VanBoxmeer & Stranges Ltd.

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July 5, 2019
VB&S #: **19158**

JAM Properties
180 Cheapside Street
London, Ontario
N6A 1Z8
Attn: Mr. Archie Leach

JAM Properties
Structural Review and Comments
123 Queens Avenue
London, Ontario

SUPPLEMENTAL REPORT #1

Dear Mr. Leach:

This letter serves to supplement our report dated May 07, 2019. VB&S was provided the opportunity to add to the original report and determine the structural integrity of the structure and to test the concrete and determine whether the concrete is sound. The assessment of the building was completed in two ways. First, by constructing a digital model of the building and completing a structural analysis. Second, by taking core samples of the existing concrete and testing them to determine the structural integrity of the concrete.

1.1 Structural Analysis

On May 14, 2019, Rick Stranges, P. Eng., and Michael Hatt, EIT, (of VB&S) were on site to survey the concrete structure. Physical measurements of the entire structure were taken. The measurements included but were not limited to the wall thickness, floor thickness, floor beam dimensions/locations and the reinforcing steel size and spacing (where exposed) in the walls and piers.

VB&S used these measurements to construct a virtual 3D model using E-Tabs software. E-Tabs is an integrated structural analysis and design software that allows structural engineers to analyze and design various structures. Results from the software allow the engineer to determine which virtual elements are overstressed, and to revise specific parameters until that element is capable of supporting the applied loads.

When the virtual model was built, loads were applied to the structure. The loads as prescribed by the Ontario Building Code include the self-weight of the concrete, dead and live loads applied to the floor structure, and wind loads. Given the age of the building, it was not required to check that the structure would be capable of resisting any seismic load. In discussions with the City, we agreed that as the structure and the occupancy was not changing at this time, and as the original building was not designed for seismic loads, this

study would not have to meet that requirement.

Once the E-tabs results were obtained, VB&S used a software called “S-Concrete” to check the capacity of the elements that were shown to be overstressed in E-Tabs. We use S-Concrete software to design structural concrete elements and in this case walls. The program allows us to construct a virtual wall and precisely arrange the reinforcing within that wall. In this way, S-Concrete allows for a more accurate analysis of specific structural elements. After obtaining the loads and reactions of the overstressed elements from the E-Tabs model, we applied those loads to the wall in S-Concrete. We were then able to verify the stresses in the wall and determine if the maximum permissible stresses in the wall have been exceeded.

1.2 Concrete Sampling (PML)

Peto MacCallum Ltd. (PML) was requested by VB&S to obtain samples of the concrete structure and report on the integrity of the concrete. On June 13, 2019, two PML technicians met with Michael Hatt on site. PML attempted to take concrete samples at three slab locations and one wall location on the third floor of the building. See Appendix ‘B’ Figure 3.

PML reported that the concrete was in such poor condition that proper samples could not be cored and sent to the lab for analysis. Due to the severe deterioration and delamination of the concrete, PML abandoned taking additional samples from the remaining floors. It was reported that attempting to obtain additional samples would be useless as the crumbled and broken concrete could not be tested. Photographs #2 and #4 of the PML report show the condition of the delaminated concrete, where asphalt topping was removed. It was verified by both VB&S and PML that the concrete was severely deteriorated and spalled.

PML notes that the concrete is in very poor condition, and as a result the concrete has extremely low compressive strength. They note that the concrete is in such a state that the slabs are not suitable for the purpose for which they were originally designed.

The condition of the corroded reinforcing and the severely deteriorated concrete renders the floor beyond repair.

1.3 Structural Results

The entire structure was modelled and analyzed, and some of the areas that are overstressed are highlighted in this report. It was determined that most of the walls along the east and south ends of the building were severely overstressed under the OBC applied wind and gravity loads. As shown in the analysis results (Appendix ‘C’), walls in locations noted **V, W, X, Y** and **Z,** as shown in Appendix ‘B’, are overstressed by as much as twice their capacity. Below is a summary of the results in the 5 wall locations highlighted in this report.

Wall Location 'V'	E-Tabs Model	– Overstressed
	S-Concrete Analysis	– 142% Overstressed
	S-Concrete Warnings	– Warnings of Inadequate Steel
Wall Location 'W'	E-Tabs Model	– Overstressed
	S-Concrete Analysis	– 23% Overstressed
	S-Concrete Warnings	– Warnings of Inadequate Steel
Wall Location 'X'	S-Concrete Model	– Overstressed
	S-Concrete Analysis	– 8% Overstressed
	S-Concrete Warnings	– Warnings of Inadequate Steel
Wall Location 'Y'	S-Concrete Model	– Overstressed
	S-Concrete Analysis	– 102% Overstressed
	S-Concrete Warnings	– Warnings of Inadequate Steel
Wall Location 'Z'	S-Concrete Model	– Overstressed
	S-Concrete Analysis	– 48% Overstressed
	S-Concrete Warnings	– Warnings of Inadequate Steel

It is also important to consider that the digital analysis of the structure assumes the concrete and reinforcing steel to be working in tandem as designed. However, based on inspection by VB&S and PML, the concrete has been severely cracked and delaminated in many locations, weakening its bond with the reinforcing steel. With this in mind, the structural elements of the building cannot be expected to perform even to the level assumed by the digital analysis. This leaves the structural elements even more overstressed than shown above.

In the Peto MacCallum Ltd. (PML) report, it was noted that the concrete strength could not be determined. A structural analysis of the floor slabs was not completed, as without the concrete strength a calculated concrete stress could not be determined.

2.1 Summary

The analysis results revealed that many of the walls were highly overstressed. The level of overstress removes all factors of safety from the wall, leaving the wall in a severe state of lateral instability.

The inability of PML to obtain a concrete sample from the concrete floor is a major concern. PML notes that the concrete is so deteriorated that it crumbled when trying to extract a core, and therefor the concrete strength could not be determined.

The results of the virtual model/analysis, and the concrete sampling obtained from PML, confirm the assumptions we noted in our original report.

It is our professional opinion that this building is structurally unsound. We recommend that this structure be demolished immediately as it is unsafe.

We thank you for the opportunity to submit this report. If you have any questions, please do not hesitate to call.

Regards,
VanBoxmeer & Stranges
Engineering Ltd.

Rick Stranges, P. Eng.
Vice-President
RAS/ras

APPENDIX 'A'

Peto MacCallum Ltd. - Report

Peto MacCallum Ltd.
CONSULTING ENGINEERS

June 13, 2019

PML Ref.: 19LM005
Report: 1

Ms. Martha Leach
JAM Properties
180 Cheapside Street
London, Ontario
N6A 1Z8

Dear Ms. Leach

Concrete Coring and Testing
123 Queens Avenue
London, Ontario

Peto MacCallum Ltd. (PML) visited the referenced project site on June 13, 2019, at the request of Mr. Michael Hatt of VanBoxmeer & Stranges Engineering Limited, to extract a number of concrete core samples to be submitted to PML's laboratory for compressive strength testing, to assist in the analysis on the structural integrity of the noted concrete building.

Upon arrival at the site, located at 123 Queens Ave, London, Ontario, it was observed that the building is an old concrete building with obvious signs of severe cracking in the walls and the suspended floor slab area. Inspection of the suspended floor slab, at some areas, indicated that a thin layer of asphalt with approximate thickness of 25 mm was overlying the concrete floor slab where rebar was observed at approximately 150 mm from top of the slab. Upon trying to core-drill, the concrete crumble and broke into pieces.

Based on our observations during the attempt to extract core samples for testing, the slab concrete has deteriorated to the extent that sound (or intact) concrete core samples could not be extracted. The fact that the concrete easily crumbled into pieces upon core-drilling is indicative of deteriorated concrete with extremely low compressive strength. From a concrete material view point, the concrete slab is not suitable for the purpose for which the structure was designed. A structural analysis/evaluation should be carried out to assess the remaining service life, if any.

As a result and based on our discussions with Mr. Hatt who was present at the site during our visit, no concrete coring was performed at the noted concrete building.

Photographs showing the observed poor concrete condition in the building are attached for reference.

Should you have any questions regarding the information presented, please contact our office.

Sincerely

Peto MacCallum Ltd.

Souzan Dabbagh, M.Eng, P.Eng.
Discipline Manager – Inspection and Testing
and Geotechnical Services

SD:ak

Enclosure(s) : 4

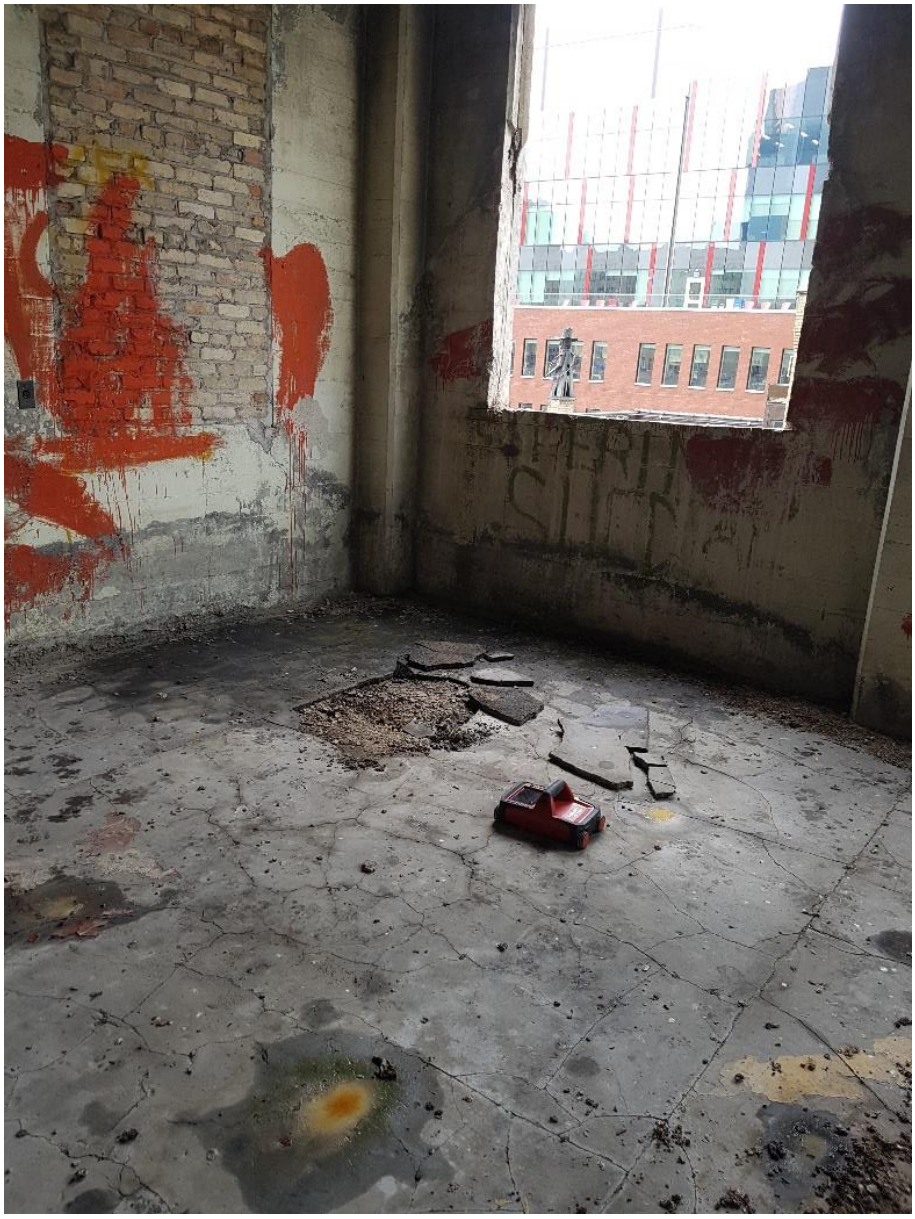
1 cc: JAM Properties (email only)
1 cc: Van Boxmeer & Strangers Engineering Limited (email only)

4023 Meadowbrook Drive, Unit 103. London, Ontario N6L 1E6
Tel: (519) 203-7500
E-mail: kitchener@petomaccallum.com
BARRIE, COLLINGWOOD, HAMILTON, KITCHENER, LONDON, TORONTO

APPENDIX A

Site Photographs

4023 Meadowbrook Drive, Unit 103. London, Ontario N6L 1E6
Tel: (519) 203-7500
E-mail: kitchener@petomaccallum.com
BARRIE, COLLINGWOOD, HAMILTON, KITCHENER, LONDON, TORONTO



Photograph No. 1 – Severe Concrete Floor and Wall Cracks

Photograph No. 2 – Asphalt Layer Overlying the Poor Concrete Floor Slab

Photograph No. 3 – Overall Picture Showing Poor Concrete Floor and Wall Conditions

Photograph No. 4 – Broken Pieces/Crumble of Concrete Floor Showing Unsuitable Coring Conditions

APPENDIX 'B'

Analysis Model

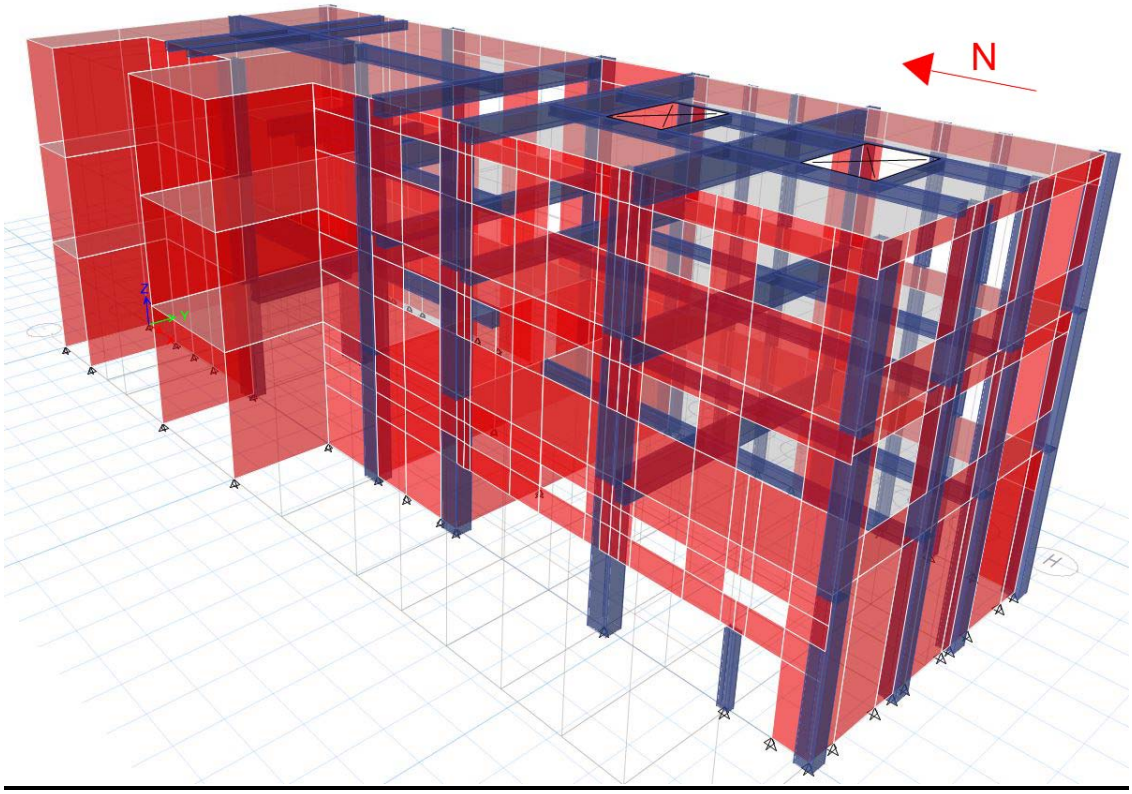


Figure 1 - 3D Model

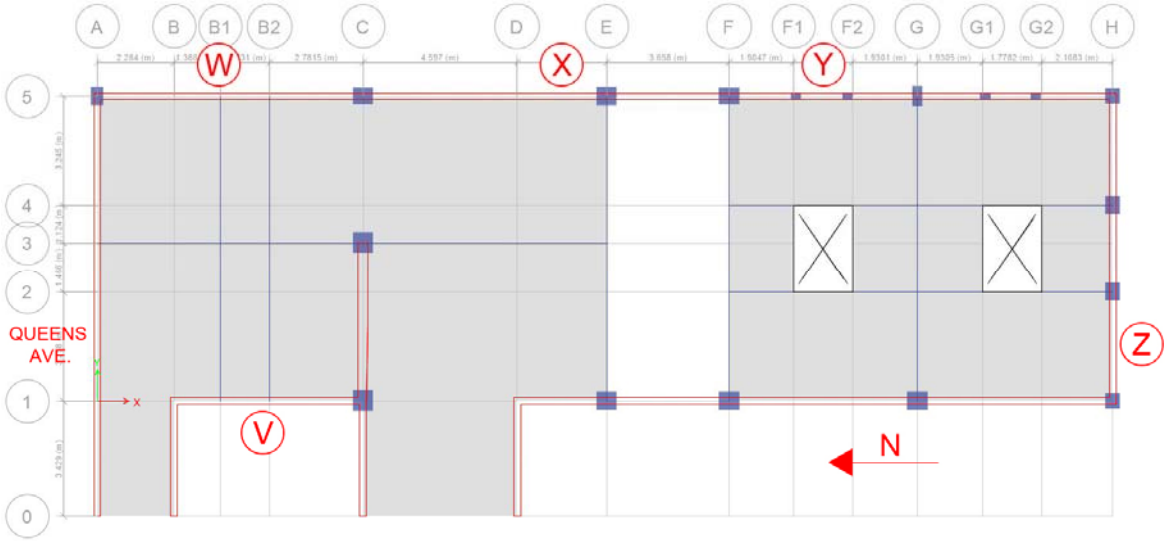


Figure 2 - Roof Framing Plan

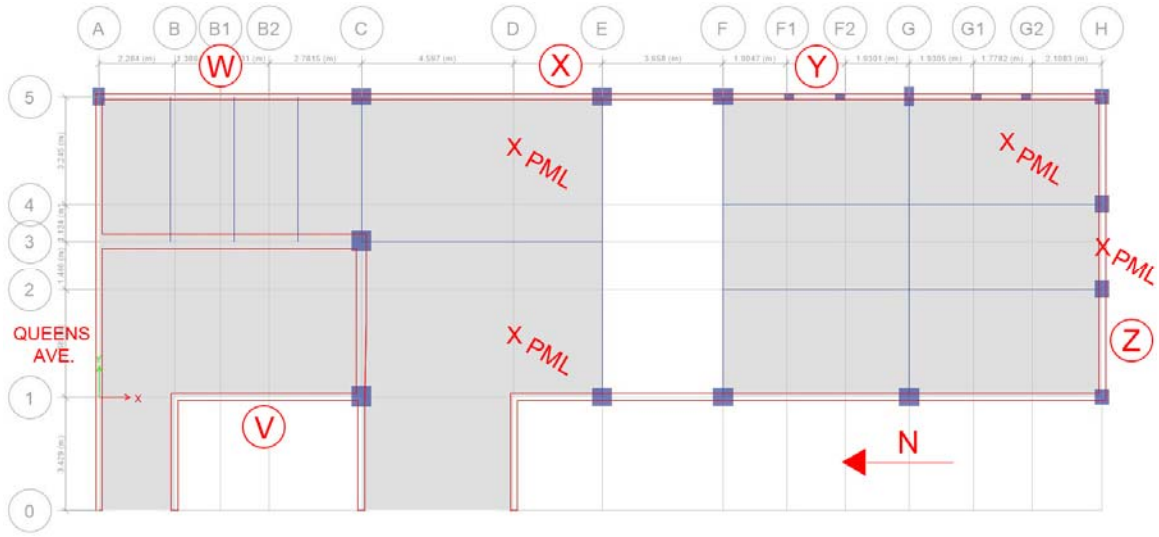


Figure 3 - 3rd Floor Framing Plan

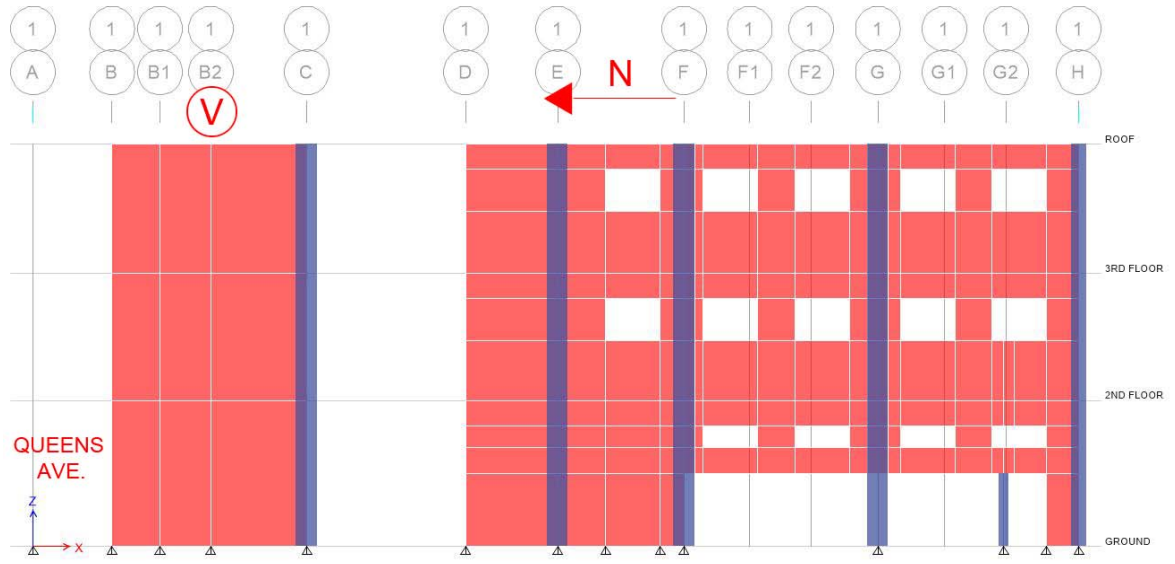


Figure 4 - Gridline 1 Elevation

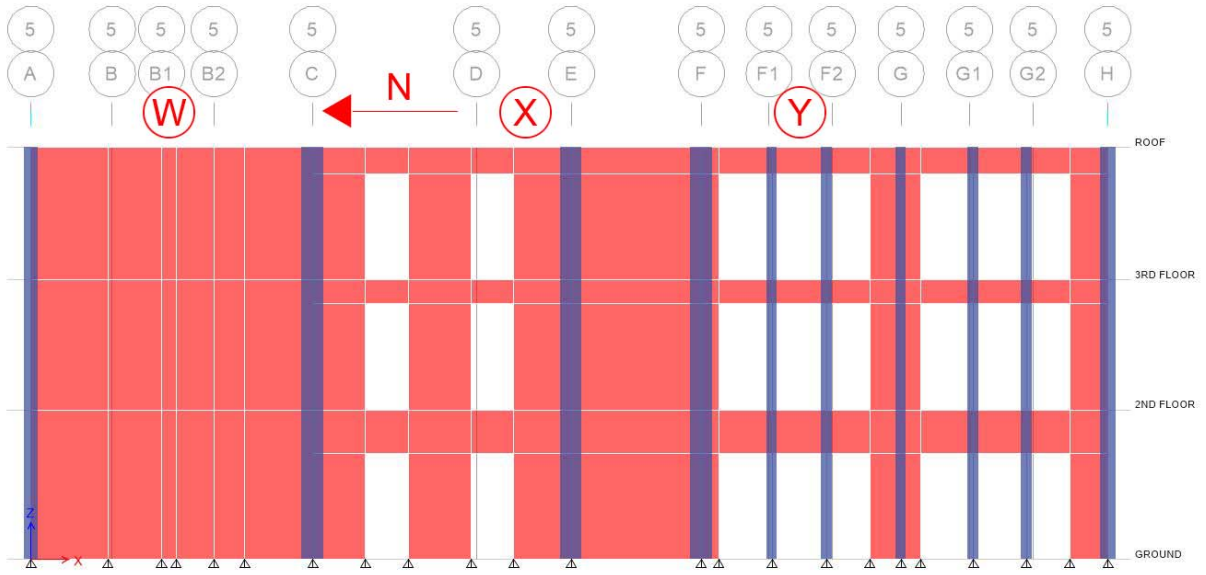


Figure 5 - Gridline 5 Elevation

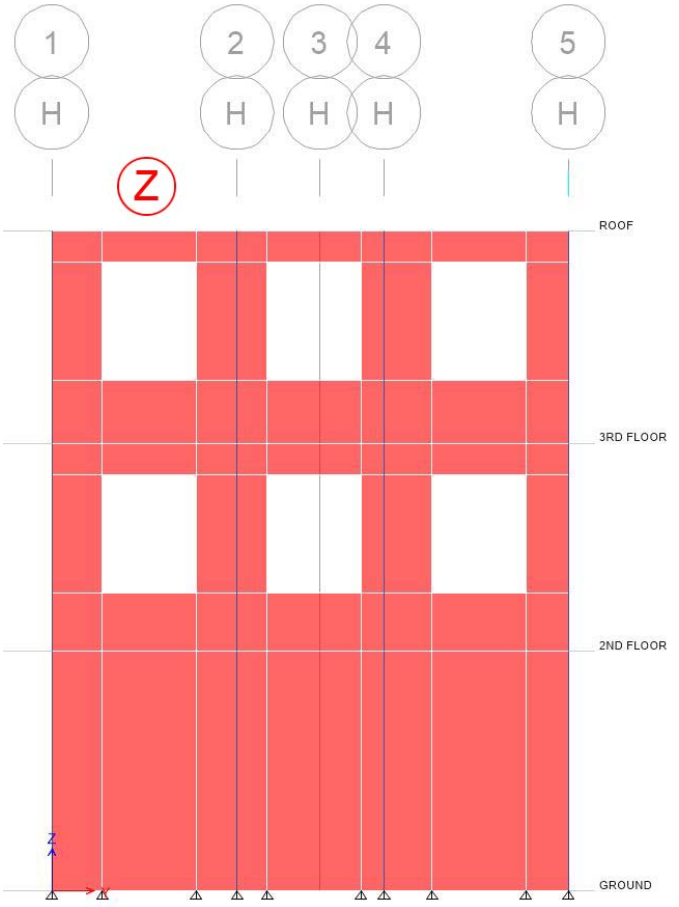


Figure 6 - Gridline H Elevation

APPENDIX 'C'

Analysis Results

ETABS Shear Wall Design

CSA A23.3-14 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
ROOF	PW21	5104.5	0	5641	203.2	1

Material Properties

E_c (MPa)	f'_c (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
24942	25	1	275	275

Design Code Parameters

Φ_c	Φ_s	IP_{MAX}	IP_{MIN}	P_{MAX}
0.65	0.85	0.04	0.0025	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	2284	0	7925	0	5641	203.2
Bottom	Leg 1	2284	0	7925	0	5641	203.2

Flexural Design for P_f, M_{f3} and M_{f2}

Station	D/C	Flexural	P_f kN	M_{f2} kN-m	M_{f3} kN-m
Top	1.026	4. 1.25D + 1.4W(y) + 0.5L	82.0934	38.3381	49.0831
Bottom	0.238	4. 1.25D + 1.4W(y) + 0.5L	208.1524	-23.5646	-110.4123

Design Inadequacy Message: Pier fails in flexure or P-M-M interaction !!

Shear Design

Station Location	ID	Rebar mm²/m	Shear Combo	P_f kN	M_f kN-m	V_f kN	V_c kN	V_r kN
Top	Leg 1	0	12. 1.25D - 1.4W(y) + 0.5L	93.4772	81.0646	57.4569	0	0
Bottom	Leg 1	0	12. 1.25D - 1.4W(y) + 0.5L	219.5361	133.4678	57.4569	0	0

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P_f kN	M_f kN-m	c mm	Inelastic Rotational Demand
Top	Leg 1	0	14. D - Q(y) + 0.5L	74.2114	60.5332	0	0
Bottom	Leg 1	0	14. D - Q(y) + 0.5L	0	0	0	0

Boundary Element Check (Part 2 of 2)

Inelastic Rotational Capacity	Ductility Status
0	Not Needed
0	Not Needed

LOCATION V: ETABS Results for Wall on Gridline 1 From B to C

S-CONCRETE 2019.1.1 (c) S-FRAME Software Inc. www.s-frame.com

File Name: Q:\ ... Analysis\19158 SCONC\19158 Wall Test.SCO

Section Name	Consultant
Concrete Section	VB&S

Summary

Status	Unacceptable
Maximum	1.000
V (shear) Util	0.106
N vs M Util	2.421

Canadian Building Standards
CSA Standard A23.3-14, "Design of Concrete Structures"
CSA Standard A23.1-04, "Concrete Materials and Methods of Concrete Construction"

Design Aids, Manuals, and Handbooks
"Concrete Design Handbook", Cement Association of Canada, 3rd Edition, 2006
"Prestressed Concrete Structures", Collins and Mitchell, Prentice Hall Inc., 1991 (MCFT)

Section Dimensions
I-Shape
L1 = 5610 mm
T1 = 200 mm

Quantities (approx.)
Concrete = 2689 kg/m
Steel = 20.6 kg/m
Primary = 11.0 kg/m
Secondary = 9.6 kg/m

Material Properties
fc' = 25 MPa
fy (panel vert) = 275.0 MPa
fy (panel horz) = 275.0 MPa
fy (zone vert) = 275.0 MPa
fy (zone horz) = 275.0 MPa
Wc = 2400 kg/m3
Ws = 7850 kg/m3
Poisson's Ratio = 0.2
hagg = 20 mm
Es = 200000 MPa
Ec = 24943 MPa
Gc = 10393 MPa
fr = 3.0 MPa

Gross Properties
Zbar = 0 mm
Ybar = 0 mm
Ag = 1122.0xE3 mm2
Ig (y-y) = 3740.0xE6 mm4
Ig (z-z) = 2942.6xE9 mm4
Ashear (Y) = 935000 mm2
Ashear (Z) = 935000 mm2
Jg = 14624xE6 mm4

Effective Properties
Ae = 1122.0xE3 mm2
Ie (y-y) = 3740.0xE6 mm4
Ie (z-z) = 2942.6xE9 mm4
Ase (Y) = 935000 mm2
Ase (Z) = 935000 mm2
Je = 14624xE6 mm4

Overstrength Factors
Normal (y-y) = 1.5
Normal (z-z) = 1.5
Rd = 1.5, Ro = 1.3

Panel 1
14-10M @ 450 Vert
10M @ 450 Horz

N vs M Results

GLC	61	
Status	Unacceptable	Message 1
Utilization	2.421	
Maximum	1.000	
Theta	13°	
w	1.00	

Axial Utilization
Nf = -169.6 kN
Nr (max) = -8317.5 kN
Utilization = 0.020

Moment Utilization
Mf = 117.2 kNm
Mr = 48.4 kNm
Utilization = 2.421
Mn = 54.7 kNm
Mp = 64.0 kNm

Shear and Torsion Utilization

GLC	138	
Status	Acceptable	
Utilization	0.106	= Uz + Uy
Maximum	1.000	
Method	Simplified	

Shear Z-Direction
Nf = -296.6 kN
Mf (y-y) = 82.3 kNm
Vfz = 15.8 kN
bw = 5610 mm
d = 100 mm

Shear Y-Direction
Nf = -296.6 kN
Mf (z-z) = -20.4 kNm
Vfy = 51.4 kN
bw = 200 mm
d = 4488 mm

LOCATION V: S-Concrete Results for Wall on Gridline 1 From B to C – Page 1

Ductility Requirements

No Earthquake Loads

List of Messages

Message 1	Unacceptable	Axial Load and Moment Utilization equals or exceeds Maximum. Clauses 10.1, 10.10, or 14.2.2 of A23.3
Message 17	Warning	fy of Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 18	Warning	fy of Shear Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 47	Warning	Panel Vertical Steel Ratio does not meet the minimum. Clause 14.1.8.5 of A23.3
Message 49	Warning	Panel Horizontal Steel Ratio does not meet the minimum. Clause 14.1.8.6 of A23.3
Message 68	Warning	Zone required with minimum bars. Clause 14.1.8.8.1 or 21.6.3.7.4 of A23.3
Message 75	Warning	Horizontal bars may require sideways hooks or may need to be anchored within zone Clause 21.5.5.3 of A23.3

LOCATION V: S-Concrete Results for Wall on Gridline 1 From B to C – Page 2

ETABS Shear Wall Design

CSA A23.3-14 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
ROOF	PW1	3962.5	9093	7925	203.2	1

Material Properties

E_c (MPa)	f'_c (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
24942	25	1	275	275

Design Code Parameters

Φ_c	Φ_s	IP_{MAX}	IP_{MIN}	P_{MAX}
0.65	0.85	0.04	0.0025	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	0	9093	7925	9093	7925	203.2
Bottom	Leg 1	0	9093	7925	9093	7925	203.2

Flexural Design for P_f, M_{f3} and M_{f2}

Station	D/C	Flexural	P_f kN	M_{f2} kN-m	M_{f3} kN-m
Top	1.036	3. 1.25D + 1.4W(x) + 0.5L	105.5626	-53.196	-123.9426
Bottom	0.049	12. 1.25D - 1.4W(y) + 0.5L	289.9453	19.5598	90.5061

Design Inadequacy Message: Pier fails in flexure or P-M-M interaction !!

Shear Design

Station Location	ID	Rebar mm^2/m	Shear Combo	P_f kN	M_f kN-m	V_f kN	V_c kN	V_r kN
Top	Leg 1	0	3. 1.25D + 1.4W(x) + 0.5L	105.5626	123.9426	49.1424	0	0
Bottom	Leg 1	0	3. 1.25D + 1.4W(x) + 0.5L	295.5528	93.1941	41.1722	0	0

Boundary Element Check (Part 1 of 2)

Station Location	ID	Edge Length (mm)	Governing Combo	P_f kN	M_f kN-m	c mm	Inelastic Rotational Demand
Top	Leg 1	0	14. D - Q(y) + 0.5L	85.7966	-92.6012	0	0
Bottom	Leg 1	0	14. D - Q(y) + 0.5L	0	0	0	0

Boundary Element Check (Part 2 of 2)

Inelastic Rotational Capacity	Ductility Status
0	Not Needed
0	Not Needed

LOCATION W: ETABS Results for Wall on Gridline 5 From A to C

S-CONCRETE 2019.1.1 (c) S-FRAME Software Inc. www.s-frame.com

File Name: Q:\ ... alysis\19158 SCONC\19158 Wall Test 4.SCO

Summary

Status	Unacceptable
Maximum	1.000
V (shear) Util	0.112
N vs M Util	1.227

Section Name	Consultant
Concrete Section	VB&S

Canadian Building Standards
CSA Standard A23.3-14, "Design of Concrete Structures"
CSA Standard A23.1-04, "Concrete Materials and Methods of Concrete Construction"

Design Aids, Manuals, and Handbooks
"Concrete Design Handbook", Cement Association of Canada, 3rd Edition, 2006
"Prestressed Concrete Structures", Collins and Mitchell, Prentice Hall Inc., 1991 (MCFT)

Section Dimensions
I-Shape
L1 = 7925 mm
T1 = 200 mm

Quantities (approx.)
Concrete = 3799 kg/m
Steel = 28.6 kg/m
Primary = 14.9 kg/m
Secondary = 13.7 kg/m

Material Properties
fc' = 25 MPa
fy (panel vert) = 275.0 MPa
fy (panel horz) = 275.0 MPa
fy (zone vert) = 275.0 MPa
fy (zone horz) = 275.0 MPa
Wc = 2400 kg/m3
Ws = 7850 kg/m3
Poisson's Ratio = 0.2
hagg = 20 mm
Es = 200000 MPa
Ec = 24943 MPa
Gc = 10393 MPa
fr = 3.0 MPa

Gross Properties
Zbar = 0 mm
Ybar = 0 mm
Ag = 1585.0xE3 mm2
Ig (y-y) = 5283.3xE6 mm4
Ig (z-z) = 8295.6xE9 mm4
Ashear (Y) = 1320.8xE3 mm2
Ashear (Z) = 1320.8xE3 mm2
Jg = 20797xE6 mm4

Effective Properties
Ae = 1585.0xE3 mm2
Ie (y-y) = 5283.3xE6 mm4
Ie (z-z) = 8295.6xE9 mm4
Ase (Y) = 1320.8xE3 mm2
Ase (Z) = 1320.8xE3 mm2
Je = 20797xE6 mm4

Overstrength Factors
Normal (y-y) = 1.5
Normal (z-z) = 1.5
Rd = 1.5, Ro = 1.3

Panel 1
19-10M @ 450 Vert
10M @ 450 Horz

N vs M Results

GLC	61	
Status	Unacceptable	Message 1
Utilization	1.227	
Maximum	1.000	
Theta	300°	
w	1.00	

Axial Utilization
Nf = -133.8 kN
Nr (max) = -11740.3 kN
Utilization = 0.011

Moment Utilization
Mf = 136.3 kNm
Mr = 111.1 kNm
Utilization = 1.227
Mn = 127.2 kNm
Mp = 152.0 kNm

Shear and Torsion Utilization

GLC	157	
Status	Acceptable	
Utilization	0.112	= Uz + Uy
Maximum	1.000	
Method	Simplified	Warning

Shear Z-Direction
Nf = -105.3 kN
Mf (y-y) = -53.7 kNm
Vfz = 47.9 kN
bw = 7925 mm
d = 100 mm

Shear Y-Direction
Nf = -105.3 kN
Mf (z-z) = -120.2 kNm
Vfy = 16.6 kN
bw = 200 mm
d = 6340 mm

LOCATION W: S-Concrete Results for Wall on Gridline 5 From A to C – Page 1

Ductility Requirements

No Earthquake Loads

List of Messages

Message 1	Unacceptable	Axial Load and Moment Utilization equals or exceeds Maximum. Clauses 10.1, 10.10, or 14.2.2 of A23.3
Message 17	Warning	fy of Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 18	Warning	fy of Shear Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 47	Warning	Panel Vertical Steel Ratio does not meet the minimum. Clause 14.1.8.5 of A23.3
Message 49	Warning	Panel Horizontal Steel Ratio does not meet the minimum. Clause 14.1.8.6 of A23.3
Message 68	Warning	Zone required with minimum bars. Clause 14.1.8.8.1 or 21.6.3.7.4 of A23.3
Message 75	Warning	Horizontal bars may require sideways hooks or may need to be anchored within zone Clause 21.5.5.3 of A23.3
Message 85	Warning	Simplified Method of Shear Design cannot be used for this section. Clauses 11.3.6.3 or 11.3.6.1 of A23.3

LOCATION W: S-Concrete Results for Wall on Gridline 5 From A to C – Page 2

S-CONCRETE 2019.1.1 (c) S-FRAME Software Inc. www.s-frame.com

File Name: Q:\ ... alysis\19158 SCONC\19158 Wall Test 2.SCO

Section Name	Consultant
Concrete Section	VB&S

Summary	
Status	Unacceptable
Maximum	1.000
V (shear) Util	0.158
N vs M Util	1.084

Canadian Building Standards
CSA Standard A23.3-14, "Design of Concrete Structures"
CSA Standard A23.1-04, "Concrete Materials and Methods of Concrete Construction"

Design Aids, Manuals, and Handbooks
"Concrete Design Handbook", Cement Association of Canada, 3rd Edition, 2006
"Prestressed Concrete Structures", Collins and Mitchell, Prentice Hall Inc., 1991 (MCFT)

Section Dimensions
I-Shape
L1 = 1770 mm
T1 = 200 mm

Quantities (approx.)
Concrete = 848 kg/m
Steel = 6.9 kg/m
Primary = 3.9 kg/m
Secondary = 2.9 kg/m

Material Properties
fc' = 25 MPa
fy (panel vert) = 275.0 MPa
fy (panel horz) = 275.0 MPa
fy (zone vert) = 275.0 MPa
fy (zone horz) = 275.0 MPa
Wc = 2400 kg/m3
Ws = 7850 kg/m3
Poisson's Ratio = 0.2
hagg = 20 mm
Es = 200000 MPa
Ec = 24943 MPa
Gc = 10393 MPa
fr = 3.0 MPa

Gross Properties
Zbar = 0 mm
Ybar = 0 mm
Ag = 354000 mm2
Ig (y-y) = 1180.0xE6 mm4
Ig (z-z) = 92421xE6 mm4
Ashear (Y) = 295000 mm2
Ashear (Z) = 295000 mm2
Jg = 4383.9xE6 mm4

Effective Properties
Ae = 354000 mm2
Ie (y-y) = 1180.0xE6 mm4
Ie (z-z) = 92421xE6 mm4
Ase (Y) = 295000 mm2
Ase (Z) = 295000 mm2
Je = 4383.9xE6 mm4

Overstrength Factors
Normal (y-y) = 1.5
Normal (z-z) = 1.5
Rd = 1.5, Ro = 1.3

Panel 1
5-10M @ 450 Vert
10M @ 450 Horz

N vs M Results

GLC	559	
Status	Unacceptable	Message 1
Utilization	1.084	
Maximum	1.000	
Theta	180°	
w	1.00	

Axial Utilization
Nf = -0.6 kN
Nr (max) = -2631.3 kN
Utilization = 0.000

Moment Utilization
Mf = 12.4 kNm
Mr = 11.5 kNm
Utilization = 1.084
Mn = 13.5 kNm
Mp = 16.8 kNm

Shear and Torsion Utilization

GLC	230	
Status	Acceptable	
Utilization	0.158	= Uz + Uy
Maximum	1.000	
Method	Simplified	Warning

Shear Z-Direction
Nf = -102.3 kN
Mf (y-y) = -10.5 kNm
Vfz = 7.5 kN
bw = 1770 mm
d = 100 mm

Shear Y-Direction
Nf = -102.3 kN
Mf (z-z) = 34.5 kNm
Vfy = 24.2 kN
bw = 200 mm
d = 1416 mm

LOCATION X: S-Concrete Results for Wall on Gridline 5 From D to E – Page 1

Ductility Requirements

No Earthquake Loads

List of Messages

Message 1	Unacceptable	Axial Load and Moment Utilization equals or exceeds Maximum. Clauses 10.1, 10.10, or 14.2.2 of A23.3
Message 17	Warning	fy of Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 18	Warning	fy of Shear Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 47	Warning	Panel Vertical Steel Ratio does not meet the minimum. Clause 14.1.8.5 of A23.3
Message 49	Warning	Panel Horizontal Steel Ratio does not meet the minimum. Clause 14.1.8.6 of A23.3
Message 68	Warning	Zone required with minimum bars. Clause 14.1.8.8.1 or 21.6.3.7.4 of A23.3
Message 75	Warning	Horizontal bars may require sideways hooks or may need to be anchored within zone Clause 21.5.5.3 of A23.3
Message 85	Warning	Simplified Method of Shear Design cannot be used for this section. Clauses 11.3.6.3 or 11.3.6.1 of A23.3

LOCATION X: S-Concrete Results for Wall on Gridline 5 From D to E – Page 2

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File Name: Q:\ ... alysis\19158 SCONC\19158 Wall Test 3.SCO

Section Name	Consultant
Concrete Section	VB&S

Summary

Status	Unacceptable
Maximum	1.000
V (shear) Util	0.226
N vs M Util	2.017

Canadian Building Standards
CSA Standard A23.3-14, "Design of Concrete Structures"
CSA Standard A23.1-04, "Concrete Materials and Methods of Concrete Construction"

Design Aids, Manuals, and Handbooks
"Concrete Design Handbook", Cement Association of Canada, 3rd Edition, 2006
"Prestressed Concrete Structures", Collins and Mitchell, Prentice Hall Inc., 1991 (MCFT)

Section Dimensions
I-Shape
L1 = 1100 mm
T1 = 200 mm

Material Properties
fc' = 25 MPa
fy (panel vert) = 275.0 MPa
fy (panel horz) = 275.0 MPa
fy (zone vert) = 275.0 MPa
fy (zone horz) = 275.0 MPa
Wc = 2400 kg/m3
Ws = 7850 kg/m3
Poisson's Ratio = 0.2
hagg = 20 mm
Es = 200000 MPa
Ec = 24943 MPa
Gc = 10393 MPa
fr = 3.0 MPa

Gross Properties
Zbar = 0 mm
Ybar = 0 mm
Ag = 220000 mm2
Ig (y-y) = 733333xE3 mm4
Ig (z-z) = 22183xE6 mm4
Ashear (Y) = 183333 mm2
Ashear (Z) = 183333 mm2
Jg = 2597.2xE6 mm4

Effective Properties
Ae = 220000 mm2
Ie (y-y) = 733333xE3 mm4
Ie (z-z) = 22183xE6 mm4
Ase (Y) = 183333 mm2
Ase (Z) = 183333 mm2
Je = 2597.2xE6 mm4

Overstrength Factors
Normal (y-y) = 1.5
Normal (z-z) = 1.5
Rd = 1.5, Ro = 1.3

Quantities (approx.)
Concrete = 527 kg/m
Steel = 4.9 kg/m
Primary = 3.1 kg/m
Secondary = 1.8 kg/m

Panel 1
4-10M @ 450 Vert
10M @ 450 Horz

N vs M Results

GLC	55	
Status	Unacceptable	Message 1
Utilization	2.017	
Maximum	1.000	
Theta	165°	
w	1.00	

Axial Utilization
Nf = -18.6 kN
Nr (max) = -1646.1 kN
Utilization = 0.011

Moment Utilization
Mf = 22.3 kNm
Mr = 11.0 kNm
Utilization = 2.017
Mn = 12.8 kNm
Mp = 15.5 kNm

Shear and Torsion Utilization

GLC	136	
Status	Acceptable	
Utilization	0.226	= Uz + Uy
Maximum	1.000	
Method	Simplified	Warning

Shear Z-Direction
Nf = -29.9 kN
Mf (y-y) = -13.4 kNm
Vfz = 12.6 kN
bw = 1100 mm
d = 100 mm

Shear Y-Direction
Nf = -29.9 kN
Mf (z-z) = -13.4 kNm
Vfy = 6.8 kN
bw = 200 mm
d = 880 mm

LOCATION Y: S-Concrete Results for Wall on Gridline 5 From F1 to F2 – Page 1

Ductility Requirements

No Earthquake Loads

List of Messages

Message 1	Unacceptable	Axial Load and Moment Utilization equals or exceeds Maximum. Clauses 10.1, 10.10, or 14.2.2 of A23.3
Message 17	Warning	fy of Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 18	Warning	fy of Shear Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 47	Warning	Panel Vertical Steel Ratio does not meet the minimum. Clause 14.1.8.5 of A23.3
Message 49	Warning	Panel Horizontal Steel Ratio does not meet the minimum. Clause 14.1.8.6 of A23.3
Message 68	Warning	Zone required with minimum bars. Clause 14.1.8.8.1 or 21.6.3.7.4 of A23.3
Message 75	Warning	Horizontal bars may require sideways hooks or may need to be anchored within zone Clause 21.5.5.3 of A23.3
Message 85	Warning	Simplified Method of Shear Design cannot be used for this section. Clauses 11.3.6.3 or 11.3.6.1 of A23.3

LOCATION Y: S-Concrete Results for Wall on Gridline 5 From F1 to F2 – Page 2

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File Name: Q:\ ... 8 Wall Test 5 Gridline H From 1 to 2.SCO

Summary

Status	Unacceptable
Maximum	1.000
V (shear) Util	0.446
N vs M Util	1.478

Section Name	Consultant
Concrete Section	VB&S

Canadian Building Standards
CSA Standard A23.3-14, "Design of Concrete Structures"
CSA Standard A23.1-04, "Concrete Materials and Methods of Concrete Construction"

Design Aids, Manuals, and Handbooks
"Concrete Design Handbook", Cement Association of Canada, 3rd Edition, 2006
"Prestressed Concrete Structures", Collins and Mitchell, Prentice Hall Inc., 1991 (MCFT)

Section Dimensions
I-Shape
L1 = 1650 mm
T1 = 200 mm

Material Properties
fc' = 25 MPa
fy (panel vert) = 275.0 MPa
fy (panel horz) = 275.0 MPa
fy (zone vert) = 275.0 MPa
fy (zone horz) = 275.0 MPa
Wc = 2400 kg/m3
Ws = 7850 kg/m3
Poisson's Ratio = 0.2
hagg = 20 mm
Es = 200000 MPa
Ec = 24943 MPa
Gc = 10393 MPa
fr = 3.0 MPa

Gross Properties
Zbar = 0 mm
Ybar = 0 mm
Ag = 330000 mm2
Ig (y-y) = 1100.0xE6 mm4
Ig (z-z) = 74869xE6 mm4
Ashear (Y) = 275000 mm2
Ashear (Z) = 275000 mm2
Jg = 4063.9xE6 mm4

Effective Properties
Ae = 330000 mm2
Ie (y-y) = 1100.0xE6 mm4
Ie (z-z) = 74869xE6 mm4
Ase (Y) = 275000 mm2
Ase (Z) = 275000 mm2
Je = 4063.9xE6 mm4

Overstrength Factors
Normal (y-y) = 1.5
Normal (z-z) = 1.5
Rd = 1.5, Ro = 1.3

Quantities (approx.)
Concrete = 791 kg/m
Steel = 6.6 kg/m
Primary = 3.9 kg/m
Secondary = 2.7 kg/m

Panel 1
5-10M @ 450 Vert
10M @ 450 Horz

N vs M Results

GLC	28	
Status	Unacceptable	Message 1
Utilization	1.478	
Maximum	1.000	
Theta	199°	
w	1.00	

Axial Utilization
Nf = -32.8 kN
Nr (max) = -2457.0 kN
Utilization = 0.013

Moment Utilization
Mf = 22.3 kNm
Mr = 15.1 kNm
Utilization = 1.478
Mn = 17.4 kNm
Mp = 20.8 kNm

Shear and Torsion Utilization

GLC	137	
Status	Acceptable	
Utilization	0.446	= Uz + Uy
Maximum	1.000	
Method	Simplified	Warning

Shear Z-Direction
Nf = -26.5 kN
Mf (y-y) = -3.1 kNm
Vfz = 25.0 kN
bw = 1650 mm
d = 100 mm

Shear Y-Direction
Nf = -26.5 kN
Mf (z-z) = 17.2 kNm
Vfy = 50.5 kN
bw = 200 mm
d = 1320 mm

LOCATION Z: S-Concrete Results for Wall on Gridline H From 1 to 2 – Page 1

Ductility Requirements

No Earthquake Loads

List of Messages

Message 1	Unacceptable	Axial Load and Moment Utilization equals or exceeds Maximum. Clauses 10.1, 10.10, or 14.2.2 of A23.3
Message 17	Warning	fy of Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 18	Warning	fy of Shear Reinforcing is not within an Acceptable range. Clause 8.5.1 of A23.3, 300 <= fy <= 500 MPa
Message 47	Warning	Panel Vertical Steel Ratio does not meet the minimum. Clause 14.1.8.5 of A23.3
Message 49	Warning	Panel Horizontal Steel Ratio does not meet the minimum. Clause 14.1.8.6 of A23.3
Message 68	Warning	Zone required with minimum bars. Clause 14.1.8.8.1 or 21.6.3.7.4 of A23.3
Message 75	Warning	Horizontal bars may require sideways hooks or may need to be anchored within zone Clause 21.5.5.3 of A23.3
Message 85	Warning	Simplified Method of Shear Design cannot be used for this section. Clauses 11.3.6.3 or 11.3.6.1 of A23.3

LOCATION Z: S-Concrete Results for Wall on Gridline H From 1 to 2 – Page 2