Reinforcing: material strain capacity of cold drawn mesh is highly variable.
Strain induced by long term effects such as shrinkage.
Shrinkage strains alone can be sufficient to exceed the strain capacity of cold drawn mesh.

Table C5.4 approximate date range pre-1945 shows a lower bound tensile strain, esu = 10%
Table C5.4 cold drawn mesh, esu = 1.5%
Table C5.4 probable yield strength fy = 280 Mpa.
C5.4.3.2 of the guidelines released in July 2017 - reinforcement in NZ structure built during the 1930's to the 1970's
The reinforcing steels probable yield strength may be taken as 1.08 x 1.15 = 1.25 times the spceified stress values

C5.4.3 - the probable modulus of elasticity of reinforcing steel may be taken as 200,000 Mpa
Table C5.10 - $\varepsilon s,max = 0.6\varepsilon su <= 0.06$

University of Canterbury Lectur Notes - ENCI332 (2008)

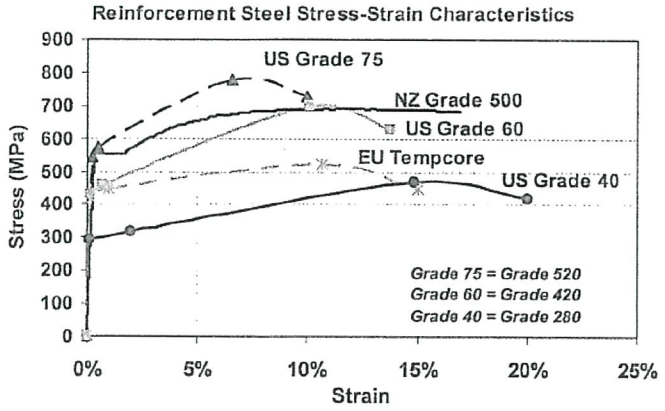


Figure 2.10. Typical reinforcing steel stress-strain curves for modern New Zealand, US and European bars

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 4.0 MATERIAL & SECTION PROPERTIES ISTEG Bars Interpretation & Assumption	SAWREY CONSULTING ENGINEERS LTD			
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Interpretation Our interpretation is that the yield point has been exceeded or nearly been exceeded by the manufacturing process.

strain as manufactured

try db = 0.75 "
= 19.05 mm

C = 2 x pi() x (db/2)
= 59.84734005 mm

H =pitch = 12.5 db
= 238.125 mm

L helix = sqrt(H^2 + C^2)
= 245.5304864 mm

DL = L helix - H
= 7.405486368 mm

esm = DL/L
= 3.11% for Isteg
= 0.00% for Plain

Strain at rupture (our interpretation)

erup = rupture strain
= 7.1% table C5.4

Test reports make no mention of uncertainty in the measured ultimate strain therefore, the strain limitiations of cold drawn mesh are not applicable.

Residual Strain

eres = erup - esm - esy - eshr
= 3.50% for isteg bars
= 6.61% for plain bars

Shrinkage Strain

eshr = shrinkage strain
= 0.10% assumed

Strain at yield strength

esy = 0.4% + esm
= 0.40% for round bars
= 3.51% for ISTEG bars

Strain at ultimate strength (our interpretation)

esu = 0.6 x eres + esy
= 4.37% for round bars
= 5.61% for ISTEG

Stress adopted for the model

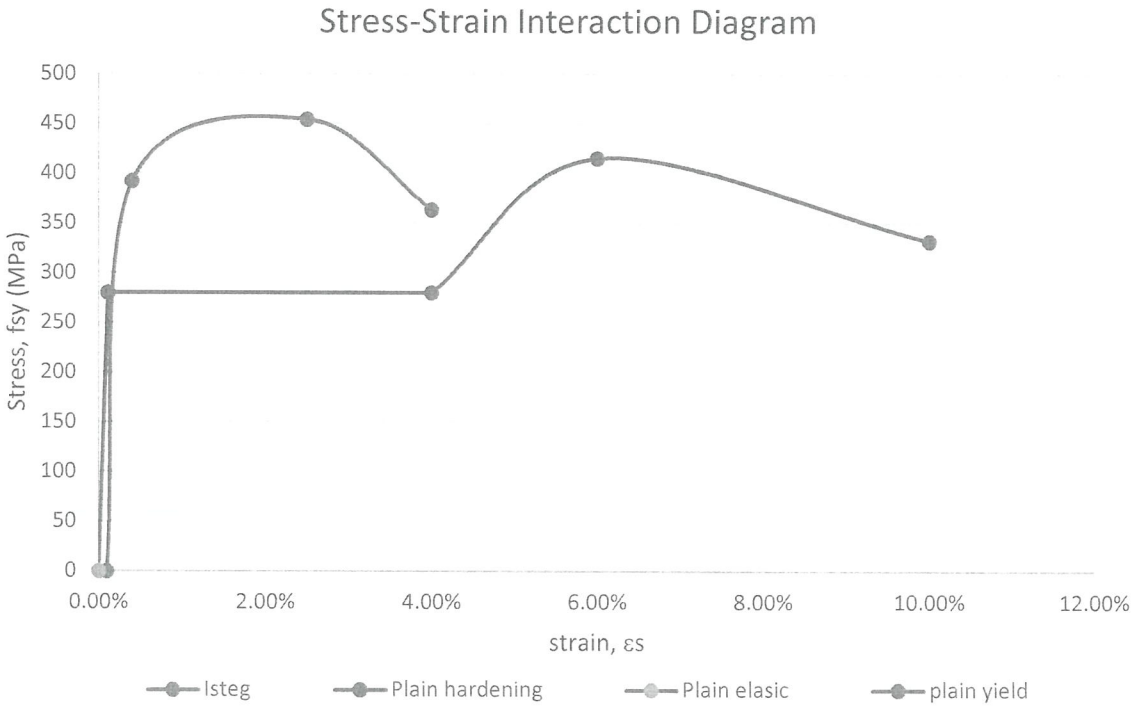
Es= 30124000 PSI
= 207698 Mpa

fy = 18000 PSI allowable x FOS = 2
= 248 Mpa assumed yield point
fyp = 280 MPa (table C5.4)
= 1.13 fy

es	plain bar fs (PSI)	plain bar fs (Mpa)	Isteg scale factor	Isteg fs (Mpa)	plain x fs for plain	plain fyp (Mpa)	x fyp for plain	Isteg fyp (Mpa)
0	0	0	0	0	1.129	0		
0.0011			0	0	1.129	280		
0.0400	34000	234	1.48	347.35	1.129	264.1935484	1.48	392.17
0.0600	53000	368	1.09	402.59	1.129	415	1.09	454.54
0.1					0.8 x fyp @ 6%	332.3870968	0.8 x fyp @ 6%	363.63

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 4.0 MATERIAL & SECTION PROPERTIES ISTEG Yield Stress Assumed for this DSA	SAWREY CONSULTING ENGINEERS LTD			
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Plain elasic		plain yield		Plain hardening		Isteg		
es	fyp	es	fyp	es	fyp	es	es	fyp
0%	0							
0.0011	280	0.0011	280			esm + eshr	0.10%	0
		0.0400	280	0.0400	280	esy	0.40%	392.17
				0.0600	415.483871	esu	2.50%	454.5
				0.1000	332.3870968	es rupture	4.00%	363.6



summary of assumptions

Assume that the yield point of the plain round bars used in the testing had been 234 Mpa.

The probable yield strength adopted for this DSA is reached when the bar reaches 0.4% strain (i.e. 0.4% - shrinkage + manufacturing strain)

fyp = (4%+esm-eshr) x fp isteg
(4%+esm)

= 0.97 x fp isteg

= 381.0 Mpa

However, conservatively assume, to allow for uncertainty in the steel used for this building. **fyp = 324 Mpa**

This has been reviewed and accepted by Cpeng Engineers TD and SRKS.

vided with straight untwisted ends 24 in. long for comparative tension tests on the original material.

The concrete for all tests was made of uniform materials, proportions, curing, and strength, the 69 control cylinders closely checking the uniform strength of approximately 3300 p.s.i. in 28 days.

1. TENSION TESTS

In addition to the determination of the usual physical properties, the tension tests included strain measurements from which the modulus of elasticity and the stress-strain curves were obtained. Both "continuous" load tests (with continuous application of increasing load) and "repeated" load tests (with release of loading at intervals to obtain permanent "set" measurements) were included.

The "useful" limit or "yield strength" of reinforcing steel is defined as the stress producing a permanent elongation of 0.2 per cent or a total elongation under load of 0.4 per cent. These two criteria yield almost identical values. Below this stress, the effect of any plastic yielding upon the usefulness of the material is negligible; beyond this stress, the capacity of the concrete to follow the strain of the steel is impaired. For all bars tested, the "yield strength" was determined from the plotted stress-strain curves. In the case of the hot-rolled rods (plain and deformed bars), this yield strength is not appreciably different from the yield point as determined by the "drop of the beam" method. In the case of the cold worked material (Isteg bars), in which the stress-strain graph is a smooth curve in the region of yield, there is no definite "yield point" and the "drop of the beam" method cannot be used.

The results of the tension tests on the Isteg bars are recorded in Table 1.

TABLE 1—TENSION TESTS ON ISTEG BARS

Isteg Bar Size	Type of Test	Yield Strength p.s.i.	Ultimate Strength p.s.i.
⅜" ϕϕ	Repeated	56,500	65,800
⅜" ϕϕ	Continuous	56,400	66,900
⅜" ϕϕ	Continuous	56,100	66,200
½" ϕϕ	Continuous	56,100	65,700
½" ϕϕ	Repeated	55,600	65,600
½" ϕϕ	Continuous	55,500	66,700
⅝" ϕϕ	Repeated	51,700	61,900
⅝" ϕϕ	Continuous	51,300	62,400
⅝" ϕϕ	Continuous	51,200	61,900
¾" ϕϕ	Repeated	50,900	58,150
¾" ϕϕ	Continuous	50,800	58,200
¾" ϕϕ	Continuous	49,700	58,900

fy (PSI)	fy (MP)
56500	390
56400	389
56100	387
56100	387
55600	383
55500	383
51700	356
51700	356
51300	354
51200	353
50900	351
50800	350
49700	343

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 5.0 URM Infill Parts Coefficient for Out of Plane Actions	SAWREY CONSULTING ENGINEERS LTD			
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In Canterbury? 1=Y 0

If IL1 or 6 month DWL, hazard analysis etc, input Ru Rs= 0.35

1 Classification of Part - Refer Table P.2&3

Criteria	Part Risk Factor Rp ref. Table 8.1	Structure limit state	
a hazard to human life within the structure, e.g. Vessels containing a hazardous material; Ceiling systems; Heavy partitions; Warehouse racking; Items exceeding [7.5kg&3m; 25kg on wall, 50kg on floor]; Lift support systems.	1.0	ULS	ULS

Wp = 35.77 kN
P = 0.00
h = 2.40 m

Tp = sqrt((0.28h/(1+2P/W))
= 0.82 sec
esuation C8.23 - simplification for regula

1	P. 1	a hazard to life outside the	1	ULS
2	P.2&3	a hazard to human life with	1	ULS
3	P.2&3	a hazard to human life with	1	ULS
4	P.4	contiuing function of the e	1	ULS
5	P. 5	IL4 BLDGS -OPERATIONAL (	1	SLS2
6	P. 6	SLS1 Part for which the cor	2	SLS1
7	P. 7	SLS1 All other parts. eg ligh	1	SLS1

2 Elastic Site Spectra for the Building

Site Subsoil Class:	Table3.1 NZS	C	
Spectral shape factor Ch(0).	Ref Table 3.1, NZS	1.33	Spectral shape factor $C_v(0.1)$ for Eqtn 3.2(2)
Hazard Factor	Z	0.4	table 3.3 of NZS1170.5
Building Importance Level	"I"	3	table 3.2 of AS/NZS1170.0
Design working life		50 years	table 3.3 of AS/NZS1170.0
Risk Factor, R for the structure= Rs or Ru		1.30	table 3.5 of NZS1170.5
Near-fault factor	N(T,D)	1.0	eqtn 3.1(2), 3.1(3) of NZS1170.5
Note	ZRu=	1	(maximum value is 0.7)

C(0)= Ch(0) z R N(T,D)=	**0.692**

3 Floor Height Cofficient C_{Hi}

Height of structure, m	h_n	10	height to uppermost seismic weight or mass
Height of part, m	h_i	1.2	height of attachment to the part
Floor Height Coeficcient	C_{Hi}	**1.20**	eqtn 8.3 (1) or (2) or (3) of NZS1170.5

4 Part Spectral Shape Coefficient

Period of the Part, sec	Tp	0.82	Note: use the period of the part, not the building period.
Part Spectral Shape Coefficient Ci (Tp)		**1.86**	eqtn 8.4.1 of NZS1170.5

7 Design Response Coefficient for the Part

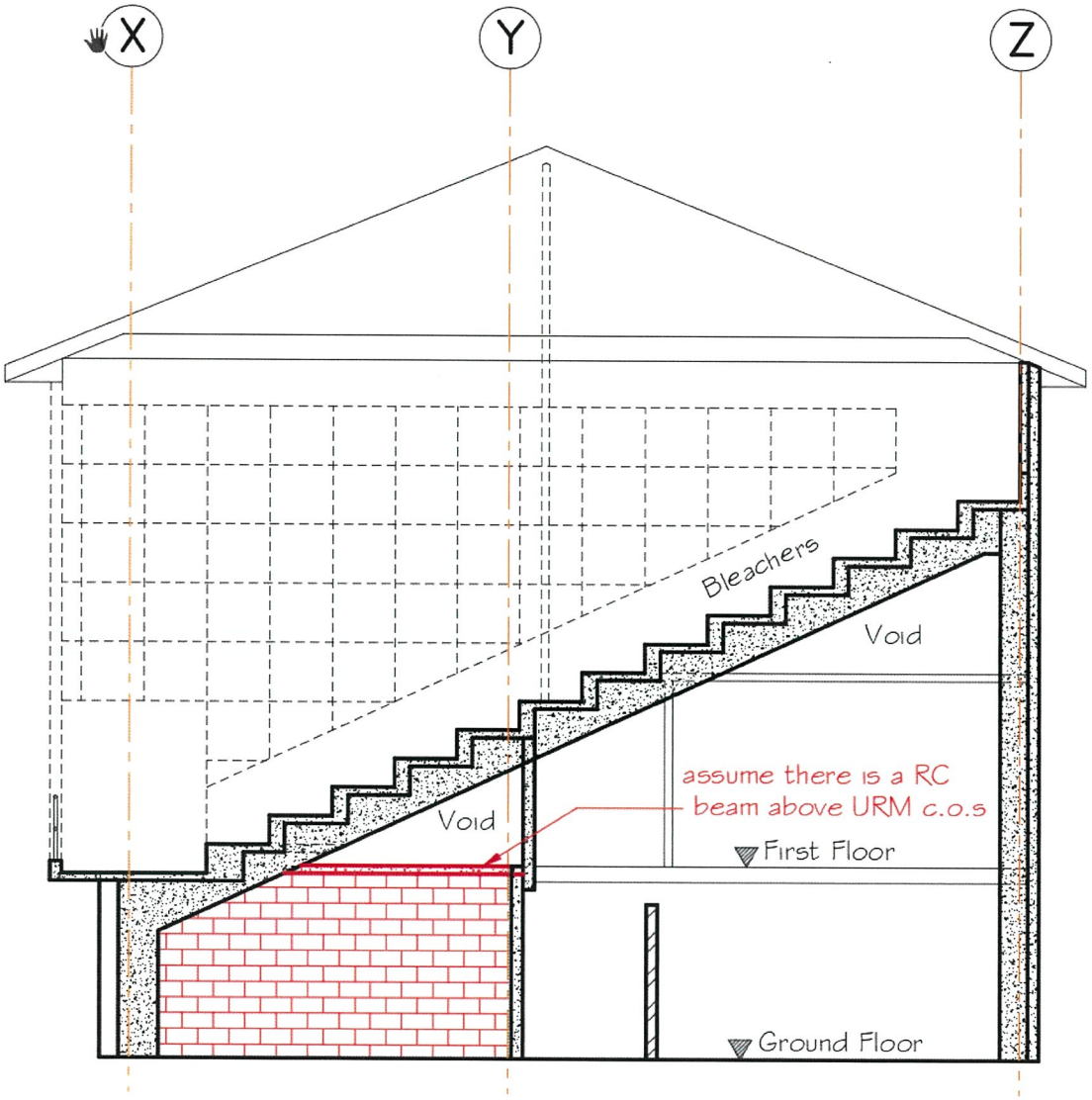
Cp(Tp) = C(0) CHi Ci(Tp) = 1 x 1 x 1.9

= **1.544**

Cp(Tp)

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 5.0 URM Infill OUT OF PLANE ACTIONS (OOP) - GROUND FLOOR WALLS	SAWREY CONSULTING ENGINEERS LTD			
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Assume there is a beam on top of the brick.



Assessment of Masonry Infill for Out-of-Plane Actions (section 7.6 of the guidelines)

1) Horisontal and vertical arching coefficients

no wall other side of column? Y
no wall above? Y
Ground floor? Y

tgross = 120 mm
hinf = 3000 mm
Linf = 4581 mm

f'cp = 20.7 Mpa
Ecr col = 6900 Mpa
Ecr beam = 9200 Mpa

f'mp = 12 Mpa
E'm = 8400
t <= hinf/8? OK

	Col LHS	COL RHS	Col Avg	Beam Bot	Beam Top	Beam Avg
gap >.02t	N	N	N	N	N	N
b (mm)	406	507	456.5	355	406	406
d (mm)	761	507	634	609	559	559
I (mm^4)	1.5E+10	5.5E+09	9.7E+09	6.7E+09	5.9E+09	5.9E+09
E_{cr} (MPa)	6.9E+03	6.9E+03	6.9E+03	9.2E+03	9.2E+03	9.2E+03
h, L (mm)	3000	3000	3000	4581	4581	4581
a, b	58	45	52	41	40	40
a,b limit	50	50	50	50	50	50
a_{arch}, b_{arch}			50			40

aarch = 50
barch = 40

(50 limit only applies to corner column with no wall adjacent)

(50 limit only applies to top beam with no wall above)

$$\alpha_{arch} = \frac{1}{h_{inf}}\left(E_{bc}\, I_{bc}\, h_{inf}^2\right)^{0.25} \le 50$$

$$\beta_{arch} = \frac{1}{L_{inf}}\left(E_{bb}\, I_{bb}\, L_{inf}^2\right)^{0.25} \le 50$$

Nominal Thickness
n = 2
p = 5 mm
tnom = tgross - np (equation C8.10)
= 110 mm
Effective Thickness
t = t_{nom} x 0.98 (C8.8.5.2 step 2)
= 107.8 mm

2) In-plane cracking capacity reduction coefficient

gmax= 1
g1 = 1.1*(1-hinf/55t) = 0.543
g = min(g_{max},g_1) = 0.543

3) The out-of-plane probable strength of an infill wall

qprob = 730*g*(f'm)^0.75*t^2*(a_{arch}/L_{inf}^2.5+b_{arch}/h_{inf}^2.5)
= 3.5 kPa
= 47.6 kN
= 92% NBS (IL2)

4) The out-of-plane demand

brick weight 18 kN/m3 (C8.7.8)
ρ= 18 x tgross
= 2.16 kPa

hn = 10 m
hi = 1.80 m
T(p) = 1.00 sec
Cp(Tp) = 1.341
Cph = 1
R = 1.3

Fph = Cp(Tp)*Cph*Rp*Wp
= 1.7433 *ρ
= 3.765528 kPa

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 5.0 URM Infill URM INFILL - TRANSVERSE - WALL B2 TO B8 - IN-PLANE STIFFNESS	SAWREY CONSULTING ENGINEERS LTD			
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Probable In-plane Stiffness

f'm = 12 Mpa

hinf = 3000 mm

Linf = 4581 mm

tinf = 120 mm

E'm = 8400.0 Mpa

Efc = 6900.0 Mpa

λ1 = Em x tinf x sin (2f)

= 923974.3

λ2 = 4 x Er x Icl x hinf

= 4 x Ec x Icl x hinf

= 455911.9 x10^12

λ = (λ1/(λ2*10^12))^0.25

= 0.001193149

f'cp = 20.7 Mpa

b = 507 mm

d = 507 mm

Hcol = hinf + d (of beam)

= 3559 mm

Icol = bd^3/12

= 5506.2 x 10^6 mm4

θ = atan (hinf/Linf)

= 0.580 rad

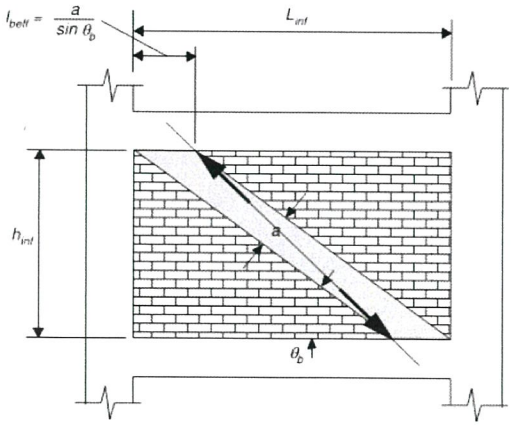
= 33.220 degrees

r inf = sqrt(hinf^2 + Linf^2)

= 5475.9 mm

a = 0.18 x (λ x hcol)^-0.25 x rinf

= 686.6 mm



equivalent strut

D = 686.6 mm

B = 120 mm

qb = 0.616321428 rad

35.31261665 deg

eq1 = taqb

= 0.708370112

eq2 = hinf/(Linf-(a/sinqb))

0.884138079

eq1 - eq2 = -0.175767967

Figure C7.16: Estimating infill strut demands on beams (FEMA 306, 1998)

Probable in-plane strenth

Vin1 = 0.33 x sqrt (f'm) x t x Linf

= 564.5 kN

Vin2 = 0.83 x t x Linf

= 409.9 kN

Vin3 = 0.4 x t x Linf + 0.45P

= 647.5 kN

in accordance with C7.7.2.2, Vin3 doesn't typically govern

Vin = min(Vin1, Vin2, Vin3)

= 409.9 kN

The calculation for P or qe is unclear

P= (D/hinf)^2 x qe^2 x t x Linf x Em

= adopt the following

P = 1000 kN

Corner crushing strength

k = 250 mm (C7.7.2.3)

vcc = K x t x f'm

= 323.4 kN

fVN = min(Vin1, Vin2, Vcc)

= 323.4 kN

Effect of reinforcem N/A

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 5.0 URM Infill URM INFILL - TRANSVERSE - WALLA1 TO A7 - OUT-OF-PLANE	SAWREY CONSULTING ENGINEERS LTD			
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Assessment of Masonry Infill for Out-of-Plane Actions (section 7.6 of the guidelines)

1) Horisontal and vertical arching coefficients

no wall other side of column? n
no wall above? n
Ground floor? Y
tgross = 240 mm
hinf = 3000 mm
Linf = 4581 mm
t <= hinf/8? OK

f'cp = 20.7 Mpa
Ecr col = 6900 Mpa
Ecr beam = 9200 Mpa
f'mp = 12 Mpa
E'm = 8400

	Col LHS	COL RHS	Col Avg	Beam Bot	Beam Top	Beam Avg
gap >.02t	N	N	N	N	N	N
b (mm)	406	507	456.5	355	406	406
d (mm)	761	507	634	609	559	559
I (mm^4)	1.5E+10	5.5E+09	9.7E+09	6.7E+09	5.9E+09	5.9E+09
E_{cr} (MPa)	6.9E+03	6.9E+03	6.9E+03	9.2E+03	9.2E+03	9.2E+03
h, L (mm)	3000	3000	3000	4581	4581	4581
a, b	58	45	52	41	40	40
a,b limit	1000	1000	1000	1000	1000	1000
a_{arch}, b_{arch}			52			40

aarch = 52
barch = 40

(50 limit only applies to corner column with no wall adjacent)

(50 limit only applies to top beam with no wall above)

$$\alpha_{arch} = \frac{1}{h_{inf}}\left(E_{bc}\, I_{bc}\, h_{inf}^2\right)^{0.25} \le 50$$

$$\beta_{arch} = \frac{1}{L_{inf}}\left(E_{bb}\, I_{bb}\, L_{inf}^2\right)^{0.25} \le 50$$

Nominal Thickness
n = 2
p = 5 mm
tnom = tgross - np (equation C8.10)
= 230 mm
Effective Thickness
t = t_{nom} x 0.98 (C8.8.5.2 step 2)
= 225.4 mm

2) In-plane cracking capacity reduction coefficient

gmax= 1
g1 = 1.1*(1-hinf/55t)
= 0.834
g = min(g_{max},g_1)
= 0.834

3) The out-of-plane probable strength of an infill wall

qprob = 730*g*(f'm)^0.75*t^2*(a_{arch}/L_{inf}^2.5+b_{arch}/h_{inf}^2.5)
= 23.6 kPa
= 323.7 kN
= 313% NBS (IL2)

4) The out-of-plane demand

brick weight 18 kN/m3 (C8.7.8)
ρ= 18 x tgross
= 4.32 kPa

hn = 10 m
hi = 1.80 m
T(p) = 1.00 sec
Cp(Tp) = 1.341
Cph = 1
R = 1.3

Fph = Cp(Tp)*Cph*Rp*Wp
= 1.743 *ρ
= 7.531 kPa

Probable In-plane Stiffness

f'm = 12 Mpa
hinf = 3000 mm
Linf = 4581 mm
tinf = 240 mm

E'm = 8400.0 Mpa
Efc = 6900.0 Mpa

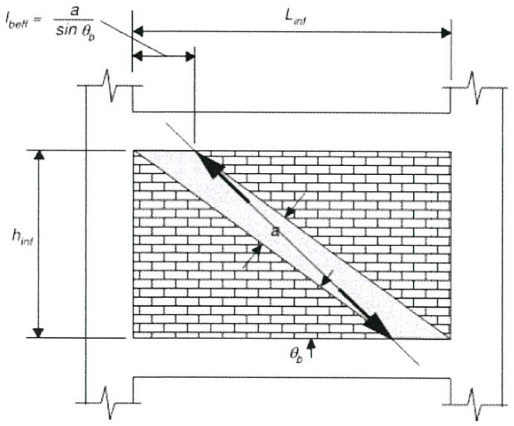
λ1 = Em x tinf x sin (2f)
= 1847948.6
λ2 = 4 x Er x Icl x hinf
= 4 x Ec x Icl x hinf
= 455911.9 x10^12
λ = (λ1/(λ2*10^12))^0.25
= 0.001418901

f'cp = 20.7 Mpa
b = 507 mm
d = 507 mm
Hcol = hinf + d (of beam)
= 3559 mm
Icol = bd^3/12
= 5506.2 x 10^6 mm4

θ = atan (hinf/Linf)
= 0.580 rad
= 33.220 degrees

r inf = sqrt(hinf^2 + Linf^2)
= 5475.9 mm

a = 0.18 x (λ x hcol)^-0.25 x rinf
= 657.5 mm



equivalent strut
D = 657.5 mm
B = 240 mm

qb = 0.610158214 rad
34.95949048 deg
eq1 = taqb
= 0.699154388
eq2 = hinf/(Linf-(a/sinqb))
0.873746275
eq1 - eq2 = -0.174591888

Figure C7.16: Estimating infill strut demands on beams (FEMA 306, 1998)

Probable in-plane strenth

Vin1 = 0.33 x sqrt (f'm) x t x Linf

= 1180.4 kN

Vin = min(Vin1, Vin2, Vin3)

= 857.0 kN

Vin2 = 0.83 x t x Linf

= 857.0 kN

The calculation for P or qe is unclear

P= (D/hinf)^2 x qe^2 x t x Linf x Em

= adopt the following

P = 1000 kN

Vin3 = 0.4 x t x Linf + 0.45P

= 863.0 kN

in accordance with C7.7.2.2, Vin3 doesn't typically govern

Corner crushing strength

k = 250 mm (C7.7.2.3)

vcc = K x t x f'm

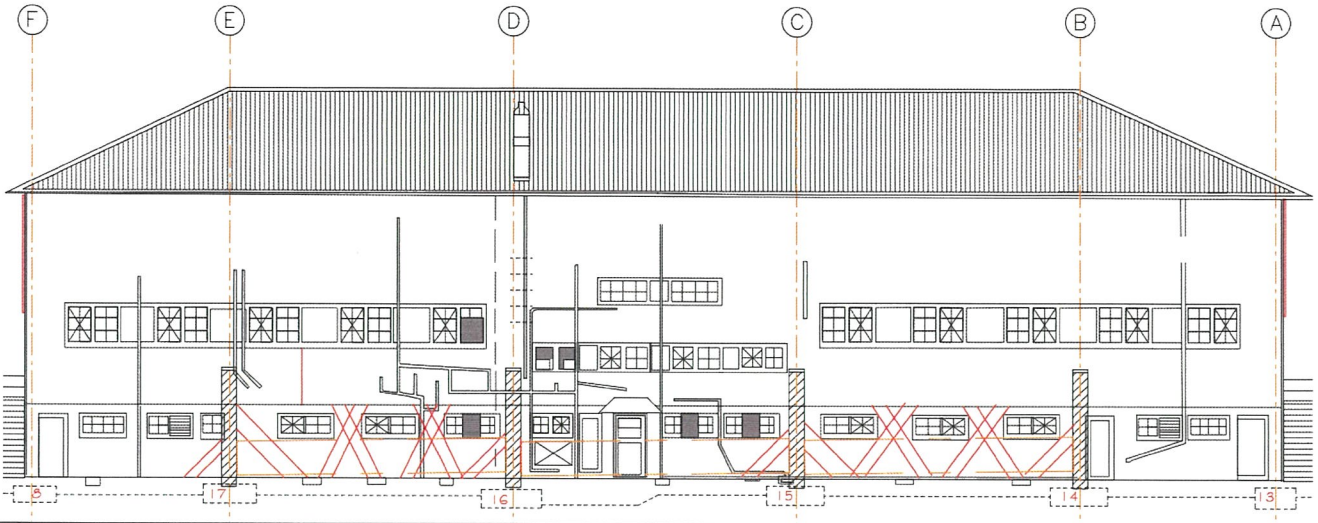
= 676.2 kN

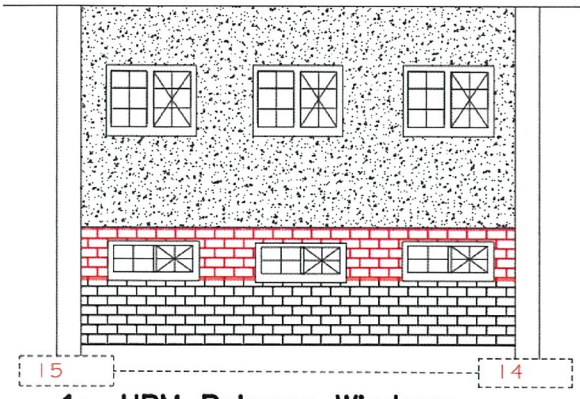
fVN = min(Vin1, Vin2, Vcc)

= 676.2 kN

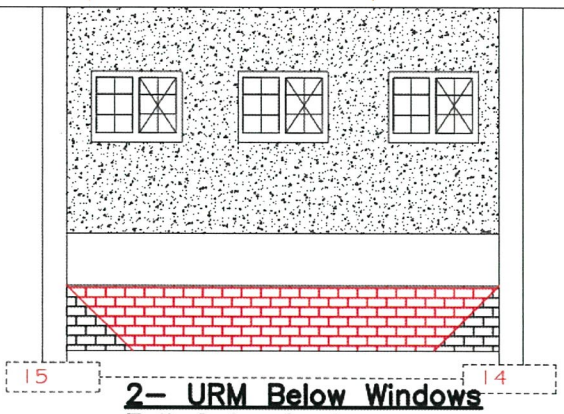
Effect of reinforcem N/A

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 5.0 URM Infill BRICK INFILL -WEST LONGITUDINAL WALL - PSUEDO PUSH-OVER ANALYSIS	SAWREY CONSULTING ENGINEERS LTD			
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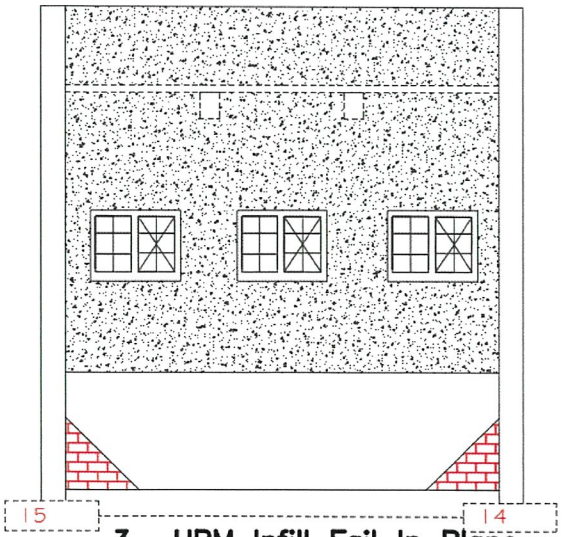




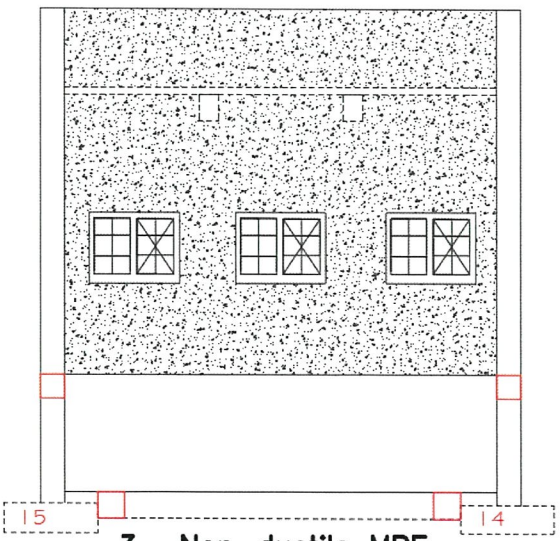
1– URM Between Windows
Fail In–plane
Toe Crushing 25kN (equation C8.31)
Not in model (demand not evaluated)



2– URM Below Windows
Fail Out–of–plane
By Observation



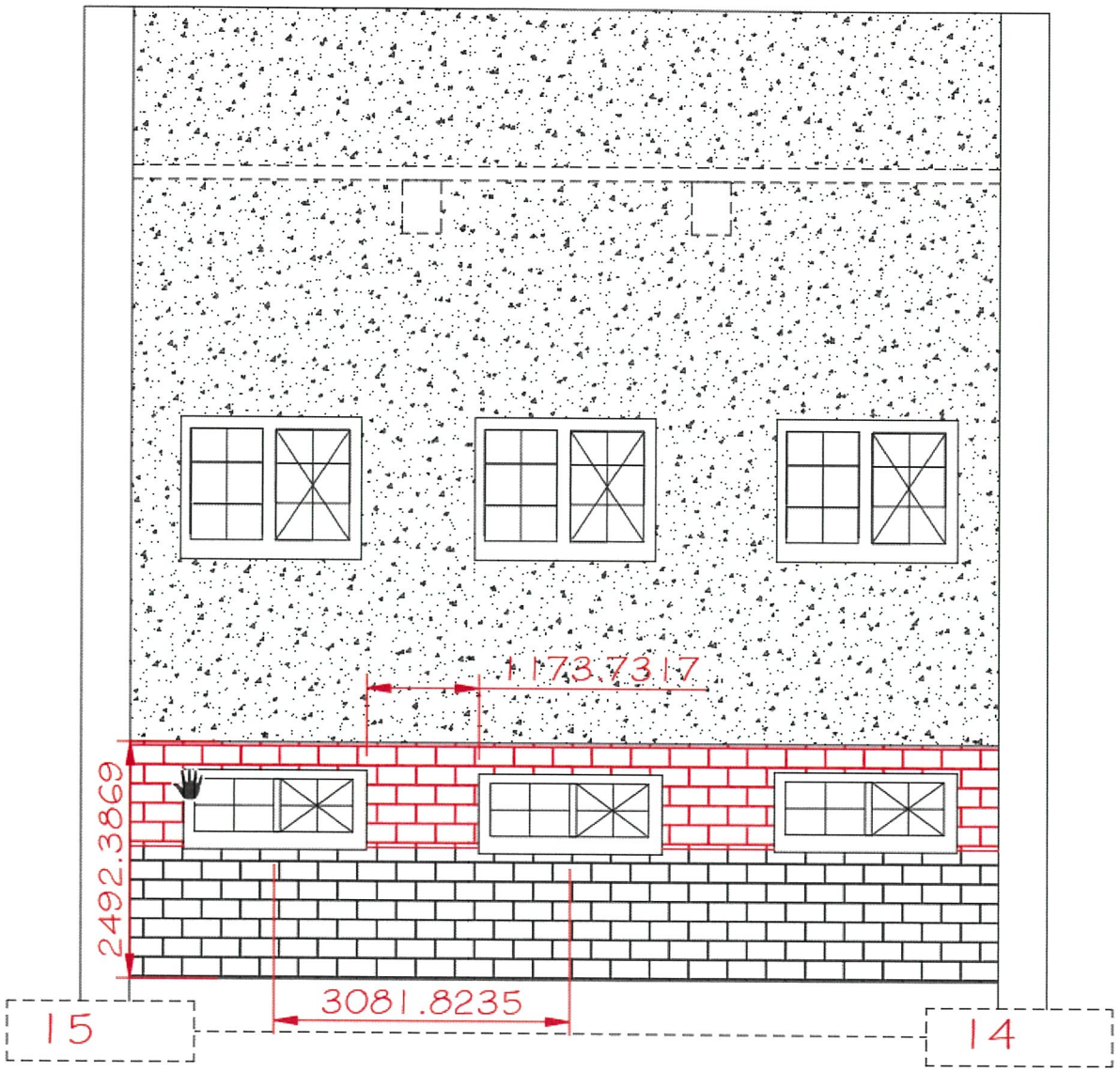
3– URM Infill Fail In Plane
or Short Columns in shear/bending
or Ground Beam in bending



3– Non–ductile MRF
Bending failure
By Observation

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Adopt a URM model for assessment of the west wall out of plane.



Length = 1.174 m
Height = 2.492 m
Wbot = Lbot/Ltop x Wtop
= 2.625 x W top

L1 = 550 mm (173mm removed for toe crushing)
H1 = 1120 mm
A1 = 0.616 m2

L2 = 3081.8 mm (173mm removed for toe crushing)
H2 = 1372 mm
A2 = 4.2282296 m2

L3 = 550
H3 = 2492
A3 = 1.3706 m2

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 5.0 URM Infill BRICK INFILL -WEST LONGITUDINAL WALL - COL 14 TO 15 OUT-OF-PLANE	SAWREY CONSULTING ENGINEERS LTD			
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Assessment of Masonry Infill for Out-of-Plane Actions (section 7.6 of the guidelines)

1) Horisontal and vertical arching coefficients

no wall other side of column? n
no wall above? n
Ground floor? Y
tgross = 240 mm
hinf = 2492 mm
Linf = 550 mm
t <= hinf/8? OK

f'cp = 20.7 Mpa
Ecr col = 9200.0 Mpa
Ecr beam = 9200 Mpa
f'mp = 12 Mpa
E'm = 8400

	Col LHS	COL RHS	Col Avg	Beam Bot	Beam Top	Beam Avg
gap >.02t	Y	Y	Y	N	N	N
b (mm)	406	507	456.5	355	127	127
d (mm)	761	507	634	609	305	305
I (mm^4)	1.5E+10	5.5E+09	9.7E+09	6.7E+09	3.0E+08	3.0E+08
E_{cr} (MPa)	9.2E+03	9.2E+03	9.2E+03	9.2E+03	9.2E+03	9.2E+03
h, L (mm)	2492	2492	2492	550	550	550
a, b	69	53	62	119	55	55
a,b limit	1000	1000	1000	1000	1000	1000
a_{arch}, b_{arch}			0			55

aarch = 0
barch = 55

(50 limit only applies to corner column with no wall adjacent)

(50 limit only applies to top beam with no wall above)

$$\alpha_{arch} = \frac{1}{h_{inf}}\left(E_{bc}\, I_{bc}\, h_{inf}^2\right)^{0.25} \le 50$$

$$\beta_{arch} = \frac{1}{L_{inf}}\left(E_{bb}\, I_{bb}\, L_{inf}^2\right)^{0.25} \le 50$$

Nominal Thickness
n = 2
p = 5 mm
tnom = tgross - np (equation C8.10)
= 230 mm
Effective Thickness
t = t_{nom} x 0.98 (C8.8.5.2 step 2)
= 225.4 mm

2) In-plane cracking capacity reduction coefficient

gmax= 1
g1 = 1.1*(1-hinf/55t) = 0.879
g = min(g_{max},g_1) = 0.879

3) The out-of-plane probable strength of an infill wall

qprob = 730*g*(f'm)^0.75*t^2*(a_{arch}/L_{inf}^2.5+b_{arch}/h_{inf}^2.5)
= 37.3 kPa
= 51.1 kN
= 122% NBS (IL2)

4) The out-of-plane demand

brick weight 18 kN/m3 (C8.7.8)
ρ= (A1 + A2)/A3 x 18 x tgross
= 63.62 x tgross
= 15.27 kPa

hn = 10 m
hi = 1.2 m
T(p) = 0.82 sec
Cp(Tp) = 1.544
Cph = 1
R = 1.3

Fph = Cp(Tp)*Cph*Rp*Wp
= 2.007 *p
= 30.647 kPa

Probable In-plane Stiffness - solid infill Adopt the URM infill stiffness model for the partially filled frame.

f'm = 12 Mpa
hinf = 1372 mm
Linf = 9076 mm
tinf = 240 mm

E'm = 8400.0 Mpa
Efc = 9200.0 Mpa

f'cp = 20.7 Mpa
b = 507 mm
d = 507 mm

Hcol = hinf + d (of beam)
= 3400 mm

Icol = bd^3/12
= 5506.2 x 10^6 mm4

$\lambda 1$ = Em x tinf x sin (2f)
= 595891.9

$\lambda 2$ = 4 x Er x Icl x hinf
= 4 x Ec x Icl x hinf
= 278004.9 x10^12

λ = ($\lambda 1$/($\lambda 2$*10^12))^0.25
= 0.001209982

θ = atan (hinf/Linf)
= 0.150 rad
= 8.596 degrees

r inf = sqrt(hinf^2 + Linf^2)
= 9179.1 mm

a = 0.18 x (λ x hcol)^-0.25 x rinf
= 1160.1 mm

equivalent strut
D = 1160.1 mm
B = 240 mm

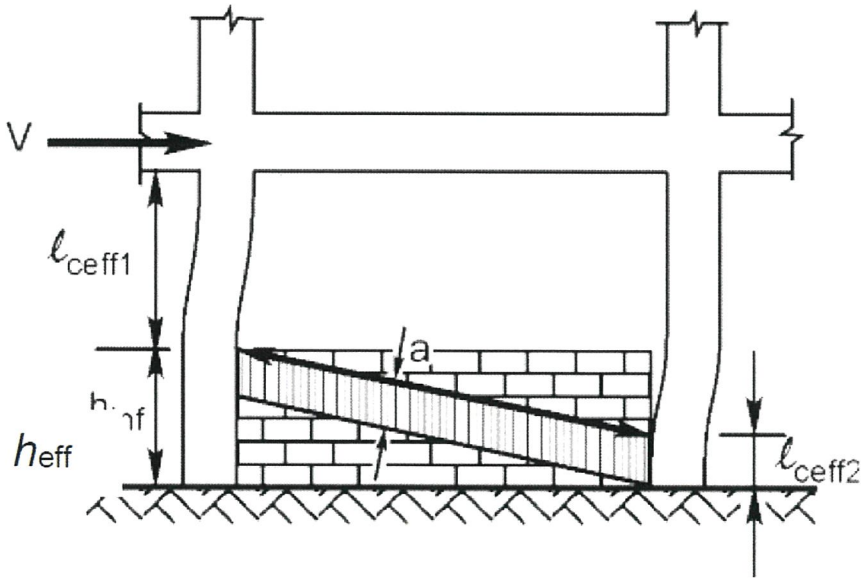


Figure C7.13: Compression strut analogy – partial infills

Probable in-plane strenth

Vin1 = 0.33 x sqrt (f'm) x t x Linf

= 2490.1 kN

Vin2 = 0.83 x t x Linf

= 1807.9 kN

Vin3 = 0.4 x t x Linf + 0.45P

= 1321.3 kN

in accordance with C7.7.2.2, Vin3 doesn't typically govern

Vin = min(Vin1, Vin2, Vin3)

= 1321.3 kN

The calculation for P or qe is unclear

P= (D/hinf)^2 x qe^2 x t x Linf x Em

= adopt the following

P = 1000 kN

Corner crushing strength

k = 250 mm (C7.7.2.3)

vcc = K x t x f'm

= 720.0 kN

fVN = min(Vin1, Vin2, Vcc)

= 720.0 kN

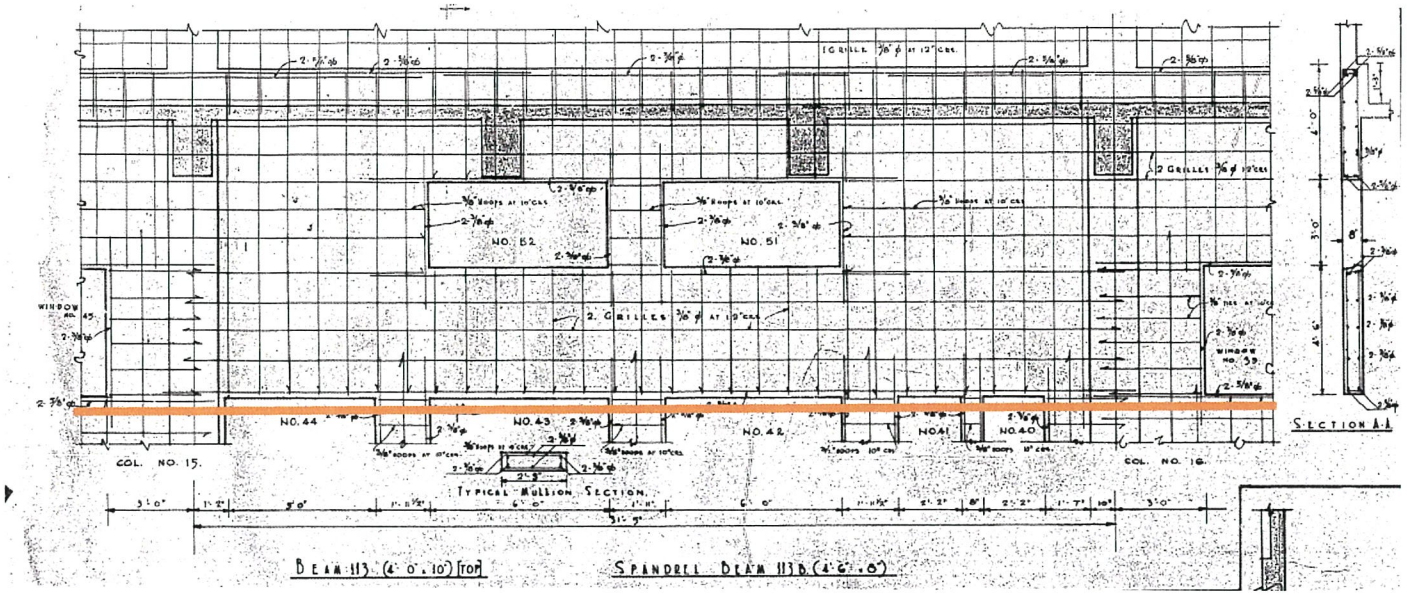
Effect of reinforcem N/A

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 7.0 REINFORCED CONCRETE & CONCRETE MASONRY STRUCTURE BACK WALL BETWEEN COLUMNS 15 & 16

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wall **Col 15 and 16 at L2 to L3**



db =	0.625	in	assume the end of the bar is anchered into the column cage
=	15.875	mm	
no. =	4	(2 isteg bars)	
As =	197.9326	mm2 per bar	
=	791.7304	mm2 total	
=	300	MPa	
f =	1		
fNt =	237.5191	kN	

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 7.0 REINFORCED CONCRETE & CONCRETE MASONRY STRUCTURE RETURN WALLS ABOVE BLEACHERS AT EACH END

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MEMBER PROPERTIES

V* = n/a kN

Member: wall

Curviture: single

H = 2.2 m

As = $\pi * d_b \text{^} 2/4$

	layer	No. bars	d_b in	d_b mm	A_s mm^2
oo	1	2		9.5	141.76
oo	2	2		9.5	141.76
oo	3	2		9.5	141.76
oo	4	2		9.5	141.76
oo	5	2		9.5	141.76
	∑	10			709

Shear Reinforcing		Section Properties			Demand	
		Observation type	B	(table 3.1)		
prob fyt =	280 MPa	f'm =	12 Mpa	(table 10.1)	N* =	0 kN
db =	in	vbm =	0.7 MPa	(table 10.1)	μΔ=	1.25
=	9.500 mm	vg =	1.5 MPa	(table 10.1)	=	nominal (table 3.2)
Av =	70.882 mm^2	D =	ft			
s =	in		4755 mm			
=	400.0 mm	Bw=	in			
			140 mm			
		d' =	0 in			
			70 mm			

MASONRY CONTRIBUTION, v_m (§ 10.3.2.6)

C1 = $33 * \rho_w * fy/300$ §10.3.2.6 (a)

= 0.033

STEEL RATIO:

dBeam/Col = D-d'-db/2

= 4685 mm

d Wall = 0.8*Lw

= 3804 mm

d = 4685 mm

Ag = d*B

= 655900 mm^2

ρw = $As/(b_w * d)$

0.108%

check ρ_w > 0.07% OK

WALL:

he/Lw < 0.25	C2 = 1.5	§10.3.2.6 (b)
he/Lw > 1	C2 = 1.0	§10.3.2.6 (b)
otherwise	C2 = $0.42*[4-1.75*(h_e/L_w)]$ = 1.34	
he/Lw = h/L_w		
= 0.463	C2 = 1.3	§10.3.2.6 (b)
BEAM or COLUMN:	C2 = 1.0	§10.3.2.6 (c)

C2 = 1.339936909

vm = $(C_1 + C_2) * v_{bm}$ (eq 10-6)

= 0.961 MPa

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 7.0 REINFORCED CONCRETE & CONCRETE MASONRY STRUCTURE Partial Infill Block Wall - G to L1 between col 3 & 9	SAWREY CONSULTING ENGINEERS LTD		
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		Jul-23	10131	ULM 7. **3**

AXIAL LOAD CONTRIBUTION, v_p (§ 10.3.2.7)

CHECK MAXIMUM AXIAL LOAD:

N*max = 0.1*f'm*Ag §10.3.2.7 (a)
= 787 2/25 kN
N'= min(N*max,N*)
= 0 kN

ANGLE OF AXIAL LOAD:

A= (Lw-a/2)/h
= 2.13 m
α = tan-1(A/2)
= 47 °

COMPRESSION BLOCK:

α= 0.85
β= 0.85
C = (β*c)*(α*f'c)*bw
T= As fy
c= Asfy/(αβf'c*b_w)
= 163.5 mm
a = β*c
139 mm

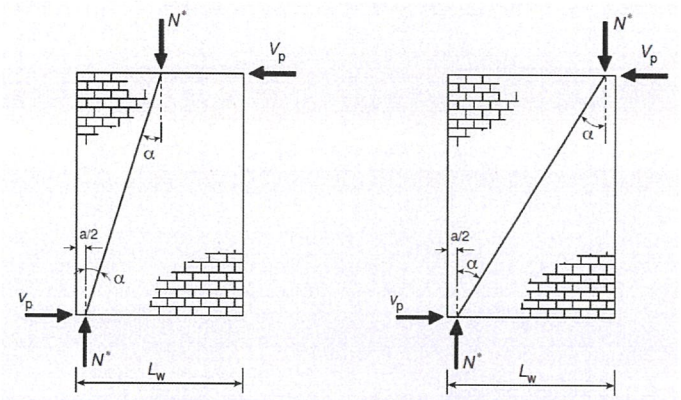


Figure 10.2 – Contribution of axial load to wall shear strength

AXIAL LOAD CONTRIBUTION:

vp,max= 0.1*f'm §10.3.2.7 (B)
= 1.2 MPa
v'p= 0.9*[N'/(bw*d)]*tanα (eq 10-7)
= 0.00 MPa

vp= min($V_{p,max}$,V'$_p$)
= 0.000 MPa

SHEAR REINFORCING (§ 10.3.2.11)

BEAM OR COLUMN §10.3.2.10 (A)	**WALL** §10.3.2.10 (B)
smin = min(0.5d,600)	smin = 0.5L_w
= 600 mm	= 2378 mm
s>s_{min} ? NOT OK	s>s_{min} ? NOT OK
C3= 1.0 §10.3.2.11 (ii)	C3= 0.8 §10.3.2.11 (i)

Avmin= 0.15*bw*s/fy (eq 10-9)
= 30 mm^2
A_v>A_{vmin}? OK
C3= 0.8

vs = C3*$A_v f_y$/(b_ws) (eq 10-8)
= 0.284 Mpa

TOTAL SHEAR, Vn (eq C5.24)

vnMAX = v_g §10.3.2.4
= 1.5 Mpa
vn = v_m+v_p+v_s (eq 10-5)
= 1.245

Φ= 1.00
Vn = v_n*bw*d (eq 10-4)
= 816 kN

ΦVn = 816.454 kN (eq 10-3)
= N/A NBS (IL3)

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adding concrete to 4 columns - shear

- say add

B' =	508	mm
D' =	240	mm
dbv =	10	mm
Sv =	100	mm
no. =	4	legs
Av =	78.53982	mm2 per leg
=	314.1593	mm2
f =	1	
fyt =	324	Mpa
f'c =	37.5	Mpa

-to existing

B'' =	508	mm
D'' =	508	mm
dbv =	9.5	mm
Sv =	229	mm
no. =	3	legs
Av =	70.88218	mm2 per leg
=	212.6466	mm2
f =	1	
fyt =	280	Mpa
f'c =	30	Mpa

Shear Capacity (to NZS 3101:Part1 2006 - chapter 10)

ka =	1	
kn =	1	ignore axial
vb min =	0.08 sqrt (f'c)	
=	0.489898	MPa
vb max =	0.2 x sqrt(f'c)	
=	1.224745	MPa
Acv =	D x Bv	
	107520	mm2
Bv =	B-50-10	
=	448	mm2
rw =	Asx2 / Acv	
=	0.036523	
vb =	(0.07+10rw)sqrt(f'c)	
=	2.66525	Mpa
Vc =	ka kn Vb Acv	
=	286.5677	kN
Vs =	Av x fyt x Bv/s	
=	456.0085	kN
fVn =	f(Vc+Vs)	
=	742.5761	kN

ka =	1	
kn =	1	ignore axial
vb min =	0.08 sqrt (f'c)	
=	0.438178	MPa
vb max =	0.2 x sqrt(f'c)	
=	1.095445	MPa
Acv =	D x Bv	
	223520	mm2
Bv =	B-52-16	
=	440	mm2
rw =	Asx2 / Acv	
=	0.018658	
vb =	(0.07+10rw)sqrt(f'c)	
=	1.40533	Mpa
Vc =	ka kn Vb Acv	
=	314.1194	kN
Vs =	Av x fyt x Bv/s	
	114.402	kN
fVn =	f(Vc+Vs)	
=	428.5214	kN

Total Shear Capacity

Vtot =	fVn exstg + fVn new
	1171.098

Adding concrete to 4 columns - Moment

- say add

B = 240
D = 508
db = 25 mm
no. = 4
As = pi() x db^2/4
= 490.8739 mm2 per bar
= 1963.495 mm2

f = 1
fy = 324 Mpa
f'c = 37.5 Mpa
a = 0.85
b = 0.85

Nt = As fy
= 636.1725 kN
d' = 50 mm
jd = D-d'-dbv-db/2a/2
= 393.9201 mm
a = As fy /(a f'c B)
= 83.15981
B = 508 mm
fMn = f fy As jd
= 250.6011 kNm

f Mn tot = f Mn exstg + fMn new
526.0751 kNm

- existing

B = 508
D = 508
db = 31.7 mm no. = 2
db'' = 25.4 mm no. = 1
As = no. x pi() x db^2/4
=
= 2085.185 mm2

f = 1
fy = 325 Mpa
f'c = 30 Mpa
a = 0.85
b = 0.85

Nt = As fy
= 677.6851 kN
d' = 50 mm
jd = D-d'-dbv-db/2a/2
= 406.4926 mm
a = As fy /(a f'c B)
= 52.31474
B = 508 mm
fMn = f fy As jd
= 275.474 kNm

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 7.0 REINFORCED CONCRETE & CONCRETE MASONRY STRUCTURE Concrete Block Wall - between col 10 & col 11

SAWREY CONSULTING ENGINEERS LTD

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MEMBER PROPERTIES

V* = n/a kN
Member: wall
Curviture: double
H = 2.2 m

As = $\pi * d_b$^2/4

	layer	No. bars	d_b in	d_b mm	A_s mm^2
o	1	1		9.5	70.88
o	2	1		9.5	70.88
o	3	1		9.5	70.88
o	4	1		9.5	70.88
o	5	1		9.5	70.88
	∑	5			354

Shear Reinforcing		Section Properties			Demand	
		Observation type	B	(table 3.1)		
prob fyt =	280 MPa	f'm =	12 Mpa	(table 10.1)	N* =	0 kN
db =	in	vbm =	0.7 MPa	(table 10.1)	μΔ=	1.25
=	9.500 mm	vg =	1.5 MPa	(table 10.1)	= nominal	(table 3.2)
Av =	70.882 mm^2	D =	ft			
s =	in		2200 mm			
=	400.0 mm	Bw=	in			
			140 mm			
		d' =	0 in			
			70 mm			

MASONRY CONTRIBUTION, v_m (§ 10.3.2.6)

C1 = 33*ρ_w*fy/300 §10.3.2.6 (a)
= 0.037

STEEL RATIO:

dBeam/Col = D-d'-db/2
= 2130 mm
d Wall = 0.8*Lw
= 1760 mm
d = 2130 mm
Ag = d*B
= 298200 mm^2
ρw = As/(b_w*d)
0.119%
check ρ_w > 0.07% OK

WALL:

he/Lw < 0.25	C2 = 1.5	§10.3.2.6 (b)
he/Lw > 1	C2 = 1.0	§10.3.2.6 (b)
otherwise	C2 = 0.42*[4-1.75*(h_e/L_w)] = 0.95	
he/Lw = h/L_w		
= 1.000	C2 = 0.9	§10.3.2.6 (b)
BEAM or COLUMN:	C2 = 1.0	§10.3.2.6 (c)

C2 = 0.945

vm = (C_1 + C_2)*v_{bm} (eq 10-6)
= 0.687 MPa

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 7.0 REINFORCED CONCRETE & CONCRETE MASONRY STRUCTURE Partial Infill Block Wall - G to L1 between col 3 & 9	SAWREY CONSULTING ENGINEERS LTD		
		Date	Project No.	By Page No.
		Jul-23	10131	ULM 7. **7**

AXIAL LOAD CONTRIBUTION, v_p (§ 10.3.2.7)

CHECK MAXIMUM AXIAL LOAD:

N*max = 0.1*f'm*Ag §10.3.2.7 (a)
= 357 21/25 kN
N'= min(N*max,N*)
= 0 kN

ANGLE OF AXIAL LOAD:

A= (Lw-a/2)/h
= 0.98 m
α = tan-1(2*A)
= 45 °

COMPRESSION BLOCK:

α= 0.85
β= 0.85
C = (β*c)*(α*f'c)*bw
T= As fy
c= Asfy/(αβf'c*b_w)
= 81.8 mm
a = β*c
69 mm

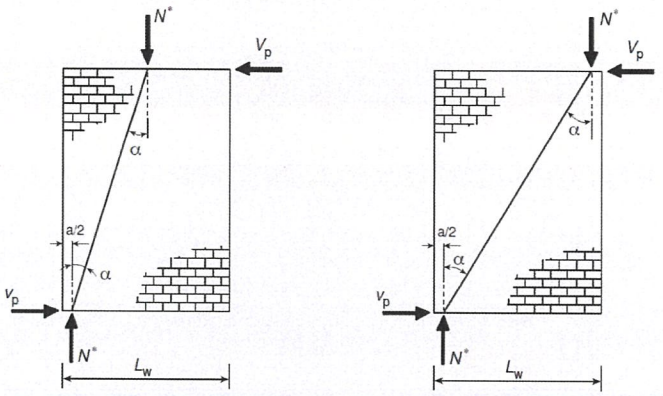


Figure 10.2 – Contribution of axial load to wall shear strength

AXIAL LOAD CONTRIBUTION:

vp,max= 0.1*f'm §10.3.2.7 (B)
= 1.2 MPa
v'p= 0.9*[N'/(bw*d)]*tanα (eq 10-7)
= 0.00 MPa

vp= min($V_{p,max}$,V'_p)
= 0.000 MPa

SHEAR REINFORCING (§ 10.3.2.11)

BEAM OR COLUMN §10.3.2.10 (A)	**WALL** §10.3.2.10 (B)
smin = min(0.5d,600)	smin = 0.5L_w
= 600 mm	= 1100 mm
s>s_{min} ? NOT OK	s>s_{min} ? NOT OK
C3= 1.0 §10.3.2.11 (ii)	C3= 0.8 §10.3.2.11 (i)

Avmin= 0.15*bw*s/fy (eq 10-9)
= 30 mm^2
A_v>A_{vmin}? OK
C3= 0.8

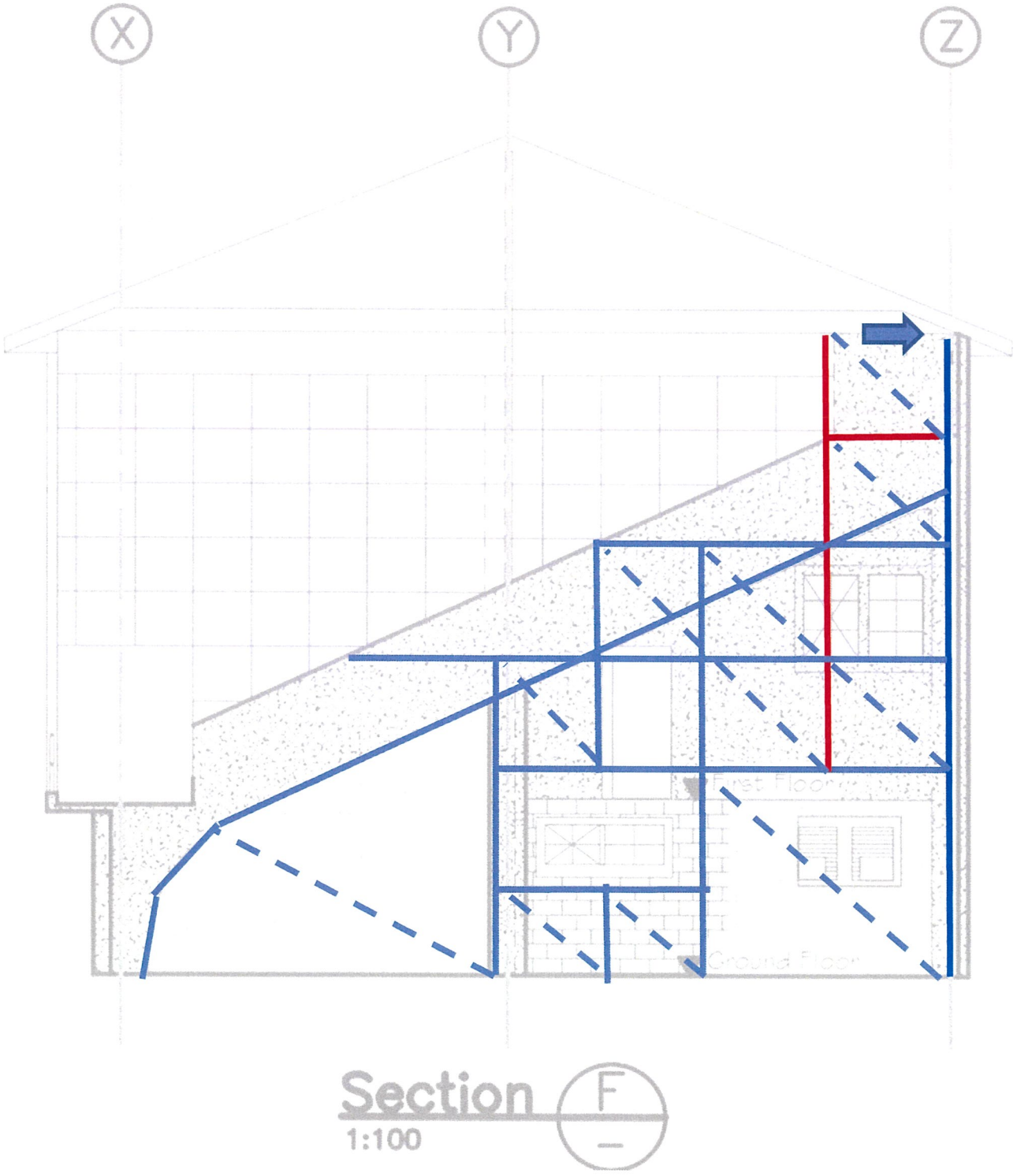
vs = C3*$A_v f_y$/(b_ws) (eq 10-8)
= 0.284 Mpa

TOTAL SHEAR, Vn (eq C5.24)

vnMAX = v_g §10.3.2.4
= 1.5 Mpa
vn = v_m+v_p+v_s (eq 10-5)
= 0.971

Φ= 1.00
Vn = v_n*bw*d (eq 10-4)
= 289 kN

ΦVn = 289.449 kN (eq 10-3)
= N/A NBS (IL3)

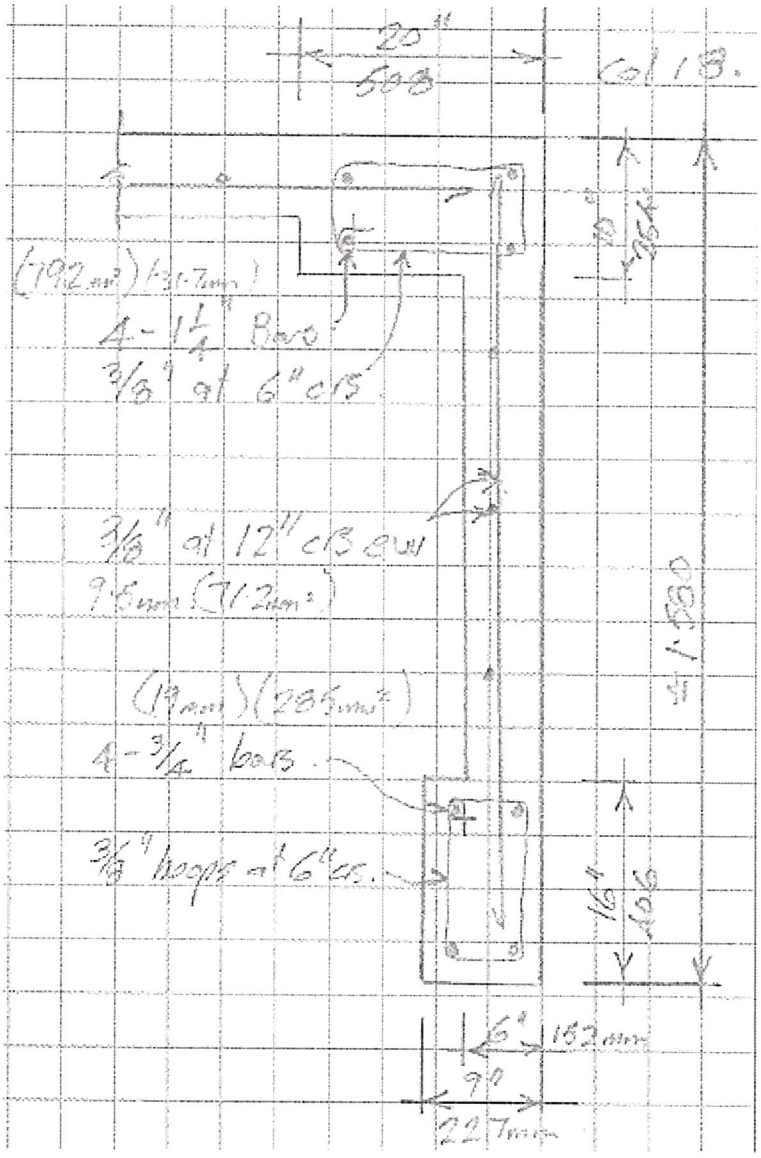


Section F
1:100

Return walls above bleachers each end item 1370

shear capacity of wall & columns

f'cp =	35	Mpa
ϕ =	1	
fyp =	280	MPa
a =	0.85	
b =	0.85	



Shear Capacity

fvc = f x 0.17 x sqrt(f'c)
= 1005.734 kN

	Vc col 18	Vc wall	Vc col end	
f	1	1	1	
vc (Mpa)	1.0057336	1.0057336	1.0057336	
b (mm)	508	152	227	
d (mm)	254-50-32/2	0.8 x (1580-254-406)	406-50-19/2	
	188	736	346.5	
fvc (kN)	f vc b d	f vc b d	f vc b d	
	96.052	112.513	79.106	
				287.67148

	Vs col 18	Vs wall	Vs col end	
f	1	1	1	
Av (mm2)	2 x 71.2		2 x 71.2	
	142.4	71.2	142.4	
fy (Mpa)	280	280	280	
d (mm)	254-50-16	1.58x0.8	406-50-19/2	
	188	1264	346.5	
s (mm)	152	304	152	
Vs (kN)	f Av fy d/s	f Av fy d/s	f Av fy d/s	
	49.315368	82.891789	90.892421	
				223.09958

Vc + Vs = 510.77106 kN

Bending Capcity

return walls above bleachers - north & south end continued

Earthwuake E-W
moment Capacity of wall

no.	4	
db =	0.75	in
=	19.05	mm
corrosion =	20%	of area
db res =	15.24	mm

f =	1	
fy =	325	Mpa
As =	no. pi()/4 x (db res)^2	
=	729.6588	mm2
Nt =	As fy + fVfn	
=	460.1391	kN
jd =	1580-406/2-a/2	
=	1375.766	mm
a =	As fy /(a b f'c B)	
=	2.468873	
B =	508	mm
fMn =	f fy As jd	
=	633.0435	kNm

Earthwuake W - E
moment Capacity of wall

no.	4	
db =	1.25	in
=	31.75	mm
corrosion =	0%	of area
db res =	31.75	mm

f =	1	
fy =	325	Mpa
As =	no. pi()/4 x (db res)^2	
=	3166.922	mm2
jd =	1580-254/2-a/2	
=	1376.796	mm
a =	As fy /(a b f'c B)	
=	152.408	mm
B =	227	mm
fMn =	f fy As jd	
=	1417.067	kNm

As 150PRFC
Force in steel at yield

As =	2250	mm2
w =	17.7	kg/m
fy =	320	MPa
As fy =	720	kN

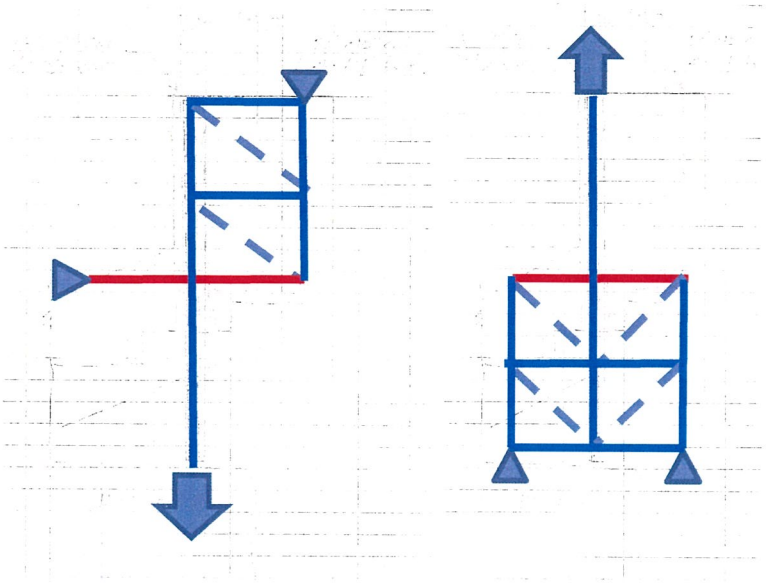
16/M20 bolts

f' =	29%	anchor group reduction factor
fVfn =	44.6	kN per bolt coppied from design calculations
f' fVfn =	223	kN x no anchors
=	223	kN

bolts limited by transverse rebar.
5 anchors into the wall above the bleacher bea
12 anchors inot the bleacher beam/ wall below

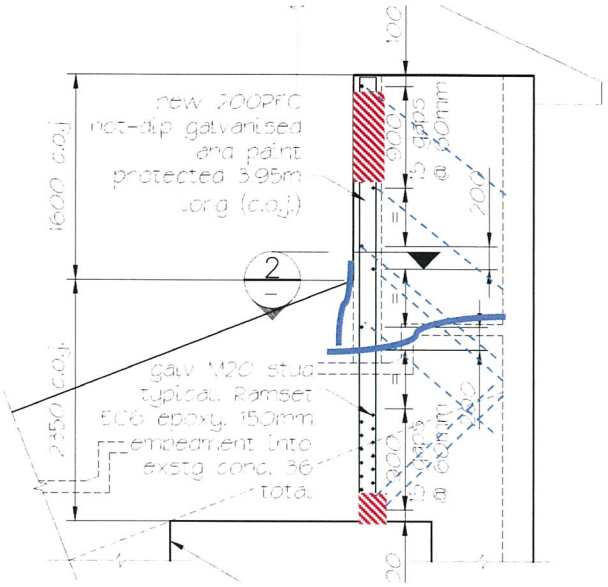
assume failure has occurred at the top of the concrete parapet/barier in tension due to lack of ancho
Critical section for bending moment is at the top of the bleacher beam.

HORIZONTAL WALL REBAR - STRUT & TIE



model 1: pull anchors down

model 2: pull anchors up.



model 3: anchors & exstg column rebar pull u

Horizontal bar - RHS of column

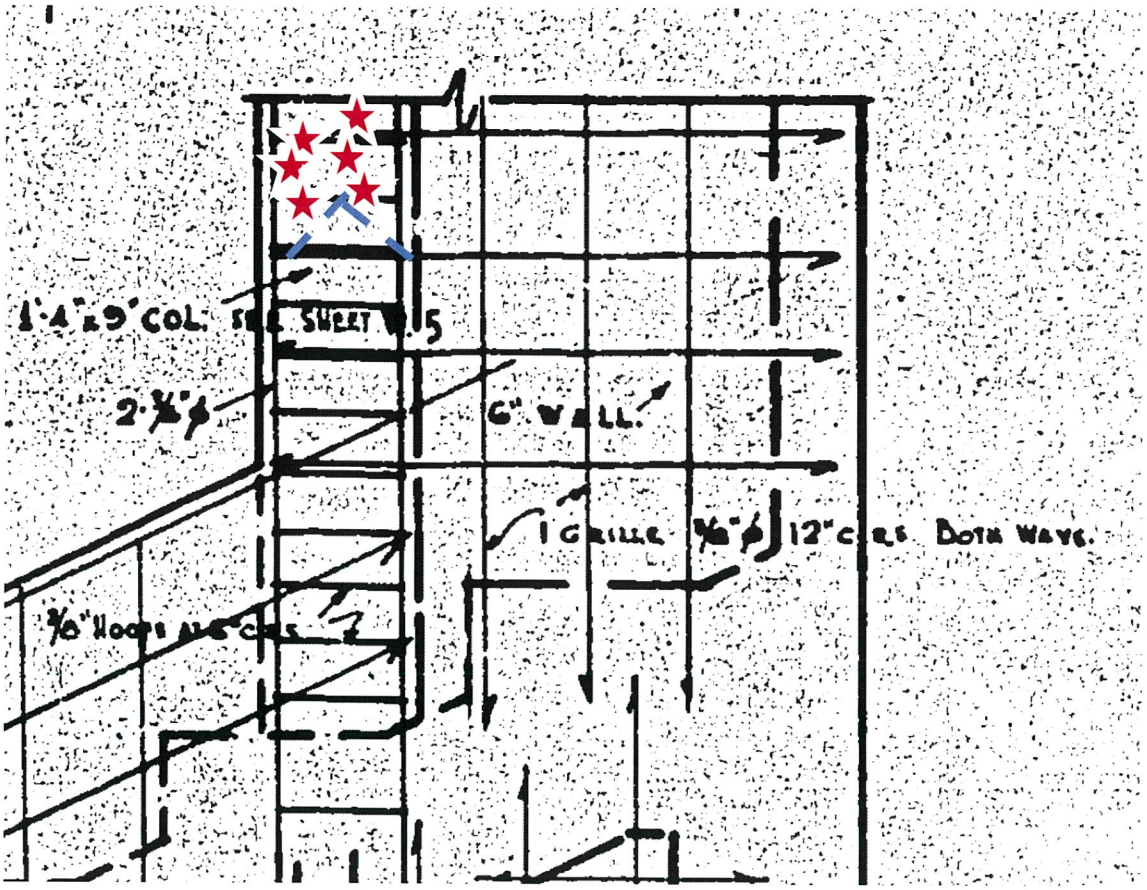
f =	1	
fyp =	280	Mpa
db =	0.375	"
=	9.525	mm
no.	2.25	bars
As =	pi() x db^2/4 x no.	
=	160.3	mm2
ϕNt =	44.9	kN

not critical because the bolt group is below bleachers
and some anchors are into the primary bleacher beam

Horizontal bar - LHS of column
above the primary bleacher beam is barier
the barier is a RC wall with a trimmer bar
assume the trimmer bar laps 600mm
the trimmber bar is an isteg bar (2 bars)

db =	0.375	in isteg bar
=	9.525	mm
no.	3	bars

so the column is pulled apart from the barrie



model 4: coumn split at top
stirrups + horizontal bar

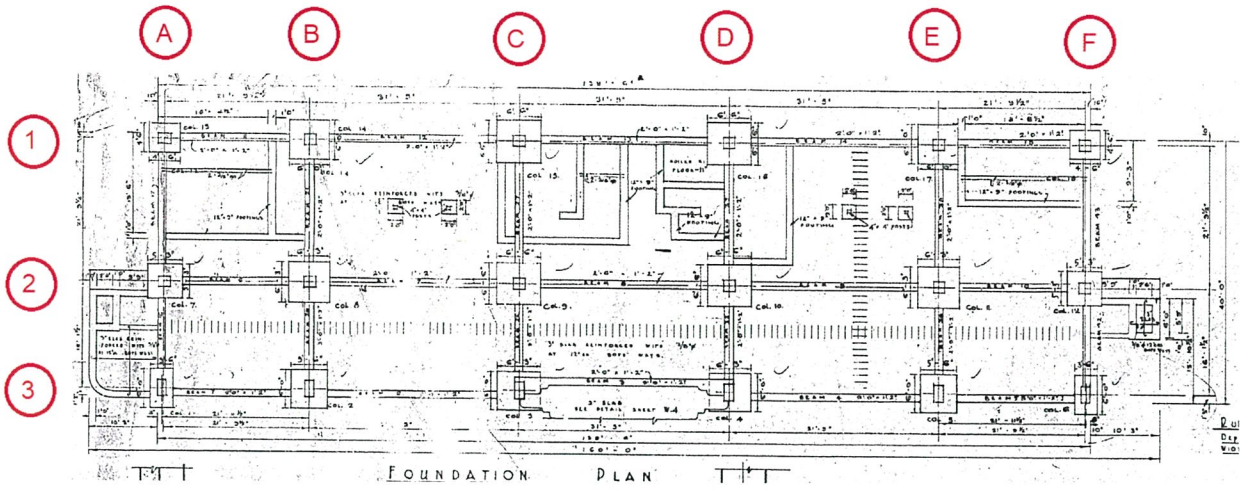
f =	1	
fyp =	280	Mpa
db =	0.375	"
=	9.525	mm
no.	3	bars at 6" crs
=	0.19685	bars at 60mm crs
S =	6	" crs
=	152.4	
As =	pi() x db^2/4 x no.	
=	14.0	mm2
ϕNt =	3.9	kN per anchor

Anchors

S =	60	mm crs
fvn =	44.6	kN per bolt
	774.192	mm crs adjusted for stirrups

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 8.0 Foundations Vertical Bearing Resistance	SAWREY CONSULTING ENGINEERS LTD			
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Petone Rec Grandstand - Preliminary foundation bearing check



Footing 1 - A (1.37m x 1.37m)

G	Length (m)	Height (m)	Weight (kPa)	G (kN)	Q (kN)	1.2G + 1.5Q (kN)
External Wal	6.7	1.5	4.32	43.4		52.1
Internal Wall	3.35	1.5	2.16	10.9		13.0
Column	0.6	1.5	14.4	13.0		15.6
Foundation	1.37	1.37	14.4	27.0		32.4
External Grou	6.7	0.61	8.64	35.3		42.4
Internal Grou	6.7	0.61	8.64	35.3		42.4
Slab	3.32	3.38	1.824	20.5		24.6
G from Staad.Pro				237		284.4
Q from Staad.Pro					141	211.5
Q Ground Floor (4kPa)			4		66	99.4
total				422.3	207.2	817.7

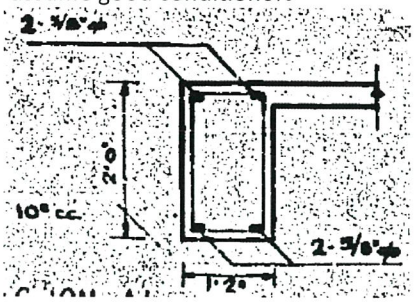
	W (m)	L (m)	area (m2)	G (kPa)	Q (kPa)	1.2G + 1.5Q (kPa)
bearing area (pads)	1.37	1.37	1.88			
bearing area (footings)	0.36	5.41	1.92			
total bearing area (pad & footing)			3.80	85	42	164
bearing area (slab)	0.22	5.41	1.19	85	42	164

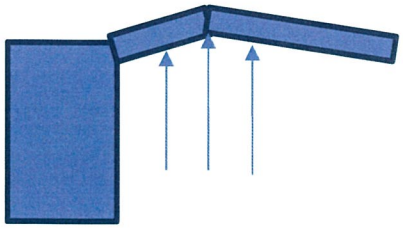
	qu	ϕ	qa (kPa)	cap/demand G	cap/demand Q	cap/demand 1.2G + 1.5Q
Bearing pressure capacity - (pad & footing)	300	1	300	354%	722%	183%
Bearing capacity of structure - (slab out-of-plane)	200	1	200	236%	481%	122%

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 8.0 Foundations Contribution of Slab to Vertical Bearing Capacity	SAWREY CONSULTING ENGINEERS LTD			
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Slab Out-Of-Plane Bending capacity

Assume two hinges form for a failure mechanism
Assume beam has sufficient torsional restraint/capacity to develop slab bending
Assume an active plane of 49 degrees for kh=0.2
assume good condition6%

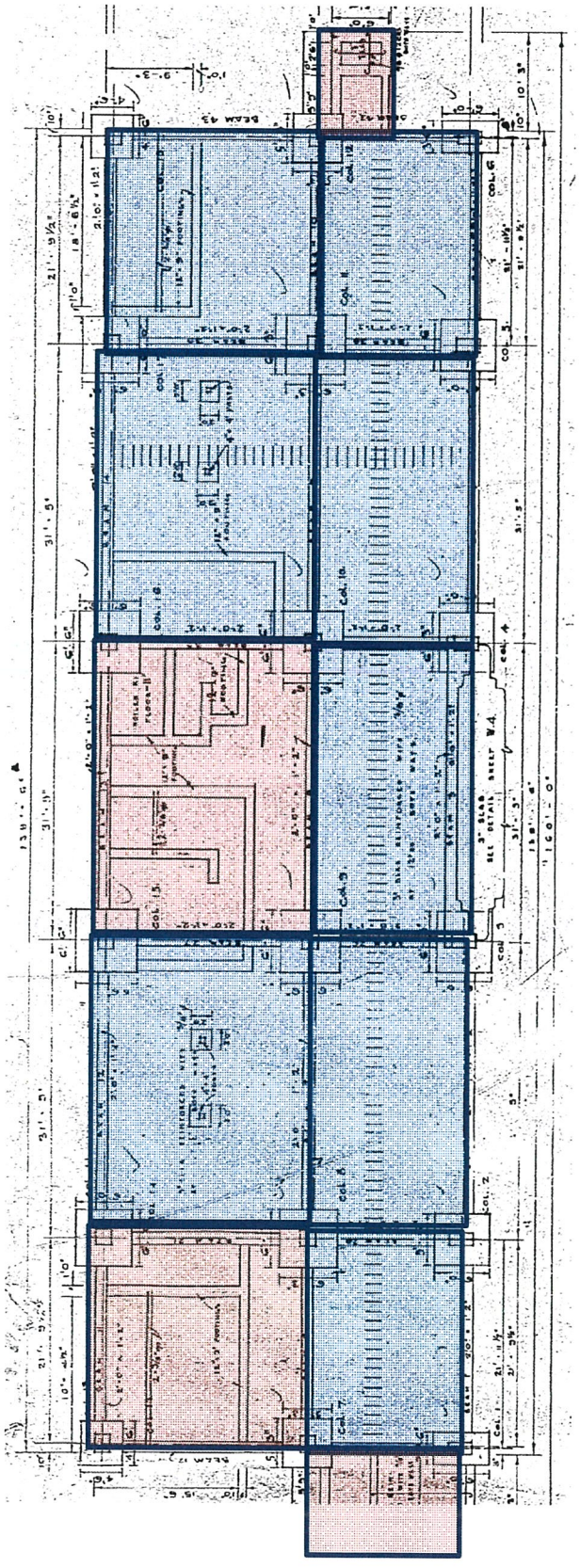




two hinges must form for a mechanism

B =	1000	mm	f =	1	
D =	3	"	fy =	280	Mpa
=	76.2	mm	f'c =	30	Mpa
db =	0.375	"	a =	0.85	
db =	9.525	mm	b =	0.85	
S =	12	" crs			
=	304.8	mm	Nt =	As fy	
no. =	3.3		=	65.8403	kN
As =	pi() x db^2/4		d' =	38.1	mm
=	71.25574	mm2 per b	jd =	d'-a/2	
=	235.1439	mm2	=	36.80901	mm
			a =	As fy /(a f'c B)	
			=	2.581973	
			fMn =	2 x f fy As jd	
				2.42351662	knm per hinge
			=	4.847033	kNm/m

fMn - M* =	6.8369E-05	
L =	H x atan(H)	
=	0.22015824	m
L/2 =	0.11007912	m
A =	L x B	
=	0.22015824	m2
M* =	P x L	
=	4.84696486	kN
P =	44.0316471	kN
=	200	kPa



Three possible failure modes are possible as shown in Figure A6:

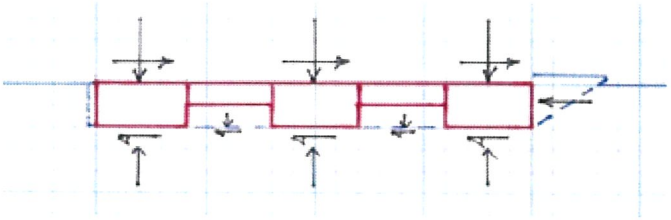
a tip-to-tip sliding, where beams are close spaced and connected by a strong floor slab

b sliding with tilting, where beams are further apart and connected by a strong floor slab and the resulting passive wedge forming under the floor will 'jack up' one side of the building; and

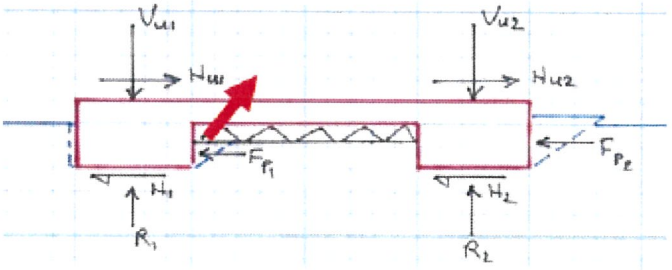
c sliding without tilting, where the passive wedge is able to lift the floor without lifting the building.

Figure A6:

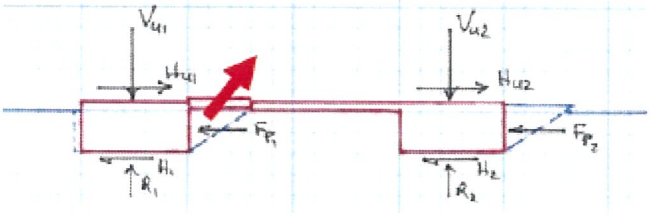
a Tip-to-tip sliding



b Sliding with tilting



c Sliding with weak floor slab



Assumed Model

Tip-to-tip sliding

Sliding with weak floor slab

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 8.0 Foundations Base Shear Resistance - Passive Pressure	SAWREY CONSULTING ENGINEERS LTD			
		Date	Project No.	By	Page No.
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Passive Bearing Pressure - For East to West Shaking:

assume no slab
assume no soil to soil friction
assume no soil to pad friction

ϕ =	28	degrees
=	0.48869219	rad
δ =	0.5 ϕ	
=	14	degrees
=	0.2443461	rad
β=	0	degrees
γ=	18	kN/m3
H=	2	ft
=	0.609	m
no. =	2.5	ground beams
L =	160	ft per ground beam
=	48.72	m per ground beam
=	121.8	m
kp =	5.5	from NAVFAC chart
R=	3/5 x (0.746-0.674) + 0.746	
=	0.7892	

Pph = 0.5 x g x H^2 x kp x R x cos(d)
= 14.0582408 kN/m

Ppv = 0.5 x g x H^2 x kp x R x sin(d)
= 3.50511311 kN/m

Hu = Pph x L
= 1,712.29 kN
= 13% NBS(IL3)

No strength reduction factor is applied to the calculated passive resistance because base sliding is self-limiting and will not endanger the stability of the building in most cases (ie sites on level ground).

Passive Bearing Pressure - For North to South Shaking:

ϕ =	28	degrees
=	0.48869219	rad
δ =	0.5 ϕ	
=	14	degrees
=	0.2443461	rad
β=	0	degrees
γ=	18	kN/m3
H=	2	ft
=	0.609	m
no. =	4.3	ground beams
L =	42	ft per ground beam
=	12.789	m per ground beam
=	54.9927	m
kp =	5.5	from NAVFAC chart
R=	3/5 x (0.746-0.674) + 0.746	
=	0.7892	

Pph = 0.5 x g x H^2 x kp x R x cos(d)
= 14.0582408 kN/m

Ppv = 0.5 x g x H^2 x kp x R x sin(d)
= 3.50511311 kN/m

Hu = Pph x L
= 773.10 kN

No strength reduction factor is applied to the calculated passive resistance because base sliding is self-limiting and will not endanger the stability of the building in most cases (ie sites on level ground).

For Vertical Actions on the slab

Ppv = 3.50511311 kN/m
< 22.4985769 kN/m
OKAY

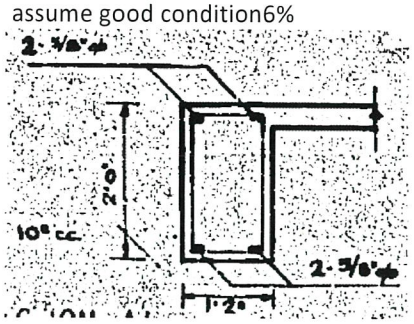
slab bending out of plane capacity (see next two pages)
P = 22.4985769 kN/m

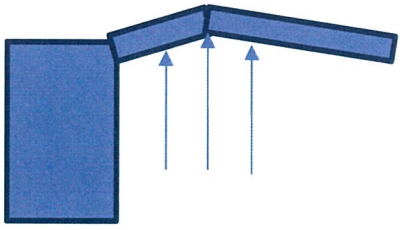
Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 8.0 Foundations Base Shear - Contribution of the Slab to Passive Resistance	SAWREY CONSULTING ENGINEERS LTD			
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Slab Out-Of-Plane Bending capacity

Assume two hinges form for a failure mechanism
Assume beam has sufficient torsional restraint/capacity to develop slab bending
Assume an active plane of 49 degrees for kh=0.2

assume good condition6%



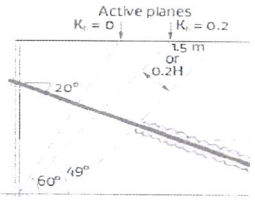


two hinges must form for a mechanism

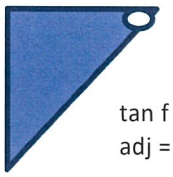
B = 1000 mm
D = 3 "
= 76.2 mm
db = 0.375 "
db = 9.525 mm
S = 12 " crs
= 304.8 mm
no. = 3.3
As = pi() x db^2/4
= 71.25574 mm2 per b
= 235.1439 mm2

f = 1
fy = 280 Mpa
f'c = 30 Mpa
a = 0.85
b = 0.85

Nt = As fy
= 65.8403 kN
d' = 38.1 mm
jd = d'-a/2
= 36.80901 mm
a = As fy /(a f'c B)
= 2.581973
fMn = 2 x f fy As jd
2.42351662 knm per hinge
= 4.847033 kNm/m



L



H= 0.609 m

49 degrees
0.86 rad

tan f = opp/adj
adj = opp x atan (f

fMn - M* = 0
L = H x atan(H)
= 0.43087465 m
L/2 = 0.21543733 m
A = L x B
= 0.43087465 m2
M* = P x L
= 4.84703323 kN
P = 22.4985769 kN
= 52.2160606 kPa
qa soil = 200 kPa x θ
= 200 kPa

Therefore, slab strength governs

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 8.0 Foundations Base Shear Resistance - Sliding Friction	SAWREY CONSULTING ENGINEERS LTD			
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For tip-to-tip sliding

Assume the wieght of walls & columns bear on the soil below the sliding plane

ϕ = 28 degrees
= 0.489 rad
μ = 0.7 x tan(ϕ)
= 0.372

γsoil = 18 kN/m3
Hsoil = 0.533 m
W soil = 9.594 kPa

γslab = 24 kN/m3
Hslab = 0.076 m
W slab = 1.824 kPa

A9-10-15-16 = 72100600 mm2
= 72.1 m2
A7-8-13-14 = 51122500 mm2
= 51.1 m2

A nth stair = 10.25 ft along
= 6 ft across
= 3.1 m along
= 1.8 m across
= 5.7 m2

Asth stair = 16.1 ft across
= 10.3 ft along
= 4.9 m across
= 3.1 m along
= 15.3 m2

W total = 11.418 kPa

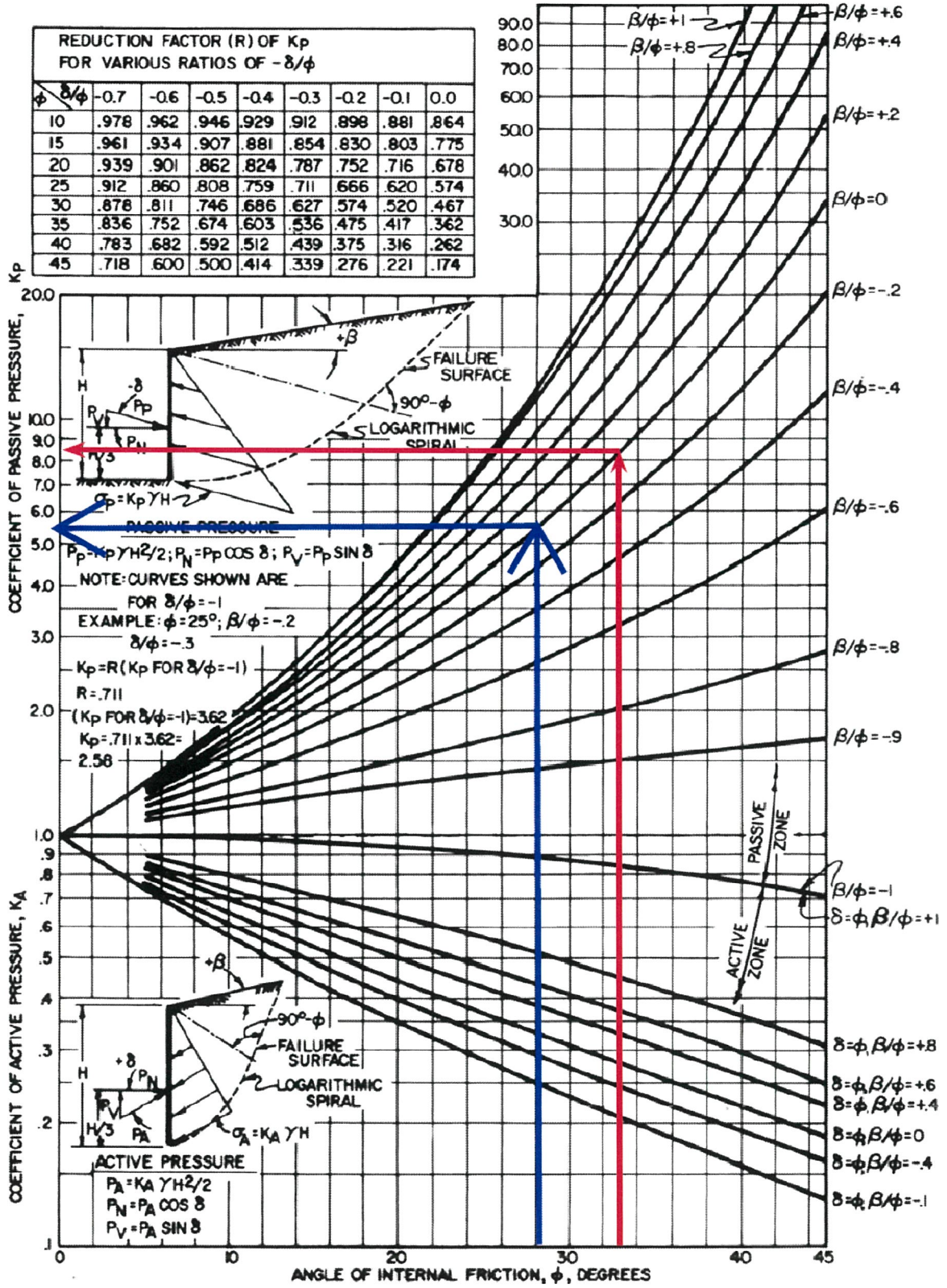
Rs = W x μ
μ = 0.372

	Area (m2)	R (kN)
9-10-15-16	72.1	306.4
7-8-13-14	51.1	217.3
nth stair	5.7	24.2
sth stair	15.3	65.1
R total		613.0

direction	nth to sth	east to west
Hu (kN)	773.10	1,712.29
R (kN)	613.0	613.0
total (kN)	1,386.13	2,325.32
%NBS (IL3)	10%	18%

Vb ESM = 13,205.12 kN

Figure A7: NAVFAC (1986) chart for active and passive soil pressure



Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 9.0 End Wall - Glazing Weight of Glass	Date	Project No.	By	Page No.
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Rationale assessment of the end walls.

Space class 1 - spaces that function as egress paths, provide mergency assembly or access are public property or where people regularly concretgate.
(Table A4.2: Building space classes and their functional purposes)

Glazing - timber mullion end fixings

Site observation: A nail can be pressed into the rotten timber by hand in worst positions.
Light cladding systems including curtain walls. Support frames that could fall into space class 1.
(Table A4.1: Parts that pose a significant life safety hazard)
The nails and timber are in poor condition. The timber faming coming down with panels attached.
Categorization: expected to be a significant lifesafety hazard (table A4.2).

Glazing - cladding fixings ino the mullion

Site observation: A nail can be pressed into the rotten timber by hand in worst positions.
Assume each 'window' is an individual pane. i.e. the timber framing/trims mark the permieter

t =		6	mm (assumed)
W =		609	mm (assumed)
H =		1827	mm (assumed)
A =	W x H		
=		1.112643	m2
g glass =		25.5	kN/m3 (Table A1 NZS1170.1)
=		0.153	kPa
=		15.59633028	kg/ m2
=		17.35314771	
<		25	kg (talbe A4.1 of the guidelines)

(the upper limit for light weight elements)
Moderate sized panes of glass are not expected to be a significant lifesafety hazard (table A4.2)
The failure of individual panels of glass is not typically considered to be of sufficient severity to meet th

C6.2.3 Load paths through connections

Inadequate load paths through connections is the most common cause of local failures in steel buildings during earthquakes. Inadequate load paths through connections was the principal cause of welded connections failures during the 1994 Northridge earthquake (refer to Section C6.3.2.1 for more details).

C6.2.4 Building condition (deterioration over time)

Deterioration due to environmental effects such as corrosion may have a major effect on the seismic performance of steel framed buildings. When exposed to aggressive environments that facilitate corrosion, structural steel members/connections may sustain significant deterioration such as reduction in member strength due to loss of base material to oxidation. The ductile capacity of corroded members may be significantly reduced if the members sustain localised corrosion as the zone of yielding will be limited to the reduced cross section.

Column bases and hold down bolts are the elements most prone to severe localised loss of material due to long term corrosion. There were several reported failures of industrial structural systems in the 1987 Edgecumbe earthquake due to column failures at the base from corrosion. In addition, reduction in member strengths due to corrosion was reported as one of the main factors contributing to failure of braces during this earthquake (Butcher et al., 1998).

Note:

A condition assessment, particularly of pre-1976 steel framed buildings, is recommended as part of the DSA. Refer to Section C6.4 for more details.

C6B.5 Steels of Unknown Origin

When the origins of structural steelwork cannot be confirmed, the default nominal strengths in Table C6B.10 should be used.

Table C6B.10: Nominal strengths for structural steels of unknown origin

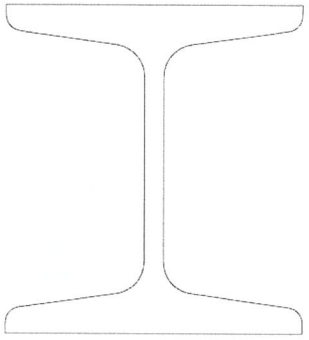
Time period	Yield strength (MPa)	Tensile strength (MPa)
Pre-1948	210	-
1948–Now	230	-

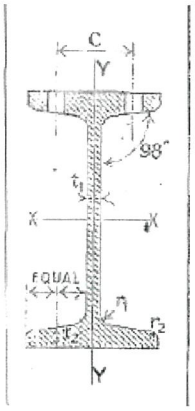
Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 9.0 End Wall - Glazing Steel Section Properties	Date	Project No.	By	Page No.
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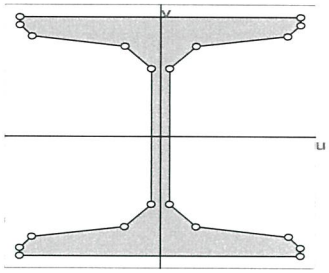
Stanchion 5" x 4.5" x 20lb

	Reference Mark	Size Inches	Weight per foot lbs.	Standard Thicknesses: Web t_1	Standard Thicknesses: Flange t_2	Radii: Root r_1	Radii: Toe r_2	Centres of Holes G Inches
	" 2	5×4½	20	·29	·513	·49	·24	2·5

	H	B	tw	tf	r1	r2
in	5	4.5	0.29	0.513	0.49	0.24
mm	127	114.3	7.366	13.0302	12.446	6.096







Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 9.0 End Wall - Glazing Structural Steel Post - Compression - Assume No Corrosion	Date	Project No.	By	Page No.
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Design Parameters — from staad.pro - assume that two cols load share

	try: 5 x 4.5 x 20 lb Stanchion			N*c=	20.5	kN	L =	4.42	m
	N*t=	0	kN	Pmid=	0	kN	kc = 1		
	Φ =	1		M* =	0	kNm	Lec =	4.42	m
	αb =	0.5	(Coefficient for residual stresses AS4100 Table 6.2.4)				kb = 1		
	αm =	1	tively assume:	E =	200000	MPa	Leb =	4.42	m
Section Properties					2.00E+08				
	wslf =	29.763	kg/m	2.98E-01	An =	3.94E+03	mm^2	3.94E-03	m^2
	IX=	1.07E+01	$x10^6mm^4$	1.07E-05	Iy =	2.70E+00	$x10^6mm^4$	2.70E-06	m^4
	rx =	52	mm	5.20E-02 m	ry =	26.2	mm	0.0262	m
	zex =	1.68E+02	$x10^3mm^3$		zey =	4.72E+01	$x10^3mm^3$		
	fy =	210	Mpa		fy web =	210	Mpa		
kPa	G =	8000	Mpa	8.00E+06 kPa	kf =	1		1	kPa
	J =	3.07E+02	$x10^3mm4$	3.07E-04	Iw =	7.64E+00	$x10^9mm^6$	7.64E-09	m^6

Compression Strength Reduction Factor, αc

$\lambda_n = L_e/r_y*\sqrt{k_f}*\sqrt{f_y/250}$
$= 154.6182028$

$\alpha_a = 2100*(\lambda_n-13.5)/(\lambda_n\text{^}2-15.3*\lambda_n+2050)$
$= 12.56184948$

$\lambda = \lambda_n+\alpha_b*\alpha_a$
$= 160.8991276$

$\eta_1 = 0.00326*(\lambda-13.5)$
$= 0.480521156$

$\eta = \max(\eta,0)$
$= 0.480521156$

$\xi = ((\lambda/90)\text{^}2+1+\eta)/(2*(\lambda/90)\text{^}2)$
$= 0.731612643$

$\alpha_c = \xi*(1-SQRT(1-(90/(\xi*\lambda))\text{^}2))$
$= 0.260043797$

Beam strength reduction Factors, α_s, α_m

$M_s = f_y*Z_{ex}$
$= 9.91$ kNm

$\alpha_1 = Ms/Mo$
0.334021698

$\alpha_s = 0.6*(\sqrt{\alpha_1\text{^}2+3}-\alpha_{1)}$
0.857965637

$M_{cr} = \alpha_s*Ms$
$= 8.50415539$ kNm

$M_{o,buckle} = (Pi()\text{^}2*E*Iy)/(Le\text{^}2)$
$= 2.73E+05$

$M_{o,twist} = G*J$
$= 2.46E+03$

$M_{o,warp} = (pi()\text{^}2*E*Iw)/(Le\text{^}2)$
$= 7.7193E+02$

$M_o = \sqrt{M_{o,buckle}*(M_{o,twist}+M_{o,warp})}$
$= 29.7$ kNm

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 9.0 End Wall - Glazing Structural Steel Post - Compression - Assume No Corrosion	Date	Project No.	By	Page No.
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Design Capacities

Compression

$\Phi N_s = \Phi * k_f * f_y * A_n$ = 827.4 kN

$\Phi N_c = \alpha_a * \Phi N_s$ = 215.2 kN

Tension

$\Phi N_t = \Phi * f_y * A_n$ = 827.4 kN

= 1050% NBS (IL3)

Bending

$\Phi M_s = \Phi * M_s$ = 9.9 kNm

$\Phi M_b = \Phi * \min(\alpha_m M_{cr}, M_s)$ = 8.5 kNm

Deflection

$\delta_{slf} = ((w*L)+P)*L^4/(185*E*I)$

L = 4.2 m = 0.927 mm

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Design Parameters

$M^* =$ 0 kNm
$N^*_c =$ 20.5 kN
$N^*_t =$ 40 kN
$f_y =$ 210 Mpa
= 2.10E+05 kPa

$\Phi =$ 1
L = 4.42 m
k = 0.75
$L_e =$ 3.315 m

try: Plate
t = 8.000 mm
w = 100.000 mm
$\lambda_{ey} =$ 16.000 (Plate element Slenderness Limit AS4100 Table 6.2.4)

$\alpha_b =$ 0.5 (Coefficient for residual stresses AS4100 Table 6.2.4)

$P_{mid} =$ 0 kN

Section Properties

$A_n = b*d$
= 800.000 mm^2
= 8.00E-04 m^2
$w_{slf} = 7850*A_n*10^{-6}$
= 6.280 kg/m
= 0.0628 kN/m
$b_e = MIN(\lambda_{ey}*d*SQRT(250/f_y),b)$
= 8.000 mm
= 8.00E-03 mm
$k_f = b/b_e$
= 1.000

$I_x = t*w^3/12*10^{-6}$
= 0.667 $x10^6 mm^4$
= 6.67E-07 m^4
$r_x = I_x/A_n$
= 28.868 mm
= 2.89E-02 m
$Z_x = t*w^2/6*10^{-3}$
= 13.333 $x10^3 mm^3$
= 1.33E-05 m^3
E = 200000 MPa
= 2.00E+08 kPa

$I_y = w*t^3/12*10^{-6}$
= 0.004 $x10^6 mm^4$
= 4.27E-09 m^4
$r_y = sqrt(I_y^2/A_n)$
= 2.309 mm
= 2.31E-03 m
$Z_y = w*t^2/6*10^{-3}$
= 1.067 $x10^3 mm^3$
= 1.07E-06 m^3
G = 80000 MPa
= 8.00E+07 kPa

Torsion Constant

(Advanced Strength and Applied Elasticity, Ugural & Fenster, Elsevier, ISBN 0-444-00160-3)

w/t	β	w/t	β
1	0.141	6	0.299
1.5	0.196	6.5	0.301
2	0.229	7	0.303
2.5	0.249	7.5	0.306
3	0.263	8	0.308
3.5	0.272	8.5	0.310
4	0.281	9	0.312
4.5	0.286	9.5	0.314
5	0.291	10	0.312
5.5	0.295	∞	0.333

w/t = 12.5
β= 0.333
$J = \beta*w*t^3*10^{-3}$
= 17.050 $x10^3 mm^4$
= 1.70E-08 m^4

Assume Warping Constant is Negligable

Iw = 0 $x10^9 mm^6$
= 0 m^6

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 9.0 End Wall - Glazing Structural Steel Post - Compression Assume Flanges Corro	Date	Project No.	By	Page No.
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Compression Strength Reduction Factor, αc

λ_n = $L_e/r_y*\sqrt{k_f}*\sqrt{f_y/250}$
= 1.32E+03
α_a = $2100*(\lambda_n-13.5)/(\lambda_n^2-15.3*\lambda_n+2050)$
= 1.596526497
λ = $\lambda_n+\alpha_b*\alpha_a$
= 1316.398103

η_1 = $0.00326*(\lambda-13.5)$
= 4.247447815
η = $\max(\eta,0)$
= 4.247447815
ξ = $((\lambda/90)^2+1+\eta)/(2*(\lambda/90)^2)$
= 0.512263902
α_c = $\xi*(1-\sqrt{1-(90/(\xi*\lambda))^2})$
= 0.00458283

Beam strength reduction Factors, α_s, α_m

Ms = f_y*Z_{ex}
= 2.80 kNm
α_1 = Ms/Mo
86.60246334
α_s = $0.6*(\sqrt{\alpha_1^2+3}-\alpha_{1)}$
0.010391275
M_{cr} = α_s*Ms
= 0.029 kNm

$M_{o,buckle}$ = $(Pi()^2*E*Iy)/(Le^2)$
= 7.66E+02
$M_{o,twist}$ = G*J
= 1.36E+00
$M_{o,warp}$ = $(pi()^2*E*Iw)/(Le^2)$
= 0.00E+00
M_o = $\sqrt{M_{o,buckle}*(M_{o,twist}+M_{o,warp})}$
= 0.032 kNm

Conservatively assume: α_m = 1

Design Capacities

Compression
ΦN_s = $\Phi*k_f*f_y*A_n$
= 168.0 kN
ΦN_c = $\alpha_a*\Phi N_s$
= 0.77 kN
4%

Tension
ΦN_t = $\Phi*f_y*A_n$
= 168.0 kN

Bending
ΦM_s = $\Phi*M_s$
= kNm
ΦM_b = $\Phi*\min(\alpha_m M_{cr}, M_s)$
= kNm

Combined $N^*/(\Phi N_t)+M^*/(\Phi M_b)$ =

Deflection
δ_{slf} =
δ_{axial} =

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 9.0 End Wall - Glazing Structural Steel Post - Compression - Assume Half Corrode	Date	Project No.	By	Page No.
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Design Parameters

try: 150PFC | N*c= 20.5 kN | L = 4.3 m

N*t= 0 kN | Pmid= 0 kN | kc = 1.2

Φ = 1.1 | M* = 0 kNm | Lec = 5.16 m

αb = 0.5 (Coefficient for residual stresses AS4100 Table 6.2.4) | kb = 1

αm = 1 atively assume | E = 205000 MPa | Leb = 4.3 m

Section Properties | = 2.05E+08 kPa

wslf =	17.7 kg/m	1.77E-01	An =	2250	mm^2	2.25E-03	m^2
IX=	8.34 $x10^6mm^4$	8.34E-06	Iy =	1.29	$x10^6mm^4$	1.29E-06	m^4
rx =	60.8 mm	6.08E-02 m	ry =	23.9	mm	0.0239	m
Zex =	129 $x10^3mm^3$		Zey =	38.5	$x10^3mm^3$		
fy =	210 Mpa		fy web =	320	Mpa		
G =	80000 Mpa	8.00E+07	kf =	1		1	
J =	54.9 $x10^3mm^3$	5.49E-05	Iw =	4.59	$x10^9mm^6$	4.59E-09	m^6

Compression Strength Reduction Factor, αc

$\lambda_n = L_e/r_y * sqrt(k_f) * sqrt(f_y/250)$

= 197.875235

$\alpha_a = 2100*(\lambda_n-13.5)/(\lambda_n^2-15.3*\lambda_n+2050)$

= 10.14188651

$\lambda = \lambda_n+\alpha_b*\alpha_a$

= 202.9461783

$\eta 1 = 0.00326*(\lambda-13.5)$

= 0.617594541

$\eta = max(\eta,0)$

= 0.617594541

$\xi = ((\lambda/90)^2+1+\eta)/(2*(\lambda/90)^2)$

= 0.659060719

$\alpha c = \xi*(1-SQRT(1-(90/(\xi*\lambda))^2))$

= 0.171518149

Beam strength reduction Factors, α_s, α_m

$M_s = f_y * Z_{ex}$

= 27.09 kNm

$\alpha 1 = M_s/M_o$

#DIV/0!

$\alpha_s = 0.6*(sqrt(\alpha_1^2+3)-\alpha_1)$

#DIV/0!

$M_{cr} = \alpha_s * M_s$

= #DIV/0! kNm

$M_{o,buckle} = (Pi()^2*E*I_y)/(Le^2)$

= #DIV/0!

$M_{o,twist} = G*J$

= 4.39E+03

$M_{o,warp} = (pi()^2*E*I_w)/(Le^2)$

= #DIV/0!

$M_o = sqrt(M_{o,buckle} * (M_{o,twist}+M_{o,warp}))$

= #DIV/0! kNm

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 9.0 End Wall - Glazing Structural Steel Post - Compression - Assume Half Corrode	Date	Project No.	By	Page No.
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Design Capaci Compression $\Phi N_s = \Phi * k_f * f_y * A_n$ = 519.8 kN

$\Phi N_c = \alpha_a * \Phi N_s$ = 89.1 kN

435%

Tension $\Phi N_t = \Phi * f_y * A_n$ = 519.8 kN

Bending $\Phi M_s = \Phi * M_s$ = 29.8 kNm

$\Phi M_b = \Phi * \min(\alpha_m M_{cr}, M_s)$ = #DIV/0! kNm

Combined $N^*/(\Phi N_t)+M^*/(\Phi M_b)$ = #DIV/0!

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT 10.0 RESULTS COMPARE TO ORIGINAL DSA	SAWREY CONSULTING ENGINEERS LTD			
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X1 Z0.3 X0.3 Z1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (1 W-E + 0.3 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
121	wall	G to L1	col 8 to 9	concrete	112	1017	1381.516	40	312	422.008
145	wall	G to L1	col 10 to 11	block	28	958	1265.863	9	277	362.849
471	column	L3 to roof	col 14		34	59	83.962	42	99	151.842
494	beam	L1	col 3	bleacher	926	354	220.502	2461	1291	397.411
583	truss	roof	col 13 to 8	chord	410	1	1.627	427	1	1.371
591	truss	roof	col 13 to 8	top chord	184	2	3.388	185	1	2.675
887	brace	roof	col 13 to 8	pipe	274	0	1.375	277	0	1.595
897	beam	Ground	col 3	bleacher	1044	421	381.715	2704	1150	226.901
1082	beam	L1	col 3	bleacher	755	104	52.785	2225	85	50.225
1370	wall	L3 to roof	Col 13		212	1196	2821.936	174	1098	2612.523
~~1412~~	~~stairs~~	~~G to L1~~	~~col 6 to 12~~		~~244~~	~~2~~	~~7.895~~	~~244~~	~~1~~	~~2.497~~
1469	column	G to L1	col 14		1144	1982	1641.7	1258	550	468.044
1776	beam	L1	col 10	link	311	74	50.873	1025	154	90.078

X1 Z-0.3 X0.3 Z-1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (1 W-E + 0.3 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
121	wall	G to L1	col 8 to 9	concrete	108	987	1339.164	35	286	385.713
145	wall	G to L1	col 10 to 11	block	28	940	1243.636	11	284	375.016
471	column	L3 to roof	col 14		30	68	97.573	44	106	162.863
494	beam	L1	col 3	bleacher	801	326	212.761	2605	1426	428.993
583	truss	roof	col 13 to 8	chord	338	1	1.538	362	1	1.392
591	truss	roof	col 13 to 8	top chord	159	2	3.255	160	2	2.771
887	brace	roof	col 13 to 8	pipe	220	0	1.228	233	0	1.498
897	beam	Ground	col 3	bleacher	899	400	368.342	2879	1218	242.157
1082	beam	L1	col 3	bleacher	644	99	50.286	2345	83	65.331
1370	wall	L3 to roof	Col 13		194	988	2320.736	144	931	2217.31
~~1412~~	~~stairs~~	~~G to L1~~	~~col 6 to 12~~		~~0~~	~~2~~	~~8.06~~	~~0~~	~~1~~	~~3.774~~
1469	column	G to L1	col 14		1017	1982	1639.255	1214	660	559.227
1776	beam	L1	col 10	link	117	92	58.884	289	181	101.726

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT **10.0 RESULTS** COMPARE TO ORIGINAL DSA	SAWREY CONSULTING ENGINEERS LTD			
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X-1 Z0.3 X-0.3 Z1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (1 W-E + 0.3 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
121	wall	G to L1	col 8 to 9	concrete	113	1018	1382.101	34	284	383.62
145	wall	G to L1	col 10 to 11	block	27	966	1277.601	11	283	374.093
471	column	L3 to roof	col 14		25	61	87.545	35	99	152.719
494	beam	L1	col 3	bleacher	789	270	253.893	2419	1265	389.787
583	truss	roof	col 13 to 8	chord	321	1	1.495	339	1	1.296
591	truss	roof	col 13 to 8	top chord	148	2	3.173	145	1	2.359
887	brace	roof	col 13 to 8	pipe	218	0	1.083	219	0	1.323
897	beam	Ground	col 3	bleacher	830	355	308.539	2635	1130	223.276
1082	beam	L1	col 3	bleacher	628	79	42	2186	60	49.662
1370	wall	L3 to roof	Col 13		176	1007	2365.876	136	866	2060.084
~~1412~~	~~stairs~~	~~G to L1~~	~~col 6 to 12~~		~~262~~	~~2~~	~~7.848~~	~~262~~	~~1~~	~~2.34~~
1469	column	G to L1	col 14		1006	940	1051.584	1137	483	345.084
1776	beam	L1	col 10	link	314	80	53.707	1017	156	90.952

X-1 Z-0.3 X-0.3 Z-1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (1 W-E + 0.3 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
121	wall	G to L1	col 8 to 9	concrete	112	1001	1359.003	39	305	413.672
145	wall	G to L1	col 10 to 11	block	26	942	1244.972	9	272	356.243
471	column	L3 to roof	col 14		41	70	101.405	53	106	164.019
494	beam	L1	col 3	bleacher	1056	481	246.286	2688	1477	444.828
583	truss	roof	col 13 to 8	chord	431	1	1.678	447	1	1.524
591	truss	roof	col 13 to 8	top chord	202	2	3.468	199	2	2.975
887	brace	roof	col 13 to 8	pipe	281	0	1.603	290	0	1.763
897	beam	Ground	col 3	bleacher	1245	482	301.045	2994	1258	249.704
1082	beam	L1	col 3	bleacher	872	104	52.641	2421	94	67.686
1370	wall	L3 to roof	Col 13		213	1221	2885.302	175	1159	2763.754
~~1412~~	~~stairs~~	~~G to L1~~	~~col 6 to 12~~		~~0~~	~~2~~	~~8.416~~	~~0~~	~~1~~	~~3.601~~
1469	column	G to L1	col 14		1200	906	1011.098	1347	517	381.836
1776	beam	L1	col 10	link	97	84	55.071	282	179	100.527

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT **10.0 RESULTS** COMPARE TO ORIGINAL DSA

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Staad.Pro Refrence	member type	height	column number	notes	ϕNn kN	ϕVn kN	ϕMn kNm	ϕNn NBS(IL3)	ϕVn NBS(IL3)	ϕMn NBS(IL3)
121	wall	G to L1	col 8 to 9	concrete		636			62%	
145	wall	G to L1	col 10 to 11	block		295			31%	
471	column	L3 to roof	col 14			144	79		197%	70%
494	beam	L1	col 3	bleacher		501.8	581.4		49%	189%
583	truss	roof	col 13 to 8	chord	166			39%		
591	truss	roof	col 13 to 8	top chord	91			45%		
887	brace	roof	col 13 to 8	pipe	144			51%		
897	beam	Ground	col 3	bleacher						
1082	beam	L1	col 3	bleacher		451	377.61		434%	715%
1370	wall	L3 to roof	Col 13	improved		511	633		42%	22%
1412	stairs	G to L1	col 6 to 12		528			202%		
1469	column	G to L1	col 14	improved		551	394		28%	24%
1776	beam	L1	col 10	link	128			18%		

* Capacities have been taken from 2014 calculations - evaluated using NZS3101

fyp = 325

= 1.083333 x 300 Mpa

					X1	Z0.3		X0.3	Z1	0.69
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (1 W-E + 0.3 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
241	column	G to L1	15		851	1101	1211.219	1225	604	640.314
290	wall	L1 to L2	15	strut & tie	417	17	42.016	130	47	101.405
329	wall	L1 to L2	16	strut & tie	212	24	51.012	76	16	38.483
1455	column	G to L1	17		1145	1115	1175.453	1107	551	380.217
1466	column	G to L1	16		800	1955	1546.919	1261	579	446.647
1469	column	G to L1	14		1017	1982	1639.255	1258	550	468.044
1470	wall	G to L1	16 to 17	URM	0	70	650.807	0	21	196.219
1625	wall	G to L1	14 to 15	URM	1772	163	877.778	493	46	250.479
1626	wall	G to L1	16 to 17	URM	1766	169	870.917	523	51	253.636
1640	wall	L1 to L2	15	strut & tie	291	77	78.783	73	249	255.733
1667	wall	L1 to L2	16	strut & tie	~~284~~	~~51~~	~~53.582~~	~~169~~	44	~~56.011~~
1810	wall	G to L1	14 to 15	URM	0	64	619.482	0	19	177.21

					X1	Z-0.3		X0.3	Z-1	0.69
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (1 W-E + 0.3 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
241	column	G to L1	15		851	1101	1211.219	1222	629	674.008
290	wall	L1 to L2	15	strut & tie	417	17	42.016	124	50	106.541
329	wall	L1 to L2	16	strut & tie	212	24	51.012	119	16	38.85
1455	column	G to L1	17		1145	1115	1175.453	1256	551	380.342
1466	column	G to L1	16		800	1955	1546.919	1201	641	494.805
1469	column	G to L1	14		1017	1982	1639.255	1214	660	559.227
1470	wall	G to L1	16 to 17	URM	0	70	650.807	0	22	207.899
1625	wall	G to L1	14 to 15	URM	1772	163	877.778	592	54	293.665
1626	wall	G to L1	16 to 17	URM	1766	169	870.917	577	55	277.37
1640	wall	L1 to L2	15	strut & tie	291	77	78.783	140	260	265.974
1667	wall	L1 to L2	16	strut & tie	284	51	53.582	115	54	61.926
1810	wall	G to L1	14 to 15	URM	0	64	619.482	0	21	203.111

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT **10.0 RESULTS** BACK WALL	SAWREY CONSULTING ENGINEERS LTD			
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X-1 Z0.3 X-0.3 Z1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (1 W-E + 0.3 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
241	column	G to L1	15		800	2073	1814.849	1215	650	638.143
290	wall	L1 to L2	15	strut & tie	124	22	44.408	59	47	101.051
329	wall	L1 to L2	16	strut & tie	529	31	52.594	174	16	37.852
1455	column	G to L1	17		1133	2050	1732.369	1236	635	526.718
1466	column	G to L1	16		828	997	1007.631	1280	314	312.689
1469	column	G to L1	14		1006	940	1051.584	1137	483	345.084
1470	wall	G to L1	16 to 17	URM	1698	71	658.547	520	22	204.18
1625	wall	G to L1	14 to 15	URM	0	133	806.432	0	42	259.261
1626	wall	G to L1	16 to 17	URM	0	140	808.36	0	44	250.374
1640	wall	L1 to L2	15	strut & tie	310	79	75.713	167	248	254.975
1667	wall	L1 to L2	16	strut & tie	351	56	66.665	102	47	63.561
1810	wall	G to L1	14 to 15	URM	1699	67	642.116	540	21	200.757

X-1 Z-0.3 X-0.3 Z-1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (1 W-E + 0.3 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
241	column	G to L1	15		827	2006	1755.743	1214	631	677.713
290	wall	L1 to L2	15	strut & tie	135	22	44.837	87	51	107.369
329	wall	L1 to L2	16	strut & tie	504	31	53.541	126	16	39.237
1455	column	G to L1	17		992	1997	1685.992	1127	589	488.389
1466	column	G to L1	16		789	967	975.28	1190	277	272.447
1469	column	G to L1	14		1200	906	1011.098	1347	517	381.836
1470	wall	G to L1	16 to 17	URM	1652	69	641.12	481	20	187.894
1625	wall	G to L1	14 to 15	URM	0	128	776.573	0	35	211.593
1626	wall	G to L1	16 to 17	URM	0	136	783.407	0	39	220.847
1640	wall	L1 to L2	15	strut & tie	274	88	82.84	115	261	267.221
1667	wall	L1 to L2	16	strut & tie	358	51	63.626	152	43	61.722
1810	wall	G to L1	14 to 15	URM	1642	65	621.477	461	18	171.442

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT **10.0 RESULTS** BACK WALL	SAWREY CONSULTING ENGINEERS LTD			
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URM Wall convert N* = 0.9925 x V* assuming the N* brace is at a 45 degree angle

Staad.Pro Refrence	member type	height	column number	notes	ϕNn kN	ϕVn kN	ϕMn kNm	ϕNn NBS(IL3)	ϕVn NBS(IL3)	ϕMn NBS(IL3)
241	column	G to L1	15	improved		1171	526		56%	29%
290	wall	L1 to L2	15	strut & tie	258			62%		
329	wall	L1 to L2	16	strut & tie	258			49%		
1455	column	G to L1	17	improved		1171	526		57%	30%
1466	column	G to L1	16	improved		1171	526		60%	34%
1469	column	G to L1	14	improved		1171	526		59%	32%
1470	wall	G to L1	16 to 17	URM**		720			42%	
1625	wall	G to L1	14 to 15	URM**		720			40%	
1626	wall	G to L1	16 to 17	URM**		720			40%	
1640	wall	L1 to L2	15	strut & tie	258			83%		
1667	wall	L1 to L2	16	strut & tie	258			72%		
1810	wall	G to L1	14 to 15	URM**		583.6			34%	

* Capacities have been taken from 2014 calculations - evaluated using NZS3101

**URM wall below windows - cantilever out of plane - 39%NBS(IL3)

fyp = 325

= 1.083333 x 300 Mpa

hyp = 9.33 m

adj = 9.26 m

adj/hyp = 0.9925

					X1	Z0.3		X0.3	Z1	0.69
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
461	beam	G		Grid A	1140.9	493.6	154.0	384.3	448.8	260.8
465	beam	L1		Grid A	1206.8	191.8	235.6	561.2	46.7	380.0
476	beam	G		Grid B	759.4	445.1	190.8	688.6	656.6	317.2
479	beam	L1		Grid B	888.5	241.2	312.8	950.5	73.7	449.6
493	beam	L1		Grid C	1208.7	236.2	315.5	3927.4	947.5	909.0
507	beam	L1		Grid D	693.0	233.7	307.0	1203.2	75.8	624.3
521	beam	L1		Grid E	861.4	244.6	296.8	2480.5	581.4	474.1
533	beam	G		Grid F	871.5	389.8	153.8	466.6	359.4	159.8
536	beam	L1		Grid F	906.4	142.7	225.1	535.6	55.2	250.1
897	beam	G		Grid C	992.0	444.8	377.2	1902.9	1155.1	545.9
939	beam	G		Grid D	586.7	139.3	147.1	824.5	636.4	337.1
940	beam	G		Grid E	692.0	454.8	413.6	1251.7	729.2	409.4

					X1	Z-0.3		X0.3	Z-1	0.69
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (-0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (-1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
461	beam	G		Grid A	1100.4	476.3	154.3	1085.9	502.8	117.0
465	beam	L1		Grid A	1151.1	184.4	229.8	1202.9	194.0	224.3
476	beam	G		Grid B	693.0	335.5	190.1	1203.3	729.3	344.3
479	beam	L1		Grid B	688.8	240.5	312.7	1416.1	134.1	347.1
493	beam	L1		Grid C	1053.9	234.7	281.8	3362.2	662.6	702.7
507	beam	L1		Grid D	779.1	230.8	302.8	1954.1	185.4	580.7
521	beam	L1		Grid E	1167.0	241.2	291.4	2302.9	406.9	384.1
533	beam	G		Grid F	908.4	407.7	150.5	841.3	406.0	86.0
536	beam	L1		Grid F	953.6	139.5	233.4	927.2	140.1	213.0
897	beam	G		Grid C	863.3	410.1	375.1	2595.5	1212.4	474.0
939	beam	G		Grid D	782.9	183.1	145.1	1600.4	762.2	247.3
940	beam	G		Grid E	940.8	441.1	406.3	1767.2	617.8	332.5

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X-1 Z0.3 X-0.3 Z1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
461	beam	G		Grid A	490.1	446.4	233.8	384.8	451.7	262.8
465	beam	L1		Grid A	604.3	142.5	360.8	563.9	47.9	383.2
476	beam	G		Grid B	435.2	396.5	245.4	712.7	657.1	318.1
479	beam	L1		Grid B	538.3	191.0	266.3	951.1	58.7	449.4
493	beam	L1		Grid C	1132.9	277.4	342.4	3924.6	946.2	908.2
507	beam	L1		Grid D	571.3	175.8	248.6	1201.9	59.1	623.2
521	beam	L1		Grid E	1432.4	283.0	323.9	2475.2	579.3	473.6
533	beam	G		Grid F	481.3	359.3	164.3	464.1	357.9	159.1
536	beam	L1		Grid F	536.0	136.3	265.7	533.3	54.2	249.4
897	beam	G		Grid C	583.3	329.5	290.9	1920.7	1154.2	545.5
939	beam	G		Grid D	489.9	358.4	189.8	845.1	635.3	336.5
940	beam	G		Grid E	774.3	386.6	302.7	1276.2	727.2	408.6

X-1 Z-0.3 X-0.3 Z-1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (-0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (-1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
461	beam	G		Grid A	1153.1	499.9	175.3	1130.3	521.0	123.9
465	beam	L1		Grid A	1220.8	196.6	237.7	1260.5	202.0	231.6
476	beam	G		Grid B	775.3	446.2	255.5	1255.2	778.3	359.7
479	beam	L1		Grid B	892.0	195.5	272.9	1510.0	150.7	368.5
493	beam	L1		Grid C	1200.6	287.3	317.0	3409.5	677.5	712.9
507	beam	L1		Grid D	691.1	183.0	260.4	1926.7	181.5	571.4
521	beam	L1		Grid E	860.9	294.0	339.4	2172.8	378.7	368.7
533	beam	G		Grid F	867.1	388.6	143.7	797.8	386.9	81.5
536	beam	L1		Grid F	903.5	142.4	225.3	875.6	128.8	203.5
897	beam	G		Grid C	1042.8	442.0	302.4	2649.5	1228.8	481.0
939	beam	G		Grid D	590.2	378.5	198.9	1552.0	748.3	243.2
940	beam	G		Grid E	752.9	158.2	319.6	1684.5	578.5	315.1

Staad.Pro Refrence	member type	height	column number	notes	ϕNn kN	ϕVn kN	ϕMn kNm	ϕNn NBS(IL3)	ϕVn NBS(IL3)	ϕMn NBS(IL3)
461	Column	G	col 1	Grid A		597	427		119%	183%
465	beam	L1	col 1	Grid A		284	337		144%	93%
476	Column	G	col 2	Grid B		314	226		58%	88%
479	beam	L1	col 2	Grid B		284	337		118%	108%
493	beam	L1	col 3	Grid C		282	172		43%	27%
507	beam	L1	col 4	Grid D		284	337		122%	78%
521	beam	L1	col 5	Grid E		284	337		71%	99%
533	Column	G	col 6	Grid F		314	226		77%	138%
536	beam	L1	col 6	Grid F		284	337		199%	127%
897	Column	G	col 3	Grid C		314	226		37%	60%
939	Column	G	col 4	Grid D		314	226		60%	97%
940	Column	G	col 5	Grid E		314	226		62%	55%

* Capacities have been taken from 2014 calculations - evaluated using NZS3101 - lower than for a DSA

**URM wall below windows - cantilever out of plane - 39%NBS(IL3)

fyp = 325

= 1.083333 x 300 Mpa

					X1	Z0.3		X0.3	Z1	0.69
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					Rx (kN)	Ry (kN)	Rz (kN)	Rx (kN)	Ry (kN)	Rz (kN)
1	foundation	Ground	col 14	pad	246.0	1411.0	155.0	73.0	1433.0	489.0
2	foundation	Ground	15	pad	2861.0	1211.0	189.0	814.0	1336.0	607.0
3	foundation	Ground	16	pad	299.0	1278.0	326.0	86.0	1784.0	768.0
4	foundation	Ground	17	pad	2852.0	1212.0	173.0	825.0	1142.0	550.0
8	foundation	Ground	8	pad	1895.0	1741.0	597.0	619.0	1752.0	1463.0
9	foundation	Ground	col 13	pad	127.0	1431.0	301.0	38.0	1340.0	363.0
11	foundation	Ground	1	pad	278.0	1184.0	428.0	86.0	1161.0	450.0
12	foundation	Ground	18	pad	130.0	1096.0	179.0	37.0	1113.0	245.0
13	foundation	Ground	6	pad	284.0	915.0	333.0	96.0	829.0	328.0
15	foundation	Ground	2	pad	66.0	810.0	261.0	20.0	1387.0	593.0
16	foundation	Ground	3	pad	1219.0	1163.0	483.0	377.0	2874.0	1576.0
17	foundation	Ground	4	pad	27.0	606.0	139.0	9.0	1589.0	747.0
18	foundation	Ground	5	pad	1296	836	253	415	1822	875

					X1	Z-0.3		X0.3	Z-1	0.69
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (-0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (-1 W-E - 0.3 S-N)		
					Rx (kN)	Ry (kN)	Rz (kN)	Rx (kN)	Ry (kN)	Rz (kN)
1	foundation	Ground	col 14	pad	240.0	1412.0	167.0	68.0	1447.0	523.0
2	foundation	Ground	15	pad	2792.0	1192.0	201.0	763.0	1334.0	636.0
3	foundation	Ground	16	pad	291.0	1266.0	264.0	80.0	1602.0	519.0
4	foundation	Ground	17	pad	2786.0	1215.0	176.0	791.0	1167.0	556.0
8	foundation	Ground	8	pad	1858.0	1753.0	165.0	625.0	1831.0	405.0
9	foundation	Ground	col 13	pad	124.0	1553.0	207.0	36.0	1536.0	225.0
11	foundation	Ground	1	pad	271.0	945.0	1073.0	90.0	905.0	1165.0
12	foundation	Ground	18	pad	126.0	1170.0	133.0	36.0	1230.0	158.0
13	foundation	Ground	6	pad	277.0	801.0	689.0	101.0	776.0	710.0
15	foundation	Ground	2	pad	64.0	695.0	608.0	18.0	1247.0	1435.0
16	foundation	Ground	3	pad	1184.0	1360.0	1253.0	390.0	3190.0	3290.0
17	foundation	Ground	4	pad	27.0	559.0	203.0	10.0	1185.0	967.0
18	foundation	Ground	5	pad	1255	954	743	416	2003	1984

X-1 Z0.3 X-0.3 Z1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					Rx (kN)	Ry (kN)	Rz (kN)	Rx (kN)	Ry (kN)	Rz (kN)
1	foundation	Ground	col 14	pad	2615.0	1423.0	155.0	753.0	1444.0	489.0
2	foundation	Ground	15	pad	386.0	1052.0	190.0	108.0	1328.0	607.0
3	foundation	Ground	16	pad	2739.0	1375.0	325.0	799.0	1795.0	765.0
4	foundation	Ground	17	pad	343.0	1167.0	174.0	99.0	1134.0	550.0
8	foundation	Ground	8	pad	1896.0	1746.0	594.0	615.0	1752.0	1462.0
9	foundation	Ground	col 13	pad	143.0	1366.0	304.0	43.0	1318.0	363.0
11	foundation	Ground	1	pad	299.0	1199.0	435.0	92.0	1163.0	453.0
12	foundation	Ground	18	pad	120.0	1161.0	176.0	34.0	1103.0	245.0
13	foundation	Ground	6	pad	276.0	908.0	332.0	93.0	825.0	326.0
15	foundation	Ground	2	pad	1197.0	814.0	262.0	367.0	1389.0	593.0
16	foundation	Ground	3	pad	80.0	1153.0	479.0	26.0	2872.0	1576.0
17	foundation	Ground	4	pad	1178.0	600.0	138.0	381.0	1590.0	747.0
18	foundation	Ground	5	pad	89	826	252	26	1820	874

X-1 Z-0.3 X-0.3 Z-1 0.69

Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (-0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (-1 W-E - 0.3 S-N)		
					Rx (kN)	Ry (kN)	Rz (kN)	Rx (kN)	Ry (kN)	Rz (kN)
1	foundation	Ground	col 14	pad	2551.0	1426.0	167.0	711.0	1460.0	524.0
2	foundation	Ground	15	pad	377.0	1035.0	201.0	102.0	1325.0	636.0
3	foundation	Ground	16	pad	2673.0	1362.0	264.0	767.0	1614.0	520.0
4	foundation	Ground	17	pad	334.0	1173.0	176.0	95.0	1160.0	556.0
8	foundation	Ground	8	pad	1858.0	1758.0	166.0	621.0	1830.0	405.0
9	foundation	Ground	col 13	pad	140.0	1500.0	210.0	40.0	1514.0	226.0
11	foundation	Ground	1	pad	291.0	963.0	1098.0	96.0	907.0	1174.0
12	foundation	Ground	18	pad	117.0	1227.0	133.0	33.0	1219.0	158.0
13	foundation	Ground	6	pad	269.0	790.0	681.0	97.0	771.0	705.0
15	foundation	Ground	2	pad	1164.0	717.0	627.0	375.0	1257.0	1439.0
16	foundation	Ground	3	pad	77.0	1349.0	1243.0	26.0	3186.0	3288.0
17	foundation	Ground	4	pad	1140.0	546.0	197.0	388.0	1185.0	965.0
18	foundation	Ground	5	pad	87	941	735	24	1999	1979

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT **10.0 RESULTS** Foundations - Vertical Bearing Pressure	SAWREY CONSULTING ENGINEERS LTD			
		Date	*Project No*	*By*	*Page No.*
		Jul-23	10131	JLM	10. **12**

Staad.Pro Refrence	member type	height	column number	notes	Rx kN	Ry kN	Rz kNm	Rx NBS(IL3)	Ry NBS(IL3)	Rz NBS(IL3)
1	foundation	Ground	col 14	pad		2756.0			193%	
2	foundation	Ground	15	pad		2756.0			228%	
3	foundation	Ground	16	pad		1378.0			100%	
4	foundation	Ground	17	pad		2756.0			227%	
8	foundation	Ground	8	pad		5512.0			314%	
9	foundation	Ground	col 13	pad		1378.0			89%	
11	foundation	Ground	1	pad		1378.0			115%	
12	foundation	Ground	18	pad		1378.0			112%	
13	foundation	Ground	6	pad		2756.0			301%	
15	foundation	Ground	2	pad		2756.0			288%	
16	foundation	Ground	3	pad		2756.0			125%	
17	foundation	Ground	4	pad		2756.0			251%	
18	foundation	Ground	5	pad		2756			199%	

Bearing capacity at col 13 has been calculated based on Area of ground beam, pad & slab

Other bearing capacities have been scaled up from this by either:

a factor of 2 for perimeter piles and a factor of 4 for internal piles

Assumes no reactions are in tension.

					X1 Z0.3			X0.3 Z1		
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
1411	wall	G to L2	col 1 to 7	240 brick	346.3	1.4	4.4	379.8	2.0	5.1
1412	wall	G to L2	col 6 to 12	240 brick	236.7	2.3	8.0	227.7	0.8	2.7
1477	wall	G to L2	col 2 to 8	120 brick	167.3	3.3	9.8	291.9	10.0	31.0
1478	wall	G to L2	col 4 to 10	120 brick	129.1	0.7	1.0	426.0	1.9	5.4
1730	wall	G to L2	col 1 to 7	240 brick	176.4	3.1	6.2	235.8	1.4	3.7
1766	wall	G to L2	col 2 to 8	120 brick	294.3	4.1	10.9	500.7	13.1	35.4
1773	wall	G to L2	col 3 to 9	140 block	392.6	67.8	76.8	1149.7	179.0	292.4
1774	wall	G to L2	col 4 to 10	120 brick	230.4	0.9	1.8	689.2	2.2	5.0
1780	wall	G to L2	col 4 to 10	120 brick	365.5	31.8	145.5	845.7	54.4	118.0
1786	wall	G to L2	col 5 to 11	140 block	282.3	31.8	44.3	815.7	42.7	93.1
1801	wall	G to L2	col 6 to 12	240 brick	325.7	2.3	5.5	315.6	2.1	4.4
1845	wall	G to L2	col 3 to 9	140 block	762.5	70.8	93.7	1954.0	183.1	316.8
1847	wall	G to L2	col 5 to 11	140 block	473.6	67.8	94.1	1213.2	158.2	309.9

					X1 Z-0.3			X0.3 Z-1		
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (-0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (-1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
1479	wall	G to L2	col 1 to 7	240 brick	303.2	5.4	16.3	339.0	6.2	18.6
1480	wall	G to L2	col 2 to 8	120 brick	253.3	2.5	7.2	1017.7	5.6	18.3
1481	wall	G to L2	col 4 to 10	120 brick	19.9	1.8	5.6	31.9	4.7	15.0
1482	wall	G to L2	col 6 to 12	240 brick	139.1	4.2	11.9	144.9	4.3	12.1
1725	wall	G to L2	col 1 to 7	240 brick	500.4	3.0	11.2	553.4	3.5	12.8
1767	wall	G to L2	col 2 to 8	120 brick	190.9	0.4	2.6	332.6	1.1	4.5
1772	wall	G to L2	col 3 to 9	140 block	322.0	9.8	63.4	1295.9	28.6	245.2
1775	wall	G to L2	col 4 to 10	120 brick	155.5	0.4	2.3	440.8	1.1	6.5
1785	wall	G to L2	col 5 to 11	140 block	432.7	10.7	90.9	908.4	19.5	173.8
1800	wall	G to L2	col 6 to 12	240 brick	363.3	2.3	8.0	366.4	2.3	8.0
1809	wall	G to L2	col 6 to 12	120 brick	22.4	3.1	10.1	33.0	3.2	10.3
1846	wall	G to L2	col 3 to 9	140 block	453.4	35.7	110.7	1714.6	95.3	397.7
1848	wall	G to L2	col 5 to 11	140 block	541.0	47.5	182.5	1082.2	80.6	360.6

					X-1 Z0.3			X-0.3 Z1		
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
1411	wall	G to L2	col 1 to 7	240 brick	325.2	1.3	4.3	358.8	1.8	4.7
1412	wall	G to L2	col 6 to 12	240 brick	249.8	2.3	7.8	241.1	0.7	2.3
1477	wall	G to L2	col 2 to 8	120 brick	133.0	3.1	9.8	273.5	9.9	31.1
1478	wall	G to L2	col 4 to 10	120 brick	152.5	0.8	1.3	433.1	1.9	5.5
1730	wall	G to L2	col 1 to 7	240 brick	163.7	3.8	8.0	222.7	1.3	3.6
1766	wall	G to L2	col 2 to 8	120 brick	234.9	4.7	12.3	469.9	13.3	35.8
1773	wall	G to L2	col 3 to 9	140 block	342.6	60.7	63.6	1134.8	176.8	288.5
1774	wall	G to L2	col 4 to 10	120 brick	268.0	1.0	2.1	700.5	2.3	5.0
1780	wall	G to L2	col 4 to 10	120 brick	385.7	31.8	141.8	849.3	54.5	117.8
1786	wall	G to L2	col 5 to 11	140 block	396.1	32.8	51.8	860.5	43.2	96.4
1801	wall	G to L2	col 6 to 12	240 brick	344.8	2.4	5.5	335.2	2.2	4.7
1845	wall	G to L2	col 3 to 9	140 block	683.1	68.9	91.4	1930.4	182.5	316.1
1847	wall	G to L2	col 5 to 11	140 block	661.6	65.2	89.8	1284.5	157.3	308.6

					X-1 Z-0.3			X-0.3 Z-1		
Staad.Pro Refrence	member type	height	column number	notes	G + 0.3Q + EU Modal (-0.3 W-E - 1 S-N)			G + 0.3Q + EU Modal (-1 W-E - 0.3 S-N)		
					N* (kN)	V* (kN)	M* (kNm)	N* (kN)	V* (kN)	M* (kNm)
1479	wall	G to L2	col 1 to 7	240 brick	314.4	5.6	16.9	345.6	6.3	19.0
1480	wall	G to L2	col 2 to 8	120 brick	435.9	2.9	8.6	1077.2	5.8	18.8
1481	wall	G to L2	col 4 to 10	120 brick	18.3	1.5	4.5	31.3	4.6	14.7
1482	wall	G to L2	col 6 to 12	240 brick	131.4	4.0	11.3	138.8	4.0	11.4
1725	wall	G to L2	col 1 to 7	240 brick	516.3	3.1	11.6	561.2	3.5	13.1
1767	wall	G to L2	col 2 to 8	120 brick	227.1	0.6	3.4	352.9	1.2	5.0
1772	wall	G to L2	col 3 to 9	140 block	468.2	12.2	89.2	1343.7	29.4	254.4
1775	wall	G to L2	col 4 to 10	120 brick	122.0	0.3	1.7	430.1	1.1	6.3
1785	wall	G to L2	col 5 to 11	140 block	304.5	10.2	75.7	852.9	19.2	166.6
1800	wall	G to L2	col 6 to 12	240 brick	339.6	2.2	7.6	343.2	2.2	7.7
1809	wall	G to L2	col 6 to 12	120 brick	17.4	3.0	9.6	30.6	3.1	9.8
1846	wall	G to L2	col 3 to 9	140 block	643.7	44.8	154.8	1777.1	98.4	412.3
1848	wall	G to L2	col 5 to 11	140 block	374.2	38.9	131.6	1008.4	76.5	337.7

Project	PETONE RECREATION GROUND GRANDSTAND UDY STREET / KIRKS AVE DETAILED SEISMIC ASSESSMENT **10.0 RESULTS** Transverse URM Infill Walls	SAWREY CONSULTING ENGINEERS LTD			
		Date	*Project No*	*By*	*Page No.*
		Jul-23	10131	JLM	10. **15**

West to East (+Z direction)

N* = 1.4142 x V*/Z assuming the N* brace is at a 45 degr

Staad.Pro Refrence	member type	height	column number	notes	col 1 to 7 N* (kN)	Col 2 to 8 N* (kN)	col 3 to 9 N* (kN)	col 4 to 10 N* (kN)	col 5 to 11 N* (kN)	col 6 to 12 N* (kN)
1411	wall	G to L2	col 1 to 7	240 brick	379.84					
1412	wall	G to L2	col 6 to 12	240 brick						249.84
1477	wall	G to L2	col 2 to 8	120 brick		291.87				
1478	wall	G to L2	col 4 to 10	120 brick				433.07		
1730	wall	G to L2	col 1 to 7	240 brick	235.75					
1766	wall	G to L2	col 2 to 8	120 brick		500.71				
1773	wall	G to L2	col 3 to 9	140 block			1,149.69			
1774	wall	G to L2	col 4 to 10	120 brick				700.55		
1786	wall	G to L2	col 5 to 11	140 block					860.48	
1801	wall	G to L2	col 6 to 12	240 brick						344.83
1845	wall	G to L2	col 3 to 9	140 block			1,954.00			
1847	wall	G to L2	col 5 to 11	140 block					1,284.52	
				+Z direction ΣN* x Z	425	547	2,142	782	1,480	410

East to West (-Z direction) - Same Walls

Z = 0.69 - to reduce MRS scale factor for Z direction from 2.48 to 1.72

Staad.Pro Refrence	member type	height	column number	notes	col 1 to 7 N* (kN)	Col 2 to 8 N* (kN)	col 3 to 9 N* (kN)	col 4 to 10 N* (kN)	col 5 to 11 N* (kN)	col 6 to 12 N* (kN)
1479	wall	G to L2	col 1 to 7	240 brick	345.55					
1480	wall	G to L2	col 2 to 8	120 brick		1,077.17				
1481	wall	G to L2	col 4 to 10	120 brick				31.86		
1482	wall	G to L2	col 6 to 12	240 brick						144.89
1725	wall	G to L2	col 1 to 7	240 brick	561.25					
1767	wall	G to L2	col 2 to 8	120 brick		352.93				
1772	wall	G to L2	col 3 to 9	140 block			1,343.70			
1775	wall	G to L2	col 4 to 10	120 brick				440.85		
1785	wall	G to L2	col 5 to 11	140 block					908.38	
1800	wall	G to L2	col 6 to 12	240 brick						366.40
1809	wall	G to L2	col 6 to 12	120 brick						33.01
1846	wall	G to L2	col 3 to 9	140 block			1,777.08			
1848	wall	G to L2	col 5 to 11	140 block					1,082.19	
				-Z direction ΣN* x Z	626	987	2,153	326	1,373	376
				+ Z direction V*(kN)	442	698	1,523	231	971	266
				- Z direction V*(kN)	300	387	1,514	553	1,047	290
				fVn (kN)	676	323	816	323	816	676
				NBS(IL3)	153%	46%	54%	58%	78%	233%

PROJECT

Petone Recreation Ground Grandstand

Udy Street / Kirks Ave - Detailed Seismic Assessment

Section 11: Raking Beams and Vertical Seismic

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DATE	PROJECT NO.	BY	PAGE NO.
28-06-23	10131	JL	11.0

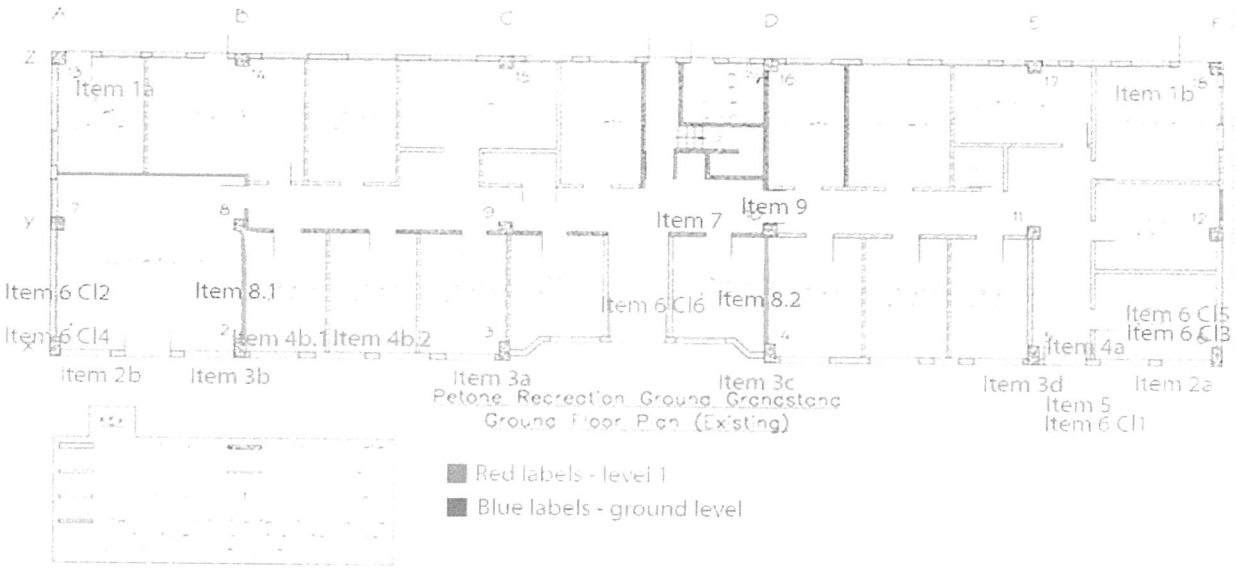
Table of Contents

1	Plan of Items
2 - 7	Bleacher Raking Beam
8 - 13	Longitudinal Bleacher Beam
14- 19	Vertical Roof Truss and column
20- 22	Rear Column
23	Summary Table

Assumptions

-Concrete strength = 35MPa
-Isteg bar yield strength = 300MPa
-Internal steel of internal faces of concrete beams not affected by corrosion

2 Building Plans and Scanning Locations



PROJECT

~~Petone Recreation Ground Grandstand~~

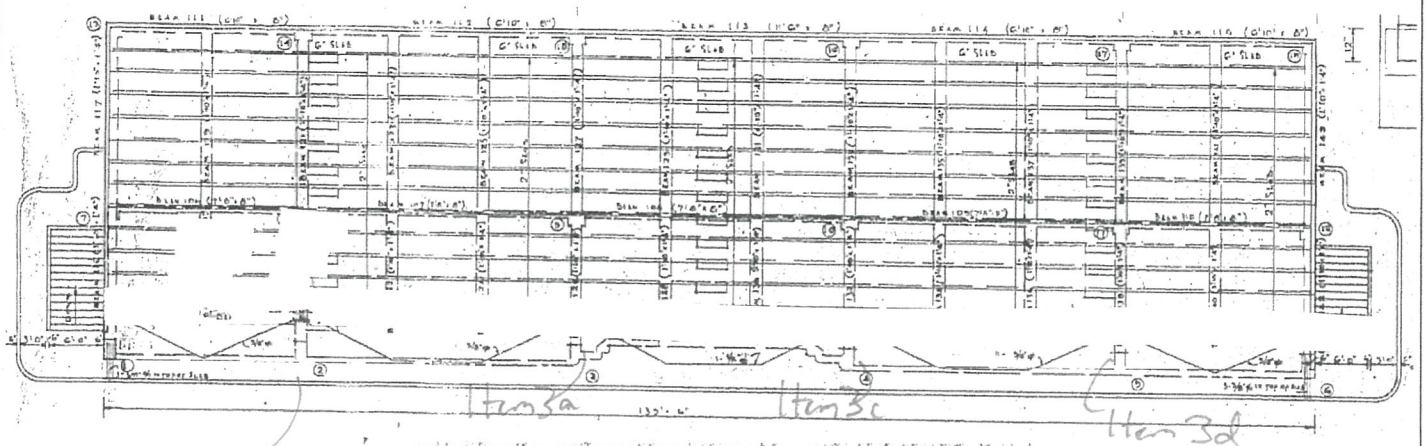
Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

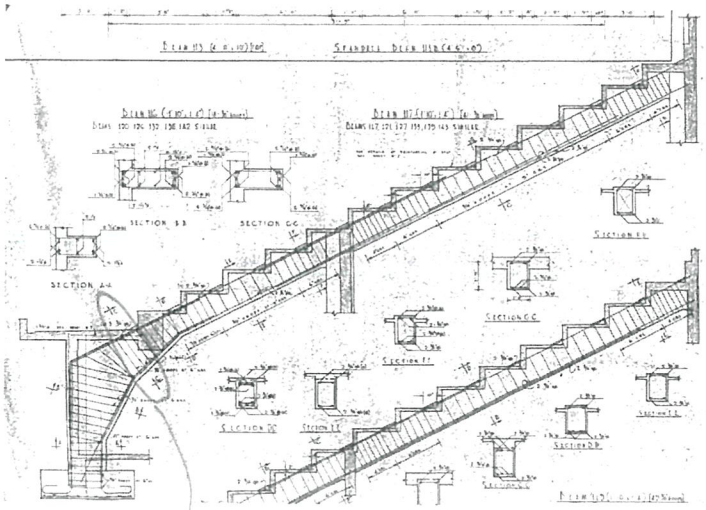
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Beam 120 and similar (116,126,132,138,142)



Item 3b



Section of interest.

Petone Recreation Ground Grandstand

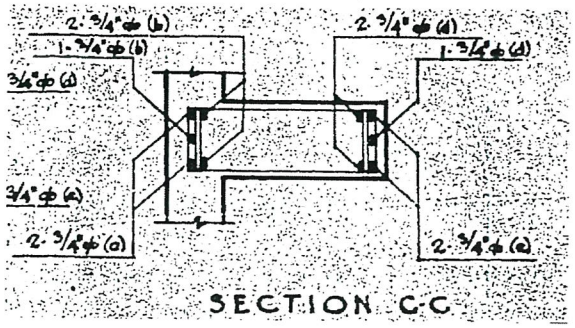
Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

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28.06.23	1013	JL	11.3

Capacity of bleacher beams based of CSI report



	Grid B	Grid C	Grid D	Grid E
Test Result	Item 3b	Item 3a	Item 3c	Item 3d
Bar 1	16.7	5	12	16.2
Bar 2	17.7	0	14	16.2
Stirrup	12	0	3.1	6.3
Area for single corroded bar	465	20	267	412
Cover	25	0	0	50
Top Steel	39%	2%	22%	34%
Isteg	Y	Y	Y	Y
Original Diameter	19.05	19.05	19.05	19.05
Exposed and Visual Bars	1	1	1	1
Unexposed Bars	4	4	4	4
Exposed and Visual Bar Area	465	20	267	412
Ave Est Remaining Area of Unexposed Bars	50%	30%	50%	50%
Unexposed Bars Area	1140	684	1140	1140
Total Area (Corrosion)	1605	704	1407	1552
Total Area (No Corrosion)	2850	2850	2850	2850
% Top Steel Remaining	**56%**	**25%**	**49%**	**54%**
Bot Steel				
Isteg	Y	Y	Y	Y
Original Diameter	19.05	19.05	19.05	19.05
Edge Bars	0	0	0	0
Internal Bars	5	5	5	5
Edge Bars Corroded Area	0	0	0	0
Non Corroded Area	2850	2850	2850	2850
Total Area (Corrosion)	2850	2850	2850	2850
Total Area (No Corrosion)	2850	2850	2850	2850
% Bot Steel Remaining	**100%**	**100%**	**100%**	**100%**
Stirrup				
Original Diameter	12	12	12	13
Total Area 3 stirrup	339	226	234	297
Total Area (No Corrosion) 3 stirrup	339	339	339	398
% Stirrup remaining	**100%**	**67%**	**69%**	**74%**
Capacity				
d' (Assumeall sides)	25	0	0	50
b (factored with test cover)	356	306	306	406
d (factored with test cover)	788	763	763	813
fy	324	324	324	324
As_test	1605	704	1407	1552
				Average of Grid B,D,E
ØMn(test) =	**385.2**	**171.7**	**337.4**	**374.3** 365.6
ØVn=	**334.7**	**275.9**	**277.3**	**365.5** 325.8

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	10131	JL	11.4

Rectangular Concrete Section Analysis

b-b

Bending

Geometry

B	356	mm
D	788	mm
d'	25.00	mm
d = D - d'	763.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.63E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	321.4	kN
Acv	271628.0	mm2
vc	0.6	
vb	0.84	
vb	1.18	
vb	0.84	
kd	0.9	
ka	0.850	
pw	0.00716	

Aggregate size 10 mm

Shear steel contribution

Vs 72.4 kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	325				1605	1605
	Secondary	325			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				339	339
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 385.15 kNm

Shear Capacity

ØVn = 334.7 kN

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	10131	JL	11.5

Rectangular Concrete Section Analysis

c-c

Bending

Geometry

B	306	mm
D	763	mm
d'	0.00	mm
d = D - d'	763.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.63E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	276.3	kN
Acv	233478.0	mm2
vc	0.5	
vb	0.65	
vb	1.18	
vb	0.65	
kd	0.9	
ka	0.850	
pw	0.00398	

Aggregate size 10 mm

Shear steel contribution

Vs 48.3 kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	325				704	704
	Secondary	325			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				226	226
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 171.70 kNm

Shear Capacity

ØVn = 275.9 kN

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	1013	JL	11.6

Rectangular Concrete Section Analysis

d-d

Bending

Geometry

B	306	mm
D	763	mm
d'	0.00	mm
d = D - d'	763.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.63E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	276.3	kN
Acv	233478.0	mm2
vc	0.6	
vb	0.83	
vb	1.18	
vb	0.83	
kd	0.9	
ka	0.850	
pw	0.00703	

Aggregate size	10	mm

Shear steel contribution

Vs	50.0	kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	325				1407	1407
	Secondary	325			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				234	234
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 337.42 kNm

Shear Capacity

ØVn = 277.3 kN

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	1013I	JL	11.7

Rectangular Concrete Section Analysis

d-d e-e

Bending

Geometry

B	406	mm
D	813	mm
d'	50.00	mm
d = D - d'	763.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.63E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	366.5	kN
Acv	309778.0	mm2
vc	0.6	
vb	0.77	
vb	1.18	
vb	0.77	
kd	0.9	
ka	0.850	
pw	0.00597	

Aggregate size 10 mm

Shear steel contribution

Vs 63.5 kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	325				1552	1552
	Secondary	325			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				297	297
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 374.33 kNm

Shear Capacity

ØVn = 365.5 kN

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

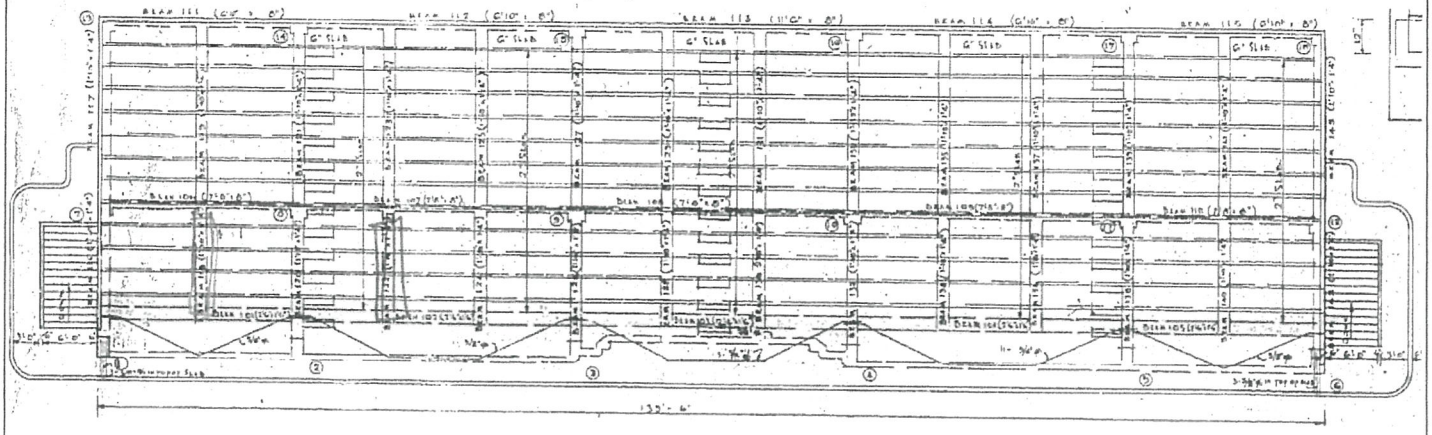
Section 11:Raking Beams, Vertical Seismic

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Bleachers RC Beam

Chek Vertical EQ loading onto "Bleacher Beam" highligthed below:



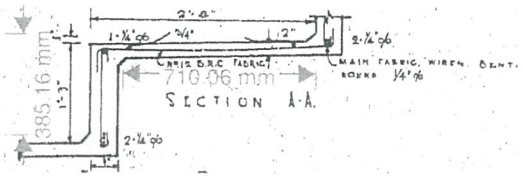
$\psi E := 0.6$ $\psi a := 1 = 1.00$ $Cv := 4.5$

Stair weight

Weight of single step

$$G_{step} := \frac{(0.381\ m \cdot 0.050\ m + 0.711\ m \cdot 0.05\ m) \cdot 24\ \frac{kN}{m^3}}{0.711\ m} + 0.15\ kPa = 1.99\ kPa$$

$Q_{step} := (5.0\ kPa) = 5.00\ kPa$



Beam 118 (red)

Selfweight of Beam 118

$$G_{118} := 0.559\ m \cdot 0.406\ m \cdot 24\ \frac{kN}{m^3} = 5.45\ \frac{kN}{m}$$

Reaction onto Beam 102 and Similar

$w_{trib} := 3.45\ m$

$Span := \frac{3.9\ m}{2} = 1.95\ m$

$P_{Gravity} := \left(1.2 \cdot \left(G_{step} \cdot w_{trib} + G_{118}\right) + 1.5 \cdot \left(\psi a \cdot Q_{step} \cdot w_{trib}\right)\right) \cdot Span = 79.29\ kN$

$P_{EQvert} := \left(\left(G_{step} \cdot w_{trib} + G_{118}\right) + \psi a \cdot \psi E \cdot Q_{step} \cdot w_{trib}\right) \cdot Cv \cdot Span = 198.95\ kN$

Beam 120 (blue)

Selfweight of Beam 120

$$G_{120} := 0.559\ m \cdot 0.406\ m \cdot 24\ \frac{kN}{m^3} = 5.45\ \frac{kN}{m}$$

Reaction onto Beam 102 and Similar

$w_{trib} := 3.2\ m$

$Span := \frac{3.9\ m}{2} = 1.95\ m$

$P_{Gravity} := \left(1.2 \cdot \left(G_{step} \cdot w_{trib} + G_{118}\right) + 1.5 \cdot \left(\psi a \cdot Q_{step} \cdot w_{trib}\right)\right) \cdot Span = 74.47\ kN$

$P_{EQvert} := \left(\left(G_{step} \cdot w_{trib} + G_{118}\right) + \psi a \cdot \psi E \cdot Q_{step} \cdot w_{trib}\right) \cdot Cv \cdot Span = 188.00\ kN$

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

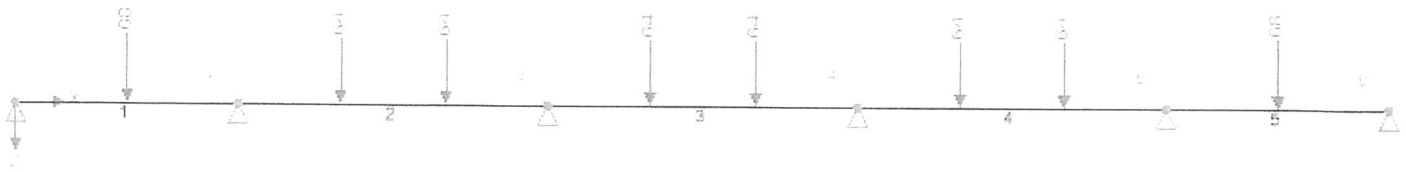
Section 11:Raking Beams, Vertical Seismic

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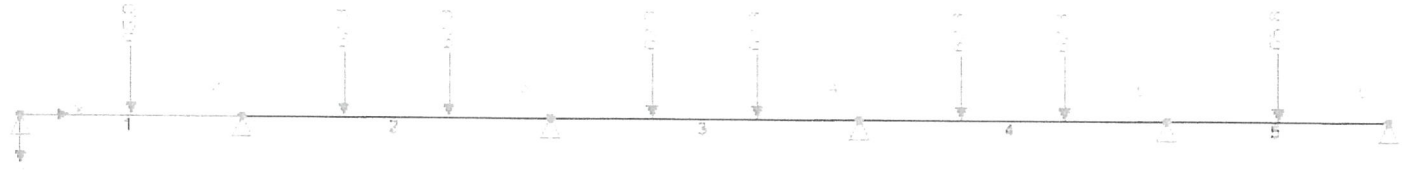
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Tedds analysis input

G

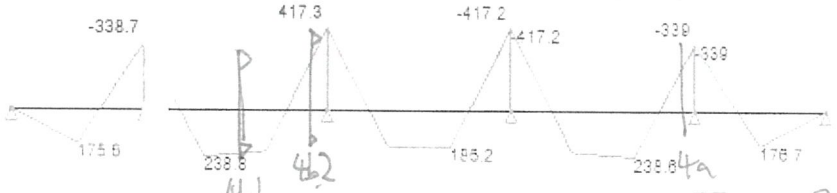


Seismic



Results from Tedds Analysis:

G+Eu (VERT) (Strength) - Moment (kNm)

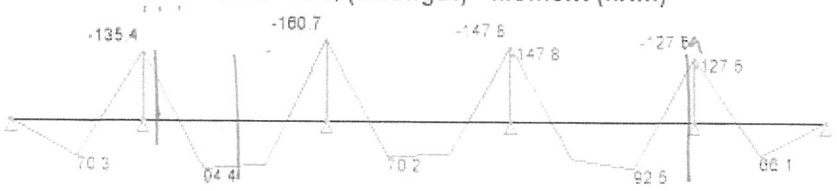


4b.1 4b.2 4a ← C.S.1 report locations

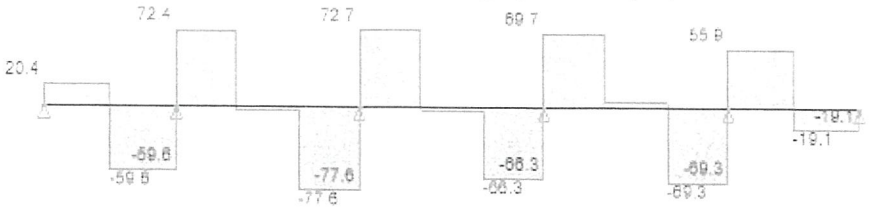
G+Eu (VERT) (Strength) - Shear (kN)



1.2G+1.5Q (Strength) - Moment (kNm)



1.2G+1.5Q (Strength) - Shear (kN)



Petone Recreation Ground Grandstand

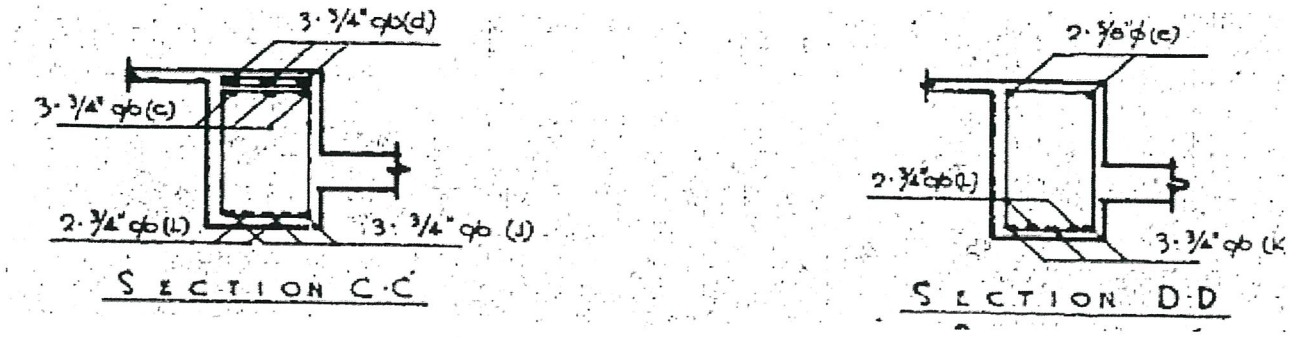
Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

28.06.23	1013l	JL	11.10

Capacity of longitudinal beam based of CSI report



		Section C	Section D	Section E (similar to Section C)
Test Result		Item 4a	Item 4b.1	Item 4b.2
Bar 1		15	9	17.5
Bar 2		15	0	17.5
Stirrup		6	9	10.5
Area for single corroded bar		353	64	481
Cover		0	0	0
Top Steel				
Isteg		Y	Y	Y
Original Diameter		19.05	19.05	19.05
Exposed and Visual Bars		1	1	1
Unexposed Bars		5	1	5
Exposed and Visual Bar Area		353	64	481
Ave Est Remaining Area of Unexposed Bars		50%	50%	50%
Unexposed Bars Area		1425	285	1425
Total Area (Corrosion)		1779	349	1906
Total Area (No Corrosion)		3420	1140	3420
% Top Steel Remaining		**52%**	**31%**	**56%**
Bot Steel				
Isteg		Y	Y	Y
Original Diameter		19.05	19.05	19.05
Edge Bars		0	0	0
Internal Bars		5	5	5
Edge Bars Corroded Area		0	0	0
Non Corroded Area		2850	2850	2850
Total Area (Corrosion)		2850	2850	2850
Total Area (No Corrosion)		2850	2850	2850
% Bot Steel Remaining		**100%**	**100%**	**100%**
Stirrup				
Original Diameter		12	12	12
Total Area 3 stirrup		254	290	313
Total Area (No Corrosion) 3 stirrup		339	339	339
% Stirrup remaining		**75%**	**85%**	**92%**
Capacity				
d'	(Assumeall sides)	0	0	0
b (factored with test cover)		357	357	357
d (factored with test cover)		712	712	712
fy		324	324	324
As_test		1779	2850	1906
		Top Steel	Bot Steel	Top Steel
ØMn(test) =		**394.8**	**617.3**	**421.9**
M*=		339.0	238.8	417.3
ØVn=		**298.7**	**304.8**	**308.7**
V*=		182	0	198.2

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	1013	JL	11.11

Rectangular Concrete Section Analysis

Item 4a

Bending

Geometry

B	357	mm
D	712	mm
d'	0.00	mm
d = D - d'	712.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.62E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	300.8	kN
Acv	254184.0	mm2
vc	0.7	
vb	0.89	
vb	1.18	
vb	0.89	
kd	0.9	
ka	0.850	
pw	0.00800	

Aggregate size 10 mm

Shear steel contribution

Vs 50.6 kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	324				1779	1779
	Secondary	324			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				254	254
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 394.75 kNm

Shear Capacity

ØVn = 298.7 kN

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	10131	JL	11.12

Rectangular Concrete Section Analysis

Item 4b1

Bending

Geometry

B	357	mm
D	712	mm
d'	0.00	mm
d = D - d'	712.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.62E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	300.8	kN
Acv	254184.0	mm2
vc	0.8	
vb	1.14	
vb	1.18	
vb	1.14	
kd	0.9	
ka	0.850	
pw	0.01221	

Aggregate size 10 mm

Shear steel contribution

Vs 50.6 kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	324				2850	2850
	Secondary	324			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				254	254
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 617.32 kNm

Shear Capacity

ØVn = 298.7 kN

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	10131	JL	11.13

Rectangular Concrete Section Analysis

Item 4b.2

Bending

Geometry

B	357	mm
D	712	mm
d'	0.00	mm
d = D - d'	712.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.62E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	300.8	kN
Acv	254184.0	mm2
vc	0.7	
vb	0.93	
vb	1.18	
vb	0.93	
kd	0.9	
ka	0.850	
pw	0.00873	
Aggregate size	10	mm

Shear steel contribution

Vs	62.4	kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	324				1906	1906
	Secondary	324			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				313	313
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 421.74 kNm

Shear Capacity

ØVn = 308.7 kN

Vertical Coefficient as per NZS1170.5:

5.4 VERTICAL DESIGN ACTIONS

5.4.1 For the structure as a whole

When required by Clause 6.4.1 the vertical design action coefficient, C_{vd}, shall be as follows:

$$C_{vd} = C_v(T_v)S_p \quad \ldots 5.4(1)$$

where

$C_v(T_v)$ = elastic site hazard spectrum for vertical loading determined from Clause 3.2 using R_s or R_u as appropriate

T_v = the vertical period of the structure to be taken as 0

S_p = the structural performance factor for the structure as given by Clause 4.4

5.4.2 For elements

When required by Clause 8.5.2, the vertical design action coefficient, C_{vd}, shall be as follows:

$$C_{vd} = C_v(T_v) \quad \ldots 5.4(2)$$

where

$C_v(T_v)$ = elastic site hazard spectrum for vertical loading determined from Clause 3.2 using R_s or R_u as appropriate

T_v = the vertical period of the element under consideration (see commentary C3.2).

3.2 SITE HAZARD SPECTRA FOR VERTICAL LOADING

The elastic site hazard spectrum for vertical loading, $C_v(T)$, for a given period T shall be given by Equations 3.2(1) to 3.2(4):

$C_v(T) = \alpha\,[C(0\text{ s}) + (C(0.1\text{ s}) - C(0\text{ s}))(T/0.05)]$ for $T \le 0.05$ s ...3.2(1)

$C_v(T) = \alpha\,C(0.1\text{ s})$ for $0.05\text{ s} < T \le 0.15$ s ...3.2(2)

$C_v(T) = \alpha\,C(0.1\text{ s})\,(0.15/T)^{0.75}$ for $0.15\text{ s} < T \le 3$ s ...3.2(3)

$C_v(T) = C_v(3\text{ s})\,(3/T)^2$ for $T > 3$ s ...3.2(4)

where

$\alpha = 0.9$ for site classes A/B and C

$\alpha = 1.5$ for site classes D and E

Therefore :

$S_p := 1.3 - 0.3 \cdot \mu$

$\mu := 1.00$

$C_v\left(T_v\right) := \alpha \cdot C\left(O_1\right)$

where:

$C\left(O_1\right) := 3.0$

$T := 0.15$

$\alpha := 1.5$

$C_{vd} := C_v\left(T_v\right) = 4.50$

PROJECT

Petone Recreation Ground Grandstand

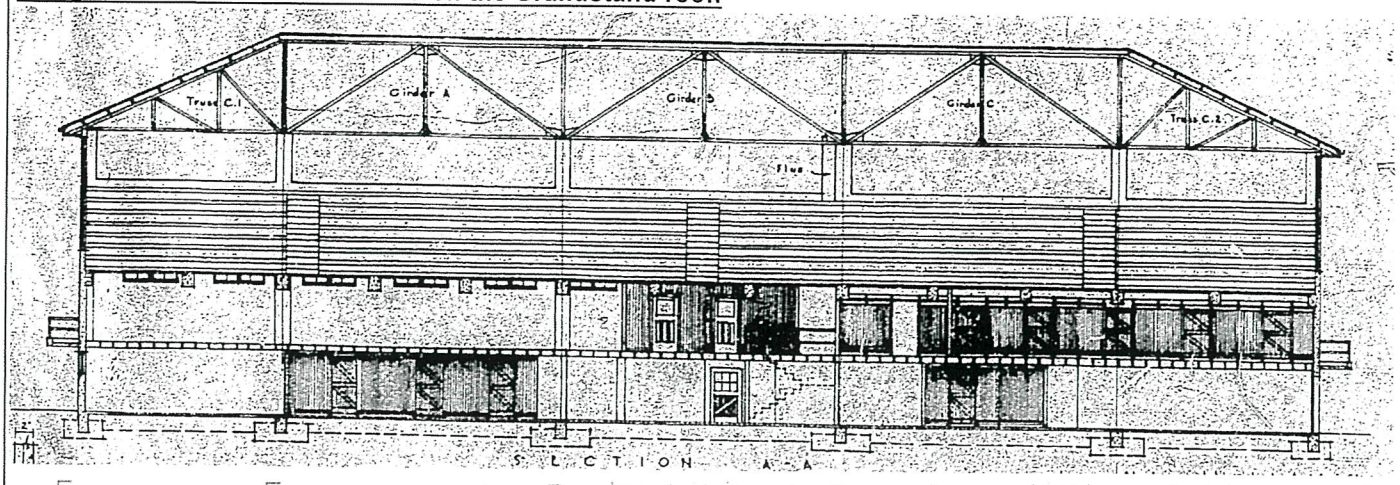
Udy St / Kirks Ave - DSA

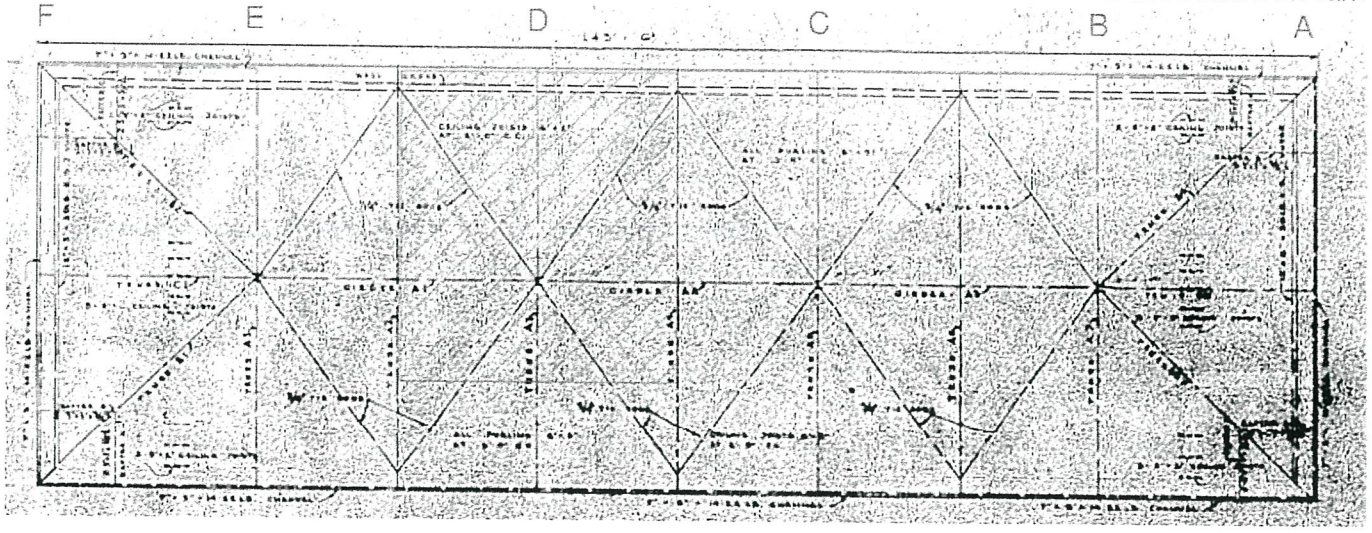
Section 11:Raking Beams, Vertical Seismic

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DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	1013 I	JL	11.15

Design Check on Vertical Actions on the Grandstand roof.





Check vertical loads acting on steel columns.

Tributary area shown above:

$a_{trib} := 104\ m^2$

$trib_w_cen := 9.5\ m$

$trib_w_edge := 8.3\ m$

Weight of roof:

Roof comprises of steel trusses, roofing iron and timber purlins (6" x 3" @ 3'cc). Consider as lightweight roofing.

$G_{roof} := 0.4\ kPa$

$Q_{roof} := 0.25\ kPa$

$\psi E := 0.3$

$G_{EQ} := \left(G_{roof} + \psi E \cdot Q_{roof}\right) \cdot a_{trib} \cdot C_{vd} = 222.30\ kN$

$G_{EQ_vert} := \left(G_{roof} + \psi E \cdot Q_{roof}\right) \cdot trib_w_cen \cdot C_{vd} = 20.31 \cdot \frac{1}{m}\ kN$

$G_{EQ_vert_g} := trib_w_cen \cdot G_{roof} \cdot C_{vd} = 17.10\ \frac{kN}{m}$

$G_{EQ_vert_Q} := trib_w_cen \cdot \psi E \cdot Q_{roof} \cdot C_{vd} = 3.21\ \frac{kN}{m}$

PROJECT

Petone Recreation Ground Grandstand

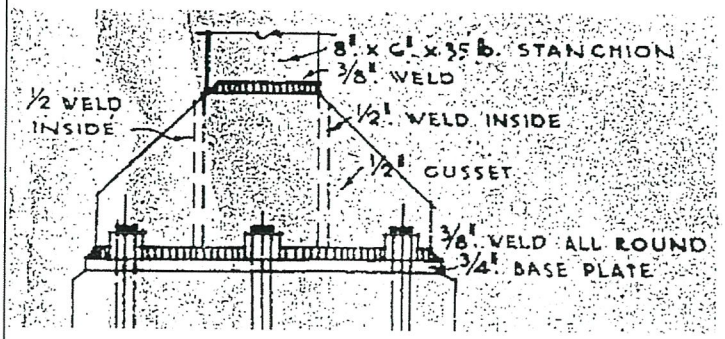
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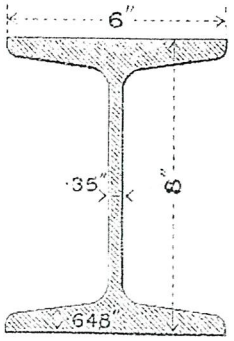
Section 11:Raking Beams, Vertical Seismic

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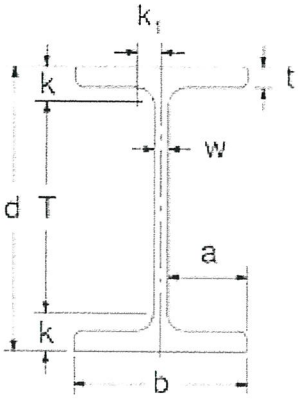
DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	10131	JL	11.16

Axial Capacity of Column:





N.B.S.H.B. 4.
8" × 6" × 35 lbs per foot.



$d := 203.2\ mm$

$b := 152.4\ mm$

$t := 16.5\ mm$

$w := 8.9\ mm$

$d' := (d - t) = 186.70\ mm$

Area

$A := 2 \cdot (b \cdot t) + (d - 2 \cdot t) \cdot w = 6543.98\ mm^2$

Second Moment of Area

$$I_x := \frac{(d - 2 \cdot t)^3 \cdot w}{12} + 2 \cdot \left(\frac{t^3 \cdot b}{12} + \frac{t \cdot b \cdot ((d - 2 \cdot t) + t)^2}{4} \right) = 4.76 \cdot 10^7\ mm^4$$

$$I_y := \frac{w^3 \cdot (d - 2 \cdot t)}{12} + 2 \cdot \left(\frac{b^3 \cdot t}{12} \right) = 9.74 \cdot 10^6\ mm^4$$

Elastic Section Modulus

$$Z_x := \frac{d \cdot b^2}{6} - \frac{(b - w) \cdot (d - 2 \cdot t)^3}{6 \cdot d} = 2.06 \cdot 10^5\ mm^3$$

Torsion Constant

$$J := \frac{2 \cdot b \cdot t^3 + d' \cdot w^3}{3} = 5.00 \cdot 10^{-7}\ m^4$$

Yield Strength

$fy := 210\ MPa$

Warping Constant

$$I_w := \frac{I_y \cdot (d)^2}{4} = 1.01 \cdot 10^{-7}\ m^6$$

Shear Modulus of Elasticity

$G := 80000\ MPa$

Area of Web

$A_{web} := w \cdot d' = 1661.63\ mm^2$

Youngs modulus of Steel

$E := 200\ GPa$

Radius f Gyration

$$r := \sqrt{\frac{I_x}{A}} = 0.09$$

Axial Capacity

Taken from 6.1 NZS3404 : Part 1 : 1997

$N_c := \alpha_c \cdot N_s$

Where

$N_s := k_f \cdot A \cdot f_y$

$\lambda_n := \left(\frac{L_e}{r}\right) \cdot \sqrt{k_f} \cdot \sqrt{\left(\frac{f_y}{250}\right)}$

$f_y := 210\ \text{MPa}$

$L_e := k_e \cdot L$

$k_e := 0.7$ From Figure 4.8.3.2 NZS3404:Part 1:1997

$L := 5.4\ \text{m}$

$k_f := 1.0$

$\lambda_n = 27.94$

$\alpha_b := 0$

UB and UC sections, hot-rolled (flange thickness up to 40 mm)	$k_f \le 1.0$	0
Box sections, welded		

$\alpha_c := 0.943$

$\phi = 1.00$

$\phi N_c := \phi \cdot \alpha_c \cdot N_s = 1295.90\ \text{kN}$ >> $G_{EQ} = 222.30\ \text{kN}$

PROJECT
PETONE REC GROUNDS

SAWREY
CONSULTING ENGINEERS LTD.

DATE	PROJECT NO.	BY	PAGE NO.
[illegible]		GRC	11.18

Existing Hall Truss - [illegible] - Items 592 & 591

Main Truss - Bottom chords: 2 - 2½" x 2½" x 3/16" angles, 1 row 5/8" bolts (63 x 63 x 5 mm) (1 row 16 mm)
- Top chords: 2 - 4" x 3" x 3/16" angles (102 x 76 x 5 mm)
- Gusset to wall: 6 - 3/4" rivets (19 mm) - Truss angles to gusset 5/16" thick.
2 - 1" Cast in bolts (25 mm) - Plate to conc beam.
- Diagonal braces: 3/4" Rod (19 mm)

Tensile capacities: f_y = 300

- Bottom chords: $\phi A_g f_y$ = 1.0 x 950 x [illegible] = 570 kN
- Top chords = 1.0 x 950 x (76 + 102 - 19 + 2) x 5 x 2 = 694 kN
- Welds: [illegible] = 6 x 44.0 = 263 kN
- Bolts = 2 x 6 x 3 = 257 kN. ← governs
- Diagonal braces: $\phi A_g f_y$ = 1.0 x 284 x 300 = 771 kN.

Compression [illegible]

Bottom chord L_e = 5'0" ϕ_c = [illegible] = 344 kN ∴ bolts govern

Top chords [illegible] 4'8" ϕ_c = 553 kN = 553 kN ✓

Total = 514 kN.

∴ Main truss + 4 No total compression truss to wall to transfer between top + bottom chords.

Say:

166 bottom chord 91 top chord.

257 kN = bolt capacity

PROJECT: PEYTON REC GROUNDWORKS

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
June 14		GRS	11.19

1979 Tower Bridge at Peyton — Work 887.

100 NB x 4.5mm wall tube. — diagonal length = 6.33m - take as 7.5m

114.3OD x 4.5mm wall

From BSC Tables. CHS Grade 350

In compression — assume L_e = 6.0m - fixed & pinned end conditions

P_c = 516kN.

In tension P_t = 349kN.

Petone Recreation Ground Grandstand

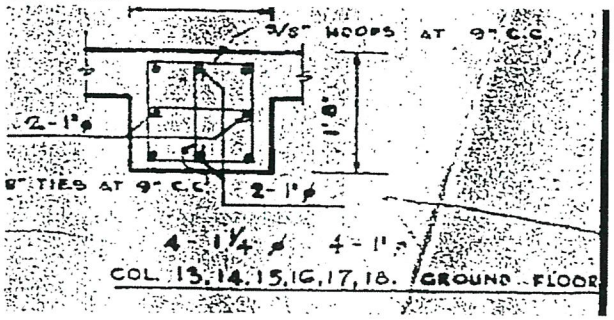
Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

28.06.23	1013[	JL	11.20

Rear Columns



Test Result	Item 1a	Item 1b	
Bar 1		9	16.9
Bar 2		0	0
Stirrup		12	10
Area for single corroded bar		64	224
Cover		0	32
Top Steel			
Isteg	N	N	
Original Diameter		19.05	19.05
Exposed and Visual Bars		2	2
Unexposed Bars		1	1
Exposed and Visual Bar Area		127	449
Ave Est Remaining Area of Unexposed Bars		85%	85%
Unexposed Bars Area		242	242
Total Area (Corrosion)		370	691
Total Area (No Corrosion)		855	855
% Top Steel Remaining		**43%**	**81%**
Bot Steel			
Isteg	N	N	
Original Diameter		19.05	19.05
Edge Bars		3	3
Internal Bars		0	0
Edge Bars Corroded Area		191	673
Non Corroded Area		0	0
Total Area (Corrosion)		191	673
Total Area (No Corrosion)		855	855
% Bot Steel Remaining		**22%**	**79%**
Stirrup			
Original Diameter		12	12
Total Area 3 stirrup		339	305
Total Area (No Corrosion) 3 stirrup		339	339
% Stirrup remaining		**100%**	**90%**
Capacity			
d'	(Assumeall sides)	0	32
b (factored with test cover)		408	472
d (factored with test cover)		458	490
fy		300	300
As_test		370	691
ØMn(test) =		**54.3**	**100.8**
ØVn =		**224.9**	**254.4**

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	1013/	JL	11.21

Rectangular Concrete Section Analysis

Item 1a

Bending

Geometry

B	408	mm
D	458	mm
d'	0.00	mm
d = D - d'	458.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.62E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	221.1	kN
Acv	186864.0	mm2
vc	0.5	
vb	0.64	
vb	1.18	
vb	0.64	
kd	1.0	
ka	0.850	
pw	0.00379	

Aggregate size 10 mm

Shear steel contribution

Vs 43.5 kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	324				370	370
	Secondary	324			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				339	339
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 54.31 kNm

Shear Capacity

ØVn = 224.9 kN

PROJECT

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

DATE	PROJECT NO.	BY	PAGE NO.
28.06.23	1013	JL	11.22

Rectangular Concrete Section Analysis

Item 1b

Bending

Geometry

B	472	mm
D	490	mm
d'	32.00	mm
d = D - d'	458.0	mm

Material properties

Ec	26541
e_{cu}	0.003
Es	2.00E+05
e_y	1.62E-03

Design parameters

rmax	0.0046
a	0.85
b_1	0.85
Ø	1.00
rmax / rb	0.75
r' / r	0.50

Concrete

f'c	35.00	MPa

Shear

Material properties

Øc	0.85
Øs	-

Analysis

Concrete contribution

Vc	255.8	kN
Acv	216176.0	mm2
vc	0.6	
vb	0.70	
vb	1.18	
vb	0.70	
kd	1.0	
ka	0.850	
pw	0.00476	

Aggregate size 10 mm

Shear steel contribution

Vs 43.5 kN

Reinforcing - Bending

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
BENDING	Primary	324				691	691
	Secondary	324			-	0	-

Reinforcing - Shear

Longitudinal		Grade (fy) (Mpa)	Dia. (mm)	Number of bars	Spacing (mm)	As (mm2)	As Total (mm2)
SHEAR	Primary	280				339	339
	Secondary				-	0	-
Transverse		fyt (Mpa)	Dia. (mm)	Legs (No.)	(mm)		
Stirrups	Primary					0	0
	Secondary					-	0

Moment Capacity

ØMn = 100.75 kNm

Shear Capacity

ØVn = 254.4 kN

Petone Recreation Ground Grandstand

Udy St / Kirks Ave - DSA

Section 11:Raking Beams, Vertical Seismic

SAWREY CONSULTING ENGINEERS LTD

28.06.23	1013[	JL	11.23

Description	CSI Item	Staad Pro	Location	Level	Structure	Load Orientation	Nn* kN	Vn* kN	Mn* kNm	ΦNn kN	ΦVn kN	ΦMn kNm	ΦNn NBS(IL3)	ΦVn NBS(IL3)	ΦMn NBS(IL3)
Backwall Corner Column	Item 1a	235	Grid A	G	Primary Structure	Horizontal 100%E-W, 30%N-S	-	19.97	16.91	-	224.90	54.30		100%	100%
Backwall Corner Column	Item 1b	234	Grid F	G	Primary Structure	Horizontal 100%E-W, 30%N-S	-	20.16	29.40	-	254.40	100.80		100%	100%
RC Raking Beam Haunch	Item 3b	479	Grid B	L1	Primary Structure	Horizontal 100%E-W, 30%N-S	-	145.74	310.03	-	325.80	365.60		100%	100%
RC Raking Beam Haunch	Item 3a	493	Grid C	L1	Primary Structure	Horizontal 100%E-W, 30%N-S	-	848.72	593.98	-	275.90	171.70		33%	30%
RC Raking Beam Haunch	Item 3c	507	Grid D	L1	Primary Structure	Horizontal 100%E-W, 30%N-S	-	197.51	341.06	-	325.80	365.60		100%	100%
RC Raking Beam Haunch	Item 3d	521	Grid E	L1	Primary Structure	Horizontal 100%E-W, 30%N-S	-	609.16	329.52	-	325.80	365.60		50%	100%
RC Long. Bleacher Beam	Item 4b.1	-	Grid B	L1	Primary Structure	Vertical Seismic	-	182.00	339.00	-	298.70	394.80		100%	100%
RC Long. Bleacher Beam	Item 4b.2	-	Inbetween Grid B - Grid C	L1	Primary Structure	Vertical Seismic	-	0.00	238.80	-	304.80	617.30		100%	100%
Roof Truss Top Chord	-	-	Grid B, C, D, E	R	Primary Structure	Vertical Seismic	151.40	-	-	91.00	-	-	60%		
Roof Truss Bottom Chord	-	-	Grid B, C, D, E	R	Primary Structure	Vertical Seismic	115.00	-	-	166.00	-	-	100%		
Steel Column	-	-	Grid B, C, D, E	L1-R	Primary Structure	Vertical Seismic	222.30	-	-	1295.90	-	-	100%		