



**Indoor Environmental Quality + Workplace Environment  
MnDOT Rochester District 6 Headquarters Remodel  
Rochester, MN**

**June 2018, Minneapolis, MN  
Sustainable Post-Occupancy Evaluation Survey (SPOES)  
B3 Guidelines**

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## 1.0 Overview

The purpose of this report is to examine the connection between sustainable design criteria used in the design and remodeling of the MnDOT Rochester District 6 Headquarters facility and occupants' satisfaction with their work environments located in the facility. This report communicates responses from employees about the overall facility and their workplace (WP). The facility was designed using the B3 Guidelines (formerly known as the Minnesota Sustainable Building Guidelines or MSBG), which were in effect at the time that the renovation and addition were funded. It was completed for occupancy in February 2016. The B3 Guidelines track specific state-funded, B3 buildings as a means of demonstrating real outcomes aimed at the conservation of energy resources, creation and maintenance of healthy environments, and occupants' satisfaction with their work environments. The Sustainable Post-Occupancy Evaluation Survey (SPOES) was developed to assess human outcomes in workplace, classroom, and residence hall settings in compliance with the B3 Guidelines project tracking requirements. This is a report of occupants' (hereafter called employees) responses from the survey conducted in February 2018.

This SPOES report focuses on employees' satisfaction with the physical environment as related to 26 indoor environmental quality (IEQ) criteria such as lighting, thermal, and acoustic conditions in their primary workspaces, i.e., offices. Employees' satisfaction with the facility (site, building, and interior) and the effect of the facility's physical environment on their perceptions of their work performance and health also are included. Finally, a brief look at employees' commuting and physical activities within the building are reported. The report provides descriptive information about employees' perceptions of the IEQ of their work environments. In addition, this information serves the broader development of knowledge regarding the influence of IEQ on employees.

## 2.0 Method

SPOES consists of a self-administered, Internet-based, questionnaire submitted to and completed by employees. The SPOES questionnaire has been tested for **validity** (measures what it is intended to measure) and **reliability** (repeatability or replicability of findings). Employees rate their level of satisfaction on a **Likert-type scale** (measurement scale) from 1 (very dissatisfied) to 7 (very satisfied) with IEQ of the facility and their primary workspaces. They also rate the influence of their physical environment on their perception of their work performance and health on a scale from 1 (hinders) to 7 (enhances).

The report provides a descriptive summary of the results stated as a **mean** (average of all responses), **standard deviations** (SD) (how different scores are from each other and the mean), and **number of responses** (N) for each question analyzed. The mean for a 7-point scale is 4.00. Lower or higher means reflect stronger tendencies towards dissatisfaction/satisfaction and hinders/enhances. Means that are close to the center of the scale (4) are considered to be neither dissatisfied/hinders or satisfied/enhances.

When interpreting **mean** responses, the following labels were used:

- 1.00 - 3.50 dissatisfied (or hinders)
- 3.51 - 4.50 neither dissatisfied (or hinders) nor satisfied (or enhances)
- 4.51 - 7.00 satisfied (or enhances)

An IEQ Score is also calculated for employees' satisfaction with IEQ criteria in their primary workspaces. This is a statistical combination of all category-level (explained below) IEQ scores, which results in a single IEQ score for all respondents and is reported in an IEQ Scorecard.

## 2.1 Description of the Questionnaire

Employees first rate their level of satisfaction with the facility (site, building, and interior) and the influence of their physical environment on their perception of their work performance and health. Then they respond to questions about their satisfaction with their primary workspaces in relation to IEQ criteria from the B3 Guidelines. Additionally, employees' demographic, physical activity, and commuting practice data are collected to provide context for the study.

In the SPOES questionnaire, the 26 IEQ criteria listed below are evaluated. There are two levels of criteria, categories and attributes. As shown in the list, the 'overall' criteria are boldfaced and called 'categories' or 'category level' criteria. A category is broader or more general such as Overall View Conditions or Overall Indoor Air Quality. Some categories have 'attributes' or 'attribute level' criteria and provide greater detail about the category. For example, Overall Thermal Conditions is a category level question, and there are four attribute level questions related to thermal conditions such as adjustability, air velocity (draft), humidity, and temperature. Overall Acoustic Conditions is a category with attributes of employees' ability to hear desired sounds and their ability to limit undesired sounds. There are 12 category-level and 14 attribute level questions. Means are calculated and reported for all category and attribute-level criteria.

An IEQ Satisfaction Score is also calculated for employees' satisfaction with IEQ in their primary workspaces. This is a statistical combination of the 12 category-level criteria only and results in a single, mean IEQ Satisfaction Score for all employees' satisfaction with the physical conditions of their primary workspaces. Attribute-level criteria are not included in the IEQ Score because unequal weight would be given to criteria that have both category and attribute-level questions.

In the following list, **category (boldface)** criteria are listed in alphabetical order. If a category has attributes, they are listed with the category.

### **Overall Acoustic Quality**

- Ability to hear desired sounds
- Ability to limit undesired sounds

### **Overall Appearance (aesthetics)**

### **Overall Cleaning and Maintenance**

### **Overall Daylighting Conditions**

- Amount of daylighting
- Adjustability of daylighting

### **Overall Electric Lighting Conditions**

- Amount of electric lighting
- Adjustability of electric lighting
- Adjustability of task lighting

### **Overall Furnishings**

- Function of furnishings
- Adjustability of furnishings

### **Overall Indoor Air Quality**

### **Overall Privacy**

### **Overall Technology**

- Access to electric outlets

### **Overall Thermal Conditions**

- Adjustability of thermal conditions
- Air velocity (drafty/stagnant)
- Humidity (dry or moist)
- Temperature (hot or cold)

### **Overall Vibration and Movement**

### **Overall View Conditions**

## 2.2 Limitations

Employees' participation is voluntary, and responses are self-reported. As is true with all survey research, the responses indicate employees' perceptions. There were no physical measurements, e.g., temperature, humidity, or lighting levels of the environment taken. This study is limited to employees' perceptions.

## 3.0 Sample Description

### 3.1 Description of Building

The MnDOT Rochester District 6 Headquarters is located at 2900 48<sup>th</sup> Street NW, Rochester, MN. The building (see Figure 1) is a three-story (plus a mechanical room below grade), 121,920 square foot building that is home to MnDOT staff, the Southern Regional Traffic Management Center (SRTMC) staff, and State Patrol staff. To support staff, the workplace includes office and conference space, support areas, locker room, cafeteria space, and storage.



Figure 1. MnDOT Rochester District 6 Headquarters. (Photo courtesy of MnDOT)

### 3.2 Project Team

The relevant project team members to the SPOES process for the MnDOT Rochester District 6 Headquarters Remodel was comprised of the owner, design team, and commissioning agent, and general contractor. They are identified below, relative to their capacity and involvement.

Owner	MN Department of Transportation (MnDOT)
Architect	BWBR
Mechanical and Electrical Engineer	Dunham Associates
Interior Designer	BWBR
Landscape Architect	Kimley Horn
Commissioning Agent	Dunham Associates
General Contractor	Knutson Construction

### 3.3 Description of Respondents

This survey was administered to 192 employees with workspace in the facility during February 2018. The response rate to the questionnaire was approximately 65%. Of those responding, 74% were male and 26% were female. The mean age of respondents was 47 years, with a range from 23-66 years of age.

The MnDOT Rochester District 6 Headquarters Remodel was completed and ready for operation in February 2016. Since that time, 84% of the respondents reported that they worked at the MnDOT Rochester District 6 Headquarters facility for more than two years, 7% of the respondents reported that they worked at the MnDOT Rochester District 6 Headquarters facility for 1-2 years, and 9% of the respondents spent less than one year at this facility. Relating to hours worked during a typical week at the MnDOT Rochester District 6 Headquarters, 35% of the employees reported they spend 40+ hours a week in the facility, 50% spend 30-40 hours a week at the MnDOT Rochester District 6 Headquarters, less than 9% spend 20-29 hours at the facility, and over 6% work there less than 20 hours per week.

Relating to the time employees spend per week in their primary workspace, 51% of the employees reported they spend more than 75% of their weekly time in their primary workspace; over 28% spend 51-75% of their time in their primary workspace; 13% spend 25-50% of their time in their primary workspace; and 8% spend less than 25% of their time in their primary workspace. These responses indicate the amount of time employees are exposed to IEQ conditions in their workplace environment.

The MnDOT Rochester District 6 Headquarters is a workplace with private offices; enclosed shared offices; workstations (cubicles) with both low and high partitions, workstations that are comprised of a work surface without partitions, work areas in a lab, and specialized workstations in the command center (i.e., the SRTMC), all serving as primary workspaces. Nearly 38% of employees indicated that their primary workspaces were located within 15 feet of an exterior window, nearly 61% of the employees were not within 15 feet of an exterior window, and under 2% were not sure how far they were from an exterior window.

## 4.0 Findings and Discussion

### 4.1 MnDOT Rochester District 6 Headquarters Facility (Site, Building, and Interior): Overall Satisfaction, Work Performance, and Health

Employees responded to questions concerning the MnDOT Rochester District 6 Headquarters facility (site, building, and interior) and their overall satisfaction with the facility, overall perceptions of their work performance in relation to the facility, and their overall perception of their health in relation to the facility. Table 1 shows the means and standard deviations of their responses as well as how the responses are interpreted. Figure 2 is a graph that shows the mean for each question, which is identified with a blue mark. The standard deviation is shown by the green/red vertical bar with green representing satisfied (or enhanced) and red representing dissatisfaction (or hindered). Gray represents the 'neither/nor' range of responses. In cases where there were no dissatisfied responses, the bar may be all green or gray and green. This graph is simply a visual image of the findings from Table 1.

Table 1 MnDOT Rochester District 6 Headquarters facility - overall satisfaction, work performance, and health

Overall	Mean	SD	N	Interpretation
Satisfaction	5.06	1.44	125	Satisfied
Work Performance	4.61	1.44	125	Enhanced
Health	4.67	1.31	125	Enhanced

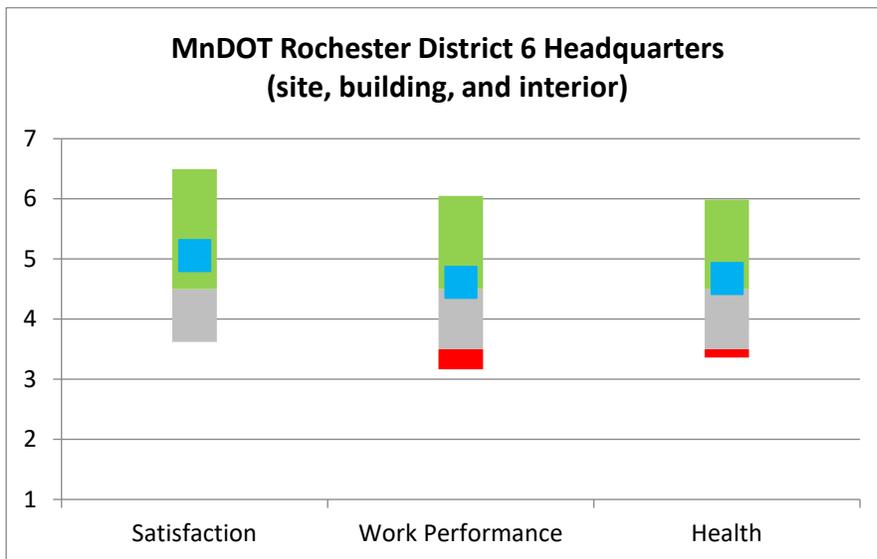


Figure 2. MnDOT Rochester District 6 Headquarters facility - overall satisfaction, work performance, and health

Results indicate that employees were **satisfied (M = 5.06)** with the physical environment of the MnDOT Rochester District 6 Headquarters facility (building, site, and interior) and reported that their overall work performance was **enhanced (M = 4.61)** by the facility. Employees reported that their overall health was **enhanced (M = 4.675)** by the facility.

#### 4.2 Primary Workspace: Overall Satisfaction, Work Performance, and Health

Employees responded to questions concerning their overall satisfaction and overall perceptions of their work performance and health as related to their primary workspace (e.g., private office, workstation, or other primary workspace). Table 2 shows the means and standard deviations of their responses as well as how the responses are interpreted. Figure 3 is a visual image of the findings from Table 2; an explanation of the graph was given for Figure 2.

Table 2. MnDOT Rochester District 6 Headquarters primary workspace – overall satisfaction, work performance and health

Overall	Mean	SD	N	Interpretation
Satisfaction	4.59	1.63	123	Satisfied
Work Performance	4.65	1.44	124	Enhanced
Health	4.67	1.21	124	Enhanced

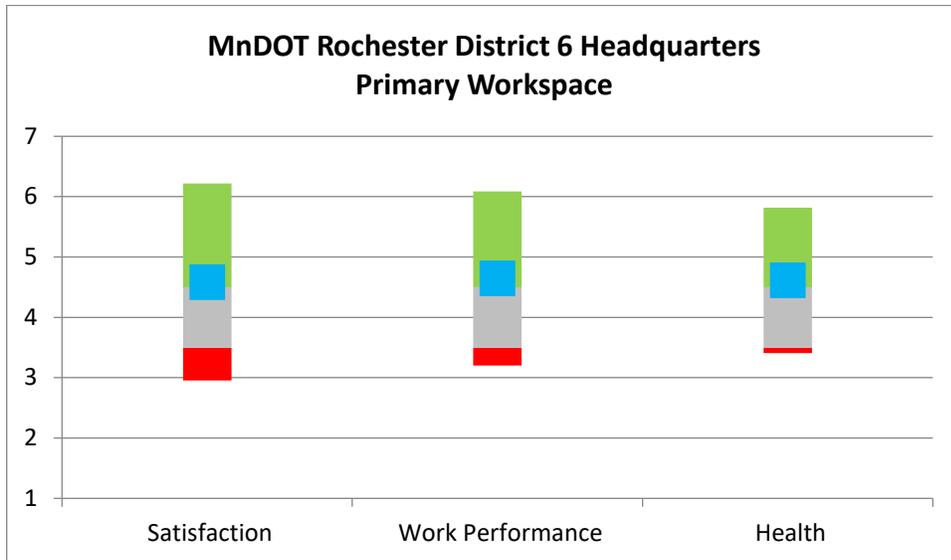


Figure 3. MnDOT Rochester District 6 Headquarters primary workspace - overall satisfaction, work performance, and health

Results indicate that employees were **satisfied (M = 4.59)** with their primary workspace, their overall work performance was **enhanced (M = 4.65)** by their primary workspace, and their overall health was **enhanced (M = 4.61)** by their primary workspace.

#### 4.3 Primary Workspace: Satisfaction with Indoor Environmental Quality (IEQ)

Employees responded to questions concerning their satisfaction with IEQ categories (thermal conditions, indoor air quality, acoustic conditions, etc.) related to their primary workspace (e.g., private office, workstation, or other primary workspace). Table 3 shows the means and standard deviations of their responses from highest to lowest mean, as well as how the responses are interpreted. Figure 4 is a visual image of the findings from Table 3; an explanation of the graph was given for Figure 2.

Table 3. MnDOT Rochester District 6 Headquarters primary workspace - satisfaction with IEQ criteria

#	IEQ Criteria (1-26) (Category level criteria are <b>bold face</b> )	Mean	SD	N	Interpretation (D = Dissatisfied) (S = Satisfied)
1	<b>Overall technology</b>	5.41	1.33	122	Satisfied
2	<b>Overall vibration and movement</b>	5.28	1.51	122	Satisfied
3	<b>Overall cleaning and maintenance</b>	5.25	1.65	122	Satisfied
4	<b>Overall indoor air quality</b>	5.20	1.58	119	Satisfied
5	<b>Overall appearance (aesthetics)</b>	5.16	1.51	122	Satisfied
6	Function of furnishings	5.08	1.60	122	Satisfied
7	Amount of electric light	5.07	1.46	121	Satisfied
8	<b>Overall furnishings</b>	5.02	1.50	122	Satisfied
9	Adjustability of task lighting	4.86	1.59	120	Satisfied
10	Adjustability of furnishings	4.85	1.81	122	Satisfied
11	<b>Overall electric lighting conditions</b>	4.84	1.59	122	Satisfied
12	Air velocity (drafty or stagnant)	4.73	1.65	121	Satisfied
13	Humidity (dry or moist)	4.63	1.62	122	Satisfied
14	Access to electric outlets	4.57	1.77	122	Satisfied
15	<b>Overall daylighting conditions</b>	4.51	1.90	122	Satisfied
16	Amount of daylighting	4.49	1.97	121	Neither S or D
17	Ability to hear desired sounds	4.39	1.87	122	Neither S or D
18	<b>Overall thermal conditions</b>	4.29	1.82	122	Neither S or D
19	Temperature (hot or cold)	4.13	1.80	122	Neither S or D
20	Adjustability of task lighting	4.02	1.88	121	Neither S or D
21	<b>Overall view conditions</b>	4.02	2.09	122	Neither S or D
22	Adjustability of daylighting	3.89	2.09	122	Neither S or D
23	<b>Overall acoustic quality</b>	3.49	1.98	122	Dissatisfied
24	<b>Overall privacy (sound and visual privacy)</b>	3.30	2.02	122	Dissatisfied
25	Ability to limit undesired sounds	3.20	1.98	122	Dissatisfied
26	Adjustability of thermal conditions	3.15	1.91	121	Dissatisfied

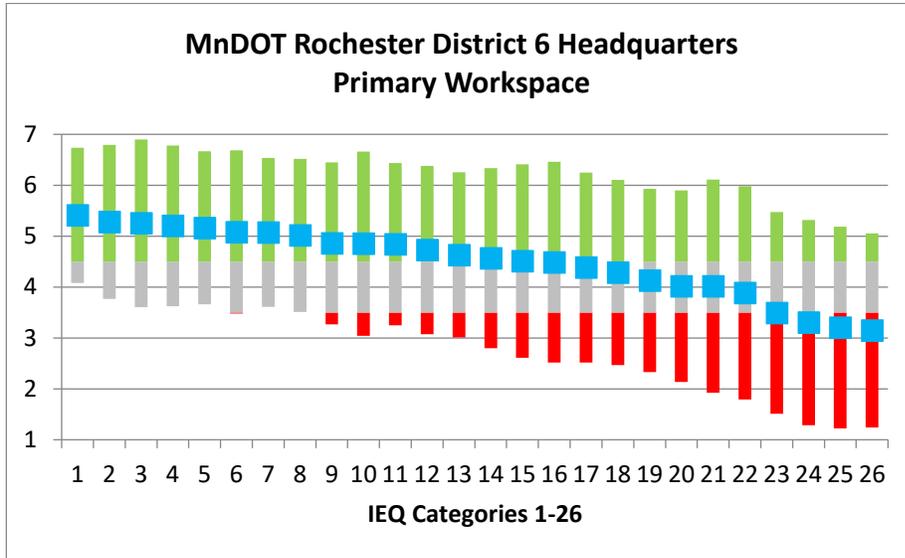


Figure 4. MnDOT Rochester District 6 Headquarters primary workspace - satisfaction with IEQ criteria (IEQ 1-26 refer to Table 3)

Results indicate that employees were **satisfied** with 15 of the IEQ criteria in their primary workspaces, i.e., means at or above 4.50. Employees were **neither satisfied nor dissatisfied** with 7 IEQ criteria, ranging from a mean of 3.89 (adjustability of daylighting) to 4.49 (amount of daylighting). Employees were **dissatisfied** with 4 of the IEQ criteria, ranging from a mean of 3.15 (adjustability of thermal conditions) to 3.49 (Overall acoustic quality). The criteria in the ‘neutral’ satisfaction range should be considered for change in addition to those in the dissatisfied range; together they comprise 11 of the 26 IEQ criteria. Potential for change will be addressed in Section 6.2 Recommendations. Further explanation of these scores also can be found in Appendix A. Open-Ended Responses.

#### 4.4 IEQ Satisfaction Scorecard

The IEQ Satisfaction Score is determined by calculating a mean of the 12 ‘Overall’ category level IEQ criteria. At this time, criteria are weighted equally in this calculation as little evidence exists that provides rationale for weighting some criteria heavier than others. The IEQ mean is representative of a fair overall IEQ score and can serve as a benchmark of employees’ satisfaction with the physical environment of their primary workspace. As shown in Figure 5, the **IEQ Satisfaction Score** for the MnDOT Rochester District 6 Headquarters is **4.65**, which falls in the lower quadrant of the satisfied range, i.e., a moderately low satisfied IEQ Score.



Figure 5. MnDOT Rochester District 6 Headquarters primary workspace - IEQ Satisfaction Score

As shown in Table 3, satisfaction with the Overall technology, Overall vibration and movement, Overall cleaning and maintenance, Overall indoor air quality, and Overall appearance (aesthetics) were the categories with the highest satisfaction means (5.16 or higher) and pulled the IEQ Satisfaction Score in a positive direction. Additionally, two other mean scores were relatively high, with scores between 5.02 (Overall furnishings) and 4.84 (Overall electric lighting conditions). With a score of 4.51, Overall daylighting conditions was at the lowest score within the satisfied range (4.51-7.0). Of the remaining four mean scores, two were in the neutral range at 4.29 (Overall thermal conditions) and 4.02 (Overall view conditions); the remaining two fell into the dissatisfied range, with scores of 3.49 (Overall acoustic quality) and 3.30 (Overall privacy, sound and visual). These four lower scores out of 12 category-level criteria pulled the IEQ Score down. Please note that the IEQ Satisfaction Score only uses the category level criteria (those labeled ‘Overall’; see section 2.1, paragraph 3 for explanation).

### 5.0 Physical Activity Engagement and Commuting Practices

In the final section of the survey, employees responded to questions regarding their overall physical activity while at MnDOT Rochester District 6 Headquarters (site, building, and interior) and their commuting practices.

#### 5.1 Physical Activity Engagement

Providing employees with opportunities for alternative paths of travel around the workplace, e.g., taking stairs as opposed to the elevator, provides opportunities to engage in additional types of physical activities. Engaging in physical travel throughout the work environment can be associated with healthier lifestyles.

Table 4. Overall physical activity (walking, stair use, etc.) affected by the MnDOT Rochester District 6 Headquarters facility

MnDOT Rochester District 6 Headquarters (site, building, and interior)	Mean	SD	N	Interpretation
Overall physical activity (walking, stair use, etc.)	4.74	1.23	121	Enhanced

Results indicate that employees felt that MnDOT Rochester District 6 Headquarters **enhanced** (**M = 4.74**) their physical activities (walking, stair use, etc.).

## 5.2 Commuting Practices

MnDOT Rochester District 6 Headquarters is located on 48<sup>th</sup> Street NW, accessible via the West Frontage Road of Hwy 52 in the northern quadrant of the city of Rochester. Access to the West Frontage Road is from either the 37<sup>th</sup> Street or 55<sup>th</sup> Street exits. A Rochester Public Transit bus stop is adjacent to the building site and on-site parking is available.

Table 5 provides results on employees’ primary mode of transportation; Table 6 summarizes commuting distances between home and the MnDOT Rochester District 6 Headquarters facility; and Table 7 summarizes employees’ ability to commute using alternative choices (walk, public transit, bike, van, or carpool, etc.). These results, although not related to IEQ, do offer insight into employees’ commuting behaviors and opinions. These data can provide important information about commuting practices that can reduce transportation energy consumption.

Table 5. Commuting Practices – MnDOT Rochester District 6 Headquarters Primary mode of transportation

Primary Mode of Transportation (N=121)	Drive Alone (or w/children <16)	Van or Carpool	Motorcycle or Moped	Bicycle	Walk	Other
Commuting to MnDOT Rochester District 6 Headquarters	92%	<2%	<1%	<1%	<1%	4%

Related to primary modes of transportation, 92% of employees drive alone (or with children under 16) with 4% using modes of transportation other than those listed and other means of commuting (i.e., van or carpool, riding a motorcycle, moped, or bicycle) to minimal degrees. No employees used public transportation or telecommute to work. (Please note that due to rounding the total may not add up to 100%.)

Table 6. Commuting Practices – MnDOT Rochester District 6 Headquarters Commuting distance traveled

Miles Traveled (N=123)	0-5	6-15	16-30	31-45	46-60	61-75	>75
Home-to-MnDOT Rochester District 6 Headquarters (One-way)	31%	30%	21%	9%	7%	2%	<1%

Results indicate that 61% of employees commuted 0-15 miles one-way between home and the MnDOT Rochester District 6 Headquarters, followed by 21% who commute 16-30 miles. Far fewer employees commuted greater distances with 9% who commute 31-45 miles, 7% who commute between 46-60 miles, and less than 3% who commute 61 or more miles to the MnDOT Rochester District 6 Headquarters facility. These are one-way miles. (Please note that due to rounding the total may not add up to 100%.)

Table 7. Commuting practices – MnDOT Rochester District 6 Headquarters location and alternative commuting behaviors

Alternative Commuting	Mean	SD	N
Ability to commute in alternative ways	3.80	1.85	123

Results indicate that location of the MnDOT Rochester District 6 Headquarters **neither enhances nor hinders (M = 3.80)** employees’ ability to commute to work in alternative ways, e.g., walk, bicycle, public transit, van or carpool, etc.

## 6.0 Conclusions

### 6.1 Summary

A post-occupancy evaluation was conducted of employees of the MnDOT Rochester District 6 Headquarters at approximately 24 months after it was first occupied. This MnDOT Rochester District 6 Headquarters facility is used as office space for MnDOT, SRTMC, and State Patrol staff. This survey reports responses from employees and their satisfaction with the physical environment of the facility and their primary workspace. Results indicate that over 85% of employees spend more than 30 hours per week in the MnDOT Rochester District 6 Headquarters facility, and approximately 79% of employees spend more than 50% of their time at the MnDOT Rochester District 6 Headquarters in their primary work space.

The survey included questions related to employees’ satisfaction with the facility (site, building, and interior) and influence of the facility on their work performance and health. Employees were **satisfied** with the facility (**M = 5.06**); they found the facility **enhanced** their work performance (**M = 4.61**) and **enhanced** their health (**M = 4.67**). In addition, similar results were reported when employees were asked these same questions about their primary workspaces (private office, shared office, workstations, etc.). They reported **satisfaction (M = 4.59)** with their primary workspaces, that their work performance was **enhanced (M = 4.65)**, and their health was **enhanced (M = 4.61)** by their primary workspace. As the range of scores was from 1-7, scores showed a moderate level of satisfaction with the facility and a lower range of satisfaction with the primary workspace and enhancement with the facility and the primary workspace. (The satisfaction/enhancement range is 4.51-7.00.)

Most of the survey questions related to employees’ satisfaction with the IEQ criteria in their primary workspaces (private office, workstations, etc.). Employees’ responses showed they were **satisfied** with the 15 of the 26 IEQ criteria. The mean satisfaction scores ranged from **4.51** (Overall daylighting conditions) to **5.41** (Overall technology). Again, this shows a somewhat moderate positive level of **satisfaction**. Employees responded **neither dissatisfied nor satisfied** to 7 IEQ criteria, with mean satisfaction scores ranging from 3.89 (adjustability of daylighting) to 4.49 (amount of daylighting). An additional 4 IEQ criteria feel within the dissatisfied range. Those mean satisfaction scores ranged from **3.15** (adjustability of thermal conditions) to **3.49** (Overall acoustic quality).

From employees’ responses, an IEQ Score was developed and shows respondents’ satisfaction with the majority IEQ of all category level criteria. For the MnDOT Rochester District 6 Headquarters, the IEQ Satisfaction Score was **4.65**. This score reflects the influence of the moderate satisfaction level of 8 of the 12 categories, the neither satisfied nor dissatisfied level of 2 of the IEQ categories, as well as the

dissatisfied level of the remaining 2 categories. Finally, employees reported that the MnDOT Rochester District 6 Headquarters **enhanced (4.74)** their physical activity, which is one of the sustainable design criteria that influences occupant behavior.

It seems obvious that employees' satisfaction can be improved by addressing the categories that had 'neither dissatisfied nor satisfied' or 'dissatisfied' scores. However, the rest of the criteria would benefit from some attention as well. The following recommendations can help address change in these criteria to further improve employees' satisfaction. Exploring these areas in more detail and making adjustments may increase overall satisfaction at the primary workspace. It must be noted that the expense of building and operating a facility is second only to employee-related expenses over the life of the building. Therefore, maintaining or improving employees' satisfaction is a sound investment, which, in turn affects their performance and their health.

This study investigated employees' satisfaction with the facility and primary workspaces. IEQ satisfaction is individual, but the results of the survey show a central tendency of moderate satisfaction with the facility and most of the IEQ categories. The results can be used as a diagnostic tool to aid in improving IEQ conditions for employees and to set the benchmarks from which improvement can be measured in the future.

## **6.2 Recommendations**

Several IEQ criteria satisfaction scores are in the positive direction, however, improvement on the 'neutral' and 'dissatisfied' criteria may be possible. For IEQ categories that can be physically measured (e.g., thermal, acoustic, and lighting), it is recommended that these measurements be taken in the primary workspaces. Specific recommendations for the most common areas of occupants' concern follow:

### **Acoustic Conditions**

- Identify acoustic criteria for overall requirements.
- Determine if any task areas differ now from their original spatial layout/use (i.e., collaborative work spaces now located adjacent to focused work areas, individual workstations).
- Develop specialized acoustical performance requirements to support functional programming employees' tasks (e.g., sources of recurrent noise that need to be controlled, special user populations that may have distinct auditory performance limitations, or multiple uses of building spaces that may have different acoustic criteria). Identify and apply appropriate acoustics modeling software for the project.
- Measure acoustic performance onsite with full building systems (heating, ventilation, and air conditioning) running.
- Identify employees' privacy concerns via focus groups and/or log complaints relative to acoustical conditions for further evaluation.
- Consider employees' tasks within shared spaces to determine if spatial layout changes can be made for increased acoustic control.

### **Lighting Conditions**

- Identify employees' lighting performance criteria that are to be met to achieve goals by conducting onsite measurements of existing illumination and compare them to standards for employees' tasks as identified by the Illuminating Engineering Society (IES).

- Determine if any task areas differ now from original intent to be sure illumination level and quality of lighting are not impeded by physical changes to the space (i.e., walls, ceilings, furnishings, fixtures, or equipment).
- Develop additional quality lighting criteria as needed for special facility (e.g., influence of daylight quality or quantity) or employee (e.g., age, task duration) issues.
- Log complaints related to lighting conditions for further evaluation.
- Identify poor lighting conditions in the workspace caused by a lack of control over daylighting, which can cause glare and eyestrain.

### **Personal Adjustability**

- Determine what adjustability issues arise with temperature, lighting, or furnishings via a focus group.
- Identify personal, individual problem areas and relate them to other IEQ issues via a log of complaints relative to adjustability.
- Provide education to employees about any existing/achievable adjustment options (e.g., furnishings, air diffusers, lighting, temperature control, etc.)

### **Privacy Conditions**

- Identify employees' privacy concerns via focus groups or log complaints relative to privacy to determine if visual or audio privacy is most affected.
- Determine if any task areas or responsibilities differ from original intent and develop alternatives or modifications.
- Consider adding noise masking equipment and/or visual screening depending on the nature of the complaints.
- Document and compare acoustic privacy problem areas with acoustic measurements to pinpoint specific problem areas.

### **Thermal Conditions**

- Measure thermal performance conditions on site.
- Log complaints related to thermal conditions for further evaluation.
- Determine special thermal comfort requirements or problems that may be encountered in the building due to physicality of work activities, duration of sitting, or design/layout considerations. Focus groups can be useful in identifying problem locations.
- Determine if any employees' task areas differ now from original layout to determine if air flow is meeting systems design intent.
- Review conditions that affect thermal comfort using the applicable version of ASHRAE Standard 55, or Human Factors Design Handbook (see B3 Guidelines). For additional information, consider reviewing Human Factors and Ergonomics Design Handbook, Third Edition (2016), by Barry Tillman, published by McGraw-Hill, NY.

## Appendix A. Open-Ended Responses

Employees had the opportunity to raise specific concerns on the overall facility and their primary workspaces. Important information can be gleaned from the open-ended survey responses. The MnDOT Rochester District 6 Headquarters employees raised many general and very specific concerns about the following themes: accessibility, acoustics and privacy, cleaning and maintenance, electrical lighting and daylighting, furnishings, indoor air quality, space planning and amenities, technology, and thermal conditions. These qualitative responses appear as if the employees are dissatisfied with some features; however, it does not mean they represent the overall sentiment from employees. However, the comments do give insight into specific issues that could be addressed by building management. The comments from the employees are provided below.

### Overall Positive/Negative

- Overall, I am very grateful to have such a nice working environment.
- Overall, I am pleased.
- Overall, I like the new building.
- Great improvement!
- The remodel was nicely done and is a great place to work! Thank you!
- Safe environment, clean and inviting.
- Very nice work space
- Stupid outdated design.
- Sound proof, temperature control, dimmer light control. [unclear if features are positive or negative]
- Overall, the [MN State Patrol] work environment is great.
- There doesn't seem to be much of an open mind allowing changes in our area to potentially suit our needs as a department better. There are also inter office areas working in our area with talk of more coming in the future, further limiting our work area. Overall, I am mostly pleased with my work space and look forward to another 30 years working with MnDOT.
- To an outsider, the new Dispatch Center is an impressive workspace with new furniture and electronics that must be similar to what they see on TV and movies. However, to those of us who need to work in the environment, it's clear that the workspace was not created with Public Service/Emergency dispatching in mind. The noise, temperature and daylighting issues cause problems that, to date, have not been fully rectified.
- Many nice features but it is an old building with retrofit windows that are not perfect.
- The office environment is not conducive to my job at all.
- Where to start?
- So, did they junior employees work on this?
- I feel at times that those of us that work in a 365/24/7 environment are forgotten about.
- This was a very needed. The work brought our work spaces up to today's standards, much the way we do with communities and their ADA needs along the state highways. The improvements are good, but the key will be to continuous improvement as needs and demands change.
- It is not practical to take a city bus to work as the time it takes would be an hour. Easier to drive the 4.5 miles as it takes me roughly 10 minutes.

### Accessibility

- We have ramps to provide access to those that are wheelchair bound, but have no automatic door openers in place.

- I still wonder why the picnic tables in the plaza area on the east side of the building were not constructed to ADA Accessibility standards.

### Acoustics and Privacy

- It is very noisy and distracting.
- Open floor plan is loud and distracting.
- Just more privacy in the cubicles and more noise filtering in the cubicles.
- I do think a little more planning could have been given regarding acoustics and the separation of functional groups.
- Ceiling not insulated so noise travels through ceiling and seems to be increased when private office doors are shut.
- Either the walls are paper thin or sound travels through the ceiling, but I can hear most every word of those in neighboring offices.
- Sound proofing is deficient. Even with closed doors you can hear everything going on in the office next door through the ceiling. Also, the design and geometry of some offices in corners makes doors perfect noise bouncing boards.
- The adjustable work station has been a wonderful benefit. It is very much appreciated the investment in that furniture option."
- Better temperature control would be nice. It would be great if we could adjust our temperature in our own sections.
- Too many people congregate outside of our department area in the hallway and use it to converse loudly instead of going to a conference room or their own private office/cubicle. Very disruptive!!!!
- The layout invites people to walk through/by our area quit frequently making privacy an issue. A downfall to the elevated desk is my computer is more visible to the general population at work. I may be requesting a "black out" screen cover to hopefully remedy this problem.
- Not much privacy in the cubicles. Some people are literally face to face with the next work station. Would be nice to have a larger wall in between the work stations for more privacy and noise blocking and some privacy for phone calls. I don't need to hear everyone in my section's phone calls. Lack of privacy sucks for our departments work area.
- The air system can be extremely loud, almost distracting at times when it is kicking in. When the system is off, there is no "white" noise to block the deadening silence. You can hear conversations of those in offices with shared wall. Almost as if there is no wall.
- Hard Walls separating sections would be preferable to the completely open-air environment. The current configuration makes privacy scarce for technicians. Without walls sound travels from one section to another and can be quite distracting.
- The walls are very thin and when the person on the other side of my wall shuts her door I can actually hear what she is saying better than when her door is open.
- I think the insulation of the walls could have been improved for sound. Very shallow, so you can hear others' conversations or others talking on a phone.
- The functional space is good. BUT the open work areas are extremely noisy and I am constantly interrupted from doing work do to loudness of people in the nearby work areas!! It would be better if we had closed sectional areas and would be a lot less distracting!
- You can hear people talking from other sections.
- Sound/voices travel very well, making it difficult to have private/confidential discussions/conversations.

- The hallway in front of the offices upstairs in program delivery area can be a distraction when there is heavy people traffic.
- Low partition walls are not conducive to a good working condition. Hallways near-by with people walking by all day. Full of distraction and no privacy.
- There is a lot of foot traffic past my office.
- For people that work on construction projects from Easter to Thanksgiving, and have to talk loud over equipment it's almost impossible to speak quietly enough not to disturb others. Being able to be heard over equipment is an important part of safety and understanding between people. The nature of our jobs is not nice quiet office environment like other department office settings. I am just saying, maybe this can be considered in future designs.
- No privacy for our work area. We are located along a main walkway and have many people walking by or using our office as a shortcut throughout the day.
- It would be nice if each functional group had their own private walled off rooms to eliminate the distractions between groups. We are wedged between two other groups and have lots of distractions from both sides. The open office concept does not work well. It was nicer and quieter in our old office that was separate from other groups. Even the slightest noises can be heard for quite a distance.
- There is no confidentiality in any conversation in the office spaces. Everything from all other areas can be heard.
- I personally would like more privacy when I'm at work, but it might be worth mentioning that I'm a bit of an introvert and would rather not be disturbed so much throughout the day. I realize that this just isn't possible with the job that I hold and that I need to make myself available to my co-workers.
- I get a lot more accomplished when not interrupted so much throughout the day, but doesn't everyone!
- Sound carries from office to office easily and workstations have no privacy for conversations that should remain within the work unit.
- Frosting on exterior facing windows of our section's office allows minimal view of outside and makes interior lighting and ductwork the focal point. Removing 18-24" would solve the problem. Sound carries throughout our section's office making discussions/phone calls potentially disrupting for others. Sound from lunch room carries directly up the stairs to our section and is disrupting at times.
- The frosting on the window needs to come down 2' at least to have more daylight come in and see out and the noise out of the lunch is very distracting plus people stand outside the our outside cubical wall to talk which is distracting (the outside wall should have been gone to the ceiling).
- The window access that we do have is covered in a frosted film that blocks the vision of daylight.
- Take the frost off the windows.

### **Cleaning and Maintenance**

- Working overnights during the spring/summer months we had a huge issue dealing with insects/crickets getting in through our exterior door. We have noticed that it was not sealed tight and have told maintenance but nothing seems to get done. Also in the winter snow gets inside as well.
- The carpet in my workplace needs to be steam cleaned or something other than just vacuuming every once and awhile.

- I find myself doing snow removal during the winter, so my employees can safely enter and exit the building. Again, we are a 365/24/7 operation.

### Electric Lighting and Daylighting

- Good lighting.
- Too much electric lighting fighting with natural lighting no way of adjusting.
- I wish the State Patrol area of the building had its own light controls.
- There is no interior "path lighting" so a person can navigate their way to an exit. After 5:30 from November into mid-February it is pitch black once the lights automatically shut off. Difficult and potentially dangerous to walk to an exit.
- The lighting controls are not user friendly. Some of are wired incorrectly so you press off button to turn on lights.
- For those of us who have to be in the building after 5 pm, it would be great if there was some way to disable the light timer. It's a pain in the butt to keep being forced to constantly turn the lights back on after 15 minutes.
- Lights sometimes turn on and off randomly during the day. The lights also turn off automatically at 5:30 pm and then you have to turn them on again every half hour after that.
- Really dislike that the light turns off in the MSP offices at night while you are trying to work. I have no individual desk lighting system. There is a plug adapter but no light.
- I would have been fine just staying in the basement, since we still have no direct window view anyway.
- We have no direct windows in our area to allow light in or see out without roaming to other work areas.
- All great except for the view and daylight. Can't see a window or daylight from my primary workspace. Thankfully the conference rooms have windows.
- [Our] section is stuck in the only area of the new building with limited natural light.
- Sunlight blinding or glaring on computers make it hard and hazardous to see.
- Natural lighting has been hard to see.
- The blinds to block the light from coming in through the windows need to be changed to block more light. I have to put up a Styrofoam piece behind my computer screen to keep from being blinded by the sun even when the blinds are down.
- Shades that don't shade only filter the sun. We don't work on laptops! Direct sun is not compatible with CADD screens.
- Certain workspaces at the northern-most section of the room are blinded by harsh sunlight as the sun goes down, also causing glare on computer screens and making it difficult to see. This problem could be solved with some sort of blind or shade, but the height and deep-placement of the windows may require some creative thinking and/or custom fitting for window treatments.

### Furnishings

- The CADD workstations are cheap and do not support the CADD equipment. Tables are severely bowing and were modified to be adjustable after installed. Real CADD workstations with chamfered corner and an adjustable workspace would have been preferred. Input from staff was disregarded.
- I love the sit stand workstations. Thank you for these stations.
- Desk Space is not adequate to lay out plans for review. Desks are not deep enough.

- Some people are getting adjustable work tops for the PC at their cube. Is this going to be a standard item?
- Since the installation of a sit/stand work station, my workspace has improved times 10. Slowly but surely, I am getting items that I request to better suit my personal needs.

### Indoor Air Quality (IAQ)

- Worry about air quality, I sneeze a lot at my work space. Feels too dry and I have a concern of what kind of air we are breathing in.
- The air filtration could be better. I've noticed a major difference between days working and my days off in the amount of sneezing and "dried nasal mucus" produced.
- Need to have a humidifier during the winter. Very dry air.
- Air very dry causes irritated eyes, stuffy nose, cough. I have very few allergy issues outside of the work space
- The air quality is very good and has allowed me to discontinue daily mold allergy medications needed in former workspace."

### Space Planning and Amenities

- Lots of wasted space in work areas.
- It would be great to have all the personal clutter and tacky items removed from work spaces.
- The wall would also be nice to be able to pin up quick reference sheets, calendars, phone numbers, etc. for at a glance reference, currently there is limited space to do that.
- The remodel is nice, but each functional group should have their own walled-off work areas, at least on the main level. At a minimum, high cube walls should be installed along the main walkway corridor next to the main floor east windows.
- The office space is the same for all engineers that are not administrative level. This is a considerable oversight in my opinion. Some positions require more collaboration within their office and the space is insufficient.
- Warm Storage Space seems to be a point of conflict between program delivery functional groups. They are competing for a very limited space in what frankly seems like an afterthought. Our group has spent years in "cold storage" and it has negatively influenced our morale. We were the first group to be moved out of our old space and will be the last group relocated.
- Kind of small. Can't turn my chair without hitting my keyboard shelf. Limited on size of map role you can roll out at your work station.
- The primary workspace as well as the entire remodeled facility, are stark and colorless. The workspaces are uninviting and sterile. Although the construction has been complete for years and we have occupied the spaces for the same time period, there has been no effort to replace the decorations, awards, artwork or any of the simple signage that portrays where we actually work. The environment for our workspaces should reflect what we do as an agency. The MnDOT logo should be graphically shown on wall spaces throughout the facility, especially where the public has access and frequents. You can walk down a 150' hallway with nothing on the walls, no awards on display, no transportation related artwork, no graphic representations of local projects and especially no color. Contractor white is not a finished wall treatment. Although the facility itself is a vast improvement over our old environs, the lack of any wall decorations at all is almost distracting in its sense of the facility being bleak, stark and definitely unfinished.
- Water in the restrooms is cold. We've been told that facilities is following the Governor's Energy initiative, but I believe that Governor is no longer serving.

- Only one restroom serves the second-floor staff and the men's room contains only one stall which feels less than necessary to prevent users from frequently having to seek another restroom in a different part of the office.
- The facility was build undersized and the biggest complaint is there is not enough bathroom spaces for the amount of employees!!!!
- The bathrooms are too small. Especially by the meeting rooms (Mississippi rooms) When you take a break from the meeting or class there is a back log of people waiting to use it. There have numerous times I have walk to 3 different bathrooms to find an open stall. This is a waste of time.
- Upstairs needs another bathroom stall.
- Not enough bathroom stalls for all the people working.
- There are not enough bathrooms, people have to wait for an open stall.
- Need more restrooms.
- Need two additional toilet stalls in the restroom upstairs in the program delivery section.
- Floor drainage.
- The amount of bathroom stalls is lacking.
- I also wish we had a water fountain in our workspace (State Patrol).
- Location of drinking fountain. Outside of rest rooms? Really?
- MnDOT refused to install a water fountain in our space [State Patrol area]. We have to walk out of our space into the MnDOT offices to have access to drinking water.
- I was asked by the District Engineer why I don't use the water bottle filler in our section of the building. I advised him we don't have one, that's why we come out to the DOT portion of the building.
- I believe budget cuts were cut more drastically when re-modeling a certain section of the building - no drinking fountain, no handicap accessible doors, lack of windows, the area is still not completely finished.
- Windows in some doors and not others, Why?
- Size of columns in a cube area, columns in resource rooms aren't as big.
- We were promised a workout room.
- A workout facility on site would be welcome to help many of those who try to maintain regular activity as part of their daily routine. It would also help encourage more people to bike to work if there's a good changing area and shower area depending on their bike commutes.
- It needs a work out facility. I thought all MnDOT HQ's were supposed to have one. Even D4 Morris has a separate building for the work out room where I transferred from. Really miss that.
- Spacing of the parking rows in the parking lot, not suitable for the all vehicles that use it.

### Technology

- The offices that are not on the outside wall have zero cell phone reception
- No cell phone coverage. (We had cell phone coverage in the basement of the old building. Yes, it is personal but people have programmed the personal cell phones in their systems and not the office phones. People expect to reach others on cell phones.) Very noisy and difficult to concentrate unless the door to the office is shut.
- I must get up to answer my phone because I cannot run my computer through the phone line and there is only one Ethernet outlet on opposite walls in the offices.

- Would be nice to have outlets positioned so you do not have to crawl under the desk to access them.
- Number of electrical outlets in the conference rooms. Where are they?

### Thermal Conditions

- Physical conditions besides temperature are amazing.
- The three separate temperature controls also seem to be difficult to find a good balance. There are also drafty, cold areas in the work area that tend to be avoided by temperature-sensitive employees.
- The air temp is not consistent as it should be.
- Though the noisy HVAC system has had acoustic baffles installed to make it quieter, there are still sometimes that the noise makes hearing radio traffic and phone conversations difficult.
- The lack of acoustic ceiling tiles, coupled with the aesthetically appealing and 'fashionable' painted industrial ceiling structure was a poor and unreasonable choice for ceiling treatment in a 911 call center.
- I wish the State Patrol area of the building had its own temperature controls. It would make our workspace much more comfortable in the hot summer and cold winter.
- Really dislike that the AC/Heat turns off during non-business hours. The MSP offices get very stuffy/hot in summer and very cool in the winter.
- We have very limited ability to increase the temperature in our offices. I would like the temperature increased somewhat.
- Temps in our portion of the building after hours have been in the low 60s.
- Work space is generally 2 to 4 degrees above where I keep my home temperature but here I always feel cold.
- It always seems so cold in the winter in our work area. Sometimes I have to wear gloves to keep my hands warm.
- My hands are often cold sitting in my office. I am in an interior office.
- Office spaces are cold and not adjustable.
- We [State Trooper] work a 24/7 schedule where we work in the office space at night and during the weekends. The Dept. of Transportation programmed the heating and cooling system to a set temperature at night and on weekends since all of the 9-5 staff are gone. On weekends and some nights in the summer our office space got up to 85 degrees with high humidity at times which made it very uncomfortable. We had to leave and work in our air-conditioned cars. During the winter the office space gets very chilly during the weekends. In the MN State Patrol side of the building it is cold the majority of the time.
- Temperature is not able to be adjusted in my work area. Is cold all year round, not just winter. Cold air from outside in winter seeps through windows and air is on high in summer. I am on north side of building.
- My office is located on the north side of the building next to very large windows and it is very cold and breezy in my area. We keep the shades pulled in the winter. You can actually see the shade moving due to the cold her coming through.
- The temperature in conference rooms is not consistent. Many are very cold.
- It is very cold in the office year-round.
- Too cold in summer
- It is always cold in here.
- On nights and weekends the heat is turned down.

## Appendix B. Glossary

### **Descriptive statistics**

Statistics used to summarize large sets of data (i.e., means, frequencies, medians). Descriptive statistics describe only the sample under consideration and are not intended to infer results to the larger population.

### **Frequency**

A descriptive statistic that provides information about how many of a particular response or measurement is observed.

### **Likert-type scale**

A measurement technique, employed in questionnaires and interviews, that utilizes a range of standardized response categories such as strongly agree, agree, etc.

### **Mean**

The average score of a set of data calculated by adding all scores together, then dividing by the number of scores.

### **N**

The number of subjects or participants responding to the questions, or a single question, in the study.

### **Reliability**

The repeatability or replicability of findings; the same results are produced each time. Instruments and procedures should produce the same results when applied to similar people in similar situations, or on a second occasion.

### **Standard deviation**

A statistic used to measure the variability of a group of scores (how different scores are from each other and the mean). For example, if the range of scores is 1-7 and the mean (average) is 5.0 with a standard deviation of 1.0, then the scores are closely clustered around the mean, i.e., there is one unit of variation among all scores. If the mean was 5.0 and the SD was 3.0, there is a broader range of variation among the scores...a smaller SD means the scores are similar and the mean score is likely to be more accurate and more useful (this is better!).

### **Validity**

The extent to which an instrument or procedure measures what it is intended to measure (internal validity). The generalizability of results to another population (external validity).