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ENERGY EDGE Post-Occupancy Evaluation Project

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ENERGY EDGE
Post Occupancy Evaluation Project

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ENERGY EDGE Post Occupancy Evaluation Project

DEDICATION AND ACKNOWLEDGMENTS:

The Energy Edge Post-Occupancy Project, and the results reported here, are dedicated to the building occupants who took time out of their work to respond to a rather formidable and lengthy questionnaire. We wish to thank also the building managers and owners for their assistance, and for their patience in dealing with our intrusions during the work hours. And to the person who estimated his or her personal time cost in filling out the Workspace Satisfaction Survey, we hope, as you do, that the results of your labors will not be in vain. The information you and others have provided serve to remind us all that the bottom line in building design and construction is the satisfaction and comfort of those who live and work within the environments created for them.

And to Nancy, John, Chris, Carreen, Julian, Mary, and Ivan, our team of dedicated research assistants, we give a special thanks for your help and interest in this project. We hope that you take with you into your own professional careers the knowledge gained from this project. Not only the knowledge of how buildings work, but also the knowledge and many insights we have all garnered from listening to the people for whom our buildings are designed.

We would also like to thank Rick Diamond of the Lawrence Berkely Laboratory and Jeff Jansen of BPA for their extensive assistance in developing and refining the Workspace Satisfaction Survey. This truly was a team effort, and we appreciate the dedication and good humor they both showed in getting this project underway.

JH
Seattle, WA
June 1990

EASTGATE CORPORATE CENTER

Executive Summary University of Washington / Post-Occupancy Evaluation Project

(Total number of surveys completed = 24 out of 46 building occupants)

Thermal Factors:

1. Overall thermal satisfaction indicates that 54% of the occupants surveyed were dissatisfied and 38% said they were "moderately" or "very" dissatisfied.
2. Cold discomfort was a major problem in the building: 80% of the occupants were cold, with 42% saying they were too cold "usually" or "always."
3. The vast majority of occupants did not experience warm discomfort.

Air Quality:

4. A total of 16 out of 24 occupants (70%) were satisfied with the air quality, and 7 (30%) were dissatisfied.
5. People who were dissatisfied said the air often seemed stuffy or stale smelling. In open-ended comments, a number of people remarked that they wished the building had operable windows so that they could open them to admit fresh air.

Lighting:

6. Overall lighting satisfaction was high. More than 80% of the occupants were satisfied with the lighting, and seventeen (75%) were "very" or "moderately" satisfied. Only three were "very" or "moderately" dissatisfied.
7. Lighting was rated as "just right" by the majority of people for most of their normal work tasks. Overall, lighting was judged to be too dim more often than it was too bright. Lighting was too dim for most reading tasks and too bright for word processing and reading glossy materials.

Daylight and Sunlight:

8. Sun brightness and sun warmth were a problem "sometimes" for about half of the occupants who had windows in their workspace.
9. Coping with sun warmth or brightness created difficulties because the windows do not have operable blinds or drapes. When asked how they cope with excessive warmth or brightness, most people said they worked elsewhere or "just put up with it."

10. Although 14 out of 19 people who have daylight in their workspace said the amount of daylight was "just right", 16 said that daylight was not sufficient for working. Electric ceiling lights were used "usually" or "always" by 17 of the 19 people in windowed offices.

11. Window glare and reflections on the computer screen from windows were a problem "sometimes" for about 30% of the occupants.

Acoustics:

12. Overall satisfaction with the level of noise in the environment indicates that 35% of the occupants were dissatisfied and 65% were satisfied.

13. Noise from conversations, phones, and the HVAC system were bothersome for eighteen out of twenty four occupants (75%). Several occupants noted that sounds readily traveled through the walls so that it was difficult to achieve control over the acoustical environment by closing doors.

Overall Workspace Satisfaction:

14. A total of 79% of the occupants were "moderately" or "very" satisfied with their workspace in the Eastgate Corporate Center, and 57% said their current workspace was "much better" than workspaces they have occupied in other buildings.

Part 1.

The Eastgate Corporate Center Building Features

The two story Eastgate Corporate Center office building has 23,728 sq. ft. of interior space located above an open garage. The tenants include an investment firm, an import/export company, an accounting business and the owner. Current tenants have been there at least a year. Several suites have been unoccupied and tenant improvement work has not been done on one suite on the first floor.

Physical Description

Walls

The building has metal stud partitions with concrete columns throughout. Exterior walls are insulated with R-19 batt insulation, and sheathed with gypsum and stucco. The interior are covered with GWB.

Roof

The roof is insulated with R-30 and is covered with BUR

Glazing

Windows are fixed and double glazed low-E glass with a U- value of .35.

Lighting

Offices are lit by 2-tube parabolic fixtures with octron lamps and have electronic ballasts. The perimeter ballasts are dimmable and controlled by a photocell dimmer with a manual override wall switch. Other controls include a work-schedule based programmable timer. The exit signs are non-electric self-luminous.

HVAC

The system is a variable air/volume system with fan-powered terminal boxes. It includes an enthalpy economizer and discriminator supply air reset controls.

DHW On-demand instant hot water heater.

Energy Conservation Measures include: The low-E glazing, variable air/volume HVAC system, the instantaneous hot water, and all of the lighting features mentioned in the above description.

Part 2. The Workspace Satisfaction Survey

SURVEY CONTENTS

The Workspace Satisfaction Survey measures occupant satisfaction with the thermal, lighting, acoustical, and air quality aspects of the work environment. In addition to ratings of these ambient environmental features, occupants also rate their satisfaction with a number of functional and aesthetic features of the office environment as well as their satisfaction with specific kinds of workspaces (e.g., computer rooms, the lobby, employee lounge, etc.)

Each section on ambient conditions includes questions on the frequency with which people experience particular kinds of discomforts or problems, how much the discomfort bothers them, and how much it interferes with their work. Occupants are also asked to identify how they cope with discomfort or environmental problems, and to what extent these behaviors enable them to achieve more satisfactory conditions. The items in the coping response check list were selected to represent three different kinds of environmental adaptation: behaviors aimed at changing the environment in some way, responses that represent changes in one's behavior rather than changes in the environment, and mental responses such as resignation or attempts to ignore the problem.

The survey gathers data on health characteristics and occupant demographics (type of job, gender, age, how long they have worked in the building and at their workstation, etc.). There is also an extensive section on computer use, with an emphasis on the lighting environment for computers.

Occupants were not identified by name in the survey. However, each survey was identified with a particular workstation to facilitate analysis of data on a locational basis.

SURVEY ADMINISTRATION PROCEDURES

Prior to the survey administration, a member of the research team visited the Eastgate Corporate Center to take photographs and to draw floor plans with workstations identified and properly located on the plan. During this visit, the research team also gathered information on

general features of the environment and the workstations, such as the presence of interior windows, the height of partitions, the number of enclosing sides in the workstation, and any distinctive aspects of the environment.

Members of the research team hand delivered the surveys to each workstation in the building in February 1990. By personally delivering the surveys we were able to correctly identify the workstation on the floor plan and answer questions regarding the study or the survey itself. At the time of the survey administration, the Eastgate Corporate Center was only about half occupied. Two large offices had recently moved out of the building, and another suite of offices on the first floor was not completed.

The survey administration visit was preceded by a letter to the building occupants explaining the purposes of the study and soliciting their involvement. The letter explained that building occupants were not required to complete the questionnaire if they did not wish to. (See Appendix A for a copy of the letter and the survey.)

If people were not at their workstations when one of the team members arrived, the questionnaire was placed on their desks or chair in full view. The survey was enclosed in an envelope to assure confidentiality of responses. At the end of the day scheduled for the survey administration, the research team gathered up the completed surveys. If people did not have time to complete the questionnaire during the day, they were asked to finish it as soon as possible and deliver it to a designated person in each office. When the surveys were completed a member of the research team returned to the Eastgate building to retrieve them.

DATA BASE

In addition to the variables in the survey, the data base also included the name of the building, the floor on which the workstation was located, the location of the workstation in terms of perimeter (along one of the exterior walls) vs interior of the building (all workstations not on the perimeter); and the orientation of each of the workstations on the perimeter (e.g., north, south, east, west, or corners).

VISUAL PRESENTATION OF DATA ON FLOOR PLANS

For selected variables, the data are presented on floor plans to enable us to see whether there are clusters of satisfaction or dissatisfaction. In

order to do the spatial inspection, workstations were identified by selecting out responses which represented highly satisfied or dissatisfied ratings of a number of variables, including thermal characteristics, noise, lighting , and air quality factors. The data are then displayed by placing dots on individual workstations to illustrate the survey responses. Plastic overlays are being used to facilitate the visual inspection of several variables simultaneously.

Part 3. Occupant and Workspace Characteristics

GENERAL BACKGROUND

A total of 24 out of about 46 people who work in the Eastgate Corporate Center at the time of the survey administration completed the Workspace Satisfaction Survey in February 1990. There were twelve males and eleven females (one person did not signify gender). Only seven people had worked in the building for more than a year, twelve people had worked there between six months and a year, and five for less than six months.

Work hours. Eleven people worked for six to eight hours a day, five worked for four to six hours, and eight worked for more than eight hours a day. Eighteen people worked five days a week, and five people worked more than five days.

Information about energy features. When asked at the end of the survey whether they had received any information about the energy features in the building, sixteen people said "no" and seven said "yes."

Job categories. Analysis of job categories of the occupant sample shows that there were six secretarial/office support staff, eleven professionals, four managers, two word processors, and two programmers. See Table 1.

WORKSPACE FEATURES

Workspace type. An analysis of the type of workspace people occupied shows that the majority of the occupants (n=13) were in enclosed, private offices. Six people had a workstation with screens or partitions shorter than ceiling height, and two people were in shared, enclosed offices. Furthermore, eighteen of the workspaces were in offices along the perimeter of the building and only six were in more interior locations.

Workspace changes. When asked what kinds of changes they had made to their current workstations, the most frequent responses were the addition of personal artifacts and posters or other wall decor. (See Fig. 1). Six people (25%) made no changes.

TABLE 1. Job Categories of Survey Respondents

Category	Number of people
Secretarial/office support	6
Graphics/designer	0
Programmer	2
Data entry	2
Word processor	2
Professional	11
Managerial	4

FIG. 1 CHANGES MADE IN CURRENT WORKSPACE

ENVIRONMENTAL SATISFACTION

Satisfaction with the functional and aesthetic features of the office setting were assessed in three ways. First, occupants were asked to rate their level of satisfaction with ten office characteristics (such as the level of privacy, the comfort of their chair, the furniture, equipment, the color of walls and partitions). The second aspect of general office evaluation was an adjective check list. Occupants were asked to select from a list of adjective those which they thought best described the Eastgate offices (they could also add their own adjectives if they wished). The final general assessment section asked occupants to describe in their own words anything they particularly liked or disliked about the office environment.

Satisfaction with office characteristics. Ratings of satisfaction with a number of office characteristics shows that the Eastgate occupants were very satisfied with the provision of non-smoking areas, the aesthetic features of the building, the amount of space available, and the location of their workspace, but less satisfied with the levels of privacy afforded in the environment and the amount of storage available to them. See Table 2.

Adjective check list. Occupants were also asked to choose adjectives that described their office environment. The most frequently chosen descriptors were "comfortable", "attractive," and "conducive to work". See Table 3 for a complete summary of the adjective descriptors.

Open-ended positive comments. Many occupants found the windows and views of the wooded setting a very positive and enjoyable feature of the building, as were the general quietness of the building and the attractiveness of the interior design.

Open-ended negative comments. The most frequently mentioned negative aspects of the building were the temperature regulation and ventilation system. The building was too cold for many people most of the time, and others commented on the inconsistent temperatures (it was too hot in the summer or when the sun entered their workspace). Several occupants also said the HVAC system was very noisy and disruptive. A couple of people who worked after hours or on the weekends said that the ventilating and heating systems were not operating during those times and the building was stifling and stuffy in the summer and very cold in the winter. Other negative comments were aimed at the lack of control over the environment (particularly the absence of window blinds and operable windows)

Table 2. Ratings of Satisfaction with Various Office Features

Feature	% Very + Mod. Satis.	% Very+ Mod. Dissat.
Provision of non-smoking areas	83%	13%
Workspace location	79%	17%
Visual attractiveness	79%	21%
Amount of space available	79%	13%
Color of the walls/partitions	75%	17%
The equipment	71%	13%
The furniture	67%	13%
Comfort of chair	63%	17%
Level of privacy	54%	25%
Amount of storage available	41%	31%

Table 3. Adjective Descriptors for the Office Environment

Adjective Descriptor	Number of Times Selected	Emotional Valence
Comfortable	17	Positive
Attractive	14	Positive
Conducive to work	12	Positive
Spacious	8	Positive
Inviting	7	Positive
Cheerful	5	Positive
Confining	5	Negative
Uplifting	4	Positive
Stimulating	4	Positive
Distracting	2	Negative
Bland	2	Negative
Too open	2	Negative
Uncomfortable	1	Negative
Unattractive	0	Negative
Oppressive	0	Negative
Unpleasant	0	Negative

and lights that seemed to brighten and dim "randomly". This latter concern may have been due to the daylight control system that automatically dims the electric lights when there is sufficient daylight in the space. However, as noted previously, most of the building occupants were not aware of the energy conservation features of the building. Thus, they may not have understood why the lights dimmed and brightened over the day.

Part 4.

Thermal Satisfaction

WARM DISCOMFORT

Only one occupant reported being too warm "always" although five said they were "sometimes" too warm. The majority (17) were "rarely" or "never" too warm. See Figure 2. Six people who said they were too warm noted that they were "moderately" or "very much" bothered by warm discomfort, and seven said they were bothered "a little." Four people said that warm discomfort interfered with their work "moderately" or "very much".

Coping with warm discomfort. Fig. 3 shows the distribution of responses to warm discomfort. As can be seen, the most frequent responses were to adjust clothing or to drink something cold. Occupants also coped with warm discomfort by contacting the staff person responsible for dealing with the problem, going outdoors, or just putting up with it. Four occupants (17%) who used these coping responses found them effective "usually" or "always" and 5 people (41%) said their coping behaviors "rarely" or "never" allowed them to achieve a more comfortable situation.

COLD DISCOMFORT

Ten occupants (42%) "usually" or "always" experienced cold discomfort and nine (37%) said they were too cold "sometimes." See Fig. 2 again. A total of 76% of the people who experienced cold discomfort said it bothered them "moderately" or "very much" and 24% said it bothered them "a little". Further, eleven people (52%) said cold discomfort interfered with their work "very much" or "moderately" and six (29%) said it interfered "a little."

Coping with cold discomfort. Fig. 4 shows the behavioral responses to cold discomfort. As can be seen, the most prevalent responses were to adjust clothing or drink something warm. Other responses included: contacting the staff person responsible for dealing with the problem, walking around, and just putting up with it.

FIG. 2 FREQUENCY OF WARM AND COLD DISCOMFORT

FIG. 3 FREQUENCY OF COPING RESPONSES TO WARM DISCOMFORT

FIG. 4 FREQUENCY OF COPING RESPONSES TO COLD DISCOMFORT

Five occupants who experienced cold discomfort (25%) said that their behavioral responses "usually" or "always" enabled them to achieve a satisfactory temperature; 50% (10 people) said they "sometimes" worked, and five (25%) said they "rarely" or "never" worked.

DRAFTINESS

Twenty people (83%) said draftiness was "never" or "rarely" a problem in their workspaces. Only two people said it was "usually" or "always" too drafty, and two said it was "sometimes" too drafty. See Fig. 5.

Coping with drafts. As can be seen from Fig. 6, people coped with draftiness primarily by adjusting clothes or contacting the appropriate staff person.

VENTILATION

A total of 16 occupants (67%) "never" or "rarely" experienced their workspace as having too little ventilation, while eight (33%) said they "sometimes" or "usually" had too little ventilation. See Fig. 7. Of those who said they experience problems with ventilation, four said they were "moderately" bothered and two people said they were bothered "a little". Nine (38%) people said ventilation problems interfered "moderately" with their work.

Coping with ventilation problems. Fig. 8 shows responses to ventilation problems. As can be seen, the most frequent behaviors were to open a door (on to a balcony) or go outside. Five people said their actions were "usually" or "always" effective in achieving a more comfortable situation, and 3 said they "sometimes" were. A number of people said they would have opened a window if they could, but the windows were not operable.

OVERALL TEMPERATURE SATISFACTION

A total of thirteen occupants (54%) were dissatisfied with temperature conditions in general and eleven (46%) were satisfied. Of those who expressed dissatisfaction, nine (38%) were "moderately" or "very" dissatisfied. See Fig. 9.

FIG. 5 FREQUENCY OF EXPERIENCING DRAFTINESS

FIG. 6 FREQUENCY OF COPING RESPONSES TO DRAFTINESS

FIG. 7 FREQUENCY OF EXPERIENCING TOO LITTLE VENTILATION

FIG. 8 FREQUENCY OF COPING RESPONSES TO VENTILATION PROBLEMS

FIG. 9 OVERALL SATISFACTION WITH TEMPERATURE CONDITIONS

TEMPERATURE SATISFACTION "RIGHT NOW"

In addition to rating their response to temperature conditions in general, occupants were also asked to assess temperature conditions at the time they completed the survey. This question was included in the survey to assess whether people differentiate between their general assessment of the thermal environment and their assessment at a particular point in time.

As can be seen from Fig. 10, people tended to be somewhat more comfortable at the time of the survey administration. Ten people (42%) were dissatisfied when they completed the survey, compared with 54% who said they were dissatisfied in general. Further, ten people (42%) were "very" or "moderately" satisfied at the time they completed the questionnaire, compared to seven (29%) "moderately" or "very" satisfied in general.

PREFERRED THERMAL SENSATIONS

When asked about their preferred thermal sensations when they work, seventeen (71%) said they preferred to be neither warm nor cool, while four (17%) said they liked to be "somewhat warm", and three (12%) said they preferred to be "somewhat cool." No one selected the option "I have no preference."

FIG. 10 COMPARISONS OF TEMPERATURE SATISFACTION "RIGHT NOW" AND "IN GENERAL"

Part 5. Air Quality

A total of 16 out of 24 occupants (70%) were satisfied with air quality, and 14 (58%) rated themselves as "very" or "moderately" satisfied. Seven people (30%) said they were "slightly" or "very" dissatisfied. See Fig. 11.

Of those who experienced air quality problems, however, five said they were "moderately" or "very much" bothered and three were bothered "a little". Stuffiness, stale smelling air, and unpleasant smells appeared to be the biggest problems. In the open-ended comments, people said the air seems to be more stuffy in summer or during warm weather than at other times. One person said the air was also very stuffy on the weekends because the HVAC system was not fully operational. Another person said there was too much spatial variation in air circulation (this person did not, however, clarify where air circulation was particularly troublesome.)

Coping with air quality problems. The most frequent response to poor air quality was to go outdoors for a while or open a door onto the balcony. See Fig. 12.

FIG. 11 OVERALL SATISFACTION WITH AIR QUALITY

FIG. 12 FREQUENCY OF COPING RESPONSES TO AIR QUALITY PROBLEMS

Part 6. Lighting and Windows

WINDOW AVAILABILITY

A total of seventeen out of twenty-four occupants had direct access to a window in their workspace, and three said they could see out a window elsewhere in the office when seated at their desk.

SUNLIGHT

Sun as an amenity. Sunlight appears to be a positive feature of the environment for the thirteen people who said sun from a window enters their work area. Seven (54%) said they liked the sun "very much", and four (30%) said they liked it "somewhat." No one disliked the presence of the sun in their workspace.

Sunlight control. Of the people who had sun in their work area, eight said the sun falls directly onto their worksurface at some time during the day. None of the thirteen could control the sun with drapes/blinds.

SUN BRIGHTNESS

Only one person who has sun in his/her workspace said it was "usually" too bright. Six (43%) said it was "sometimes" too bright, and seven (50%) said the sun was "never" or "rarely" too bright. See Fig. 13.

Of those who said the sun was too bright, five people (42%) said it bothered them "moderately" or "very much" and six (50%) said it bothered them "a little". When asked if the sun interfered with their work, five said it interfered "moderately" or "very much" and three said it interfered "a little".

Coping with sun brightness. When asked what they do when the sun is too bright, four people said they "just put up with it-- there is nothing I could do," and three said they worked elsewhere in the building. See Fig. 14. Eight people said their actions were "usually" or "always" effective in reducing discomfort from sun brightness, and three said their responses "never" worked.

FIG. 13 COMPARISONS OF FREQUENCY OF SUN BRIGHTNESS AND SUN WARMTH

FIG. 14 FREQUENCY OF COPING RESPONSES TO EXCESSIVE SUN BRIGHTNESS

SUN WARMTH

The sun is too warm "sometimes" for five people (39%) and "usually" too warm for one person as shown in Fig. 13 again. A total of seven people said it was "never" or "rarely" too warm.

When the sun is too warm, it is "moderately" or "a little" bothersome for eight people and "not at all" bothersome for three people. Sun warmth does not interfere at all with work for six people, and interferes "moderately" or "a little" for five people.

Who experiences the sun as too warm? Occupants along the east wall of the building were more likely than people at other sides of the building to experience the sun as too warm; four out of five people on the east side said the sun was too warm, compared to one out of four on the south wall, and none on the north wall.

Coping with sun warmth. Analysis of the behavioral responses to sun warmth shows that the most frequent response was to drink something cool or move to a more comfortable location. Five people said these coping behaviors "usually" or "always" were effective in creating a more comfortable situation, and three people said they "sometimes" worked.

See Fig. 15.

DAYLIGHT

Daylight availability. A total of eighteen occupants (75%) said daylight from a window enters their workspace. (Because lighting measurements have not yet been taken in the Eastgate building, these figures cannot be verified.)

Daylight as an amenity. When asked how much they like having daylight in their workspace, eighteen people (95%) said they liked it "very much" or "somewhat" and twelve (63%) said they liked the naturally occurring diurnal and seasonal changes in daylight. Only one person disliked the changes "somewhat" and six were neutral.

Amount of daylight. When asked whether the amount of daylight in their space was "too little", "just right" or "too much," fourteen people (74%) said it was "just right" and five said it was "too little".

Daylight and electric lighting. Despite the fact that so many occupants said the amount of daylight was "just right", sixteen (84%) said that daylight was not sufficient for working purposes.

FIG. 15 FREQUENCY OF COPING RESPONSES TO EXCESSIVE SUN WARMTH

In response to questions about the use of electric lighting, seventeen people (90%) who have daylight in their workspaces also use electric ceiling light "usually" or "always" and two said they use ceiling lights "sometimes." Two people said they also use desk top lighting "usually".

GLARE

When asked how often they experienced uncomfortable glare, seventeen people (74%) said "never" or "rarely", while six (26%) experienced glare "sometimes." See Fig. 16. Of those who experience glare, four people (50%) said it bothered them "moderately" or "very much", and two said it bothered them "a little". Four people said glare interfered with their work "moderately" or "very much" and one said it interfered "a little."

Locational effects. Glare was more often experienced by people on the east and south sides of the building.

Glare sources. Five people said the window in their workspace presented glare, and two people said ceiling lights created glare.

ELECTRIC LIGHTING

Electric lighting control. A total of 19 out of 24 people said they could turn ceiling lights on and off in their workspace, but only seven said they could control the number of ceiling lights in use. Six said they had a desk lamp, and three of these people said they could control the direction of light from the desk lamp. Sixteen people (76%) said they could "usually" or "always" achieve satisfactory lighting conditions by controlling the electric lights in their workspace.

Occupancy sensors and daylighting sensors. Almost all of the occupants surveyed (22 out of 24) said they were not aware of occupancy sensors in the building, nor were they aware of daylighting sensors used to regulate the electric lighting. One person commented that the ceiling lights seemed to go on and off "randomly" and several others said the lights dimmed unexpectedly. All of the occupants who made these comments said the light changes were distracting to them.

FIG. 16 FREQUENCY OF EXPERIENCING UNCOMFORTABLE GLARE

COMPUTERS AND LIGHTING

Almost all of the occupants (23 out of 24) use a computer at work. Fifteen said they used the computer for more than two hours a day.

Reflections on the computer screen. Seven of the occupants (30%) said they experienced bothersome reflections on the computer screen. Among those who experienced glare on the computer screen, four people identified windows as the primary source of reflections and four people said ceiling lights were a problem. Of those who experience reflections, all seven said they were "moderately" or "a little" bothered by the reflections and that the reflections "moderately" interfered with their work.

Coping with reflections. When asked how they responded to computer reflections, five said they moved the computer screen, five changed their position at the computer, and two dimmed the lights.

AMOUNT OF LIGHT FOR DIFFERENT TASKS

Responses to lighting varied with the type of task, as shown in Table 4. The vast majority of responses were in the "just right" category. However, the light was frequently rated too dim for reading tasks, filing, and data analysis/manipulation, and it was rated as a bit too bright for some computer tasks such as word processing.

Ambient vs. task-related light. There was less variability on responses to the ambient qualities of lighting. The vast majority of occupants considered the light to be "just right" for seeing other people and events, and for seeing objects and things in the room. For "psychological comfort", 70% said the amount of light was "just right" but 30% said it was either too bright or too dim.

OVERALL LIGHTING SATISFACTION

A summary question, on overall lighting satisfaction, indicates that 83% of the occupants were satisfied with the lighting and 17% were dissatisfied. Seventeen people (71%) were "very" or "moderately" satisfied, and two were "moderately" or "very" dissatisfied. See Fig. 17.

TABLE 4. RATINGS OF AMOUNT OF LIGHT FOR DIFFERENT TASKS & NEEDS

Task*	% Saying Just Right	% Saying Too Bright	% Saying Too Dim
Light reading/scanning	75	4	21
Concentrated reading	71	8	21
Reading glossy materials	52	26	13
Reading low contrast	78	0	22
Filing	67	4	13
Typing	57	9	9
Word processing	67	18	0
Data entry	70	9	4
Data analysis	52	9	17
Drafting/drawing on a board	17	8	8
Computer drawing	23	9	5
Conferences/meetings	71	4	0
For non-task needs:			
For psychological comfort	70	17	13
For seeing people & events	88	8	4
For seeing objects & things	83	8	8

* This table does not include the percentages who replied "not applicable to my job" so the rows will not always add up to 100%.

FIG. 17 OVERALL LIGHTING SATISFACTION

Lighting quality descriptors. Lighting quality was also assessed by an adjective check list. The most frequently checked description was "well-lit" (n=15). The next most frequently chosen adjectives were "institutional-looking" and "attractive." See Table 5.

Table 5. Adjective Descriptors for the Lighting Environment

Descriptor	Number of Selections	Emotional Valence
Well-lit	15	Positive
Institutional-looking	6	Negative
Attractive	5	Positive
Inviting	3	Positive
Cozy	3	Positive
Cheerful	3	Positive
Pleasantly dim	3	Positive
Glaring	3	Negative
Depressing	1	Negative
Boring	1	Negative
Too bright	1	Negative
Gloomy	0	Negative

Part 7. The Acoustical Environment

NOISE SOURCES

Ratings of office noises indicates that ringing phones, conversations of co-workers, and the HVAC system were the most prevalent sources of acoustical problems. A total of 67% of the occupants said ringing telephones were a problem, 70% said conversations were a source of noise, and 50% cited noises from the heating and ventilating equipment. See Table 6.

OVERALL NOISE SATISFACTION.

A total of eight people (35%) were dissatisfied overall with the level of noise in the office, with two being "moderately" and six "slightly" dissatisfied as shown in Fig. 18.

- Twenty one people were "moderately" or "a little" bothered by noise, and eighteen said noise interfered with their work "moderately" or "a little".

Coping with noise. Fig. 19 shows that ten people closed their door when they experience problems with noise, and ten cope by trying to ignore the problem and concentrating harder on their work. Open ended comments suggest, however, that closing doors may not always be an effective behavior. Several occupants said that sounds passes readily through the walls, making it difficult to deal with the distraction of other peoples' conversations. Furthermore, a few people noted that closing doors did not overcome problems of noise from the HVAC system because the noise was in their offices. Only four people ask their co-workers to be more quiet, even though conversations are the most frequent source of troublesome noise.

**Table 6. Frequency of Experiencing Problems
with Different Office Noises**

Noise Source	Usually + Always	Sometimes	Never + Rarely
Conversations of coworkers	17%	54%	29%
Ringling phones	17%	50%	33%
Office machines	4%	29%	67%
HVAC noise	25%	25%	50%
Lights	0%	25%	75%
Outdoor noise	0%	0%	100%
"White noise"	0%	5%	95%

FIG. 18 OVERALL SATISFACTION WITH ACOUSTICAL ENVIRONMENT

FIG. 19 FREQUENCY OF REPONSES TO COPING WITH NOISES

Part 8. Workspace Satisfaction

Workspace satisfaction was measured with three different questions. Two questions asked occupants to compare their workspace and the office in general with other workspaces and offices they have occupied in other buildings. The third question elicited satisfaction with their current Eastgate workspace.

COMPARATIVE JUDGEMENTS

Comparisons of the occupants' current workspaces with workspaces they have had in other buildings indicates that the Eastgate is "somewhat" or "much" better for thirteen people (57%), and about the same for eight people (35%). See Fig. 20. Fourteen people (61%) said their office as a whole is "somewhat" or "much" better than offices they had worked in previously in other buildings .

OVERALL WORKSPACE SATISFACTION

Overall workspace judgements, shown in Fig. 21, indicates that that eighteen people (79%) were "moderately" or "very" satisfied and four (17%) were "moderately" or "slightly" dissatisfied. No one was "very" dissatisfied.

FIG. 20 COMPARISONS OF PRESENT WORKSPACE AND WORKSPACES IN OTHER BUILDINGS

FIG. 21 RATINGS OF OVERALL WORKSPACE SATISFACTION

Part 9.

Satisfaction with Other Building Spaces

Table 7 shows the ratings of satisfaction with other spaces and rooms in the building. As can be seen, the lobby and building entrance, as well as the reception areas in the different offices, received high satisfaction ratings from the occupants. There was less satisfaction with computer rooms and conference rooms.

Table 7. RATINGS OF SATISFACTION WITH OTHER BUILDING SPACES

PLACE	Very +Mod. Satisfied	Somewhat Satisfied	Somewhat Dissatisfied	Very +Mod. Dissatisfied
Employee lounge	13%	22%	9%	10%
Conference Rms	49%	9%	26%	13%
Reception areas	65%	13%	4%	18%
Building lobby	68%	0%	5%	9%
Building entrance	83%	8%	0%	9%
Computer rooms	24%	10%	4%	10%

* The Table does not include people who chose the column "not available". Thus, the rows do not always add up to 100%.

Part 10.

Comments and Discussion

It is evident from the survey responses that people find the Eastgate Corporate Center an attractive and pleasant building. Nestled in a quiet setting surrounded by towering firs, it gives the impression of working in a tree house. A number of occupants said the setting and the views through the windows were a very positive feature of the office. The extensive use of interior windows increases visual access to the outdoors from most locations in the building, and this feature provides a sense of openness that is also valued by many of the occupants. However, at least one occupant said the interior windows made the office feel too open.

Despite the physical attractiveness of the building and the high level of overall satisfaction with Eastgate, there were a number of problems that need to be examine further in Phase II of the post-occupancy study.

Thermal Factors. Almost 80% of the occupants were too cold, and many were cold most of the time. When asked if they noticed an association between cold discomfort and seasonal or diurnal factors, many people said the building was coldest in the winter, and in the early morning, especially on Mondays. The problem of cold discomfort did not appear to be a function of gender or locational factors. It seems to be cold in most parts of the building for most of the occupants. Prior to the survey administration in February 1990, the HVAC system had been tuned a number of times, but the problems were still apparent when occupants filled out the survey.

Although warm discomfort did not appear to be a problem for many people, those who were too warm said that warm discomfort was primarily associated with sunshine entering the workspace, particularly in the summer. Since the windows do not have operable blinds, there is not much people can do to make themselves more comfortable when the sun is too warm.

Air Quality. Although most people were satisfied with the air quality, a number of people complained of stuffiness and stale smelling air. According to open-ended comments, the air quality problems are worse in the summer and on weekends when the

HVAC system is turned off. A few of the people who complained about the air said they were bothered by the inability to open windows to let outside air into their work area.

Acoustics. The office acoustics were unsatisfactory for a number of occupants. The primary concerns were telephones, other peoples' conversations, and noise from the HVAC. The noise of phones and conversations are a result of interior design decisions, especially the use of partitioned workstations and wall construction that allows sound to travel through easily. One person in a private office said that he/she could hear conversations elsewhere in the office even when the door was closed.

The acoustical environment had a negative effect on many people: 21 out of 24 occupants were bothered by the noise, and 18 out of 24 said noise interfered with their work. Other people's conversations are especially bothersome because they are very difficult to "block out" -- we hear them whether or not we want to. Furthermore, the knowledge that you can hear other people talk means that they can hear you. This creates a situation where conversational privacy is difficult, if not impossible, to obtain. The concern over privacy was reflected in the occupants' ratings of general office features -- one of the least satisfactory aspects of the office environment was the level of privacy afforded in the space..

The only acoustical problem directly related to the energy conservation features of the building is the noise from the HVAC system. The system had been investigated a number of times prior to our visit, but the problem does not appear to have been solved (at least as of February 1990).

Lighting. The overall lighting satisfaction levels were very high, with 83% of the occupants saying they were satisfied. Glare from windows and excessive sun brightness were problems sometimes, as were reflections on the computer screen. The building's siting in a wooded area combined with the type of glazing used may have contributed to a reduction in glare and sun brightness that are often problems in other buildings. Nonetheless, a number of people said they would have liked to be able to draw the blinds when glare or sun were most uncomfortable.

Because of the variability in the amount of lighting available for different kinds of tasks, it would be worthwhile to take lighting measures at selected locations in the building where satisfaction was

highest and lowest for different tasks, such as word processing, data entry/analysis, and reading.

Knowledge about the building. A large number of occupants were not at all aware of the energy features of the building, in particular, the daylighting and occupancy sensors. Whether or not information has an effect on satisfaction with any of the Energy Edge conservation measures cannot be determined at this point, but it is a topic worthy of further consideration for Phase II.