

HEIFER INTERNATIONAL CENTER

LITTLE ROCK, ARKANSAS

TECHNICAL REPORT II AMENDMENT

Sikandar Porter-Gill | Structural Option

Advisor: Dr. Thomas Boothby

September 27, 2013 | Revised October 25, 2013



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<p data-bbox="470 367 568 399"><u>STEP 10</u></p> <p data-bbox="527 420 690 451">PER § 6.5.12</p> $P = qG C_p - q_i (G C_{pi})$ <p data-bbox="966 451 1291 567">CANCELS OUT ON EACH SIDE OF THE BUILDING (WILL NOT BE INCLUDED IN CALCULATIONS)</p>			

PORTER-GILL

 TECH REPORT 2
 AMENDMENT

WIND LOADS

PAGE 35-2

North-South - Main Roof
Windward

q	G	C _p	=	p	
14.98	0.9098	0.8	=	10.90	psf
15.16	0.9098	0.8	=	11.03	psf
17.27	0.9098	0.8	=	12.57	psf
18.68	0.9098	0.8	=	13.60	psf
20.27	0.9098	0.8	=	14.75	psf

North-South - Main Roof
Leeward

q	G	C _p	=	p	
20.27	0.9098	-0.5	=	-9.22	psf
20.27	0.9098	-0.5	=	-9.22	psf
20.27	0.9098	-0.5	=	-9.22	psf
20.27	0.9098	-0.5	=	-9.22	psf
20.27	0.9098	-0.5	=	-9.22	psf

East-West - Main Roof
Windward

q	G	C _p	=	p	
14.98	0.9186	0.8	=	11.01	psf
15.16	0.9186	0.8	=	11.14	psf
17.27	0.9186	0.8	=	12.69	psf
18.68	0.9186	0.8	=	13.73	psf
20.27	0.9186	0.8	=	14.90	psf

East-West - Main Roof
Leeward

q	G	C _p	=	p	
20.27	0.9186	-0.2	=	-3.72	psf
20.27	0.9186	-0.2	=	-3.72	psf
20.27	0.9186	-0.2	=	-3.72	psf
20.27	0.9186	-0.2	=	-3.72	psf
20.27	0.9186	-0.2	=	-3.72	psf

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 TECH REPORT 2
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WIND LOADS

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North-South - Stair Tower
Windward

q	G	C _p	=	p	
14.98	0.9100	0.8	=	10.91	psf
15.16	0.9100	0.8	=	11.04	psf
17.27	0.9100	0.8	=	12.57	psf
18.68	0.9100	0.8	=	13.60	psf
20.27	0.9100	0.8	=	14.76	psf
21.5	0.9100	0.8	=	15.65	psf

North-South - Stair Tower
Leeward

q	G	C _p	=	p	
21.5	0.9100	-0.5	=	-9.78	psf
21.5	0.9100	-0.5	=	-9.78	psf
21.5	0.9100	-0.5	=	-9.78	psf
21.5	0.9100	-0.5	=	-9.78	psf
21.5	0.9100	-0.5	=	-9.78	psf
21.5	0.9100	-0.5	=	-9.78	psf

East-West - Stair Tower
Windward

q	G	C _p	=	p	
14.98	0.9183	0.8	=	11.00	psf
15.16	0.9183	0.8	=	11.14	psf
17.27	0.9183	0.8	=	12.69	psf
18.68	0.9183	0.8	=	13.72	psf
20.27	0.9183	0.8	=	14.89	psf
21.5	0.9183	0.8	=	15.79	psf

East-West - Stair Tower
Leeward

q	G	C _p	=	p	
21.5	0.9183	-0.2	=	-3.95	psf
21.5	0.9183	-0.2	=	-3.95	psf
21.5	0.9183	-0.2	=	-3.95	psf
21.5	0.9183	-0.2	=	-3.95	psf
21.5	0.9183	-0.2	=	-3.95	psf
21.5	0.9183	-0.2	=	-3.95	psf

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 TECH REPORT 2
 AMENDMENT

WIND LOADS

Total Shear Calculation

PAGE 35-4

North-South - Main Roof
where the width is 491'-0" minus 22'-0" = 469'-0"

Level	Floor Height	Pressure Windward	Pressure Leeward	Trib. Area	Force
1	9	10.90	-9.22	4221	85
2	14	11.03	-9.22	6566	133
3	14	12.57	-9.22	6566	143
4	17.5	13.60	-9.22	8207.5	187
Roof	10.5	14.75	-9.22	4924.5	118
TOTAL SHEAR IN N-S DIRECTION OF MAIN ROOF:					666

North-South - Stair Tower
where the width is 22'-0"

Level	Floor Height	Pressure Windward	Pressure Leeward	Trib. Area	Force
1	9	10.91	-9.78	198	4
2	14	11.04	-9.78	308	6
3	14	12.57	-9.78	308	7
4	17.5	13.60	-9.78	385	9
Roof	19.5	14.76	-9.78	429	11
Tower Top	9.00	15.65	-9.78	198	5
TOTAL SHEAR IN N-S DIRECTION OF STAIR TOWER:					42

East-West - Main Roof
where the width is 64'-0"

Level	Floor Height	Pressure Windward	Pressure Leeward	Trib. Area	Force
1	9	11.01	-3.72	576	8
2	14	11.14	-3.72	896	13
3	14	12.69	-3.72	896	15
4	17.5	13.73	-3.72	1120	20
Roof	10.5	14.90	-3.72	672	13
TOTAL SHEAR IN N-S DIRECTION OF MAIN ROOF:					69

East West - Stair Tower
where the width is 22'-0"

Level	Floor Height	Pressure Windward	Pressure Leeward	Trib. Area	Force
1	9	11.00	-3.95	198	3
2	14	11.14	-3.95	308	5
3	14	12.69	-3.95	308	5
4	17.5	13.72	-3.95	385	7
Roof	19.5	14.89	-3.95	429	8
Tower Top	9.00	15.79	-3.95	198	4
TOTAL SHEAR IN N-S DIRECTION OF STAIR TOWER:					32

PORTER-GILL

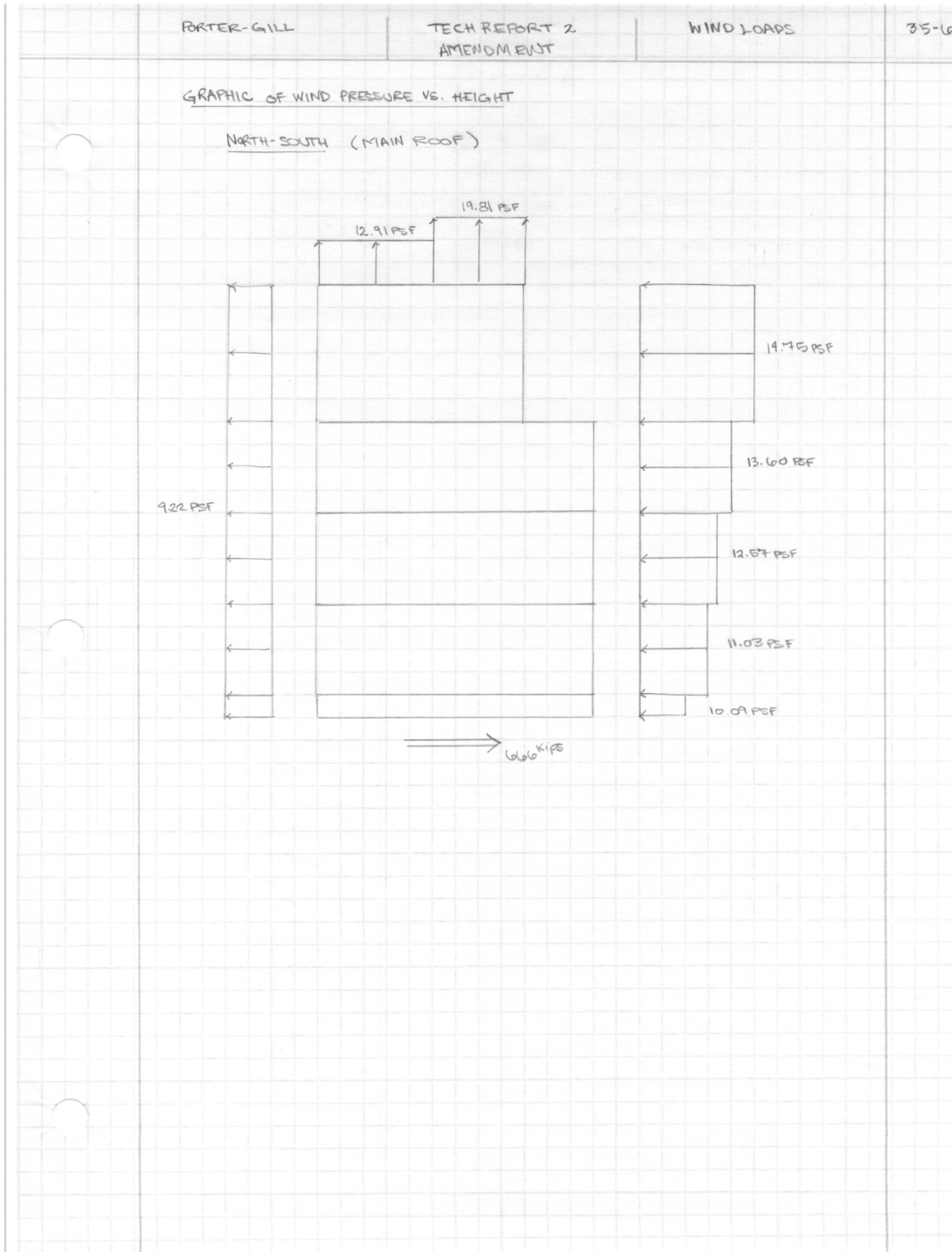
TECH REPORT 2
AMENDMENT

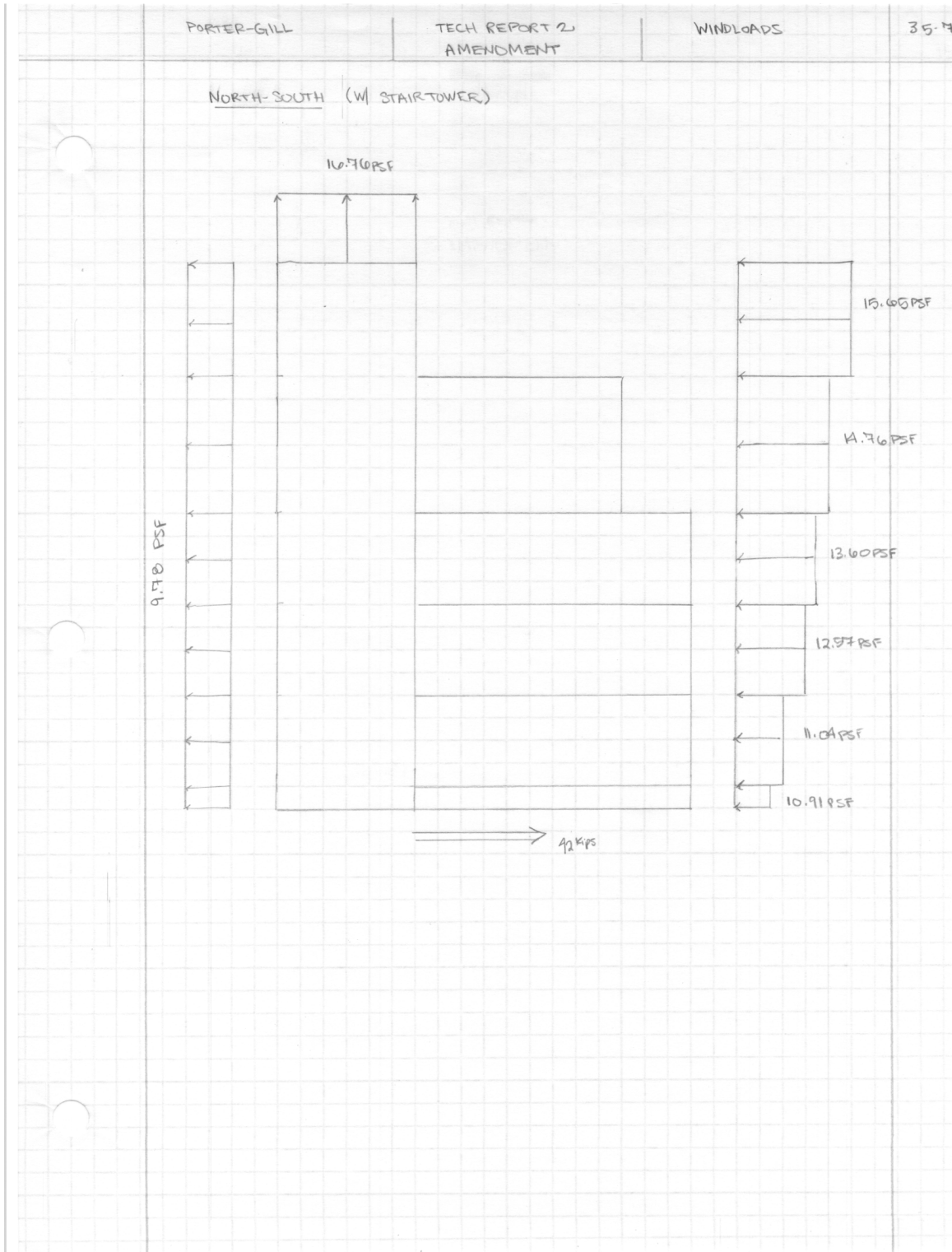
WIND LOADS

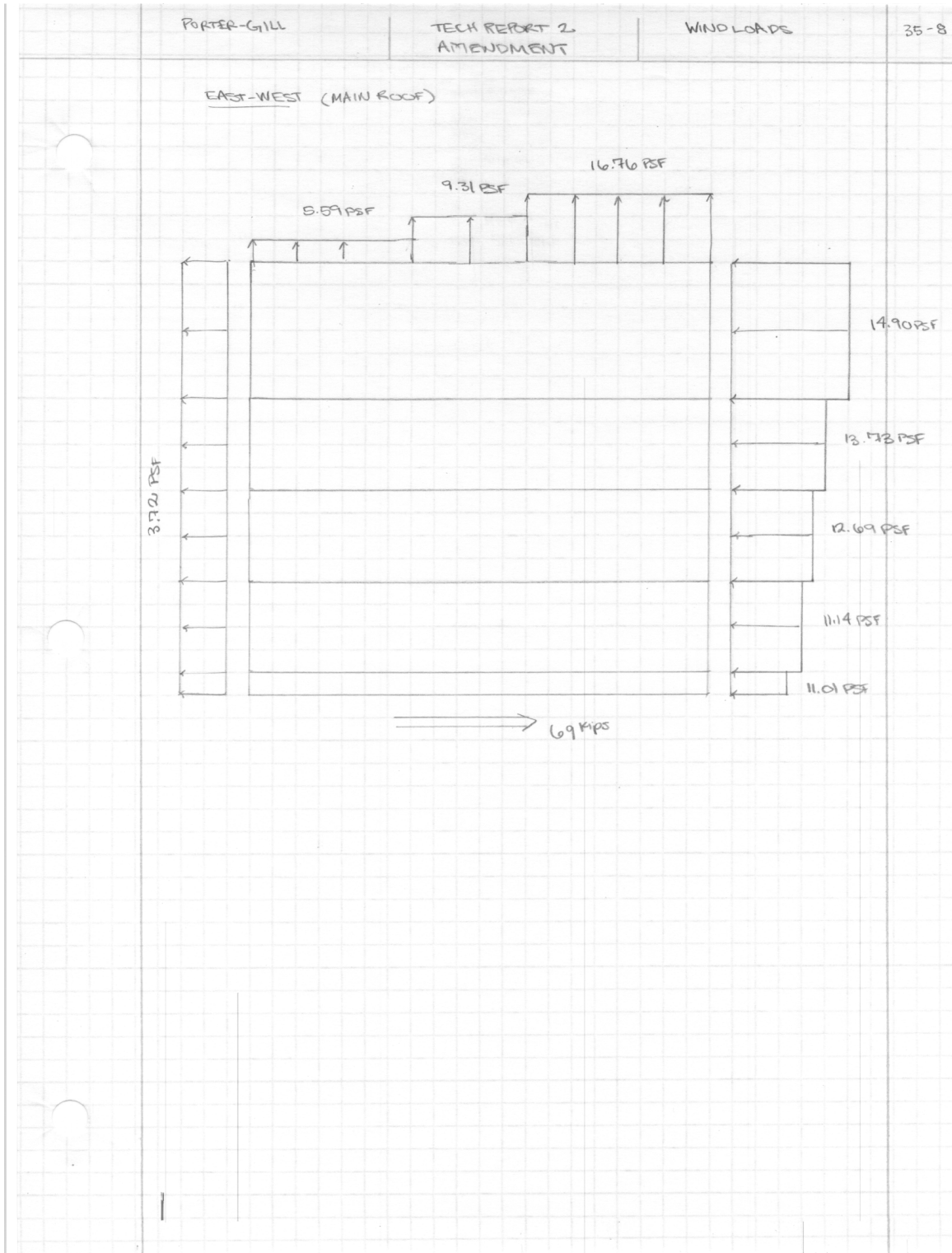
PAGE 28 Total Shear Calculation (cont...)

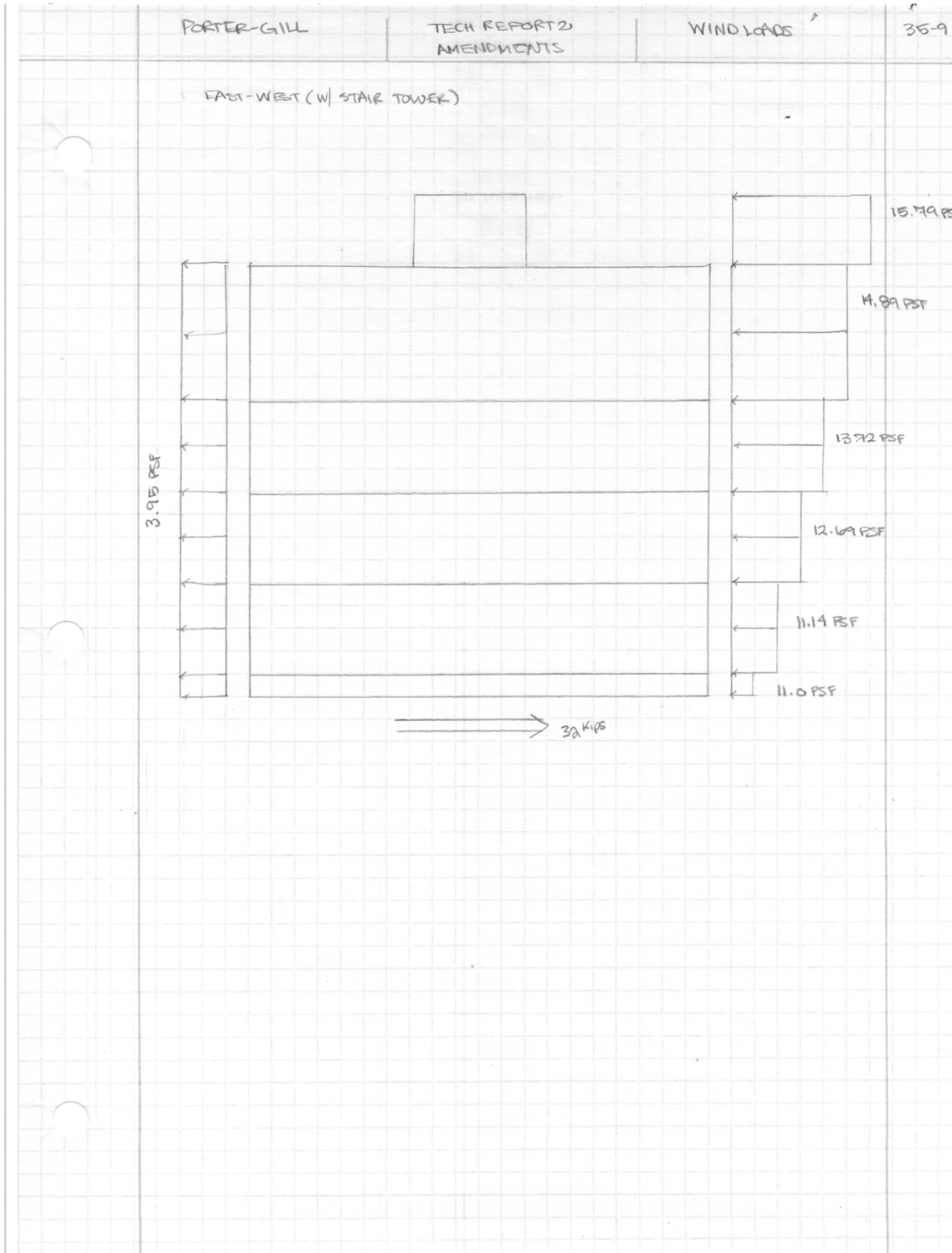
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	Shear (kips)	
North-South - Main Roof	666	
North-South - Stair Tower	42	
	708	WIND LOAD BASE SHEAR IN NORTH-SOUTH
East-West - Main Roof	69	
East-West - Stair Tower	32	
	100	WIND LOAD BASE SHEAR IN EAST-WEST







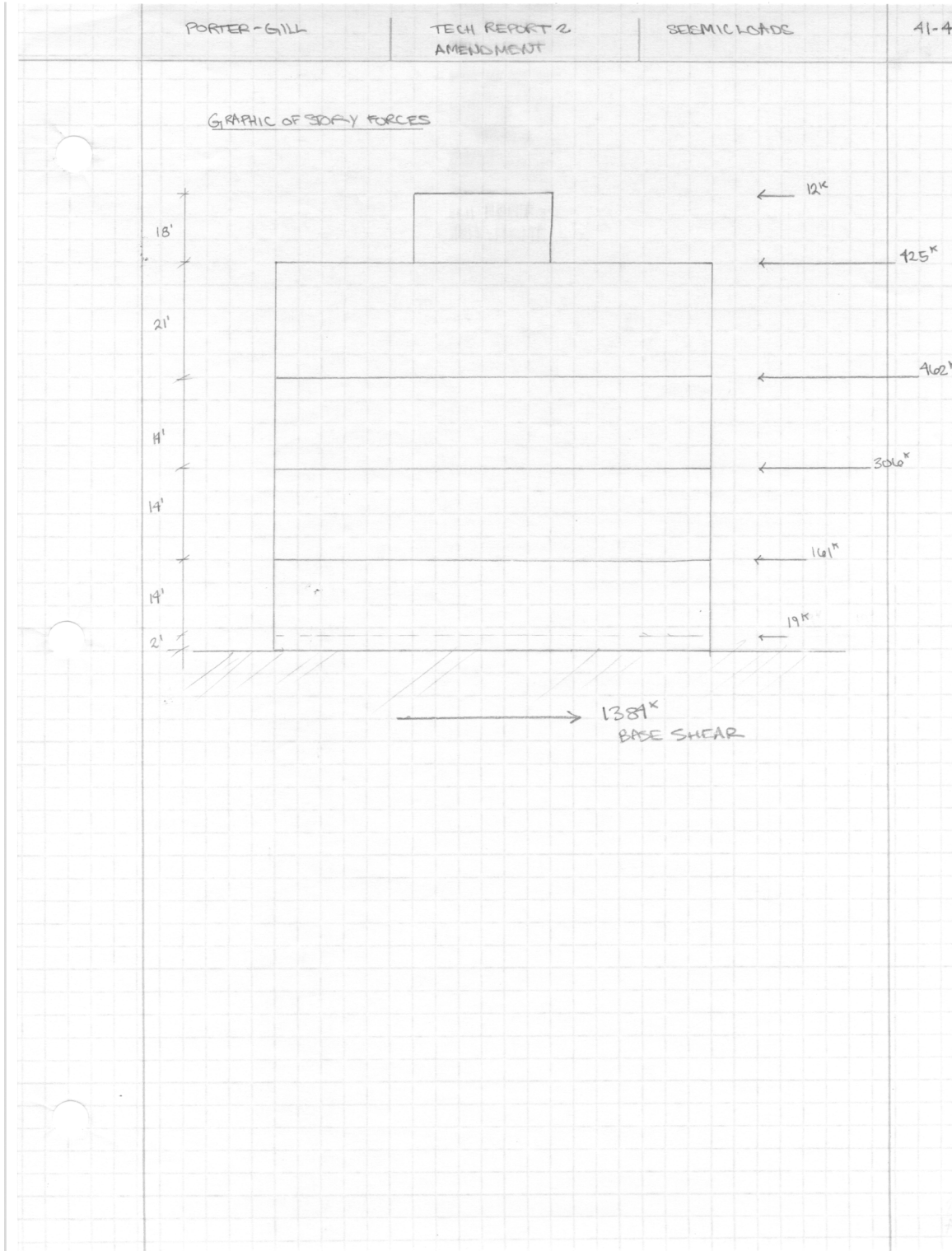


PORTER-GILL	TECH REPORT 2 AMENDMENT	SEISMIC LOADS	41-1
<u>STEP 5</u>			
PER § 9.5.3 AND § 9.5.2.5, ELF PERMITTED FOR SRC			
$\Delta_0 \quad V = C_s \cdot W$			
where $C_s = \frac{S_{DS}}{R/I}$ PER § 9.5.3.2.1			
SEISMIC RESISTING SYSTEM:			
EXISTING DESIGN			
$R = 4.5 \quad C_d = 2.5$			
PICK ORDINARY COMPOSITE BRACED FRAME			
$R = 4.0 \quad \Omega = 2.5 \quad C_d = 3$			
$\Delta_0 \quad C_s = \frac{S_{DS}}{R/I_e} = \frac{0.3704}{4/1.0} = 0.0926 \quad \text{b/c } T = T_u < T_w$			
then, $T_u < T_w$			
$\Delta_0 \quad C_s = \frac{S_{D1}}{T(R/I_e)} = \frac{0.1905}{0.535(4/1.0)} = 0.0890 \quad \leftarrow \text{"NEED NOT EXCEED"}$			
\rightarrow where $T_u = C_t h_n^k = 0.535$ FROM WIND CALCS			
CAP $C_s @ 0.0890$			
but, $C_s \geq 0.044 I S_{DS} = 0.044(1.0)(0.3704) = 0.0163$			
$0.0890 \geq 0.0163 \quad \checkmark$			
$\Delta_0 \quad C_s = 0.0890$			

PORTER-GILL	TECH REPORT 2 AMENDMENT	SEISMIC LOADS	41-2
<p><u>STEP 6</u></p> <p>§ 9.5.3.4</p> $F_x = C_{vx} \cdot V, \text{ where } C_{vx} = \frac{w_x h_x^k}{\sum w_i h_i^k}$ <p> $K = 1$ FOR $T = 0.5 \text{ SEC}$ ← $T = 0.886 \text{ SEC}$ $K = 2$ FOR $T = 2.5 \text{ SEC}$ </p> <p>INTERPOLATE K, $K = 1.01715$</p> $V = C_s \cdot W = 0.0890 \cdot (15549) = 1383.861^k \approx 1384^k \text{ BASE SHEAR}$			

DATA INPUT	Wall Load	20 psf	Perimeter of the building	1110 ft
	Roof Dead Load	60 psf	Perimeter of stair tower	88 ft
	Floor Dead Load	95 psf		
	Snow Load	10 psf		
	Partition Load	20 psf		
*0% of snow load used (per 9.5.3.2)				
k = 1.0175 (ratio)				
V = 1384 kips (calculated from page 41-2) ←				

CALCULATIONS				EFFECTIVE SEISMIC WEIGHT						SEISMIC FORCES				
	Level	h_i	Height (ft)	Floor Loads			Wall Loads		Area (ft²)	w (kips)	w*h^k	C_{vx}	Story Forces, f_i (kips)	V_i
				Dead Load (psf)	Live Load* (psf)	Total Load (psf)	Wall Load (plf)	Wall Load (lbs)						
Stair Tower Top	18	83	60	0	60	180	15840	484	45	4025	0.008	12	12	
Roof Level	21	65	60	0	60	210	233100	31555	2126	148691	0.307	425	437	
Level 4	14	44	95	20	115	350	388500	26500	3436	161535	0.334	462	898	
Level 3	14	30	95	20	115	280	310800	26500	3358	106928	0.221	306	1204	
Level 2	14	16	95	20	115	280	310800	26500	3358	56404	0.117	161	1365	
Level 1	2	2	95	20	115	160	177600	26500	3225	6529	0.013	19	1384	
									Σ	15549	484111		1384	1384 CHECK



PORTER-GILL	TECH REPORT 2	GRAVITY LOADS	42
<p><u>ADJUSTED ROOF BAY LOADING</u></p> <p><u>DEAD LOADS</u></p> <p>T&G DECK WAS OVERESTIMATED:</p> $ \begin{array}{rcccl} 57.29 \text{ PSF} & - & 30 \text{ PSF} & = & 27.29 \text{ PSF} \\ \uparrow & & \uparrow & & \\ \text{TOTAL} & & \text{T\&G} & & \\ \text{ORIGINAL} & & \text{WOOD} & & \\ \text{WEIGHT} & & \text{DECK} & & \\ & & \text{(OVERESTIMATE)} & & \end{array} $ $ 27.29 + \frac{2\frac{1}{2}'' \times 35 \text{ lb}}{12''} = 35.29 \text{ PSF} \quad \sim 36 \text{ PSF DEAD LOAD FOR ROOF} $ <p style="margin-left: 100px;"> <small>ROUND TO 35 PSF</small> </p>			