**Retro-Commissioning Memorial Stadium (72) (Dec. 2016 –**

The building is old and has undergone several renovations thru time. The West side revisions were completed in 2007. The South end zone and East stands will be renovated starting in 2018 at this point. The North end zone area maybe redone under this project also. This project was announced in the Fall of 2016.

The overall square footage of the building is approximately 170,000 square feet. This includes the enclosed space on the West and North sides of the stadium. The FY 16 utility bill for this building is $1.2 million per year at this point. Close to 50% of this is electricity.

The building is connected to the chilled water loop and has a functioning chilled water meter presently. The steam meter resides in the basement mechanical room. There are several smaller DX units which serve the building. There is a 120 ton chiller that serves the coaches offices and training facility in the Northeast portion of the building. (Problem getting chilled water to the top of the building??. Kent question)

The building has had a history of freezing problems over time. There are probably building envelop issues that need to be attended to. Guy feels that this is the case. Warren Hood seems to indicate that there are more freezing conditions on the East side of the stadium today (Feb. 11, 2016.) In a conversation with a plumber in the building (12/5/16) , he indicated that the plumbing freezing problems are not significant today and the problems of the past have been solved on the West side of the building. The West side of the building does not have freezing problems presently, although there is plenty of potential for freezing damage to the plumbing, chilled water, and sprinkler piping systems. The TAC graphics do indicate spaces with very low temperatures that are in alarm, so these spaces are not far away from a freezing condition. (Jan. 2016) We think that there are insulation problems in this area of the building which an architect should review for improvements.

There are 4 steam to hot water heat exchangers in the building for the heating systems labeled HE 3 and 4. The HW temperature is reset based upon the outdoor air temperature. These systems are on the DDC systems. There is a 100% standby hot water pump.

There is a good level of DDC controls in the building on the air handling units. There is an existing Barber Coleman LON based system in the building. There is one Siemens system in the building serving the North end zone visitor’s locker room. This is noted as AHU 5 on our plans. This unit is located above the ceiling. AHU 6 is above the ceiling in this space also.

Brett Stillwell, Lenny Willis, and Dustin Boyer will be our primary contacts at this location. Dustin seems to do the HVAC scheduling for the West side of the stadium. Noah Marx had started doing some scheduling work in this building and this is a work in progress at this building.

Talked about this item in Feb. 2016 and a work order was received from Athletics in Aug. 2016. Eileen’s study is reaching completion in Jan. 2017.

**Advisable Energy Conservation Enhancement Possibilities.**

1. Need to have a conversation with key building personnel on the operation of the building. What sensitivities exist on the North building complex where the football coaches reside? Is there somebody else in charge at this location?
2. Feb. 15, 2016 Spoke with Guy and Ken about the project. There are 8 UNCs at this location. There are lots of TAC controllers. Ken is concerned about the amount of controllers at this location. This building may have the most controllers of any on campus at this point**.**
3. Consider adding occupancy sensors in several areas of the building including the suite areas on the west side of the building and in the North end zone office areas.
4. Occupancy schedules could be improved in several areas of the building.
5. Need to add trending as much as possible.
6. Funding needs to be allocated for RCx activities. Asked for an early work order for say $20K **(Needs to be more probably)** so that we can begin looking at the building. Follow up meeting w/ Kent to follow and Warren’s financial personnel. We may to be looking at an **overall $ 1 million project.**
7. AHUs 8, 9, and 10 (North end zone area) need to be upgraded from pneumatic controls to full DDC controls. VFD’s probably are needed. The corresponding chiller was installed in 2008 needs to be monitored by DDC. There is a heat exchanger and pumps that need controls also. This heat exchanger appears to be under DDC control. **($100K needed.) May be totally demolished with upcoming project. Brett S. to update in April 2017.**
8. AHU 4 – This unit has a GCM and Network 8000 controls. There are DDC VAV boxes associated with this unit. This is a good application of occupancy sensors on the room level. Eileen thinks that these rooms do not get used much. (Not sure that the HW source is for these VAV boxes. Need to upgrade all of the existing TAC controls to Stuctureware in the North end zone area **($40K) May be demolished with upcoming project. Brett S. to update in April 2017.**
9. Lots of good applications for occupancy sensors.
10. Envelop improvement items?? Could be costly. This needs definition.
11. Raising energy consciousness would be a big item at this location. Turning off lighting, refrigeration equipment, HVAC equipment, would be a big item.

**Notes on Priorities from Feb. 2016 meeting (Kent Reifsteck notes.)**

1. Maintenance of valves, dampers, and sensors.
2. R2 UNCs (8) obsolete
	1. Retire LON on AHUs and Automated Logic controls on SEMCO wheels
	2. 32MNL to 8 MNBs AHUs (These would be BACNET panels)
3. XXX MNL Fan Coil Units (later – lower priority) Schedule 1 UNC w/ various EC (Delete old schedules.) Test network communication.
4. Long Term – Move to Automation Server and Structureware
	1. Replace 8 UNCs w/ 8 – Redo graphics with links.
5. Building envelop has issues and needs to be addressed 5th floor level.
6. **Budget ($100K. D. Hardin input needed on this item. Confirm that we don’t need to upgrade to the present campus standards.)**

**PM Deficiencies and/or suggested improvements (Controls from 2/19/16 mtg.)**

1. There are 8UNCs with a LON network in the building. Bruce suggested that the air handling unit LON controllers be replaced with a BAC net controller and the lower level LON controllers would be retained. The UNC’s would be replaced with a building automation server if the system were to be upgraded to the Structureware system. A possible solution would be to have Alpha Controls install this work and for the programming work to be done internally.
2. There seems to be a small amount of Network 8000 controls in room 128 of this building. There are DDC VAV boxes associated with this AHU4? Unit. It is likely that these should be replaced. This controller is not hooked up to the Ultavist network even.
3. The Automated Logic controller(s) on the enthalpy wheels should be retired and these should be put on the TAC system.
4. There are some easy energy conservation items that should be addressed in the near future.
5. Actuator problems that Bruce and Noah were describing on the room level equipment.
6. It was noted that room numbers on the graphics may not correspond with the room numbers in the field.
7. A chilled water pump may be needed because the top of Memorial Stadium is very tall and has a tendency to become air locked and/or chilled water never reaches the top of this building.
8. Exhaust fan and controllers at different locations and some equipment has not been found.
9. Reports of contractors doing work but are not quite capable of completing all of the control work and therefore items fall in between the cracks are missed.

**PM Deficiencies and/or suggested improvements**

1. AHU 1 and 2: CO2 sensors appear to be reading low. Humidity set points (45%) are too low also. Need to discuss with Lenny as to why this is the case.
2. AHU 3 needs to have trends added. Kitchen reheats are running and there is a 55F discharge air temperature off of the air handling unit which could be reset to a higher value. Could use some indication of exhaust air temperature and humidity.
3. DOA 1- Add trends and enthalpy wheel data missing.
4. DOA 2- Add trends heating and cooling valves are open. Humidity set point at 45% and this needs to be raised. Can EF-9 be scheduled separately from the unit? Would this allow for more building pressurization?
5. DOA 3- Same as DOA2 except in addition the preheat pump is running and the preheat valve is 100% open and the exhaust fan is named EF-10.
6. Rm 3029 Restroom FCU running. Fan start/stop trends do not work. These fans were running.
7. Fan Coil unit 3004B: Fan is linked to a women’s restroom? …seems to be in Colonade North Plan. Is this mislinked by chance?
8. Mechanical room 9005: Why run the fan coil unit in the mechanical room?
9. Room 9003: Add an occupancy sensor.
10. Room 9001: No data coming on the thermostat.
11. Suite 8035: Trends are not working. Scheduling ? Occupancy sensors?
12. DOA 4 – Enthalpy wheel does not show data. The outdoor air quantity does not modulate much. This unit runs 24/7 and does not modulate. A CO2 sensor might be good for this unit.
13. Exhaust fans and NO2 and CO sensors do not look right.
14. Liebert units and chilled water valve leakage problems – Building tonnage never gets below say 30 tons. Do we need all of these Liebert units or could some of these be retired? There are some applications where the Liebert units could be shut off at night.
15. Siemens visitor’s locker room and Siemens unit. (DX unit) This AHU 1 needs to be renamed. Good candidate for occupancy, humidity, and return air temperature. Seems like unit could be running in economizer mode today, but it is not. Unit appears to be running 24/7 at this point.
16. AHU 3 both the preheat and the cooling coils are running on this unit on a 30F day. This should not be the case. Feb. 15, 2016.
17. Exhaust fans 9 and 10 need VFD’s. Need to utilize damper control so all of the upper 3 floors don’t need to be conditioned simultaneously.
18. Kitchen hoods need to be shut down at night. Shop 55 needs to address. Auxillary programming skills probably need to improve. D. Boyer could use some help.

**Problems /Observations (Quick Cost reduction items) (12/12/16)**

1. Why do the exhaust fans (E-9 and E-10) associated with DOA-1 and DOA-2 need to be operated in an empty building? Leave them off based upon OA temperature? Dec. 19, 2016 All of the top floors of the west side of the stadium were put in an unoccupied mode and this shut down the above indicated equipment as this seems to be part of the standard sequence of operation.
2. Why do DOA 1 and DOA 2 need to run during the day at 95% in an empty building? Reduce speed at a minimum. Unless that are providing heat to the 6th and 7th levels?
3. Today we found that the fan coil units were running on the 8th level and maintaining space conditions, however the fan coil units on the 6th and 7th level were in an unoccupied mode of operation.
4. Paul Foote met with Lenny this morning regarding lighting. Lenny pointed out that Grange Grove had been updated as well as the exterior lights of the stadium.
5. Does DOA-4 need to run 24/7? We should be able to shut this down at night? Need input from Lenny. Dec. 19, 2016 A schedule was added to this unit and made operational.
6. Need to visit about Sodexo coordination on coolers, refrigerators, and the kitchen hoods. (Needs to be done yet.)
7. Get the time clocks operational on AHU 8, 9, and 10. Try to get these shut off say 12 hours a day. (Needs to be done yet.)
8. Dec. 19 AHU -3 – the existing kitchen hoods run 24/7. An investigation is needed to shut these fans off and to slow down the operation of the AHU 3 fan. (Needs to be done yet.)