Vital Signs VI:

An Instrumented Lighting Analysis of the Second and Fourth Floor Office Spaces of the NCAA Headquarters in Indianapolis, IN

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Fall Semester 2001

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Abstract

This report documents an instrumented lighting analysis comparing the second and fourth floor office spaces of the NCAA Headquarters in Indianapolis, IN, conducted by team six of the Vital Signs VI course offered at Ball State University during the fall semester of 2001.

In our initial visits to the headquarters, we were interested in studying a variety of spaces. We decided to focus on the office spaces for our report because that is where the users spend the greatest amount of time.

We developed the hypothesis that "Although illumination levels are greater in the fourth floor office spaces than in the second floor office spaces, most employees on each floor find the lighting to be adequate." To test this hypothesis, we measured illumination levels in a corresponding bay on both the second and fourth floors, see figure 1.1, and administered surveys to the employees on each floor.

We discovered that illumination levels on the fourth floor were double those on the second floor. In the survey we asked employees to respond to the statement, "The lighting is adequate in my workspace." Fifty-six percent of the employees on the second floor and eighty-four percent of the employees on the fourth floor agreed or strongly agreed with the statement.

Based on the fact that illumination levels on the fourth floor are almost double that of the second floor, and that employees on the second floor find the light level in their workspace to be adequate, we believe that the illumination levels on the fourth floor could be lowered to match those on the second floor.

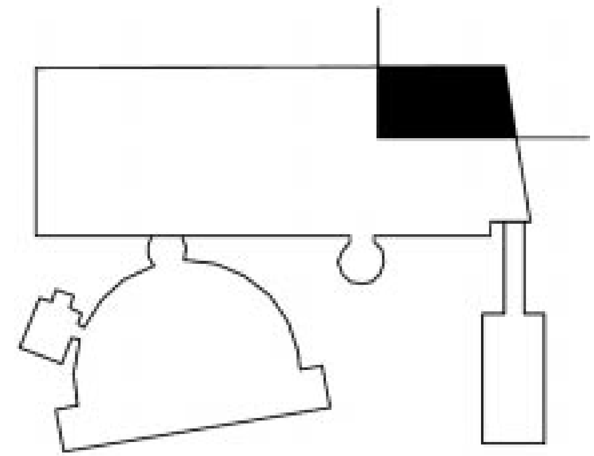

Fig. 1.1: *Key plan of the NCAA Headquarters and Hall of Champions showing the northeastern structural bay where illumination levels were measured to represent the typical levels for the second and fourth floor office spaces.*

Introduction

Fig. 2.1: *Map to NCAA Headquarters and Hall of Champions*

The Vital Signs VI course is part of a national Vital Signs program. The course teaches students how to perform a lighting assessment. Through this course, we had the opportunity to apply the knowledge that we had gained through previous environmental systems courses. This hands-on approach allowed us to understand how professionals in this field would conduct research.

The Vital Signs VI course taught us about research techniques, data presentation, and technical writing. We learned about the tools used to develop the technical assesment of lighting conditions, including light meters, luminance meters, and digital cameras. We learned how to present the data through charts, graphs, and illustrations created in programs such as Excel and Boxcar Pro. We learned about the importance of documenting our research methods so that it would be possible to replicate our experiments.

Our class performed a lighting analysis of the NCAA Headquarters and Hall of Champions in Indianapolis, IN. The NCAA Headquarters and Hall of Champions was chosen as the focus of this Vital Signs course because it is a signature building designed by architect Michael Graves. The map shown in figure 2.1 shows the location of the headquarters in downtown Indianapolis.

Introduction

We followed a specific three-step methodology to gather and present data. The indicative phase includes preliminary site visits to create an awareness of potential areas to study. The investigative phase includes follow-up visits to define a specific area of research and to get a better understanding of this area. The diagnostic phase includes in-depth field research to test our ability to prove or disprove an hypothesis that we developed in the investigative phase.

Methodology: Indicative Phase

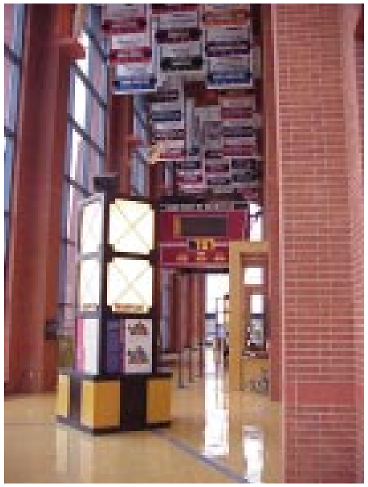

Fig. 4.1: *NCAA Hall of Champions*

Fig. 4.2: *Atrium in the Headquarters*

Our initial visit to the NCAA Headquarters and Hall of Champions in Indianapolis, IN, was on Tuesday, September 4, 2001. We met with Mike King, the manager of purchasing and procurement, and Milt Grissom, the senior property manager of REI Real Estate Services. REI is contracted by the NCAA as the property manager for the Hall of Champions and the NCAA Headquarters facilities. On this visit, we toured the Headquarters and the Hall of Champions and learned about the facilities.

The Hall of Champions acts as a transition from the brightly lit Great Hall to the dark Champions Theater. We were surprised that the video screens in the Great Hall were often difficult to see because of the direct beam radiation in this atrium-like space, see Fig. 4.1. This light also created glare on the video monitors on the Wall of Champions.

The atrium of the headquarters created fewer glare problems than the Great Hall in the Hall of Champions. The lighting fixtures in the barrel vault of this atrium seemed unnecessary as they provided very little light, and created problems because of the great expense to replace failed lamps in the high ceiling of the atrium, see Fig. 4.2. The two shades of cantaloupe paint, one shade slightly darker than the primary color, highlight the architecture of the atrium. Recessed panels of the wall are painted this darker shade to enhance the effect of light and shadow and to add depth in the space.

We noticed that the lighting of the fourth floor office space is unique for an office environment, with special uplights that illuminate the recessed panels of the barrel vault, see figure 5.1. In contrast, the lighting of the second and third floor offices is conventional, with a typical acoustic tile ceiling and regimented placement of flourescent downlight fixtures as illustrated in figure 5.2. Employees in the headquarters especially liked the fourth floor office with its barrel vault and diffuse lighting.

The offices in the High School Federation Building were uniquely lit. Large windows around the perimeter and clerestory windows around an open central space brought natural light into the building. The employees commented that this was an exceptionally pleasant space in which to work.

After the initial visit, we discussed possible topics for our study. We looked at the atrium, the conference area, and the office spaces. We were concerned about the glare created in the Great Hall of the Hall of Champions and how this affected the video exhibits. We wondered why tables around the upper floors of the atrium were utilized more than those provided in the offices. We were interested in the lighting design for the office spaces, and the difference between that of the second and fourth floors.

We had discussed several possible areas to study, but decided to focus our attention on the office workspaces.We thought that the offices were the most important areas to study, because they greatly affect the attitudes and efficiency of workers, and because employees spend more time in these spaces than any other.

Fig. 5.1: ***Fourth Floor*** *Lighting*

Fig. 5.2: ***Second Floor*** *Lighting*

Methodology: Investigative Phase

Fig. 6.1: ***Second Floor*** *Workstation*

Fig. 6.2: ***Fourth Floor*** *Workstation*

We began our investigative visit on Friday, September 28, 2001, by touring the second and fourth floor office spaces and more closely observing the lighting conditions in each space. Throughout this visit, we conducted informal interviews with employees to learn more about their lighting concerns.

We found that the employees we talked to liked the fourth floor workspaces better than those on other floors. We thought that although the light sources and strategies were different, the lighting levels on the fourth floor might actually be similar to those on other floors. Indirect lighting in the barrel-vaulted space decreased shadows on the work plane; while direct lighting in the other office spaces produced long, dark shadows on the task surface. See figures 6.1 and 6.2.

The tall cubicle walls on the lower levels obstructed light, but on the fourth floor the height of the ceiling counteracted the shadows from these walls. We observed that the cubicle system itself blocked a great amount of light. While taking an illumination reading on each side of a glass cubicle panel we found that light levels dropped from 74fc. to 51fc. We thought this might be the result of transmission loss through the glazing, or the shadowing effect of the mullions.

We talked with an employee on the second floor about his lighting concerns. He noted that there is not enough task light, and that the task lights that are provided shine onto an unused portion of the task surface. Employees utilized the task surfaces that face into the room, while light fixtures are located on the back wall of the cubicle.

The storage units built into the top panel of the cubicles created a deeply shadowed area within each cubicle; this may be why employees prefer to use other work surfaces in the space. See figures 7.1 and 7.2. Tall cubicle walls, low ceilings, and down lighting create a darker working environment on his floor. When asked about the cubicle system, the interviewee said employees preferred high walls and opaque panels for visual privacy. In his own space he put a poster over the windows to restrict views into his cubicle.

Our preliminary hypothesis was that although the quality of light was different on the second and fourth floors, the quantitative lighting levels in the second floor office space were actually similar to those in the fourth floor office space. We planned to compare the qualitative and quantitative aspects of lighting in these two office spaces.

After developing this initial hypothesis, we decided that instead of trying to determine whether the spaces were equally lit, we would focus our attention on what made the spaces so different. The ceiling on the second floor is low and dark, compared to the bright barrel vault on the fourth floor. If we could determine that the biggest difference between the spaces was not the daylighting, but the light provided by the ceiling plane, we could propose that the lighting on the second floor could be changed to make it more effective. For example, indirect lighting fixtures could be placed above the storage units on the second floor to create a more luminous ceiling plane. This reflected light may be more beneficial than the direct light that is currently on this floor.

Fig. 7.1: ***Second Floor*** *Workstation*

Fig. 7.2: ***Fourth Floor*** *Workstation*

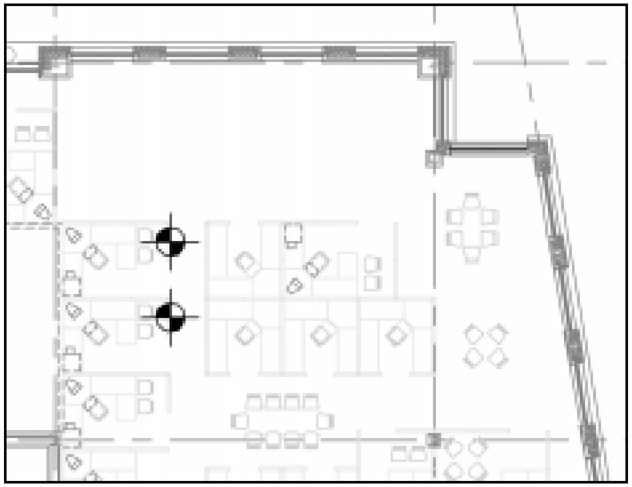

Fig. 8.1: *Floor plan of northeast corner of* ***second floor*** *office. The benchmarks show where the stowaways were placed.*

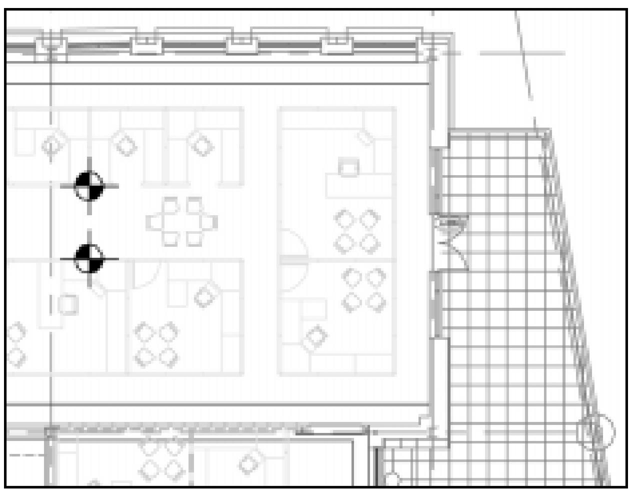

Fig. 8.2: *Floor plan of northeast corner of* ***fourth floor*** *office. The benchmarks show where the stowaways were placed.*

Although illumination levels are greater in the fourth floor office spaces than in the second floor office spaces, most employees on each floor find the lighting to be adequate.

To test this hypothesis, we first had to prove that the illumination levels on the fourth floor were in fact higher than those on the second floor. To do this we needed to find the average illumination level on each floor. We began by comparing the levels for the task surfaces on the second and fourth floors. We used a digital illumination meter to get an instantaneous reading of the illumination levels. These measurements were taken on every desk within the northeast structural bay of the second and fourth floors. This included seven desks on the second floor and seven desks on the fourth floor. The average illumination level on the second floor desks was thirty-three foot-candles, while the average illumination level on the fourth floor desks was sixty-six foot-candles. Therefore, the average illumination level on the fourth floor desks is double the average illumination level on the second floor desks.

Next, we wanted to see if the illumination levels were consistently greater on the fourth floor. We placed two stowaways near the center of the northeastern structural bay on both the second and the fourth floors to take readings over time. Figures 8.1 and 8.2 show the locations where stowaways were placed. Stowaways were used so that they could be synchronized and illumination readings from the fourth floor could be directly compared with that of the second floor. We placed the instruments at a height of seven feet, four inches on top of cubicles near the center of the bay- where they would not be shaded.

We placed the stowaways on a Tuesday and collected them on Friday, so that they took illumination measurements every 2.5 minutes from noon on October 30 until 3:30p.m. on November 1. This allowed for both daytime and nighttime measurements. Daytime illumination readings for both floors can be seen in figure 9.1. The graph shows that the fourth floor illumination levels are consistently twice as great as the second floor illumination levels.

We also wanted to know what effect natural light had on each floor. We asked the NCAA staff to leave the lights on in these spaces for a single night during our study, so on the Wednesday night of our data collection, the stowaways collected data that reflected only electrical lighting levels in each space. We were then able to subtract these levels from the daytime levels to determine the amount of natural light on each floor, see figure 9.2 for the results of this calculation. Enlarged graphs of figures 9.1 and 9.2 can be found in appendix C.

Because the illumination levels on the fourth floor were twice as high as those on the second floor, we decided to calculate the number of watts per square foot for the second and fourth floor office spaces to see if there was a correlation between illumation levels and energy consumption.

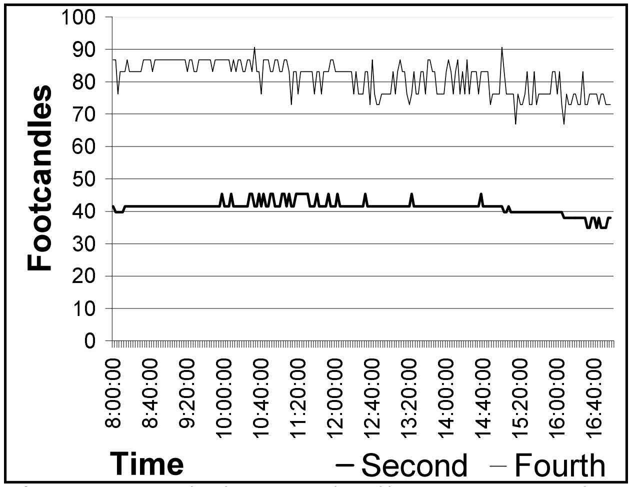

Fig. 9.1: *Graph showing the illumination readings taken by the stowaways on the second and fourth floors over a typical workday.*

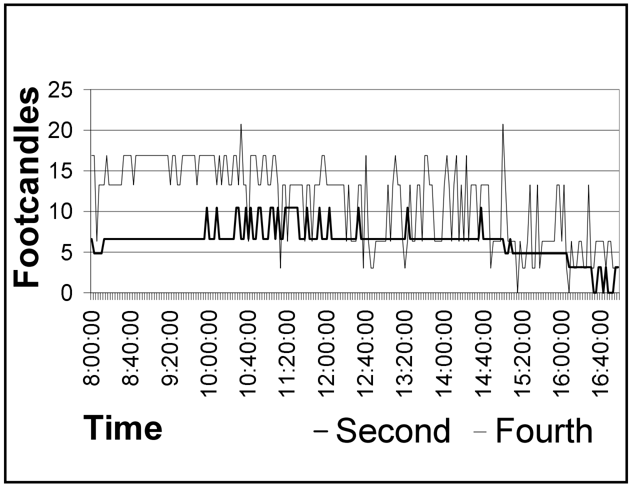

Fig. 9.2: *Graph showing the natural light levels on the second and fourth floors over a typical workday.*

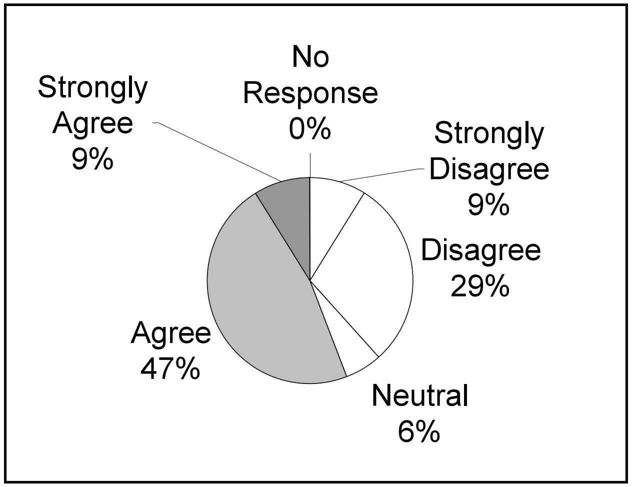

Fig. 10.1: *Pie chart showing* ***second floor*** *responses to the statement, "The lighting is adequate in my workspace."*

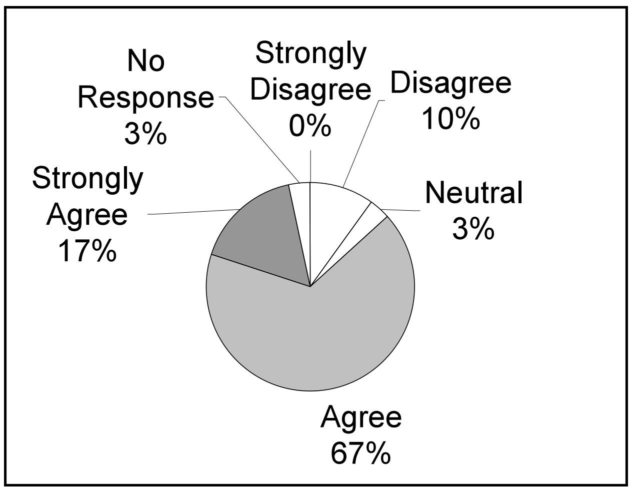

Fig. 10.2: *Pie chart showing* ***fourth floor*** *responses to the statement, "The lighting is adequate in my workspace."*

On the second floor, there are twenty direct fluorescent luminaires per bay. Each of these fixtures contains two lamps at forty watts each. Each bay is approximately 1600 square feet. By multiplying the number of luminaires by the number of lamps in each fixture by the number of watts per lamp and then dividing by the area of the bay, we found the number of watts per square foot. The second floor uses one watt per square foot which is equal to the industry standard of energy efficiency for lighting.

The fourth floor has eight indirect fixtures per bay. Each fixture contains one 400-watt lamp. Using the same formula as before, we determined that the fourth floor uses two watts per square foot, which is double the industry standard of energy efficiency for lighting. The watts per square foot in each space corresponds with the illumination levels.

To test our hypothesis, we also needed to prove that most employees on the second and fourth floors find the lighting to be adequate. To gather information about employees' opinions about lighting of the headquarters, we had surveys distributed to employees throughout the building. Complete survey results from the second and fourth floors can be found in appendix A of this report.

To find out about the adequacy of the lighting in the office spaces, we asked employees to respond to the following statement: The lighting is adequate in my workspace. Employees could respond on a scale of one to five from strongly disagree to strongly agree, respectively. Of the thrity-four surveys returned from the second floor, fifty-six percent found the lighting to be adequate. Of the thirty surveys returned from the fourth floor, eighty-four percent found the lighting to be adequate. Figures 10.1 and 10.2 show the responses by floor.

Although employees had found the lighting to be adequate, we also wanted to test the visual comfort in the second and fourth floor workstations, we made visual field maps of two workstations on both the second and fourth floors. Although we had planned early in the project to perform this field mapping exercise, the layout of the fourth floor cubicles was changed before we had the opportunity to create visual field maps. Because the lighting levels in the new cubicle layout are similar to the levels of the previous layout, we are including visual field maps of the new layout to approximate the previous conditions. These visual fieldmaps can be found in appendix B.

Based on the fact that illumination levels on the fourth floor are almost double that of the second floor, and that employees on the second floor find the light level in their workspace to be adequate, we believe that the illumination levels on the fourth floor could be lowered to match those on the second floor.

Recommendations

The IES standard for spaces that include performance of visual tasks of high contrast or large size, such as a typical office space, is an illumination level between twenty and fifty footcandles. The optimum illumination level, which is appropriate in this case, is thirty footcandles.

The second floor's average of thirty-three foot-candles per task surface is within the recommended range for office spaces, while the fourth floor's average of sixty-six foot-candles per task surface is greater than the level recommended by IES, and approximately double the optimum illumination level for office spaces.

We would recommend that the light level on the fourth floor be lowered to match that of the second floor. A possible way of reducing unnecessary artificial light is to install daylight sensors in the fourth floor office space. This would put the illumination level close to the optimum level set by IES for office spaces. In theory, this would also lower the number of watts per square foot from two footcandles per square foot to one footcandle per square foot which is the industry standard of energy efficiency for lighting. This could potentially lower the cost of energy required to light the fourth floor office spaces.

Lowering the light level in the space could also improve visual comfort by decreasing the contrast in luminance levels. We have included some visual field maps for the second and fourth floor workstations in appendix C, but further study in this area is needed.

Acknowledgements

We would like to thank the NCAA Headquarters for allowing us to perform this lighting assessment. We would like to thank all of the NCAA employees for their cooperation and support. A special thank you to Mike King, Director of Purchasing and Procurement; David Clendenin, Administrative Assistant; and Milt Grissom, R.E.I. Real Estate Services Senior Property Manager.

We would like to express our appreciation to the following professors from the CERES department at Ball State University: Robert Koester, Jeff Culp, and Robert Fisher. We would also like to thank Nick Rajkovich, graduate teaching fellow at Oregon University, for his involvement with this project.

A special thank you to Mr. Wayne Leonard, CEO of Entergy Corporation for his company's endowment of the Ball State University Vital Signs Program which has helped finance the student scholarship documented in this report.

Appendix A: Second Floor Survey Results

To learn more about occupant lighting concerns, we conducted a survey of employees in the NCAA headquarters. The survey was done in conjunction with another group from the Vital Signs VI class, but we are only showing the results to the questions that pertain to the second and fourth floor workstations. Although every employee in the headquarters was asked to complete a survey, only the results from those employees on the second and fourth floors have been included in this report. Selected quotes have been included to support the survey's findings. The entire set of original surveys can be found in the dossier for the Vital Signs VI class in the CERES office at Ball State University. Following are the second floor survey results.

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
I prefer the lighting of the barrel vault to that of other office spaces in the building.	2	5	14	3	1	9

63. Not applicable to me.
77. What is the barrel vault?
82. Don't understand the question.

My cubicle is more than three panels high.	3	4	2	10	13	2
I like the height of my cubicle.	7	4	9	11	2	1

55. Needs to go to the ceiling!
57. Would prefer walls, but it's okay.
71. No privacy. Can hear others phone conversations; people talking from fifty feet away.
88. I like to have them all the way to ceiling, for noise!

I can see a window from my workspace.	9	4	2	10	9	0
The window blinds are usually open in my section of the office.	3	5	3	11	10	2
The lighting is adequate in my workspace.	3	10	2	16	3	0

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
I wish the lighting were brighter in my office.	5	9	4	12	4	0

72. But with natural light, not electric.

I often use the task lights that are provided.	7	5	3	9	9	1

58. They don’t offer much lighting.
72. I don’t have any.

I have brought my own light fixture for my workspace.	18	11	3	0	2	0

58. Not allowed.

I think additional task lighting should be provided in each cubicle.	7	4	8	9	6	0

61. Moveable.
81. I’d rather have more overall light and sunlight.

I use the computer in my office for at least four hours every day.	1	0	0	6	27	0
There are no reflections on my computer.	7	9	5	9	4	0

57. I have a laptop so I can adjust my screen if needed.
71. Have to sit at odd angles to view screen because of glare!
72. I have a laptop so the glare is not so bad. On the desktops it is much worse.

Glare is not a problem in my workspace.	5	5	9	10	5	0

62. It is a major problem!

Appendix A: Second Floor Survey Results

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
The noise levels in my office are acceptable.	9	7	5	11	2	0

55. The noise here is terrible. This is the worst place for noise that I have ever worked.
59. Sometimes it's hard to have phone conversations.
88. I am in the hall and noise level is unacceptable.

Additional Comments or Suggestions:

55. This building might "look nice" but it is barely functional for office work. It's too dark in some places and too bright in others, and it's incredibly noisy everywhere.
66. I wish I had more privacy so no one could hear my phone conversations.
67. Bad glare on computers in the afternoon.
69. In my opinion, the lighting in the office is fine. It's nice to see the natural sunlight shining through the windows while working especially when you're in the building all day.
71. Worst workplace I've ever been in. Too bright, too noisy, too open.
83. I wish my walls were thicker.
88. I think they should have everyone in an office for following: noise, lighting (choose your own type), privacy (at least a little). To make a phone call I have to go to a room with a door, because of noise of kitchen, printer, people coming/leaving work.

Appendix A: Fourth Floor Survey Results

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
I prefer the lighting of the barrel vault to that of other office spaces in the building.	1	4	11	12	2	0
My cubicle is more than three panels high.	3	4	2	14	7	0
I like the height of my cubicle.	0	2	7	14	5	2

136. I don't like the cubicle because of the sound on the fourth floor.
151. Would like more height if space was bigger.

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
I can see a window from my workspace.	0	1	1	13	14	1
The window blinds are usually open in my section of the office.	2	3	4	12	6	3

132. Until afternoon sun causes me to close them.
143. Partially open to prevent sunlight from blinding me and my co-workers while we work.
144. Slightly closed because sometimes the light (sun) is too bright, but always open.
151. Blinds are down but open, need closed late afternoon.

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
The lighting is adequate in my workspace.	0	3	1	20	5	1
I wish the lighting were brighter in my office.	2	14	5	6	2	1
I often use the task lights that are provided.	4	9	2	9	5	1

151. On mostly cloudy days or night.
154. More so in the winter and if I work late.

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
I have brought my own light fixture for my workspace.	13	10	3	3	1	0

Appendix A: Fourth Floor Survey Results

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
I think additional task lighting should be provided in each cubicle.	2	8	10	9	0	1

132. If necessary.
135. As needed.

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
I use the computer in my office for at least four hours every day.	0	0	0	10	20	0
There are no reflections on my computer.	5	14	0	9	2	0

144. The glare is better with the new monitors, but still not great.

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
Glare is not a problem in my workspace.	4	14	4	6	1	1

143. Glare from windows depending on time of day sometimes causes a problem.

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	No Response
The noise levels in my office are acceptable.	10	13	2	3	1	1

125. New space is louder.
127. Used to sit in barrel vault and the noise was awful.
136. It's loud on the fourth floor.
143. Noise carries too much in the barrel. I can hear what's going on in a cubicle on the opposite side of the barrel better than I can hear what's going on in the cubicle next to me.
151. Can hear people on other side of barrel in normal speaking tones.

Additional Comments or Suggestions:

138. Certain times of the day I get a glare from the sun, but I am right next to the window so I can close the blinds.

143. I really like the barrel (it's an interesting architectural twist) but it needs some sort of noise reducing panels on it. The opportunity to look out a window greatly enhances my attitude at work, but is there a way to reduce the amount of sunlight so I'm not blinded without having to close the blinds? (Different glass material? Different angle of installation? Special kind of blind that allows for views to outside but reduces sunlight?) A garden or plant box of some sort (with seasonal flowers, bushes, and/or trees) would be a wonderfully pleasant addition between the back of the Hall of Champions building and the west half of the atrium.

150. When some people talk on the phone, the rest of the group can hear them better than if they used the public address system.

151. I think the barrel works well in the atrium, but causes too much noise in working areas. Plus, the light in the barrels can be too dim during bad weather and at night.

Appendix B: Second Floor Visual Comfort

Fig. 20.1: *Photograph of* ***second floor*** *workstation showing the visual field of a cubicle occupant.*

Fig. 20.2: *Visual fieldmap of the* ***second floor*** *workstation shown above.*

To test the visual comfort in the second and fourth floor workstations, we made visual field maps of two workstations on both the second and fourth floors. Fig. 27.1 and 29.1 show the approximate locations of these field maps on each floor.

To create a visual field map, we took digital photographs that would represent the visual field of an individual sitting in the cubicle. A diagram of the human horizontal field of view has been placed over these original photographs to show what the employee would actually see inside the cubicle.

Then we changed the images into six gray tones that represent six zones with similar luminance levels. To get a luminance value for each of the six zones, we used the luminance meter to take a reading within each zone. These measurements can be compared to the surrounding levels to test for visual comfort. A visual comfort ratio of 3:1 is acceptable contrast, 10:1 is noticeable contrast, and 100:1 is dramatic contrast.

For example in figure 26.2, the computer screen is in the brightest zone at approximately 30.1 foot lamberts of luminance, while the edges of the monitor are in the darkest zone at approximately 1.9 foot lamberts of luminance. So the ratio of 30.1:1.9 is approximately 15:1 and is definitely noticeable to the cubicle's occupant. Over an extended period of time this contrast could cause visual discomfort. This ratio is important when it is considered that 98% of the second and fourth floor employees surveyed agreed that they use their computers for more than four hours each day.

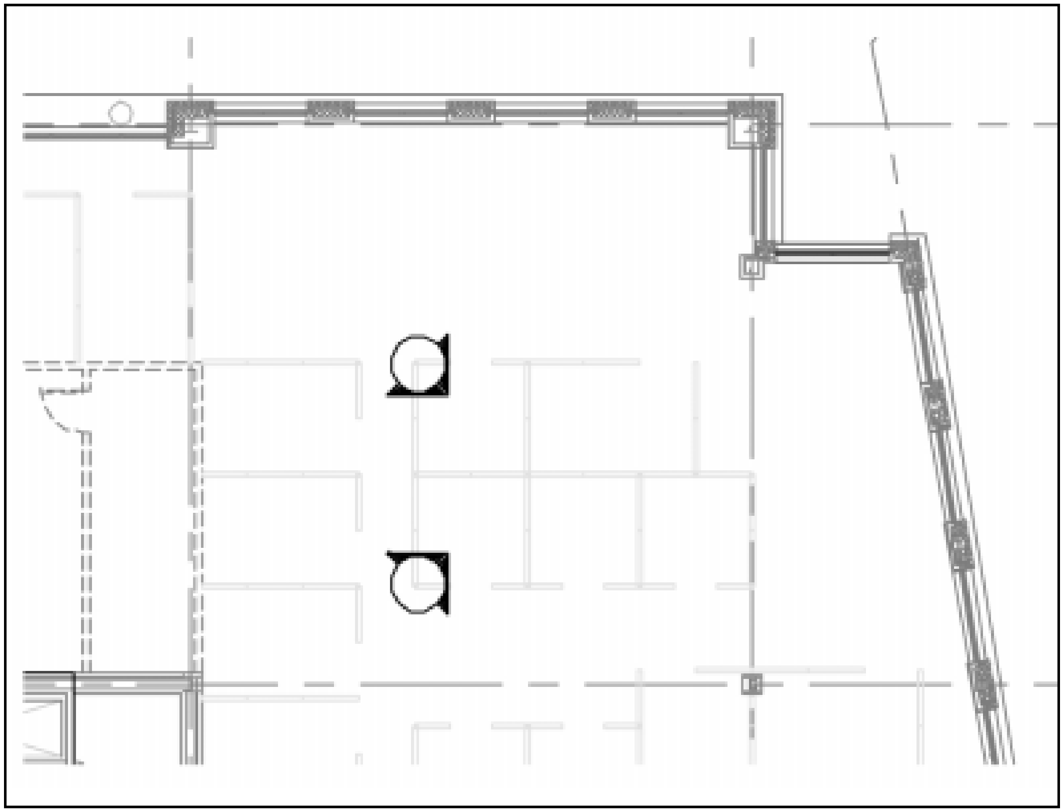

Fig. 27.1: *Map showing approximate locations of the visual fieldmaps on the* ***second floor****.*

Fig. 21.2: *Photograph of* ***second floor*** *workstation showing the visual field of a cubicle occupant.*

Fig. 21.3: *Visual fieldmap of the* ***second floor*** *workstation shown above.*

Appendix B: Fourth Floor Visual Comfort

Fig. 22.1: *Photograph of a **fourth floor** workstation showing the visual field of a cubicle occupant.*

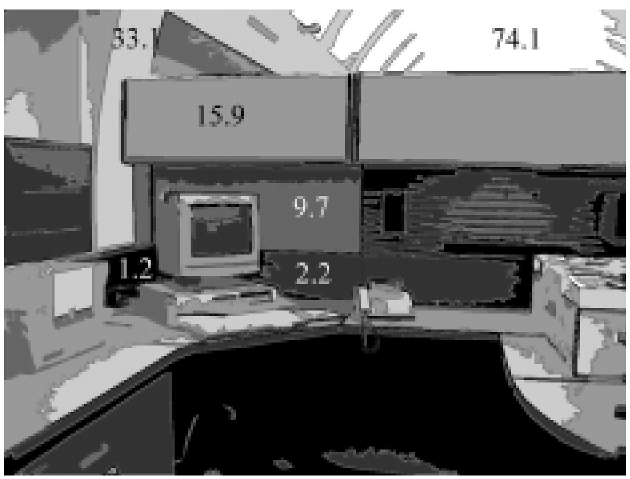

Fig. 22.2: *Visual fieldmap of the **fourth floor** workstation shown above.*

Although we had planned early in the project to perform this field mapping exercise, the layout of the fourth floor cubicles was changed before we had the opportunity to create visual field maps. Because the lighting levels in the new cubicle layout are similar to the levels of the previous layout, we are including visual field maps of the new layout to approximate the previous conditions. Figure 29.1 shows the approximate locations of the visual field maps shown on pages 28 and 29.

Fig. 23.2: *Photograph of a* ***fourth floor*** *workstation showing the visual field of a cubicle occupant.*

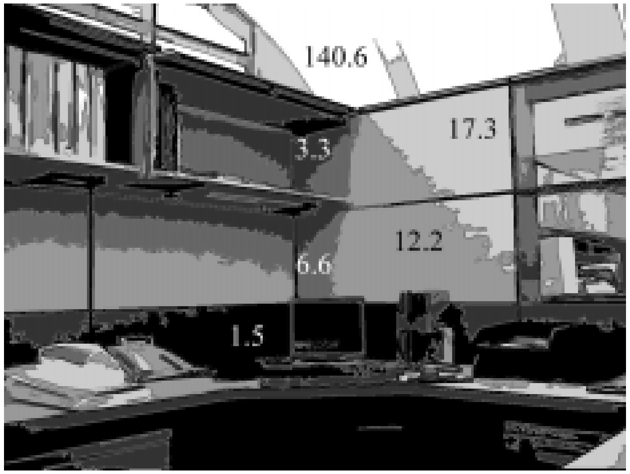

Fig. 23.3: *Visual fieldmap of the* ***fourth floor*** *workstation shown above.*

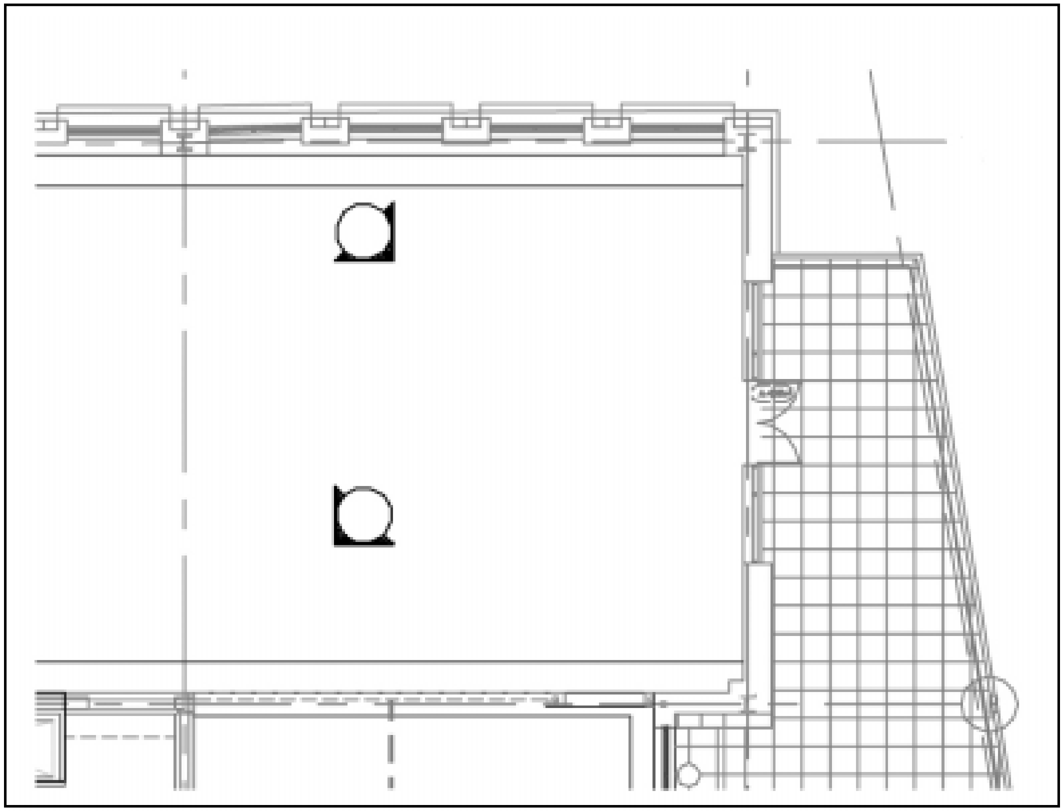

Fig. 29.1: *Map showing approximate locations of the visual fieldmaps on the* ***fourth floor***.

Appendix C: Graph of Total Illumination

The graph shown in figure 24.1 shows the pattern of illumination levels in the second and fourth floor office spaces over a typical workday. This information was gathered by stowaways placed on top of cubicles in the second and fourth floor work-stations. The graph below reinforces our belief that lighting on the fourth floor is consistently twice as great as that on the second floor.

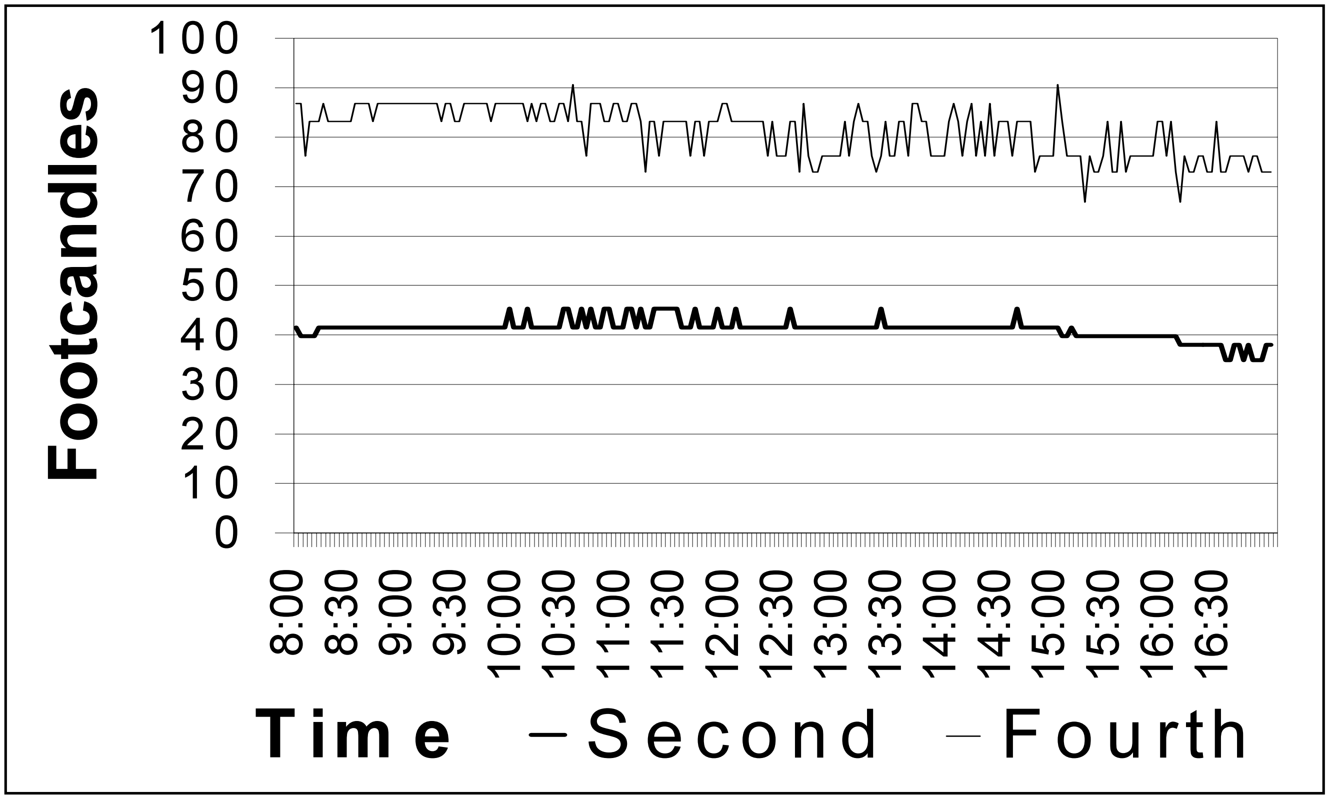

Fig. 24.1: *Graph of Total Illumination*

Appendix C: Graph of Natural Illumination

The graph in figure 25.1 shows estimated illumination levels contributed by daylight in the second and fourth floor office spaces over a typical workday. There is a greater amount of natural light on the fourth floor in the morning when the northeast corner of the building recieves direct sunlight. In the afternoon when both floors recieve only skyvault light, the amount of natural light on the second and fourth floor is similar.

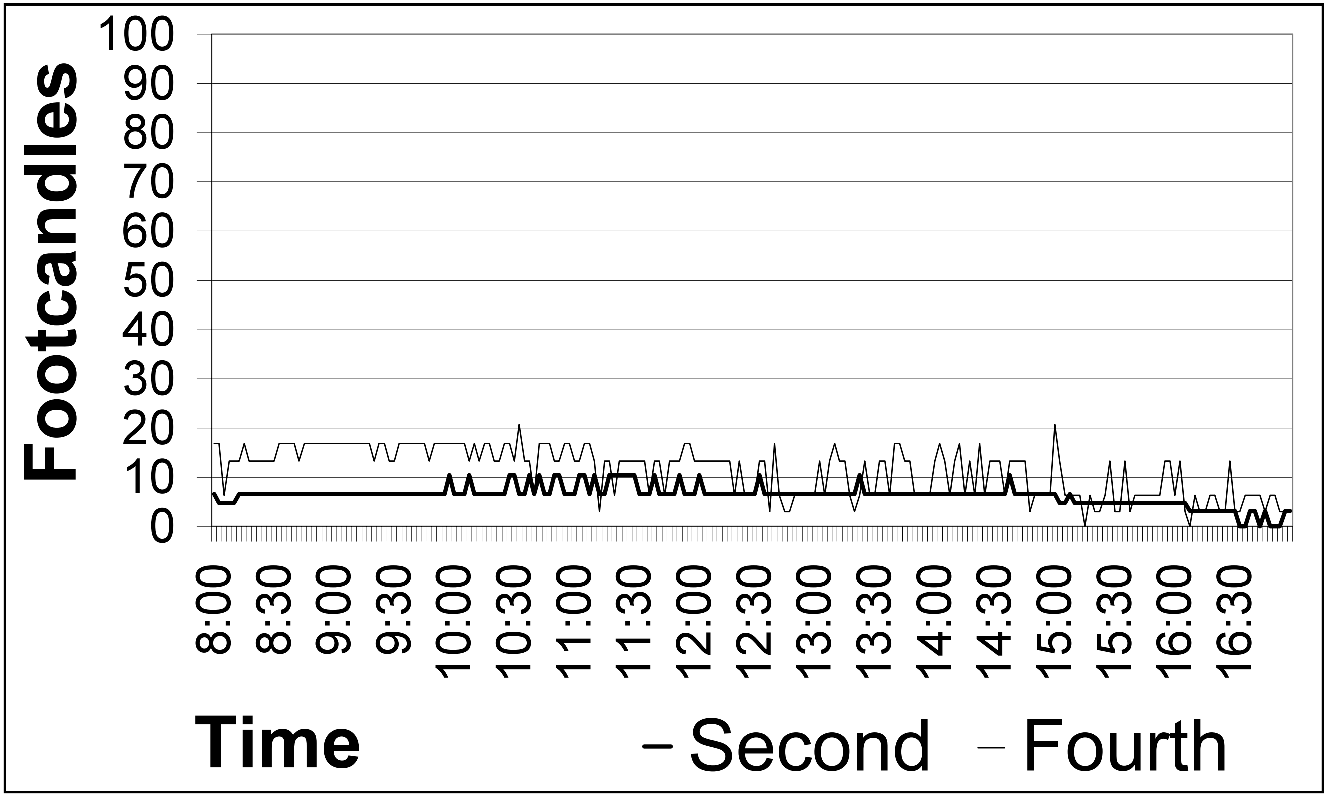

Fig. 25.1: *Graph of Natural Illumination*

Appendix D: Interview with Ron Fisher

Phone Interview with Ron Fisher from Schmidt Engineering, Architect of Record for the NCAA Headquarters

Question 1:

I'll cover some general concepts with lighting, starting with, in its broadest sense, some of the concepts that Michael Graves had.

There are really three building there. The one building your not really looking at is the one that the NCAA doesn't house, the High School Federation does. That is the old Superintendents building. These make up a sort of campus of the three buildings. Conceptually what was envisioned there was that it would really be a small type of campus of buildings that would reflect the specific functions that were going on. In the interview that Michael spoke to that the NCAA liked. There was to be a collegiate feel to these collections of buildings within the park there, in relationship to the client that the NCAA actually serves.

The Hall of Champions is a envisioned as a more public facility. The Great Hall, which is the main space that you walk into, which is nicknamed the Free Hall because you can go into that space without having to pay. It will hopefully prompt you to go into and pay a few dollars to go into the main exhibit area. With the large expanse of glass there, the desire was that there would be clearly during the day the flooding of natural light, but a sense of an inside/outside feel to the space. It would draw people in from the park to that space. There would also be a sense of activity that you would see.

At night, and this is very important, there's a sense of light, that the space itself would actually light, or to use a term that we use is a lantern, that the building, the Great Hall, would become a lantern. There really is no exterior light per se, that is on the building.

As kind of an after fact, something that wasn't part of the design team, the NCAA actually added some floods to flood the face of that building from the ground. That wasn't really the intent. The intent was for the building to glow from the light from within. Actually, from as far back as Washington Street, you could look across the park and see the building glowing as a lantern.

There are large tri-fold type murals that are on that wall, and you can actually see them better at night when the building is lit, and kind of glowing. They have different collegiate sports on these murals that are constantly moving, and you get a sense of activity. Again, this is to draw people into the building, and at night, to give it a sense of presence.

The Grand Hall is envisioned as its own kind of space, from the way it was treated not only architecturally but also with the lighting, and that it would have more of a presence at night, and then again during the day that it would be s naturally lit space with a strong sense of inside/outside.

As you would go into the actual exhibit area of the Hall of Champions, a lot of that lighting became specific to the exhibit and the experiences that were happening there.

There were a couple of consultants that were involved in the design process as well. The concept of the exhibits, the interactive videos, the music score that was developed as unique for that facility and that exhibit, that was all conceptually developed and executed by Seventeen Seventeen out of Richmond, Virginia. They do a lot of exhibit work for the Smithsonian. They did a Cowboy Hall of Fame in Oklahoma City. They were an integral part of working with the architectural and engineering design team in really understanding how the building would work as a concept, and then how the exhibits needed to work.

There was also a lighting consultant that was involved in the project, Fisher, Morantz, Renthrow and Stone, FMRS, out of New York. They worked hand in hand with Seventeen Seventeen, Michael Graves and our office in developing the different designs of some of the different areas.

The exhibit area, the lighting is to reinforce the actual designs of the exhibits and the experience you would have with them. The first space you enter into is the Hall of Honor, with the onyx panels that are back lit, and then up to the second floor gallery into areas that are a little more reminiscent of sports areas, a high tech or industrial kind of feel, as if you were in the underside of a stadium or something like that.

The office building itself, the concepts in the lighting there, really comes back to the notion that the building itself was to be very horizontal. When the NCAA was in Kansas City, they were located in a building that would be very similar to the North Keystone area of Indianapolis, north of 465, where there are just a lot of spec type of office building space or office park. They had their own building that was very closed, almost like law offices, where everyone had their own closed offices. If you needed to go from floor to floor, you took the elevator. They had card access to go from floor to floor, almost in the sense of a lock-down environment, very closed.

What they wanted to do in the new facility was to have a very open environment. I'll say even horizontal. They were trying to change their management structure, the way they interacted to be more interacted and more horizontal. The idea that the building would be very open was the concept that the atrium and the floors would step back and open into the atrium became very important in that concept. While it is a multistory building, people could literally stand at different points of the atrium or the monumental stair and look across and maybe some someone on a different floor, up or down, and meet there in the balcony area of one of the floors and have a quick conference or lot of incidental interaction, that sort of thing.

There are actually two cores to that building, the two monumental stairs at either end. The monumental stair encourages people to move either up or down without jumping into an elevator. Encouraging people to flow up or down through that building easily was very important. For code reasons they have a core fire stairs as well. It was very important that we didn't have a combined stair core that would serve as a fire stair and a communicating stair. We had an open monumental stair so that, again, people would move up and down that building very freely.

With that as the core concept of the atrium space and what that was about, the idea of bringing natural light into that atrium was important to the NCAA. Again, they came from an environment that was much more closed. It was also an environment where everybody had an office with a window. They knew culturally they would have to move away from that where it would be a much more communal space. So a naturally lit atrium became important, so that everybody, in a sense, had their own window, even though, in the open office environment people wouldn't have their own private offices and private window.

The lighting in the Administration building… The atrium is one kind of space, how it is lit, the use of natural light, the conference center and the auditorium clearly have different kind of functions. The way the lighting needs to work there and the controls, the operation of the lighting and all of that.

I might add that as you are looking at the different controls, pre-sets and all of that in that lecture auditorium, you may also want to look at the flat floor conference multi-purpose space because it also has a series of different kinds of lighting arrays in it. In fact, in that space it was kind of important that we create a kind of a custom designed, coiffured light feeling element there, so that they could get some general lighting in the space. But also, then again there are a lot of presets on options on how they can set up the lighting in there for the various functions.

The office spaces themselves have different lighting, with the barrel vaulting and the uniqueness of that. The design notion of lighting, even on that building, was to let the building itself, especially at night, kind of express itself in that lighting. There are not a lot of exterior light fixtures or things like that mounted on the building, and that was intentional, pretty consistent with Graves and they way they would look at design buildings. As you see the building is lit internally, that's how you see it through the windows, the punched openings, the fenestration, that's how it reads, and that was very intentional.

We do have some lighting out in the plaza area. It was important there, with White River State Park, that the site lighting be consistent with the site lighting that had been developed across the park. Susaki was the master planner for the White River State Park, and so they were consultants on the team also, from the site lighting standpoint, just to make sure the fixture types and just the way the lighting was handled be consistent across the park. That was fine with the team. This was also why Graves approached the building with their own elements within this kind of campus and plaza, and the park itself with the lighting as a part of their standards across the park itself work itself across that area.

In terms of some of the technical questions about the light and stuff like that, I really would recommend getting in touch with Charles Stone (Stowe) was the lead person with Fisher, Morants, Renfroe and Stone out of the New York office. Their number is 212-691-3020.

The people with Seventeen Seventeen, and again, they are the ones who worked with the exhibits.

Question 2:
Schmidt Associate, the Architect of Record, which means not only were we certifying the design, we were also the prime contract holder with the state of Indiana. Actually our contract was with White River State Park. They are technically the owner of that facility. The NCAA is technically the tenant of that building. Michael Graves was a consultant to Schmidt Associates. Their responsibility as design architects, our responsibility as Architect of Record, how those duties or responsibilities played out, the conceptual design of that building, and Michael himself was involved with that kind of conceptual design, although he has a group of associates that were really assigned to the project. They know the "book", so to speak, the kit of parts, so to speak, of the vernacular that Michael works with. So conceptually Michael developedthat. But there was an associate that was in charge of the project that really developed those concepts. Their project architect that they had involved with the project, that we interfaced with a lot on a day to day basis…The way that the team worked, and it worked very well, both firms were involved all the way through the project.

There was no black and white as far as them handling the design and then when it came time to developing the construction documents, just handing that over to us, and we took over and that sort of thing… I was involved with them in programming meetings out in Kansas City with the NCAA. We were involved in all design presentations, although the lead at that point was coming out of Michael's office. We were engaged and involved in supporting and developing that.

As that moved into the more technical end of it, we would take more of the day-to-day lead. But they were, again, involved daily with us. They had a group of individuals working very extensively, with the Internet, on drawings moving back and forth. We were very pleased with the level of technical detail that their project architect was involved with and engaged in, working with our archi tects and our team.

That was a very good relationship, it worked well. Even through construction, and again, we were in the lead of that, their individuals were involved on a day to day basis, technically through the development of the documents, were also on site every other week. We really functioned as an integrated team. Again, there were a lot of consultants involved in this project as well, and I have mentioned several of the key ones. Schmidt Associates handled the engineering, with the mechanical, electrical and plumbing engineering on the project. We had a series of specialty consultants that assisted the team.

Bob Koester: The design associate that was in the firm at Graves, you say he was different than the project architect?

Yes, Tom Rowes, an associate with Michael Graves, at the time associate, I believe now he is a partner. The individual that we worked with on a day to day basis, their project architect was Steve Panzarino.

Michael's involvement with the project, any key presentation to White River State Park and the NCAA, Michael was involved with. But once he kind of set the concept in motion, then Tom Rowe really took and developed the design. Working with Steve in our office really kind of brought that to fruition. I think most of you are familiar with Michaels work, there is clearly a style or vernacular that they work with, you could just see that rolling out. We worked hand in hand in terms of developing the structural grid, the basic patterns, back and forth, and how that would develop, and some of the technical issues through that.

They were very involved in terms of the color, both the exterior and interior colors. There is a palate there very much that Michael does influence, and they work with. They are very particular about that.

Question 3:

Actually, in terms of the preset controls, I think that was done kind of jointly with FMRS, and then our electrical engineer that worked on the project. Our particular electrical engineer, he is actually on his own now. His name is David Schuck. He is pretty experienced in theatrical lighting systems. He did a lot of that.

Another player in the project was Browning Construction. Browning Construction was the owners rep. The funding on this project was a combination of private and public dollars. The state provided some of the money. Corporate donations were also provided. That was all spearheaded through the Indiana Sports Corporation. While they weren't technically an owner, they were a player for sure, because they were the group that brokered getting NCAA to come to Indianapolis, and they were able to put up, basically, half of the money through their corporate donations. And they were really charged with running the project of moving NCAA here, that coordination.

As I said, Browning Construction was the owners rep. Their task was watching the dollars and cents. There are parts of that building that are approached as, I'll say a typical spec type office, the way it was budgeted. Some of those things that came to the table went away because they were working in a budget and a scope level of more of a spec office building.

Another person who could really give you some pretty good background on this is a fellow by the name of Greg Shaheen. Greg now works for the NCAA in the basketball championship area.

Greg is also, actually his Mother, is part owner of Long Electric; and Greg himself has a pretty good knowledge of lighting and electrical, and he was the person at the time that actually was working forIndiana Sports Court in coordinating the move of NCAA to Indianapolis. He could provide maybe some background in resources of why decisions were made. He can be reached there at the NCAA.

Question 4:

The fact that they needed to bring in a hydraulic lift

Those things were discussed, yes, like how we were going to clean windows…. I think, in fact I was talking to one of the fellows from REI, and they're looking at maybe getting some longer life bulbs maybe in that atrium space. Those things were discussed. There was, at one point, a building wide dimming and control system for the lighting that was envisioned and discussed. We ended up with a modified version of that, so that they would be able to control lighting. One of the things that was discussed was a central lighting control system that was that would be tied also to the internecine managing system, that they would be able to get longer life on their lighting and make sure they were turning on and off lights at appropriate times and that sort of thing. But that went the wayside of budgets on the initial construction costs.

Question 6:

Bob Koester: We know, going in, that the colors were quite carefully defined. The question that came up last week in the class discussion was whether, knowing that the colors were going to be what they are, how did that play a role in the lamp selection and fixture selection?

FMRS advised on the lamps for the coloration, and it was a consideration, particularly in the office area. Although, I am trying to think…, Greg Shaheen can tell this story. I believe the original lamps that went in the office area were way to pink, and they actually relamped to a different lamp. There is a story there. Greg Shaheen would know that story. Something happened there, and I don't recall which way it went, if they didn't do the original recommended lamping, and went with something else and had to change it or what happened.

Bob Koester: This is an aside, but, how early in the process did you know the inside was going to be canteloupe?

Fairly early. We had some computer rendered drawings that came from Graves office, that were completed before the completion of the documents. In fact, its kind of canny, to sit there in the atrium and look at them, and its what you see right there. That color palette was well understood, clearly by Michael, what was going to happen there. I don't think NCAA fully understood the colors. I know Ced Dempsy didn't fully understand all the colors he was going to get. But that was part of the whole palette that they were going to work with.

One of the things on this project that was a real challenge, this was put on an extremely fast timetable. We were hired by White River State Park in November… The first thing we had to do on that site, there was a steam power plant sitting on that site that had to be torn down. We had to reroute some major high-pressure steam lines. I think they were 36" high pressure steam lines that fed IUPUI and that side of the city, and get that site ready. That was a first effort while we were, one group was doing that while we were programming in Kansas City, and beginning the design, so that we could get a foundation package out to bid that spring. Another thing that was a challenge on this, because portions of the money were public monies, we had to competitively bid the project with public documents. But we were fast-tracking the project. So you didn't know what contractors or who was going to be doing all of the work. But we had to work fast-track, because it was the only way we were going to get this done.

So we had a demolition package work going on immediately while we were programming. We had a foundation package out and the foundation work going in. We didn't, at that point, know the color. But as the design kind of finished itself that spring and through that summer, we had a steel package that went out, that was another package competitively bid so that when the foundations were done, the steel started going up that summer-fall. Because we had to have NCAA moved in that building the summer of 2000. So we had, from the time we started, and literally, by the time we were really underway, we had two years to design, construct and have the client moved in, a little over two years.

There was then a main shell package that was put out for the building shell itself. And then there was a finish-out, like an interior finish-out package. By that point, what we were able to do with that was, we were working with the private monies, so we were able to kind of negotiate more packages and more work at that point, which is what we needed to do to get a lot of that work done.

The point of all that being, is, some of the things you would normally like to do in a design and assessment and evaluation process, wasn't really an option here, because of the timetable and the complexity we were working with.

Now, parallel with all of this, we were working with Seventeen Seventeen developing concepts of the Hall of Champions, the experience of the exhibits, and then they are paralleling that exhibit designs, and how we needed to integrate those things with the building. There were a lot of things going on at the same time. But unfortunately, what suffers in some of that, are some of the longer term issues of life-cycle value and those sorts of things. Clearly there were life-cycle decisions that were passed because of initial budget issues.

Question 7:

There is an E-glass in the atrium space itself, the south-facing window area. We looked at that and analyzed that, and felt that again, with the depth that we had there from the balcony back, and where the office spaces themselves would be, and the nature of that space, that sun control would not be a significant issue for us there. In terms of the windows on the north side of the building, because they were all from the office areas, because they were on the north side, that wasn't considered really as much of an issue there. In fact, it kind of gave them a heads up on this. But again, it was one of these, "Well, lets see when we get in there", the east and west end is where sun control is really needed. And there was sun control then added on those ends of the building.

Stacy D. Stinson: What about the Hall of Champions?

Again, not in that space, because, again, that was really seen as a, I'll say a transitionary space where sun control was not deemed significant. Again, out of the main free hall area, back in the exhibit, that was intentionally designed to not have windows so you could have light control for the different areas.

Question 8:

… of changing and reconfiguring it. Knowing the nature of NCAA, that will probably be a sort of ongoing thing. What was envisioned there originally was a lower partition system, or I'll say a lower being nothing much higher than… certainly not much higher than 60", and actually 48" partition., those sorts of things. That system was different.. I think that was Herman Miller. There were three or four that actually bid on the packages. So it is part of a systems furniture. But I think by the time NCAA was done with things, it probably became pretty customized.

They ended up going in with a lot higher partition panels because it was very difficult for them to…while at the executive level, they were really working to try and change that culture and have the open office. They, quite frankly, made a mistake to, then, let their managers and supervisors have a little too much say in all mistake to, then, let their managers and supervisors have a little too much say in all that because they started getting a lot of inconsistencies and that, and some of that started to break down. So they ended up with a lot higher partitions in that area. It was never envisioned to be that high.

Now, as I understand it, they are going back and they are actually lowering it, they are modifying it by lowering those partitions. It was envisioned to be a lower system, more flexible, and as it rolled out, it became a lot more customized in that process, and I think they are kind of living with that right now.

They really use REI as their facility manager to facilitate all of those things for them. As such, they don't really request much of our services, or to my knowledge, any of the other consultants.

Now, on the exhibits, the plan there was always that there would be, with the videos and the interactive aspect of that, that has a pretty short shelf life. They need to keep that current, or they are not going to have somebody that has visited that and experienced that… they are not going to come back unless there are things that are changing and evolving. NCAA has their own staff that runs the Hall of Champions. That they use Seventeen Seventeen or that sort of thing is really driven at their discretion. My impression is that so far, they haven't been doing much of that. I think White River State Park is wanting to see a little more change in some of those things.

In one sense, I guess that fact that we have not had a lot of call backs is a good thing in that the building has not had too many problems with it. On the other side of it, though, we normally, at least in our office, we are use to having probably a little closer on going relationship with clients. We do a lot of K-12 school work and university institutional work. We tend to have longer ongoing relationships. This is more of a one of a kind sort of project. That linkage isn't as strong as what we normally have in our office.

Question 10:

I would probably start with Steve Panzirino. I think he is going to be the most accessible.

The number and name for Seventeen Seventeen is John Crank, the principle with Seventeen Seventeen. Their phone number is 804-644-1717 and they are out of Richmond, VA.

Appendix D: Interview with Ron Fisher