ENERGY CENTER DESIGN LOADS

ALL LOADING TO BE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE (2012). LATERAL LOADS (WIND AND SEISMIC) ARE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE (2012) AND NATIONAL BUILDING CODE OF CANADA 2010 COMMENTARY.

1) GRAVITY LOADS

GRAVITY LOADS AS SHOWN ON LOADING DIAGRAMS.

2) SNOW LOADS

VARIABLE/DRIFTING SNOW LOADS INDICATED ON SNOW LOAD DIAGRAM INCLUDE A BASIC COMPONENT AND A DRAFTING COMPONENT.

S	=	$I_s[S_S C_b C_w C_s C_a + S_r]$	kPa	SNOW LOAD
S_s	=	2.4	kPa	(OTTAWA)
S_r	=	0.4	kPa	(OTTAWA)
C_b	=	0.8		BASIC SNOW LOAD
C_s	=	1.0		ROOF SLOPE COEFFICIENT
C_w	=	1.0		WIND COEFFICIENT
C_a	=	1.0		ACCUMULATION COOEFICIENT (NO ACCUMULATION)
I_w	=	1.0		NORMAL IMPORTANCE (ULS)
I_w	=	0.9		NORMAL IMPORTANCE (SLS)
S	=	2.32	kPa	(WHERE Ca = 1.0)

SEE SNOW LOAD DIAGRAM

3) WIND LOADS

P	=	$I_w q C_e C_p C_g$		WIND PRESSURE
$C_p C_g$	=	0.75		WINDWARD (FIGURE I-7 OF THE 2010 NBCC)
$C_p C_g$	=	-0.55		LEEWARD (FIGURE I-7 OF THE 2010 NBCC)
$q_{1/50}$	=	0.41	kPa	(OTTAWA)
I_w	=	1.0		NORMAL IMPORTANCE (ULS)
I_w	=	0.75		NORMAL IMPORTANCE (SLS)
C_e	=	$(h/10)^{0.2}$		EXPOSURE (OPEN TERRAIN)
C_e	=	0.9		

A) GYM
$V_{E\text{-}W}$ = 180 kN
$M_{E\text{-}W}$ = 2180 kN-m

$V_{N\text{-}S}$ = 105 kN
$M_{N\text{-}S}$ = 717 kN-m

B) DAYCARE
$V_{E\text{-}W}$ = 121 kN
$M_{E\text{-}W}$ =535 kN-m

$V_{N\text{-}S}$ = 60 kN
$M_{N\text{-}S}$ = 255 kN-m

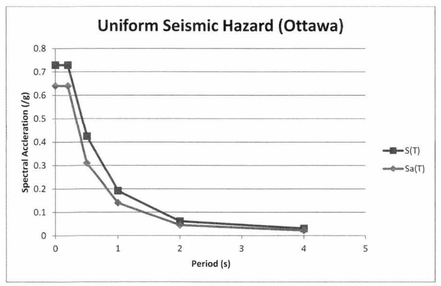
C) EXIT STAIR
$V_{E\text{-}W}$ = 5.4 kN
$M_{E\text{-}W}$ =12 kN-m

$V_{N\text{-}S}$ = 30 kN
$M_{N\text{-}S}$ = 34.8 kN-m

REFFER TO WIND UPLIFT DIAGRAM FOR ROOF WIND PRESSURES.

4) SEISMIC LOADING

- DESIGN RESPONSE SPECTRUM GRAPH (MODIFIED FOR SITE CLASS D)



V	=	$\frac{S(T_a)M_v W I_E}{R_d R_o}$	kN	SEISMIC BASE SHEAR EQUATION
Sa(0.2)	=	0.64	/g	UNIFORM SPECTRAL HAZARD FOR OTTAWA
Sa(0.5)	=	0.31	/g	
Sa(1.0)	=	0.14	/g	
Sa(2.0)	=	0.045	/g	
F_a	=	1.14		SITE CLASS MODIFICATION FACTORS (CLASS D)
F_V	=	1.37		SITE CLASS MODIFICATION FACTORS (CLASS D)
I_E	=	1.0		NORMAL IMPORTANCE
R_d	=	1.5		DUCTILITY FACTOR FOR CONVENTIONAL BRACE BAY
R_o	=	1.3		OVERSTRENGTH FACTOR FOR CONVENTIONAL BRACE BAY

NEW STRUCTURES CONSIST OF THREE (3) SECTIONS THAT ARE STRUCTURALLY SEPARATED.
- GYM
- DAYCARE/EXIT STAIR

GYM

W	=	3290	kN	
M_v	=	1.0		HIGHER MODE EFFECT FACTOR
RdRo	=	1.5 x 1.3		CONVENTIONAL CONSTRUCTION OF BRACED FRAMES ACCORDING TO OBC 2012

THE FOLLOWING STRUCTURAL IRREGULARITIES EXIST FOR GYM ACCORDING TO OBC 2012:
- TYPE 1 – VERTICAL STIFFNESS IRREGULARITY
- TYPE 2 – WEIGHT (MASS) IRREGULARITY
- TYPE 4 – IN PLANE DISCONTINUITY IN VERTICAL LATERAL FORCE RESISTING ELEMENT
- TYPE 5 – OUT OF PLANE OFFSETS
- TYPE 7 – TORSION SENSITIVITY

DYNAMIC ANALYSIS WAS PERFORMED WITH ETABS STRUCTURAL ANALYSIS PROGRAM USING A LINEAR DYNAMIC ANALYSIS BY MODAL RESPONSE SPECTRUM METHOD

NORTH-SOUTH DIRECTION

T_{OBC}	=	0.22	s	OBC EQUATION 4.1.8.11 (3) (b)
$T_{N\text{-}S}$	=	0.29	s	FROM ETABS STRUCTURAL ANALYSIS PROGRAM
$T_{N\text{-}S}$	=	0.29	s	USED TO CALCULATE $V_{N\text{-}S}$

99% MODAL PARTICIPATION IN DYNAMIC ANALYSIS

$S(T_{N\text{-}S})$	=	0.560		
V_{MAX}	=	$\frac{2\,S(0.2)WI_E}{3R_dR_o}$	kN	MAXIMUM BASE SHEAR
V_{MAX}	=	0.256*W		(GOVERNS)
V_{ESFP}	=	821	kN	
V_{DYN}	=	821	kN	DYNAMIC BASE SHEAR FROM ETABS STRUCTURAL ANALYSIS PROGRAM. DYNAMIC BASE SHEAR HAS BEEN DIVIDED BY R_DR_O, BUT NOT LESS THAN $1.0V_{ESFP}$
M_O	=	6590	kN-m	BASED ON EQUIVALENT STATIC BASE SHEAR

EAST-WEST DIRECTION

T_{OBC}	=	0.22	s	OBC EQUATION 4.1.8.11 (3) (b)
$T_{E\text{-}W}$	=	0.36	s	FROM ETABS STRUCTURAL ANALYSIS PROGRAM
$T_{E\text{-}W}$	=	0.24	s	USED TO CALCULATE $V_{E\text{-}W}$

99% MODAL PARTICIPATION IN DYNAMIC ANALYSIS

$S(T_{E\text{-}W})$	=	0.52		
V_{MAX}	=	$\frac{2\,S(0.2)WI_E}{3R_dR_o}$	kN	MAXIMUM BASE SHEAR
V_{MAX}	=	0.256*W		(GOVERNS)
V_{ESFP}	=	821	kN	
V_{DYN}	=	821	kN	DYNAMIC BASE SHEAR FROM ETABS STRUCTURAL ANALYSIS PROGRAM. DYNAMIC BASE SHEAR HAS BEEN DIVIDED BY R_DR_O, BUT NOT LESS THAN $1.0V_{ESFP}$
M_O	=	6590	kN-m	BASED ON EQUIVALENT STATIC BASE SHEAR

DAYCARE

W	=	780	kN	
M_v	=	1.0		HIGHER MODE EFFECT FACTOR
RdRo	=	1.5 x 1.3		CONVENTIONAL CONSTRUCTION OF BRACED FRAMES ACCORDING TO OBC 2012

THE STRUCTURE CONTAINS NO IRREGULARITIES

DYNAMIC ANALYSIS WAS PERFORMED WITH ETABS STRUCTURAL ANALYSIS PROGRAM USING A LINEAR DYNAMIC ANALYSIS BY MODAL RESPONSE SPECTRUM METHOD

NORTH-SOUTH DIRECTION

T_{OBC}	=	0.11	s	OBC EQUATION 4.1.8.11 (3) (b)
$T_{N\text{-}S}$	=	0.18	s	FROM ETABS STRUCTURAL ANALYSIS PROGRAM
$T_{N\text{-}S}$	=	0.18	s	USED TO CALCULATE $V_{N\text{-}S}$

99% MODAL PARTICIPATION IN DYNAMIC ANALYSIS

$S(T_{N\text{-}S})$	=	0.732		
V_{MAX}	=	$\frac{2\,S(0.2)WI_E}{3R_dR_o}$	kN	MAXIMUM BASE SHEAR
V_{MAX}	=	0.325*W		(GOVERNS)
V_{ESFP}	=	266	kN	
V_{DYN}	=	280	kN	DYNAMIC BASE SHEAR FROM ETABS STRUCTURAL ANALYSIS PROGRAM. DYNAMIC BASE SHEAR HAS BEEN DIVIDED BY R_DR_O, BUT NOT LESS THAN $0.8V_{MAX}$
M_O	=	873	kN-m	BASED ON EQUIVILANT STATIC BASE SHEAR

EAST-WEST DIRECTION

T_{OBC}	=	0.11	s	OBC EQUATION 4.1.8.11 (3) (b)
$T_{E\text{-}W}$	=	0.16	s	FROM ETABS STRUCTURAL ANALYSIS PROGRAM
$T_{E\text{-}W}$	=	0.16	s	USED TO CALCULATE $V_{E\text{-}W}$

99% MODAL PARTICIPATION IN DYNAMIC ANALYSIS

$S(T_{E\text{-}W})$	=	0.732		
V_{MAX}	=	$\frac{2\,S(0.2)WI_E}{3R_dR_o}$	kN	MAXIMUM BASE SHEAR
V_{MAX}	=	0.325*W		(GOVERNS)
V_{ESFP}	=	266	kN	
V_{DYN}	=	280	kN	DYNAMIC BASE SHEAR FROM ETABS STRUCTURAL ANALYSIS PROGRAM. DYNAMIC BASE SHEAR HAS BEEN DIVIDED BY R_DR_O, BUT NOT LESS THAN $0.8V_{ESFP}$
Mo	=	873	kN-m	BASED ON EQUIVALENT STATIC BASE SHEAR

EXIT STAIR

W	=	280	kN	
M_v	=	1.0		HIGHER MODE EFFECT FACTOR
RdRo	=	1.5 x 1.3		CONVENTIONAL CONSTRUCTION OF BRACED FRAMES ACCORDING TO OBC 2012

THE FOLLOWING STRUCTURAL IRREGULARITIES EXIST FOR EXIT STAIR ACCORDING TO OBC 2012:
- TYPE 7 – TORSION SENSITIVITY

DYNAMIC ANALYSIS WAS PERFORMED WITH SAP STRUCTURAL ANALYSIS PROGRAM USING A LINEAR DYNAMIC ANALYSIS BY MODAL RESPONSE SPECTRUM METHOD

NORTH-SOUTH DIRECTION

T_{OBC}	=	0.11	s	OBC EQUATION 4.1.8.11 (3) (b)
$T_{N\text{-}S}$	=	0.10	s	FROM SAP STRUCTURAL ANALYSIS PROGRAM
$T_{N\text{-}S}$	=	0.11	s	USED TO CALCULATE $V_{N\text{-}S}$

99% MODAL PARTICIPATION IN DYNAMIC ANALYSIS

$S(T_{N\text{-}S})$	=	0.732		
V_{MAX}	=	$\frac{2\,S(0.2)WI_E}{3R_dR_o}$	kN	MAXIMUM BASE SHEAR
V_{MAX}	=	0.325*W = 91	kN	(GOVERNS)
V_{ESFP}	=	105	kN	
V_{DYN}	=	105	kN	DYNAMIC BASE SHEAR FROM ETABS STRUCTURAL ANALYSIS PROGRAM. DYNAMIC BASE SHEAR HAS BEEN DIVIDED BY R_DR_O, BUT NOT LESS THAN $1.0V_{MAX}$
M_O	=	457	kN-m	BASED ON EQUIVILANT STATIC BASE SHEAR

EAST-WEST DIRECTION

T_{OBC}	=	0.11	s	OBC EQUATION 4.1.8.11 (3) (b)
$T_{E\text{-}W}$	=	0.16	s	FROM SAP STRUCTURAL ANALYSIS PROGRAM
$T_{E\text{-}W}$	=	0.16	s	USED TO CALCULATE $V_{E\text{-}W}$

99% MODAL PARTICIPATION IN DYNAMIC ANALYSIS

$S(T_{E\text{-}W})$	=	0.732		
V_{MAX}	=	$\frac{2\,S(0.2)WI_E}{3R_dR_o}$	kN	MAXIMUM BASE SHEAR
V_{MAX}	=	0.325*W=91	kN	(GOVERNS)
V_{ESFP}	=	105	kN	
V_{DYN}	=	105	kN	DYNAMIC BASE SHEAR FROM ETABS STRUCTURAL ANALYSIS PROGRAM. DYNAMIC BASE SHEAR HAS BEEN DIVIDED BY R_DR_O, BUT NOT LESS THAN $1.0V_{ESFP}$
Mo	=	457	kN-m	BASED ON EQUIVALENT STATIC BASE SHEAR

No.	ISSUE / REVISION	DD/MM/YY
1	FOR TENDER	01/06/18

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 1" IF THIS IS A FULL SIZE DRAWING. 0 1"

SCALE: AS NOTED

CLIENT: Conseil des écoles publiques de l'Est de l'Ontario

CONSULTANT: McINTOSH PERRY Consulting Engineers Ltd.

CONSULTANT: www.jlrichards.ca
J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS

CONSULTANT: PAGEAU MOREL
www.pageaumorel.com
Gatineau

PROFESSIONAL STAMP: LICENSED PROFESSIONAL ENGINEER S. BERNARD 100206293 PROVINCE OF ONTARIO

PROJECT NORTH: LICENSED PROFESSIONAL ENGINEER M. J. BURTT 100111392 PROVINCE OF ONTARIO

PROJECT:
MAISON DE LA FRANCOPHONIE D'OTTAWA
2720 RICHMOND ROAD, OTTAWA

DRAWING:
LOADING NOTES

DESIGN: SDB / VR	
DRAWN: JPS	DRAWING #: S02
CHECKED: MJB	
JLR #: 27672-001	

PLOT DATE: May 31, 2018 4:19:06 PM

File Location: r:\27000\27672-000.1 - cepeo - 2720 richmond road (cmh)\JLR DWG\Stuct\27672 S01 S02.dwg