Technical Assignment #1

ASHRAE Standard 62.1 Ventilation Compliance Evaluation

The Harker School - Science and Technology Building
San Jose, CA

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Executive Summary

Using ASHRAE Standards 62.1-2007, I checked my building's compliance with section 5 (Systems and Equipment Requirements) and section 6 (Ventilation Rate Procedure Analysis). Section 5 deals with many different topics ranging from mold prevention to equipment placement. Section 6 deals with the outdoor air ventilation requirement for various spaces.

The results of my section 5 compliance check, most of the results were positive. The building matched up well with the requirements laid out in the standards. The few times that they did not meet the requirements, it was mainly due to the fact that some aspects have not been documented very well, and not because they didn't comply with the standard.

My Ventilation Rate Procedure Analysis did not fare as well as the section 5 analysis. All air handlers and most spaces came up short of the required outdoor air supply. A potential reason for this is that the building was not designed using ASHRAE Standards 62.1-2007, but instead made use of the 2001 California Mechanical Code.

Section 5 Compliance Summary

Upon checking the building's compliance with section 5 of ASHRAE Standard 62.1, I discovered that it fit the guidelines for the most part with only minimal discrepancies. Not all of the points applied to my building, but the ones that did were almost all met. In the cases in which the standards aren't met, it is usually because the items in question weren't documented well enough, not because they failed to meet the requirements.

VAV boxes allow the ventilation system to control the airflow to all of the spaces. All airstream surfaces are sheet metal or metal fasteners, so they will not show any signs of erosion over time due to continuous airflow. For the same reason, they are all resistant to mold growth as well. All outdoor air intakes are located on the roof with plenty of space in between them and any contaminant sources. The specifications of the exact air handler units is not known, so compliance with things such as rain entrainment and intrusion are unknown at this time. Snow entrainment is not necessary as there is no snow in San Jose.

Drain pan types and details were not specified, so I was not able to check their compliance with the standards. I assume that the water will be supplied via the city's supply, and if that is the case then the water quality will be more than adequate.

Each AHU is located on the roof with ample space around each for maintenance and inspection. All VAV boxes, duct work, and other ventilation equipment are located with the ceiling of each floor, which are easily accessible for calibration, maintenance, and inspection.

The envelope of the building is secure and sealed properly. There is also a vapor barrier in place to prevent water from penetrating in through the slab on grade. With this being a high school building, there is no smoking of course which means there are no ETS areas to worry about.

Ventilation Rate Procedure Analysis and Summary

The Ventilation Rate Calculation Procedure in ASHRAE Standard 62.1-2007 is used to determine the minimum amount of outdoor air that is required at design conditions in the building. This calls for the calculation of the required outdoor air supplied for each space in the building. The steps involved in the calculation of this process can be found in detail in section 6 of ASHRAE Standard 62.1.

The building is supplied via three air handling units located on the roof. One serves the left side of the building which has offices, labs, classrooms, and a lecture hall. The other two serve the right side of the building which houses

mainly classrooms and offices, as well as a few media and technology based rooms.

Overall, the building fell short of the required outdoor air for most of the spaces. Several spaces were met while other spaces were lacking quite a bit of supplied outdoor air. There are several reasons for what I think could cause such a big difference.

The first such thing, is that this building was not designed using ASHRAE Standard 62.1. It was designed with the 2001 California Mechanical Code in consideration. Not only is it a different code than ASHRAE Standard 62.1-2007, but it is also several years older.

Another reason is that I did not know the actual design occupancy of any of the spaces. I assumed said occupancy by using the default values in table 6-1 in the standards. There is always the possibility that those default values are not close enough to the actual designed occupancies used to end up with similar results in the calculations.

Ventilation Rate Procedure Analysis Results

	Design Minimum	Required Minimum
AHU-1	5100	9107

As seen here, the design flow for AHU-1 falls short by almost half of the required amount.

	Design Minimum	Required Minimum
AHU-2&3	8900	13399

As seen here, the design flow for AHU-2&3 falls short by about a third of the required amount.

	ΣVoz	Vot
AHU-1	5505	9107
AHU-2&3	9319	13399
Total	14824	22506

The calculated design zone outdoor airflow is a bit closer to the required amount than the actual design flow, but not by much. They are still off by about the same fraction.

Appendix A - Space Characteristics

AHU-1	Use	Az	Pz
RM 1100	Lecture Hall	2642	397
RM 1101	Classroom	1153	41
RM 1102	Robotics Lab	1154	39
RM 1201	Conference Room	283	15
RM 1202	Classroom	1077	38
RM 1203	Classroom	1079	38
RM 1215	A/V Room	140	4
RM 1216	Storage	233	0
RM 1217	Office	81	1
RM 1218	Office	207	1

AHU-2&3	Use	Az	Pz
RM 1103	Classroom	1079	38
RM 1104	Classroom	1079	38
RM 1105	Lounge Interior	400	10
RM 1105	Lounge Perimeter	274	7
RM 1106	Classroom	1077	38
RM 1107	Classroom	1079	38
RM 1108	Classroom	1077	38
RM 1109	Media	1079	27
RM 1110	Future Tech	1079	27
RM 1111	Classroom	1077	38
RM 1112	Classroom	1079	38
RM 1131	Copy/Work	167	1
RM 1133	Office	101	1
RM 1134	Office	100	1
RM 1135	Office	150	1
RM 1136	Storage	71	0
RM 1140	Sound Room	140	4
RM 1141	Sound Room	140	4
RM 1142	Sound Room	140	4
RM 1143	Storage	186	0
RM 1144	Office	518	3
RM 1145	Office	727	4
RM 1204	Classroom	1079	38
RM 1205	Classroom	1079	38
RM 1206	Special Projects	1733	9
RM 1207	Classroom	1079	38
RM 1208	Classroom	1077	38
RM 1209	Classroom	1079	38
RM 1210	Classroom	1079	38
RM 1211	Classroom	1079	38
RM 1212	Classroom	1077	38
RM 1229	Optical Room	192	5
RM 1230	Storage	131	0
RM 1231	Storage	89	0
RM 1235	Office	972	5
RM 1237	Office	662	4

Appendix B - Calculations

AHU-1

AHU-1	Az	Pz	Rp	Ra	Rp*Pz	Ra*Az	Voz	Vpz	Zp	Evz
RM 1100	2642	397	7.5	0.06	2977.5	158.52	3136.02	3030	1.03499	1.06378
RM 1101	1153	41	10	0.12	410	138.36	548.36	400	1.3709	0.72787
RM 1102	1154	39	10	0.18	390	207.72	597.72	400	1.4943	0.60447
RM 1201	283	15	5	0.06	75	16.98	91.98	110	0.836182	1.262589
RM 1202	1077	38	10	0.12	380	129.24	509.24	400	1.2731	0.82567
RM 1203	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.82507
RM 1215	140	4	10	0.12	40	16.8	56.8	55	1.032727	1.066043
RM 1216	233	0	0	0.12	0	27.96	27.96	55	0.508364	1.590407
RM 1217	81	1	5	0.06	5	4.86	9.86	80	0.12325	1.97552
RM 1218	207	1	5	0.06	5	12.42	17.42	80	0.21775	1.88102

Vou	5504.84
Vps	5010
Xs	1.09877
Ev	0.60447
Vot	9106.88

AHU-2&3

AHU-2&3	Az	Pz	Rp	Ra	Rp*Pz	Ra*Az	Voz	Vpz	Zp	Evz
RM 1103	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1104	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1105	400	10	5	0.06	50	24	74	63	1.174603	0.794599
RM 1105	274	7	5	0.06	35	16.44	51.44	125	0.41152	1.557682
RM 1106	1077	38	10	0.12	380	129.24	509.24	400	1.2731	0.696102
RM 1107	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1108	1077	38	10	0.12	380	129.24	509.24	400	1.2731	0.696102
RM 1109	1079	27	10	0.12	270	129.48	399.48	400	0.9987	0.970502
RM 1110	1079	27	10	0.12	270	129.48	399.48	400	0.9987	0.970502
RM 1111	1077	38	10	0.12	380	129.24	509.24	400	1.2731	0.696102
RM 1112	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1131	167	1	5	0.06	5	10.02	15.02	63	0.238413	1.73079
RM 1133	101	1	5	0.06	5	6.06	11.06	125	0.08848	1.880722
RM 1134	100	1	5	0.06	5	6	11	63	0.174603	1.794599
RM 1135	150	1	5	0.06	5	9	14	63	0.222222	1.74698
RM 1136	71	0	0	0.12	0	8.52	8.52	63	0.135238	1.833964
RM 1140	140	4	10	0.12	40	16.8	56.8	150	0.378667	1.590536
RM 1141	140	4	10	0.12	40	16.8	56.8	150	0.378667	1.590536
RM 1142	140	4	10	0.12	40	16.8	56.8	150	0.378667	1.590536
RM 1143	186	0	0	0.12	0	22.32	22.32	150	0.1488	1.820402
RM 1144	518	3	5	0.06	15	31.08	46.08	150	0.3072	1.662002
RM 1145	727	4	5	0.06	20	43.62	63.62	80	0.79525	1.173952
RM 1204	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1205	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1206	1733	9	5	0.06	45	103.98	148.98	400	0.37245	1.596752
RM 1207	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1208	1077	38	10	0.12	380	129.24	509.24	400	1.2731	0.696102
RM 1209	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1210	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1211	1079	38	10	0.12	380	129.48	509.48	400	1.2737	0.695502
RM 1212	1077	38	10	0.12	380	129.24	509.24	400	1.2731	0.696102
RM 1229	192	5	10	0.12	50	23.04	73.04	140	0.521714	1.447488
RM 1230	131	0	0	0.12	0	15.72	15.72	140	0.112286	1.856917
RM 1231	89	0	0	0.12	0	10.68	10.68	140	0.076286	1.892917
RM 1235	972	5	5	0.06	25	58.32	83.32	300	0.277733	1.691469
RM 1237	662	4	5	0.06	20	39.72	59.72	300	0.199067	1.770136

Vou	9318.88
Vps	9615
Xs	0.969202
Ev	0.695502
Vot	13398.78