Appendix D. Mechanical Breadth

MECHANICAL BREADTH — PG 1 SMPJ

1) TYPICAL FLOOR

↳ SQUARE FOOTAGE:

FIRST FLOOR	29,537	GSF
TYPICAL 2-4	30,550	GSF (x3)
FIFTH	29,420	GSF

↳ WALL LENGTH:

PLAN NORTH:

$15' + 30.6 + 24.854 = 220$ LF

PLAN SOUTH: 205 LF

PLAN EAST/WEST:

$20' + 30.4 + 8 + 24 + 11'-10 + 4 = 190$ LF

↳ HEIGHT OF LEVEL: TYPICAL 13'-8"

↳ OCCUPANCY: OFFICE

MAX # PPL: 1,508 PPL Whole

↳ % GLASS:

14.52
5.75

- EAST ELEVATION

$$A_{BRICK} = (58' \cdot 13.67' - 2 \cdot 8'^2) + (2.4' \cdot 13.67') + (47' \cdot 13.67' - 8'^2)$$

$$= 1353 \text{ FT}^2$$

$$A_{GLASS} = 2 \cdot 8^2 + 8^2 + 13.67' \cdot 11' + 2.4' \cdot 13.67' + 56' \cdot 13.67' + 4 \cdot 13.67'$$

$$= 1272 \text{ FT}^2$$

$$A_{\substack{\text{MULLIONS} \\ \text{+ ALUMINUM}}} = 0.1 \cdot A_{GLASS} = 127 \text{ FT}^2$$

$$\%\ \text{GLASS} = \frac{1272 - 127}{1353 + 1272} = 0.44$$

MECHANICAL BREADTH Pg 2 EMPT

- WEST ELEVATION:

$A_{brick} = [(124 + 52)\,13.67 - 7.8^2)] = 1958\ FT^2$

$A_{glass} = 4' \cdot 13.67 + 11 \cdot 13.67 + 7.8^2 = 653\ FT^2$

$A_{mullions} = 0.05\,A_{glass} = 0.05(653) = 33\ FT^2$

$\therefore \%\ GLASS = \dfrac{653 - 33}{1958 + 653} = 0.18$

- SOUTH ELEVATION:

$A_{brick} = 7' \cdot 13.67' \cdot 3 + 64' \cdot 13.67 - 4.8^2 + 11' \cdot 13.67'$

$= 1056\ FT^2$

$A_{glass} = 4.8^2 + 50' \cdot 13.67 + 26 \cdot 13.67 \cdot 2$

$= 1650\ FT^2$

$A_{\substack{mullions \\ +\,aluminum}} = 0.1\,A_{glass} = 165\ FT^2$

$\therefore A_{glass} = \dfrac{1650 - 165}{1056 + 1650} = 0.55$

- NORTH ELEVATION

$A_{brick} = (7' \cdot 4 + 4' \cdot 4)\,13.67' = 602\ FT^2$

$A_{glass} = (18' + 26' \cdot 4 + 50' + 8')\,13.67' = 2460\ FT^2$

$A_{\substack{mullions \\ +\,Aluminum}} = 0.1\,A_{glass} = 246\ FT^2$

$\therefore \%\ GLASS = \dfrac{2460 - 246}{2460 + 602} = 0.72$

$$\text{TOTAL } \%\ GLASS = \frac{1272 - 127 + 653 - 33 + 1650 - 165 + 2460 - 246}{1353 + 1272 + 1958 + 653 + 1056 + 1650 + 2460 + 602}$$

$= 0.497 \cdot 100 = \boxed{49.7\ \%}$

MECHANICAL BREADTH PG 2 SHPT

↳ R-VALUES WALLS & ROOF

NOT AVAILABLE

↳ U-VALUES WINDOWS

ASSUME SPECTRICALLY SELECTIVE TINT DOUBLE GLAZED

↳ U = 0.24 → 0.3 (TABLE 2.491 ARCH. GRAPH. STANDARDS)

(2) BUILDING INFORMATION

- EXISTING
  - ↳ PITTSBURGH, PA
  - ↳ TOTAL FLOORS: 5
  - ↳ WINDOW SHADING UNKNOWN
  - ↳ ADJACENT BUILDINGS:
    - SIMILAR 3 TO 5 STORY BUILDINGS ACROSS STREET ON WEST SIDE ONLY
- NEW
  - ↳ OAKLAND, CA
  - ↳ TOTAL FLOORS: 7

EXISTING

System Checksums

By PSUAE

System - 001

Variable Volume Reheat (30% Min Flow Default)

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 15
Outside Air: OADB/WB/HR: 86 / 71 / 95

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0.00
Skylite Cond	0	0	0	0.00
Roof Cond	0	87,770	87,770	2.56
Glass Solar	433,559	0	433,559	12.62
Glass Cond	102,275	0	102,275	2.98
Wall Cond	77,317	17,260	94,577	2.75
Partition	0		0	0.00
Exposed Floor	0		0	0.00
Infiltration	0		0	0.00
Sub Total ==>	613,151	105,031	718,182	20.91
Internal Loads				
Lights	500,482	125,121	625,603	18.21
People	679,500		679,500	19.78
Misc	234,601	0	234,601	6.83
Sub Total ==>	1,414,583	125,121	1,539,704	44.83
Ceiling Load	230,151	-230,151	0	0.00
Ventilation Load	0	0	906,455	26.39
Ov/Undr Sizing	0		0	0.00
Exhaust Heat		-26,844	-26,844	-0.78
Sup. Fan Heat			185,836	5.41
Ret. Fan Heat		111,502	111,502	3.25
Duct Heat Pkup		0	0	0.00
Reheat at Design			0	0.00
Grand Total ==>	2,257,886	84,657	3,434,834	100.00

CLG SPACE PEAK

Mo/Hr: 9 / 13
OADB: 76

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0.00
Skylite Cond	0	0.00
Roof Cond	0	0.00
Glass Solar	680,221	33.76
Glass Cond	11,064	0.55
Wall Cond	55,129	2.74
Partition	0	0.00
Exposed Floor	0	0.00
Infiltration	0	0.00
Sub Total ==>	746,414	37.05
Internal Loads		
Lights	500,482	24.84
People	377,500	18.74
Misc	208,534	10.35
Sub Total ==>	1,086,517	53.93
Ceiling Load	181,836	9.03
Ventilation Load	0	0.00
Ov/Undr Sizing	0	0.00
Exhaust Heat		
Sup. Fan Heat		
Ret. Fan Heat		
Duct Heat Pkup		
Reheat at Design		
Grand Total ==>	2,014,767	100.00

HEATING COIL PEAK

Mo/Hr: 13 / 1
OADB: 5

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-76,641	2.48
Glass Solar	0	0	0.00
Glass Cond	-633,320	-633,320	20.48
Wall Cond	-136,725	-170,552	5.52
Partition	0	0	0.00
Exposed Floor	0	0	0.00
Infiltration	0	0	0.00
Sub Total ==>	-770,045	-880,513	28.47
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-110,468	0	0.00
Ventilation Load	0	-2,095,258	67.75
Ov/Undr Sizing	0	0	0.00
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-116,642	3.77
Additional Reheat		0	0.00
Grand Total ==>	-880,513	-3,092,413	100.00

TEMPERATURES

	Cooling	Heating
SADB	60.4	90.6
Plenum	79.8	67.7
Return	75.8	70.0
Ret/OA	78.3	21.1
Fn MtrTD	0.1	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.9	0.0

AIRFLOWS

	Cooling	Heating
Vent	30,200	30,200
Infil	0	0
Supply	129,216	40,138
MinStop/Rh	40,138	40,138
Return	129,216	40,138
Exhaust	30,200	30,200
Rm Exh	0	0
Auxiliary	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	23.4	75.2
cfm/ft²	0.85	0.26
cfm/ton	451.43	
ft²/ton	533.65	
Btu/hr·ft²	22.49	-20.24
No. People	1,510	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter gr/lb	Leave DB °F	Leave WB °F	Leave gr/lb
Main Clg	286.2	3,434.8	2,581.0	125,439	78.3	64.8	74.5	59.0	55.8	64.5
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	286.2	3,434.8								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	152,750		
Part	0		
ExFlr	0		
Roof	30,550	0	0
Wall	56,350	16,905	30

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-1,351.6	40,138	59.0	90.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-1,740.8	30,200	5.0	59.0
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-3,092.4			

Project Name:
Dataset Name: C:\CDS\TRACE700\Projects\Sam Thesis.trc

TRACE® 700 v4.1 calculated at 01:36 PM on 04/02/2008
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Figure 79 – TRACE Results

OAKLAND

System Checksums
By PSUAE

System - 001 — **Variable Volume Reheat (30% Min Flow Default)**

COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 15
Outside Air: OADB/WB/HR: 98 / 70 / 65

	Space Sens. + Lat. Btu/h	Plenum Sens. + Lat Btu/h	Net Total Btu/h	Percent Of Total (%)
Envelope Loads				
Skylite Solar	0	0	0	0.00
Skylite Cond	0	0	0	0.00
Roof Cond	0	277,480	277,480	6.25
Glass Solar	732,080	0	732,080	16.50
Glass Cond	163,302	0	163,302	3.68
Wall Cond	135,656	29,412	165,068	3.72
Partition	0		0	0.00
Exposed Floor	0		0	0.00
Infiltration	0		0	0.00
Sub Total ==>	1,031,038	306,892	1,337,930	30.15
Internal Loads				
Lights	700,675	175,169	875,844	19.74
People	677,250		677,250	15.26
Misc	328,442	0	328,442	7.40
Sub Total ==>	1,706,367	175,169	1,881,536	42.41
Ceiling Load	482,061	-482,061	0	0.00
Ventilation Load	0	0	770,700	17.37
Ov/Undr Sizing	0		0	0.00
Exhaust Heat		-26,756	-26,756	-0.60
Sup. Fan Heat			295,982	6.67
Ret. Fan Heat		177,589	177,589	4.00
Duct Heat Pkup		0	0	0.00
Reheat at Design			0	0.00
Grand Total ==>	3,219,466	150,833	4,436,981	100.00

CLG SPACE PEAK

Mo/Hr: 8 / 15
OADB: 97

	Space Sensible Btu/h	Percent Of Total (%)
Envelope Loads		
Skylite Solar	0	0.00
Skylite Cond	0	0.00
Roof Cond	0	0.00
Glass Solar	810,512	27.28
Glass Cond	153,291	5.16
Wall Cond	138,293	4.65
Partition	0	0.00
Exposed Floor	0	0.00
Infiltration	0	0.00
Sub Total ==>	1,102,097	37.10
Internal Loads		
Lights	700,675	23.58
People	376,250	12.66
Misc	328,442	11.06
Sub Total ==>	1,405,367	47.30
Ceiling Load	463,491	15.60
Ventilation Load	0	0.00
Ov/Undr Sizing	0	0.00
Exhaust Heat		
OA Preheat Diff.		
RA Preheat Diff.		
Additional Reheat		
Grand Total ==>	2,970,955	100.00

HEATING COIL PEAK

Mo/Hr: 13 / 1
OADB: 32

	Space Peak Space Sens Btu/h	Coil Peak Tot Sens Btu/h	Percent Of Total (%)
Envelope Loads			
Skylite Solar	0	0	0.00
Skylite Cond	0	0	0.00
Roof Cond	0	-130,775	6.00
Glass Solar	0	0	0.00
Glass Cond	-276,707	-276,707	12.69
Wall Cond	-111,904	-138,840	6.37
Partition	0	0	0.00
Exposed Floor	0	0	0.00
Infiltration	0	0	0.00
Sub Total ==>	-388,612	-546,323	25.06
Internal Loads			
Lights	0	0	0.00
People	0	0	0.00
Misc	0	0	0.00
Sub Total ==>	0	0	0.00
Ceiling Load	-157,712	0	0.00
Ventilation Load	0	-1,275,032	58.49
Ov/Undr Sizing	0	0	0.00
Exhaust Heat		0	0.00
OA Preheat Diff.		0	0.00
RA Preheat Diff.		-358,424	16.44
Additional Reheat		0	0.00
Grand Total ==>	-546,324	-2,179,778	100.00

TEMPERATURES

	Cooling	Heating
SADB	61.9	77.6
Plenum	82.1	67.7
Return	75.8	70.0
Ret/OA	79.1	52.2
Fn MtrTD	0.1	0.0
Fn BldTD	0.3	0.0
Fn Frict	0.9	0.0

AIRFLOWS

	Cooling	Heating
Vent	30,100	30,100
Infil	0	0
Supply	203,381	64,185
MinStop/Rh	64,185	64,185
Return	203,381	64,185
Exhaust	30,100	30,100
Rm Exh	0	0
Auxiliary	0	0

ENGINEERING CKS

	Cooling	Heating
% OA	14.8	46.9
cfm/ft²	0.95	0.30
cfm/ton	550.05	
ft²/ton	578.37	
Btu/hr·ft²	20.75	-10.19
No. People	1,505	

COOLING COIL SELECTION

	Total Capacity ton	Total Capacity MBh	Sens Cap. MBh	Coil Airflow cfm	Enter DB °F	Enter WB °F	Enter HR gr/lb	Leave DB °F	Leave WB °F	Leave HR gr/lb
Main Clg	369.8	4,437.0	4,137.0	199,788	79.1	64.0	65.1	60.6	56.8	63.0
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	369.8	4,437.0								

AREAS

	Gross Total ft²	Glass ft²	Glass (%)
Floor	213,850		
Part	0		
ExFlr	0		
Roof	91,650	0	0
Wall	78,890	23,667	30

HEATING COIL SELECTION

	Capacity MBh	Coil Airflow cfm	Ent °F	Lvg °F
Main Htg	-1,221.3	64,185	60.6	77.6
Aux Htg	0.0	0	0.0	0.0
Preheat	-958.5	30,100	32.0	60.6
Humidif	0.0	0	0.0	0.0
Opt Vent	0.0	0	0.0	0.0
Total	-2,179.8			

Project Name:
Dataset Name: C:\CDS\TRACE700\Projects\Sam Thesis.trc

Figure 80 – TRACE Results

TRACE® 700 v4.1 calculated at 01:42 PM on 04/02/2008
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