Sustainability in the Simon Squash Center

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Figure 1: The Chandler courtyard entrance to the Simon Squash Center
Introduction:

The squash courts on campus are an important part of my life, and have been for the last decade. I now am a member of the Williams varsity squash team, which means I spend as much as 14 hours a week in the facility during the winter time. As a Williamstown native, I learned to play on these courts growing up and have fond memories of playing with my friends as we worked to improve our games, and seeing the fruits of that work during tournaments hosted in Williamstown. My desire to focus on the squash courts comes from the fact that this is an important building in my life, both present and past. Coupling my sustainable values with a building I care a great deal about has proven to be a rewarding experience.

But the project is also born out of necessity. The squash facility features an excellent lounge area behind courts 1-3, which is where the men’s team plays their matches. Courts 1-3 are, by virtue of the layout of the facility, the most desirable to play on, and the purple couches in the lounge are a favorite are for the men’s and women’s team to socialize before and after practice. Unfortunately, this area maintains a temperature approximately five degrees than the rest of the squash facility, which is highly problematic for multiple reasons. As mentioned, this area is used for leisure, and is uncomfortable to be in in just a shorts and a t-shirt, which is standard attire for squash players and our coaches. More importantly, the temperature increases risk of injury. Though we try to do a good job of warming up before practices, sometimes circumstances demand we start playing or doing a workout before our bodies are fully ready. Cold temperatures make this a dangerous practice, as risk of injury increases significantly when your body is cold. Often times we will do sprints on these courts for morning practices, before which people do a haphazard warm-up and get right into the workout. We have had numerous hamstring injuries during my time at Williams, and I would not be surprised if these are at least
partially due to the cold temperatures. Lastly, the cold alters the speed of the game. Squash balls are not bouncy at room temperature, but become so when they are hit hard against the wall. When the court is below a normal temperature, however, the ball never gets as bouncy as it should, which means we practice in different conditions than we play regular matches in. The cold temperatures in this area of the squash courts are a highly practical problem, to say nothing of wasted heat energy.

**Climate:**

The Simon Squash Center underwent a $3.8 million renovation in 1997 which produced the building we have now. The facility holds twelve international sized squash courts. Six are located on the first floor, and six more on the third floor oriented directly above the lower ones. The second floor houses viewing areas for courts 1-6, as well as two office spaces. The facility is one of the nicest on any college campus, and is ideal for the men’s and women’s varsity programs. The courts also receive extensive use from recreational players, whether it is faculty at lunch time or students after classes.

The facilities property book lists the squash courts square footage as 26,326 and rises three stories in between the Lasell Gymnasium complex and the newer Chandler Gymnasium and Samuelson-Muir Pool. The area I am most concerned with is on the first floor of the facility. (See Figure 2) Using floor plans of the first floor, I have estimated the area of the space to be 5,014 square feet, which makes it only 19% of the total area of the facility. As mentioned earlier, though, it houses the three most used courts, as well as the lobby space that is a popular hangout spot for the Varsity teams and recreational users alike. There is a set of doors that separates the space from courts 4-6 and the small women’s golf office. While these doors are usually open,
courts 4-6 manage to maintain a slightly warmer temperature and are less of a concern because the main problems with the facility are in the lobby area.

The facility on the whole is comparable in size to Gladden, Morgan and Jesup, with Gladden being about 800 square feet larger, and Morgan and Jessup being about 2000 square feet smaller. Interestingly, the squash courts used only one tenth and one half as much steam as Gladden and Morgan, respectively in 2012. Jesup used 229 mmBTU to the squash center’s 357 mmBTU. Only Jesup uses fewer mmBTU/square foot. I have calculated that the specific area that I am interested in uses just under 70 mmBTU for the entire year. Yet even this relatively small amount comes up short of what it would take to heat the room to a comfortable temperature. Using more energy to heat the space is not a sustainable solution, and would cause the rest of the facility to be too warm. Instead, we must look to other options to increase the efficiency of the squash courts, and perhaps even cut steam use down the road.

**Information:**

Todd Holland was the first to mention the Stack Effect to me in a discussion we had early on in working on this project. Since that conversation, I have done research into the stack effect, and have learned that it is seriously affecting airflow through this area of the squash courts. I have also looked into the role that the floor-to-ceiling glass and metal beam architecture is playing in making the temperature cooler than it should be. Finally, I wanted to take a comprehensive look at energy efficiency in the facility, so I also have researched the lighting used in the courts to see if we are being wasteful in lighting the facility.
Interpreting:

The Stack Effect

After researching the stack effect I have determined that it is playing a serious role in dropping the temperature of the lobby area of the courts. John Straub, a professor of Building Science at the University of Waterloo explains that in winter, “warm air in a heated building is lighter than cold air outside; the cold air outside wants to rise up and out. The flow of air leaving the top of the building draws cold air through cracks at the bottom” (Straub 2012). (See Figure 3) For a building to have a strong stack effect, then, there must be a way for cold air to easily be sucked into the building, and for hot air to leave. Both are evident in this facility. The doors exiting towards the Chandler courtyard have large gaps both underneath and in between both sets of doors in the entranceway. (See Figures 4 and 5) I estimate that there is a total of 46.5 square inches of gaps in each set of doors, which is roughly the equivalent of a 7 inch by 7 inch hole in both sets of doors. Further, two emergency doors on the first floor also have significant room underneath them. This combination makes cold air constantly available to a building that is looking for it. This was not a groundbreaking discovery. For my entire Williams Squash career, the team has complained of cold temperatures in the courts. I have inspected these doors before, and when I have put my hands around the cracks, it is clear that cold air is rushing into the building. Quantifying the space available for air to enter brings the problem into real terms.

But problem is deeper than only cracks in the doors. The entranceway is designed to prevent the interior of the building from ever being exposed to the exterior. (See Figure 1) In practice, however, this has not been the case. The doors are the most convenient way to get from the athletic center to Currier quad dorms, and Driscoll, which is a popular dining hall for athletes in the winter. Every day during our practice, the men’s and women’s crew teams, for instance,
will walk through and use these doors, keeping both entranceway doors completely open for more than thirty seconds at a time. The temperature is noticeably cooler after this happens. Our players also contribute to the problem by using these doors before practice. Often somebody will come up to the window and want another player to let them into the building. That person will then do so, but since both of the doors in the entranceway are always locked, he must keep the first door open while reaching to open the second. Doing so means that both doors are open, thus allowing more air to enter the building unnecessarily.

Having established that there is plenty of cold air entering the building, I set out to find where the air might be escaping, and did not have to look hard. As mentioned, the squash facility neighbors the much older Lasell Gymnasium complex, and I found plenty of areas that seem leaky. From the second floor of the squash courts, you can exit to the long hallway that houses the indoor golf nets and leads to Lasell Gym itself. This hallway is lined with very old windows that are certainly not air tight. (See Figure 6) It is certainly feasible that the warmer air in the second floor of the squash courts is being pulled down this hallway and out these windows. On the other end of the hallway is the old gym, which is lined with the same sort of old windows found next to the golf nets, and has an old vaulted ceiling, as well as large windows on both ends of the gym. (See Figure 7) It is also possible that warm air could be rising all the way to the Upper Lasell fitness area. Other possibilities of escape are emergency exits on the second and third floors, which have significant cracks under the doors and are in the squash facility, meaning the air would have less distance to travel in order to escape.

Windows

A large contributor to the cold temperatures in the lobby area of the squash courts is the atrium area around the entrance, which features a floor to ceiling window arrangement. (See
Figure 8) I have calculated the wall to be approximately 720 square feet. The negative effects of this architectural feature are twofold. First, the metal beams are exposed to both the exterior and the interior, and do not have effective sealant, which means that the metal is chilled from outdoor temperatures and holds the same temperature on its interior side, which means that the cold is transferred through the metal into the indoor space. Second, windows are not as good insulation as drywall. The glass/metal combination significantly hurts the facility’s efficiency, but its importance to the building architecturally makes finding a solution challenging.

**Lighting**

Lead electrician Dave Dabrowski reported that each light fixture in the squash courts themselves has six F-32-T8 bulbs, which are 32 watt fluorescents. Each court has twelve of these fixtures, which means there are 864 bulbs in the facility. The lights in all twelve courts are activated by motion detectors above the doors, and can only be turned off manually by using a special key. The motion sensors are effective and a solid sustainable practice, as lights are kept off most of the day.

**Recommendations:**

*Limiting the Stack Effect*

The most simple remedy for limiting pathways for cold air to enter the building is applying door seals to both sets of double doors leading out to the courtyard. This step would effectively close the 46.5 square inches of open space between the doors, and make it much harder for cold air to enter the building. I have emailed with Tom Bona, who agreed that the doors need to realigned and have weather strips installed, and suggested that I put in a work order, which I did. While these fixes will ideally severely limit the amount of cold air that can enter through the squash
courts, it would still be a good idea to look at leaks in Lasell, as they may be drawing cold air in through other parts of the athletic center. Most simply, shrink wrapping the old, drafty windows in the golf nets hallway would keep warm air from escaping. This would be much harder for the bigger windows in Lasell, and might require retrofitting the space with new windows. Given the age of the building and cost, the feasibility of such a project seems low. Finally, it would be smart to use an infrared camera to examine the roof of Lasell Gym and the Upper Lasell fitness area for clear leaks that are contributing to the stack effect in the whole building.

The next concern, then, would be people using that door to exit the building. It seems unlikely that these behavioral patterns could be changed. John Quick sites observability and compatibility as two important factors in whether or not people can change to more sustainable practices (Quick 2010). The vast majority of the people who use the squash doors as an exit would not observe any benefit from using a different door to exit, which makes them unlikely to care enough to try a new behavior. Using a different door would also not be compatible with current practice, because people would need to use a new route that would likely add distance to their walk outside. In the dead of winter, this is a lot to ask. It is possible that a sign on the door that says something along the lines of, “For the comfort and convenience of squash players, please use a different exit”, and see some positive results.

I attempted to talk to Dave Boyer about changing the lock policy on these doors, but was unable to connect with him. I cannot imagine him being flexible on a plan that would make it easier for people to enter the building from an entrance that security clearly does not want them coming in. A better solution is to get my teammates to understand that opening the doors is a huge part of our problem, and walking a little further to another entrance would significantly warm up the facility.
Windows

The floor-to-ceiling window feature of the building is something that we are most likely stuck with. An extreme measure would be to retrofit the top of the windows with drywall, but this would be expensive and would not look as nice as the windows do now. Another possibility would be to retrofit the windows with double-paned glass and insulated glazing. Again, this process would be expensive and, given the problems that the metal beams raise, only partially effective. It seems as though this is another example of aesthetics impeding efficiency, which is something we have to live with.

Lighting

Our lighting is as good as it can be right now. Squash is such a reactionary sport, that lighting needs to be just right for players to be able to pick up the ball with their eyes. I’ve looked at a number of indoor court lighting companies, and they are all still selling fluorescent bulbs. I spoke to Todd about this issue, and he thought that the tint of LED lights was not right for squash yet. Indeed, playing under LED lights would also affect our matches when we went on the road, and would make it very difficult for opponents to play. Differences in lighting from one venue to another are exacerbated by the fact that the ball is moving very quickly, and seeing it in lighting that you are not used to can be a real challenge. When LED lights are a viable option, we should undoubtedly begin to replace the fluorescent lights, but right now that is not a good idea.

One major problem right now is that the motion sensor is broken on court 2, and the lights on that court are always on. This means that 72 32W bulbs have been running non-stop for months. I have also submitted a work order for that equipment problem.
Conclusion

I have experienced the squash courts inefficiencies for years now, and I the process of thinking more in depth about the building’s flaws has been a rewarding experience. Installing weather seals and using the courtyard doors less will result in real efficiency gains next winter, and will most likely cut the amount of energy needed to heat the squash center. The lighting in the facility is sufficiently sustainable for now, but facilities should be on the lookout for LED lights in the future. I believe my project, though small in scale, has done a good job of making Williams a more sustainable campus.
Figures

Figure 2: The lobby area in the squash courts that my project is most concerned with.

Figure 3: The stack effect shown visually in a two story house. (image from Kinetikenergysolutions.com)
Figure 4: A large crack between the exterior doors, with space for an extension cord to run through, with room to spare.

Figure 5: Notice the light shining in between and under the doors.
Figure 6: An old, drafty window across from the golf nets

Figure 7: A large, old window in the east end of Lasell. The elevation change between Lasell and the first floor of the squash courts suggests that cold air may be sucked into the squash courts by hot air escaping through windows like this one.
Figure 8: The floor-to-ceiling windows looking out on Chandler courtyard.
Bibliography
