I studied the possibility of bringing the exterior landscape inside the building.
In an effort to tie the new building in with the plaza area, I extended the semi-circular shape around the mill into a full circle and introduced another semi-circular niche into the landscape.
I came up with the concept of radiating a series of concentric circles off the center point of the existing mill.
I considered briefly the use of a skylighted roof over the entire building but was told the varying sun patterns could cause glare and non-uniform lighting patterns over the employee work stations.
Various bands of color would help emphasize horizontality in the facades.

The exterior building materials themselves could help express horizontality.
The first design development presentation showed the ground floor plan divided into three areas. The smaller pointed end of the plan contained the enclosed executive offices and executive secretarial spaces; the larger end, as mentioned earlier, was programmed as an open office area, and the middle section of the plan with its semi-circular atrium noted the location of the corporate support functions (cafeteria, conference, exhibit, employee and visitor entry and reception areas).
A mezzanine level contained more executive offices and secretarial spaces located above the other enclosed offices on ground floor. A bridge connected the mezzanine to the second floor of the existing mill where the chairman of the board and president's offices, in addition to the executive lounge and boardroom were located. The atrium, cafeteria and open office area remained open for a two story height.
There were several factors dealing with this first design development presentation that did not work. Among them were:

* The entry to the office headquarters from the corporate museum was vague and hidden. A suggestion was made to define or emphasize one side of the circular plaza surrounding the mill more than the other for a better sense of visitor entry.

* The semi-circular atrium which varied in height and width according to what corporate support function it covered would have had problems tying in with the roof lines of the rest of the building.

* A comment was made that I had created a "sacred cow" out of the existing mill by trying to generate every space in the floorplan off the concentric circle patterns stemming from the center of the mill. The concentric circle idea was the major theme and downfall of this first design development concept.

* Instead of trying to follow the strong pattern imposed by semi-circular atrium--a suggestion was made to enrich the floor plan with the odd shapes.

* The enclosed executive offices were lined up on a series of shot gun corridors which produced a very unattractive design solution. The number of offices shown just met the program needs, meaning that there was no allowance for a possible increase in the number of enclosed office spaces in the building.

* Offices for the Chairman of the Board as well as the President were isolated from the mainstream by their placement in the existing cereal mill. Studies have shown that even the top company executives have to keep some contact with the other office functions to maintain psychological sanity.

* On the other hand, a comment was made that the open office area resembled the feeling of a huge convention center and a much necessitated study was made to bring this space back down in scale with its original program requirements.

* A suggestion was made to go back to the original 30' x 30' standard office grid immediately.

* There was only one main employee entry from the vast corporate employee parking lot and that entrance required employees to first cross a busy downtown artery street before getting to the building site.

* The facades and exterior building material studies were grossly underdeveloped.

* There was no indication of a three dimensional form--axons, perspectives or model. It was difficult for jury members to perceive the possibilities of the floor levels and the key entry/exit points of the triangular concept.
In revising the triangular floor plan concept, I chose to keep a few basic aspects of the first design development presentation. One of these was the presence of the semi-circular niche carved out of the triangular plan around the existing cereal mill. Having originally served as an atrium space dividing the open office area from the enclosed executive offices, the space was redesigned to serve as a transition element between private and the more public realms of the headquarters.

I worked with the idea of revising the entrances and exits to the building, not only for employees but for visitors as well. The real question was how to break up the huge open office area (still planned for the large end of the triangle) and where to place the enclosed executive offices in relationship to the open office area. I experimented with the executive offices on the perimeter of the building surrounding the open office. I also studied the idea of level changes; the executive offices on upper levels; open office in the middle, and skylighted common areas (employee lounges, interior landscape, main circulation, etc.) on the lower level. I moved the employee cafeteria, once adjacent to the open office area, to the smaller end of the triangular plan now programmed for possible public access.
Perhaps one of the most important design moves, however, was when I re-aligned the visitor's entry on an axis parallel to the existing mill. This created a main reception area at the intersection of the visitor's axis and the employee entry. While working on various schemes of how to organize the executive offices (each one requiring a work space for the individual, a conference area and secretarial space) I came up with the idea of placing all the enclosed offices in a row along the west side of the building. This opened up the north and southeast sides of the open office area for views of the outside.

I removed a small triangular shaped section from the plan where the main reception area was located and placed that identical element in the middle of the corporate parking area as a new employee entrance. By connecting these two triangular elements with an underground tunnel, I allowed for the first time safe employee access to the headquarters without having to cross the busy downtown street separating the office site from the parking. I also introduced a similar but smaller tunnel at the small end of the floorplan allowing for service access to the basement and food storage area.

In order to establish some order in the open office area I introduced pathways perpendicular to the building core. I envisioned these circulation paths as skylighted and lined with interior landscape. There still needed to be some sort of separation between the open and enclosed office areas, so I reintroduced the atrium concept. This time instead of encircling the cereal mill, I used the atrium as a main circulation spine of the building running with the enclosed office core. I worked on subdividing the 30' x 30' grid of the open office area along its southeast border in trying to create a new rhythm in the new very plan as facade. Once resolved I extended this same new pattern along the rest of the southeast facade which bordered the cafeteria area.

The building core not only contained executive offices but other enclosed spaces and support functions as well. Directly opposite the cafeteria seating area were three private dining rooms, a kitchen, the food serving area and the dishwashing space. An auditorium was located close to the main reception and employee and visitor entry areas. The building core also served as a wet core since it contained the food preparation area and all employee restroom facilities. Larger conference rooms were generally located on either side of the restrooms.
I next decided to extend the axis which ran parallel with the existing mill from the visitors parking lot through the building on out to the employees parking lot, thereby moving the triangular employee entry building and underground tunnel located there over to keep it on axis. I likewise changed the angle of the service tunnel to the parking lot. The tunnels tied into the office headquarters at the basement level.

In order to facilitate better employee circulation and for the sake of convenience, I added another tunnel from the employee parking lot to the building and lined it up on axis with the northeast tip of the floorplan. This created another employee reception area in addition to a new northeast corner entry/exit to the building. This new axis also created a major circulation path across part of the open office area. I angled the two already existing perpendicular circulation paths so that they would intersect at employee reception areas.

I studied a variety of ways to enclose the atrium space but the one which seemed to work best was a half-cylinder for a roof enclosure. This allowed for a smoother transition between the two story building core and the one level open office and cafeteria areas. I had considered the use of passive solar technics when I programmed the building. For this reason and the fact that I wanted to incorporate some indoor landscape in the atrium for aesthetic touches, I felt glass was the best medium for the atrium enclosure. No doubt some form of reflective glass would work best to reduce some of the heat load. This heat, however, could be vented to various parts of the building during the winter months though. Sun shading devices would provide a means of control for employees whose work stations border the atrium.

I looked briefly at the idea of using a custom curtain wall on the building as a means of providing for energy efficiency. A speculative office building designed by Wolf Associates of Charlotte, North Carolina, made use of a concept of "solar belts" which horizontally wrapped the building. Fans inside these belts circulated sun warmed air to the cold side of the building in winter and reclaimed cool air from the office interiors to the hot side of the structure in the summer. The idea intrigued me but the time and effort needed to develop such a system for my project wasn't available. The design image expressed in the horizontal alternating bands of clear glass and high polished aluminum did impress me though. It was that kind of crispness in detailing that I wanted to achieve in my design efforts. I ex-
perimitted with trying to find the right ratio of clear to opaque glazing in my facade treatments. I worked with the west elevation of my project where views out of the executive offices were at a minimum. It was more important I thought to allow natural light into the offices than allow for an unpleasant view out. I considered the possibilities of using glass block to overcome this problem. However, since Cummins is in the business of manufacturing diesel engines, I wanted their headquarters to look industrialized, more of a HIGH-TECH image. Glass block fits into the post-modern theme better than it does the HIGH-TECH I believe. I decided to make use of a modular panel system for the exterior walls. I worked with several sizes until opting for a 3' square standard panel which alternated vertically with a 9" band of Corten steel. A translucent panel was used on certain rows to bring natural light into the executive offices. On the north and southeast facades bordering the open office area and cafeteria, the first three rows of panels from the ground up were replaced with glass to allow employees an abundance of natural light and views of the landscaped exterior plaza.

Structurally, I decided to go with a steel frame and bar joists. Attached to these joists over the cafeteria and open office areas were custom designed lighting fixtures which consisted of half cylinders with the light source suspended in the middle of them. These fixtures ran parallel to the atrium in 5' widths and continued the pattern already established by the shape of the atrium enclosure. Water lines and mechanical ducts were located between the webs of the joists with fire sprinklers and vents for air supply and return located conspicuously between the joints of the lighting fixtures. This tube lighting system was designed to reflect indirect lighting off either white or stainless steel half cylinders and down on the employee work stations thus reducing the possibilities of glare. Task lighting could be incorporated into the individual work stations if more light for close up work was required. The lighting fixture shape would be reversed over the cafeteria area. Suspended silk swags hung from the fixtures would soften the light given off by the tubes. With the installation of dimmers, the lighting effect could be varied for a number of functions including possible night time receptions and meetings. This idea is borrowed from the unique and successful cafeteria design scheme at John Deere West, Moline, Illinois, designed by Kevin Roche, John Dinkeloo and Associates.
Diagonal emphasis was used to separate the headquarters from the downtown park, and to line up the visitor's parking on axis with the existing mill and the employee parking lot.
The larger end of the triangle is still used as an open office area with work stations surrounding a commons area consisting of conference and restrooms, xerox and employee lounges. Note the small end of the floorplan has now been zoned for more public functions.

Using the far west portion as a building core containing enclosed offices and support functions freed the rest of the ground floor plan for use as a cafeteria and open office area.
I experimented with placing the executive offices on the perimeter of the building surrounding the open office.

I studied the idea of level changes: executive offices on the upper level, open office in the middle, and sky-lighted common areas (employee lounges, interior landscape, main circulation, etc.) on the lower level.
I moved the cafeteria to the smaller end of the triangular plan and realigned the visitor's entry on an axis parallel to the existing mill. Note the creation of a new main reception area at the intersection of the visitor's axis and the employee entry.
Various schemes of organizing the executive offices (each one requiring a work space for the individual, a conference area and secretarial space.)
I came up with the idea of placing all the enclosed offices in a row along the west side of the building. I then removed a small triangular shaped section from the plan where the main reception area was located and placed that identical element in the middle of the corporate parking area as a new employee entrance. A tunnel allowed employees access to the office building.
I introduced pathways in the open office area perpendicular to the building core and envisioned these circulation paths as skylighted and lined with interior landscape.
A conceptual diagram shows clearly the employee entrance tunnel, the atrium area acting as a main circulation spine of the building separating the enclosed building core from the open areas, and the perpendicular pathways stemming from the atrium noting further circulation corridors.
I worked on subdividing the 30' square grid of the open office area along its southeast border in trying to create a new rhythm for the now very planar facade.
I considered introducing more interior landscape and circulation paths in the open office area to help break up its still vast size.
I extended the new facade pattern along the rest of the southeast wall which bordered the cafeteria area.
Directly opposite the cafeteria seating area were several corporate functions, including private dining, kitchen, food serving and dishwashing spaces. A theater was located close to the main employee and visitor reception areas.
I next extended the axis which ran parallel with the existing mill from the visitor's parking lot through the building on out to the employee parking lot.
I also changed the angle of the building's service tunnel which connected at the basement level adjacent to the dry and refrigerated food and waste storage areas.
Another tunnel was added from the employee parking lot to the building on axis with the northeast tip of the floorplan. This created another employee reception area and a new northeast entry/exit to the building. The already existing perpendicular pathways across the open office area were angled so that they would interest at employee reception areas.
I studied a variety of ways to enclose the atrium space.
Notice the form of the atrium is carried on in the design of the custom lighting fixtures.
The solution which seemed to work best was a half-cylinder for a roof enclosure. This allowed for a smoother transition between the two story building core and the one level open office and cafeteria areas. Reflective glass would help reduce some of the heat load created by a glass covered atrium. Part of this heat could be vented to various areas of the building during the winter months though.
I looked briefly at the idea of using a sophisticated custom curtain wall on the building as a means of providing for added energy efficiency. A speculative office building designed by Wolf Associates of Charlotte, North Carolina, made use of a concept of "solar belts" which horizontally wrapped the building.
I especially liked the strong horizontality expressed in the facade treatments of the office building by Wolf Associates. I experimented with trying to find the right rhythm or ratio of clear to opaque glazing in my elevation studies.
I considered the possibility of using glass block as a building material to allow natural light into the enclosed executive offices where views out were at a minimum. I did decide, however, to make use of a modular panel system for the exterior walls, working with several sizes until opting for a 3' square standard panel which alternated vertically with a 9" band of Corten steel.
On the north and southeast facades bordering the open office area and cafeteria, the first three rows of panels from the ground up were replaced with glass to allow employees an abundance of natural light and views of the landscaped exterior plaza.
Structurally, I decided to use a steel frame and bar joists. Attached to these joists over the cafeteria and open office areas were custom-designed lighting fixtures which consisted of half cylinders with the light source suspended in the middle of them. Mechanical ducts were located between the webs of the joists with vents for air supply and return located conspicuously between the joints of the lighting fixtures.
This tube lighting system was designed to reflect indirect lighting off either white or stainless steel half cylinders and down on the employee work stations thus reducing the possibilities of glare.
Task lighting could be incorporated into the design of the office furniture and individual work stations if more direct light for close up work was required.
The lighting fixture shape would be reversed over the cafeteria area. Suspended silk swags hung from the fixtures would soften the light given off by the tubes.
SITE PLAN

The site plan shows the triangular shaped office headquarters and matching "downtown park". A brick paved civic plaza is used to separate the two. An existing landscape pattern of small trees established by a garden of the adjacent bank was carried over to the new headquarters site. A series of bollards was used to complete the circle around the existing cereal mill and to define the boundaries of the plaza. It's interesting to notice the building's semi-circular plaza around the existing mill was also reflected in the landscape in a space allocated for a circular reflecting pool. Note also the strong presence of the axis which slices diagonally through the cereal mill and the site.
Office modules of 30' square and illustrated by dots representing column locations show just how large the open office area is. Possible placement of large fig trees line the axis which defines the atrium area.
BASEMENT

The height requirement for the squash courts necessitated a sub-basement level. The service tunnel ties in with the dry and refrigerated storage areas for the kitchen above. The location of the mandatory fire stairs, which run vertically through the building core, shows up clearly in this plan.

MEZZANINE

This top level of the building core overlooks the atrium and contains more executive offices including those of the President and Chairman of the Board. Secretaries at the reception areas are responsible for booking the large conference rooms. A bridge ties the mezzanine level to the executive lounge and board room located on the second floor of the existing cereal mill. Ramps lead down from the bridge to the cafeteria and open office area.
SECTIONS

Section 1 shows the sub-basement location of the squash courts in the building core.

Section 2 illustrates the repetitive form of the atrium enclosure in the custom light fixtures over the open office area.

Section 3 is on a diagonal which slices through the existing cereal mill. The basement corridor which extends from the Museum Storage area to the employee entrance tunnel is a fire safety exit for those in the corporate museum, executive lounge or board room.
ELEVATIONS

All elevations tend to show the immense horizontality of the low rise office structure. The east elevation is viewed from the landscape/plaza area. Both east and north elevations contain a majority of glazing to allow for an abundance of natural light and views of the outdoors from the cafeteria and open office area. In order to help break up the vast uniformity of the west elevation, special "sunscreens" made of Corten steel were used to add depth to the facade. Another idea borrowed from the John Deere headquarters in Moline, Illinois.
The jury comments and scores were much better at the end of my third quarter of thesis.

* Although the presentation was still weak in definition of form (axons, perspectives, etc.), I had built a scaled partial model showing the visitor's entry, corporate museum and the main employee reception area. A segment of the building core containing executive offices, conference rooms and restroom facilities was also represented along with a small portion of the open office area and cafeteria. The atrium (including some representation of interior landscape) was clearly shown as a separation element defining the open from the enclosed spaces.

* The employee entrance tunnel connections at the basement level of the building were not thoroughly worked out.

* The elevations needed more study.

* I had noted the use of a variety of materials and colors in the facade treatments during my presentation. A suggestion was made to limit the number of exterior building materials to three or less.
As noted before, the new headquarters occupied only half of its three block long site; the other half was programmed as a small downtown park for Cummins employees and other downtown workers. Since this outdoor area was as vast as that of the building itself, it meant that some considerable time and effort was needed to come up with a logical landscape plan. Very little thought was given to the outdoor surroundings during the schematic first quarter of design. It was during the new concept and design development phase though that I first started consulting with landscape critics on ways to try and define certain site perimeters and possible design solutions affecting them.

The only real program requirements I had envisioned for the site plan were the inclusion of:
1) a ceremonial visitor's arrival and drop off area intended for corporate guests and architectural tour buses
2) a visitor's parking area
3) an outdoor dining area adjacent to the employee cafeteria
4) some form of water as a landscape device
5) a continuation of the "tree garden" concept used in the landscaping of the bank adjacent to the office site
6) a possible incorporation of a pedestrian arcade surrounding the building, similar to the one used in front of the adjacent post office (this idea was never fully developed)
I began my landscape studies with the plaza area surrounding the existing cereal mill. I had noted a special reverence for the mill by carving out the semi-circular niche around it in the building's floor plan. Since the mill had been programmed as a corporate museum and visitor reception area, it seemed only logical to place special emphasis on the design of the mill's plaza as a visitor's entry area. Surprisingly enough, my first attempts at designing the mill's plaza and drop off area did not include completing a full circle out of the already present semi-circular niche encompassing the mill. Instead I worked more with the ceremonial arrival of the visitor's auto and possible arrangements for visitor's parking, initially located on the building site. Water was introduced in the form of a small pool surrounding the front of the cereal mill. Visitor access to the corporate museum was at the rear of the existing structure during the early design schemes. The first major problem dealt mainly with aesthetics--trying to accommodate approximately 40 autos on the site without impairing the strong geometrical image of the project and still maintaining provisions for a landscaped "downtown park."

I was especially impressed with the design solution reached by Charles Moore and Associates in the creation of the Piazza d'Italia in New Orleans. The Piazza serves as a focal point or gathering place for the Italian residents of the city. Although the Piazza d'Italia is elliptical in form, it did give me the notion to round out the shape of the mill's plaza instead of having a blunt ended concept which I had used to accommodate the visitor's drop off area.

While looking through a sketchbook, I came across a rendering of a circular outdoor plaza, complete with large potted trees, surrounding a museum. This drawing helped me to visualize the kind of space I was hoping to create for the cereal mill's plaza.

With the circular mill plaza complimenting the strong geometric forms used in the office headquarters design, I set about schematically designing the rest of the site plan. I experimented with running a ceremonial visitor's arrival lane along the southeast facade of the headquarters. This allowed for a drop off point in front of the corporate museum where the new visitor's entry was located. The problem with this idea was trying to find an exit point for the lane. I also quickly noticed that by placing the arrival lane and drop off area next to the building, I had destroyed the pure geometry of my design concept. I had, however, resolved to introduce water on the site in the form of a circular reflecting pool--paralleling the image of the cereal mill's plaza. Just exactly where to place this pool was another question.
I next studied the idea of running the arrival lane for a short distance in line with the diagonal site plaza separating the headquarters from the "downtown park." At the visitor's drop off point in front of the mill, the lane would angle off and continue to run, this time parallel with the building's interior atrium and the north-south downtown streets. The reflecting pool, still undetermined in dimension, was sandwiched on the site in between the diagonal plaza and the new arrival lane. The visitor's parking area had been moved to a new location adjacent to and east of the building site. The visitor's pedestrian approach was defined clearly as a pathway on axis with the existing mill.

Somehow, I still felt that the site plan was not resolved to its maximum potential. There were still problems with the presence of the arrival lane on the site. Landscape critics agreed that the lane sliced awkwardly through the site and took up too much of the landscape considering it would be used for its proper use so infrequently.

* One should remember that this lane was designed for purposes of mainly impressing a visitor by creating more of a ceremonioal entry to the corporate headquarters. Its use would probably be resolved for the arrival of the Board of Directors and special guests. Most business visitors to Cummins headquarters would park their autos in the area reserved for visitor's parking and walk to the visitor's reception area located just inside the corporate museum.

It was while viewing a site plan of the Royal Crescent and the Circus at Bath, England that I decided to try yet another landscape scheme. By envisioning the circular reflecting pool as the Circus in plan and part of the mills plaza as the Royal Crescent, I eventually came with the third and final landscape design scheme. I elevated the circular mill's plaza by two feet, thereby showing further reverence to the existing structure (which was Cummins' first machine shop) by placing it on a pedestal. A series of soft-lit bollards encircling the mill on its pedestal plaza would also help highlight the existing structure. In contrast to this, I planned for a downward spraying peripheral fountain surrounding the circular reflecting pool whose size and location I had finally determined. Seating placed around the perimeter of the pool would create a nice noon time relaxation spot for office employees and other downtown workers. I introduced a pedestrian pathway from the pool to Jackson street parallel with the pedestrian pathway from the visitor's parking area to the corporate museum. I had mentioned earlier my desires to incorporate the "tree garden" concept of the adjacent bank into my site plan. I did go ahead and ex-
tend this tree pattern along the south and east sides of my site. I also made several modifications to the diagonal site plaza separating the office building from its "downtown park." I narrowed its width at the southwest end but kept the plaza wider outside the cafeteria area to accommodate outdoor dining. I extended the size and shape of the plaza at its northeast end, creating a new triangular shaped visitor's arrival plaza, adjacent to the mill's elevated plaza. To help establish some order and break up the vastness of this new arrival plaza, I introduced several bands of dark colored paving bricks into the plaza's paving pattern, radiating them from the mill's plaza area to Jackson street. Four of these paving bands, as well as a series of flagpoles adjacent to the sidewalk on Jackson street, were used to define a visitor's drop off area. This new drop off was located on the building site adjacent to the corporate museum and visitor's entry area and just opposite the visitor's parking area. A ramp was included in the design of the elevated mill's plaza to provide the handicapped with access to the corporate museum from the visitor's arrival plaza.
My first attempts at designing the mill's plaza and visitor's drop off area did not include completing a full circle out of the already present semi-circular niche encompassing the mill. Water was present in the form of a small pool surrounding the front of the cereal mill.
In the early landscape schemes, I dealt more with the ceremonial arrival of the visitor's auto and possible arrangements for visitor's parking. The major question was one of aesthetics—how to accommodate approximately 40 autos on the site without destroying the strong geometrical concept of the project.
I was impressed with the design solution reached by Charles Moore and Associates in the creation of the Piazza d'Italia in New Orleans and because of its strong image, I decided to round out the shape of my existing mill's plaza.
This rendering of a circular outdoor plaza complete with large potted trees, helped me to visualize the kind of space I was hoping to create for the existing mill's plaza.
I proceeded to schematically design the rest of the site plan. I experimented with running a ceremonial visitor's arrival lane along the southeast facade of the headquarters. The problem with this idea was trying to find an exit point for the lane. I soon noticed that this scheme destroyed the pure geometry of my design concept.
I next studied the idea of running the arrival lane for a short distance in line with the diagonal site plaza. At the visitor's drop off point in front of the mill, the lane would angle off and continue to run parallel with the building's interior atrium and the north-south downtown streets. Water, in the form of a circular reflecting pool, is shown here sandwiched between the diagonal plaza and the arrival lane. Note the visitor's pedestrian pathway on axis with the existing mill.
I got an idea for yet another landscape scheme while viewing a site plan of the Royal Crescent and the Circus at Bath, England.
For my final landscape design scheme, I planned for a downward spraying peripheral fountain surrounding the circular reflecting pool, whose size and location I had finally determined. I extended the "tree garden" concept of the adjacent bank along the south and east sides of my site. I also made several width modifications to the diagonal site plaza separating the office building from the "downtown park."
I extended the size and shape of the diagonal site plaza at its northeast end, thus creating a new triangular shaped visitor's arrival area adjacent to the existing mill's circular plaza. In contrast to the sunken pool, I elevated the mill's plaza by two feet, thereby showing further reverence to the existing structure by placing it on a pedestal. I introduced several radiating bands of dark colored paving bricks into the plaza's paving pattern to help break up the vastness of the new arrivals plaza. This plaza also included a visitor's drop off area located on the building site.
Special Studies
In general, the facility should allow work-flow and communication processes to function optimally.

- The building should facilitate workplace rearrangement without structural alterations.
- As much as possible, the facility should accommodate the group and workplace arrangements established by the correlation diagram.
- Groups which have a great deal of communication with each other should not be separated vertically.
- Office areas should be divided by as few permanent walls as possible.
- Columns should not divide the office area or hinder rearrangement of workplaces. Generally, there should be no less than 30 feet between columns.
- Every part of the open landscape should enjoy the same conditions of lighting, air conditioning, and acoustics.
- A 5-foot grid usually works well for telephone and electricity outlet systems.
- The floor should have a load-bearing capacity which allows installation of all necessary furniture and equipment in any location in the office.
- It should be possible to look out of the windows from any workplace.
- The optically effective height of the open area should be about 9 feet. Greater height gives less acoustical privacy.
- The lighting of the office area should provide equally pleasant working conditions for all workplaces. Generally, light intensity should be 100 footcandles after 50 percent of normal usage.
- The temperature and humidity of the office should be fully controlled.
- The acoustical balance of the office should guarantee that normal conversations cannot be understood beyond 18 feet, or 12 feet with screens.

- The number of floors should be kept to a minimum, producing large squarish floor areas.
- All office areas within one floor should be functionally accessible from one point. The entire flow of visitors, personnel, material, and paper from one floor to another should pass through this point of accessibility.
- Vertical transportation elements should be collected, forming the building core.
- Special areas related to or requiring vertical transportation elements should be collected at the building core.
- In order to maximize open-landscape flexibility, the building core should be located to one side of the building.
- The sound level in the office should be between 50 and 55 decibels (NC 40 to 45) with as little fluctuation as possible.
- The air-conditioning system should be designed in interior and exterior zones to ensure balanced temperature control at the center and edges of the space.
- Air speed at the work surface should not exceed 6 inches per second.
- The rate of fresh air exchange should accommodate the relatively large concentration of office personnel in the open-landscape area.
- Relative humidity within the office should be between 45 and 55 percent.
- The noise level generated by the air-conditioning system should be considered in the overall acoustical balance of the space.
- The entire lighting system should be glare-free. This means the angle of vision to the light source should be no greater than 45 degrees, or light-source shields should be provided.
Most advantages of the office landscape are measureable; however, there are quite a few, confirmed by open-landscape users over the course of many projects, that are very real but intangible, that is, difficult to measure. Some of these intangible benefits are listed below.

- The landscape is a more pleasant and stimulating work environment than the conventional office, and affects efficiency and productivity positively.
- Communication and work flow between individuals and groups are improved.
- Work flow and communication inefficiencies are easier to detect and rectify.
- Access to individuals, groups, and information is easier and faster.
- A feeling of group identity is created or bolstered, and individual and group morale is higher.
- Because they are no longer in individual cubicles or offices, the users often work in small teams, taking advantage of each other's knowledge, ideas, and fresh points of view.
- The openness of and user visibility within the landscape cause the users to become more considerate of one another.
- Possibly because of close identification with the space itself, and because it is aesthetically pleasing, the users tend to improve their personal grooming.
- By the same token, individual workplaces are also more orderly than in the conventional office.
- The organization's overall image to visitors and business associates is enhanced.
- Absenteeism and abuse of sick leave are reduced.
- Personnel turnover is reduced and recruiting new personnel is easier.
- Department transfers and new employees adjust more quickly and easily to their new positions because of user accessibility and openness of communication.
- The users understand and appreciate the landscape because of their participation in its planning and design.
- There is less verticality in the organization's structure and hierarchy.
- User relationships and interactions become closer and less formalized because communication lines are more open and equal.
- The users' self-esteem and security grow and are supported by more open communication and an equitable, nonarbitrary status distribution program.

- The users feel more esteemed by their colleagues because their accomplishments are more visible. This, and a growing sense of individuality and identity, causes the users to take more pride in their work, then to be more esteemed, etc., so that an upward spiral results from the mutual reinforcement of self-esteem, esteem by colleagues, and productivity.
- The users' pride in and identification with the organization are also renewed and strengthened, perhaps because by planning and implementing an office landscape the organization has shown itself to be progressive and interested in its personnel as well as efficiency.
- User complaints, most commonly directed at management, are almost eliminated. This may be due, at least in part, to the close proximity and accessibility of management to other users.
  - Increased user/management interaction fortifies mutual esteem.
  - Accessibility, visibility, and open communication lines allow management to pinpoint group members of real value to the organization, and to put these employees' talents to the best uses. For example, if it becomes apparent to a supervisor that a given employee is especially talented in an area she/he is not primarily involved in, then the supervisor can change the employee's tasks and involvement accordingly. This is good for both the organization and the individual, and probably would not be a possibility without employee/management familiarity. This familiarity also enables management to identify any employees who are altogether unproductive.
  - The office landscape facilitates faster, more informed decision making. Mutual accessibility, proximity to group activities, and informal communication which encourages negative as well as positive reports combine to make more complete information available to management when decisions are needed.
Functional Considerations

- Furniture should be of standardized design—to minimize investment costs and simplify inventory.
- Workplace requirements should be met by a combination of standard components—to minimize furniture variety and allow maximum flexibility.
- Furniture should be rigidly constructed—to avoid vibration and assure stability.
- Furniture should be lightweight—to aid workplace flexibility.

- Furniture should be designed for maximum comfort—to promote efficiency and well-being.
- Components should be easily moved without special tools or equipment—to facilitate rapid rearrangement and replacement at minimum cost.
- Furniture design should have adequate floor clearance—to allow easy cleaning.
- Frequently used files should not be enclosed—to minimize search/access time and aid in maintaining orderly files.
- Workplace filing equipment should be mobile and separate from the desk—to minimize the furniture moved in workplace rearrangement and to allow files to be moved to any place of need.
- Workplace file carts should be designed for a seated person and contain files at one level only—to allow easy access.
- Group files should be at two levels—to conserve space.
- Workplace and group file carts should contain suspended files which accommodate the most frequently used paper sizes: letter, legal, and computer printouts—to provide maximum flexibility for materials storage and to allow the user to remove materials easily.
- File carts should be accessible from the top—to provide quick, easy filing and retrieval with maximum visibility of material.

- Central/archive files should be contained in open shelves extending from floor to approximately 6 feet above floor—to conserve space and maintain convenience and safety.
- Bound materials at the workplace should be on open bookshelves which are usable from both sides—to conserve space and bookcase costs and permit usage by more than one person.
- Workplace and group file carts should be modular units—to provide flexibility and allow expansion.
- Furniture and equipment casters and glides should be oversized—to permit easy use on carpets.
- Furniture edges should be smooth and round—to prevent injury to persons and clothing.
- Visual aids boards and visual/acoustical screens should be equipped with long, but thin and narrow, feet—to prevent the units from tipping, and to prevent individuals from tripping over the feet.
Environmental Considerations

- Work surfaces should be nonreflecting with low color/tone contrasts between surfaces and work papers—to reduce eye strain.
- Furniture and equipment should have minimum vertical sound-reflective surfaces—to aid, not hinder, the overall acoustical balance of the space.
- Furniture should be open, transparent, with as few skirts and panels as feasible—to prevent the user from feeling crowded or closed in and to allow more complete sound control.
- Drawers, doors, casters, and other potential noise producers should be designed for quiet operation—to eliminate disturbing and unexpected noises.

Aesthetic Considerations

- Furniture should enhance the office environment—to affect office work positively and to attract potential employees.
- Pieces of furniture designed and/or selected should be compatible with the overall open landscape—to provide an aesthetically pleasing environment.
- Lounge furniture should be different from workplace furniture—to provide psychological as well as physical breaks from office work.
- Heights of furniture types (screens, plants, visual aids boards, bookcases) should vary—to eliminate a potential visual plane between floor and ceiling.
CEILING

AIR SHOULD MOVE VERTICALLY
CEILING SHOULD PROVIDE LIGHT AT WORK SURFACE
POWER AND SIGNAL SYSTEM

THROUGH FLOOR SERVICE

THROUGH CEILING SERVICE

PRIMARY SERVICE
- A pleasant environment should be provided the entire office staff, eliminating possible competition for better space.
- A monotonous office environment should be avoided because the environment directly relates to the employees' attitudes toward their work.
- The environment should be stimulating, but should not cause stress or antagonize the users. A mixture of colors is suggested, with slightly more of the red than the blue spectrum.
- Extreme light/dark contrasts should be avoided. Colors selected for the open landscape should be harmonious, with distinction at close range, but blending at a distance.
- Exaggerated or super graphics, if used, should be carefully planned, designed, and placed to avoid becoming tiresome to the users.
- Columns and power and signal poles should blend with their surroundings and not be emphasized.
- The carpet should be light-reflective to permit the white or off-white ceiling to pick up a very slight color tint.
- The carpet should be nondirectional, with either no pattern, or a small, slight one. Large patterns and directional designs optically oppose workplace arrangements.

- Autumn colors are suggested for carpets. Black or other dark colors, and pale blues and greens have either a dulling or sleep-provoking effect on the users.
- Desk and other work surfaces should be light in color, to avoid high contrast with work papers. Light woods (oak, birch, ash) are recommended over dark ones (walnut, teak, rosewood) where wooden furniture is used.
- Floor entries/exits and traffic lanes should not be emphasized by color variations which will hinder future workplace rearrangements.
- The open landscape should have a comprehensive color scheme. If more than one floor is involved, each floor may have color scheme variations provided they do not prohibit between-floor furniture interchanges.
- Because lounges are somewhat separate from the general open-landscape area and serve a different function, colors for lounge furniture and furnishings should deviate from the overall color scheme.
- Graphics must identify, inform, or direct.
- Graphics should not be integral parts of furniture and furnishings, or the flexibility of both graphics and furniture is compromised.
- Graphics including persons' names and/or titles should be designed to permit these names and/or titles to be changed easily.
Plants and Planters  Plants may be used to identify status, ensure adequate distances between workplaces and groups, and define corridors in the open office, but their psychological functions are probably more important. They enhance the environment aesthetically and soften the overall effect of the office on its users and visitors.

Plants should be large, with several plant types in each planter, and each should have its own pot so it can be replaced without interfering with other plants in the planter. Typically, there are four plants per planter, initially forming a regular shape about 3 feet across and the same height as a low screen. As the plants grow, the group should be shaped until it reaches the height of the larger screens, when selected plants should be replaced with smaller new ones.

The department usually negotiates a contract for the purchase and installation of plants and planters based on specifications determined by the planning team with the aid of a plant specialist. But plant maintenance must also be considered, and is generally arranged by contract with a local nursery. An important issue in negotiating the plant maintenance contract is plant replacement. Since the nursery benefits from the office by replacing large plants with smaller ones, it is not uncommon for the nursery to provide weekly plant maintenance, including watering, feeding, pruning, and shaping, in exchange for the large plants it replaces. This arrangement benefits the organization because it requires only an initial cost for the plants.

NOTE: The growth of plants in an open-plan office is phenomenal. Not only do the constant temperature, humidity, and lighting levels positively affect them, but the activity and proximity of people also seem to quicken their growth.

Planters should adequately accommodate four large plant pots, including space around the tops of the pots for easy removal, and ample room at the bottom to minimize the possibility of root rot. The planters should be lined and waterproofed, equipped with carpet casters or glides for easy relocation, and should sit close to the floor. The exteriors of the planters may be of any material aesthetically compatible with other furniture and furnishings.
The last quarter of thesis was basically a time for clean up and reevaluating some of my earlier design solutions. I was surprised to find myself making as many modifications to the design before irking the final drawings as I did. One of the largest areas which had been left unresolved up to this point was the exterior landscaping of the site and final layout of the employee parking area. In response to the immense size of this employee auto space, I introduced two more employee entrance areas and another underground tunnel connecting the parking area to the office headquarters. This provided greater access/egress to the office building and the office building. I also realigned the northern employee entrance tunnel so that it was perpendicular to the building.

Located at the building's end of the three employee entrance tunnels were new elevator cores for better vertical accessibility throughout the building core. In relation to these elevator cores were newly designed reception areas on the ground floor and mezzanine level. Not only was vertical circulation improved, but horizontal access throughout the open office was simplified, in addition to the atrium's length being slightly shortened.

Externally, the facades were composed of a fewer number and variety of building materials. The size of the modular panel on the building's exterior curtain wall was changed from 3' square to 3' x 5' format. The rows of panels alternated with bands of polished stainless steel set flush with the rest of the curtain wall. Previously in the facade treatment, I had used alternating bands of Corten steel channels. A 3'9" x 10' panel was used as a parapet to define the top of the building.

Since employee access/egress to the building was supplied by the three underground tunnels, no ground floor entry to the office headquarters was needed on the buildings west side. This entry was previously shown as a small slit in the building's west facade lined up on axis with the existing mill structure and the new main reception area. With this small entry slit missing and the decorative sunscreens no longer present, the west elevation soon took on a style of immense horizontal uniformity. What was not shown in the final drawings was the constant pattern of trees along this wall to help bring into scale the building's strong horizontality.

The following is a summary of some of the design features and changes made during the final design development and presentation stage:
SITE PLAN

* the employee parking area layout was finalized
* tennis courts adjacent to the employee parking area and included in a design development scheme were later removed
* three employee entrance tunnels instead of the two shown earlier connected the office headquarters to the employee parking area. The service tunnel was realigned to run along side one of the employee entrance tunnels.
* the circular plaza surrounding the existing cereal mill was elevated two feet to serve as a sculpture court
* a peripheral fountain was included in the design of the reflecting pool
* the width of the diagonal plaza separating the building from the "downtown park" was narrowed at the southwest end and widened at the northeast corner
* the diagonal site plaza accommodated outdoor dining adjacent to the cafeteria
* the new visitor's arrival plaza has radiating bands of dark colored paving brick stemming from the mill's plaza to Jackson street to help break up its vast size
* bollards were extended along the arrival plaza to define a new visitor's drop off area. A series of flagpoles help denote the entry and exit points of the drop off area.

BASEMENT

* a new employee entrance tunnel was added at the southwest end of the building site to provide greater access/ egress to the office headquarters for employees
* the service tunnel and the northern employee entrance tunnel were realigned so that they were perpendicular to the building
* new elevator cores were located at the building's end of the employee entrance tunnels
* the locations of the dry and refrigerated storage and waste areas for the kitchen were changed slightly

GROUND FLOOR

* the major change was the redesigning of the employee reception areas which now included elevator cores for better vertical circulation throughout the building core
* an additional employee reception area just opposite the cafeteria was added with the inclusion of a third employee entrance tunnel
* the office headquarters' main reception area on axis with the corporate museum was enlarged
* employee entrance and waiting areas were added to each of the three tunnels at the corporate parking area

* the west ground floor and entry adjacent to the main reception area was removed (access/egress to the building's west side is via the tunnels only)

* the south end of the atrium was shortened slightly and its north entry was more clearly defined

* the circulation corridors in the open office area were realigned so that they were once again perpendicular to the atrium's path

* the restrooms and entry located at the northeast corner of the building were removed

* the position of the public restrooms in the corporate museum was changed ever so slightly

* the enclosed ground floor connection from the corporate headquarters was removed allowing visitors the opportunity to walk completely around the existing mill's plaza

MEZZANINE

* a covered outdoor executive terrace adjacent to the chairman of the board's office was added

* the three mezzanine reception areas were redesigned to accommodate elevator cores

* the main executive reception area adjacent to the bridge leading to the board room and executive lounge was enlarged

ELEVATIONS

NORTH ELEVATION:

* a more direct entry to the atrium's north end was resolved

* the employee entrance areas to the tunnels are shown at the corporate parking area location

EAST ELEVATION:

* the 3' square modular panel size was changed to a 3' x 5' panel

* a 3'9" x 10' panel was used as a parapet to define the top of the building

* the atrium was slightly shortened at the south end

* the plaza surrounding the existing mill was elevated two feet placing the mill on a small pedestal and serving as a possible sculpture court area
* shadow lines were used to help emphasize the pattern of 5' setbacks along the southeast facade

* the location of the outdoor executive terrace is shown at the south end of the mezzanine level of this facade

WEST ELEVATION:

* the immense horizontality of the building was shown clearly in the west facade

* the small slit towards the middle of the facade has been removed. It once masked the location of a ground floor entry at the point where the diagonal axis in line with the existing mill protruded through the west side of the building

* the decorative sunscreens were removed

* not shown in this elevation were a series of trees which lined the west facade helping to break up the vastness of its 900' length

PARTIAL ELEVATIONS

Since two of the building's dimensions were so long, elevations had to be drawn at a smaller scale than desired. Partial elevations were used to help clarify the configuration of the exterior curtain wall.

WEST PARTIAL ELEVATION:

* the revised curtain wall was shown more clearly with the 3' x 5' modular panels alternating with bands of polished stainless steel (originally a 3' square panel was used with alternating channels of Corten steel)

* the 3'9" x 10' parapet panel was used to define the top of the building

EAST PARTIAL ELEVATION:

* shadow lines indicate the pattern of 5' setbacks in the southeast facade

WALL SECTIONS

EAST SECTION:

* shown cut through the open office area

* the bottom of the custom lighting fixtures formed the 10'6" ceiling height of the open office area

* the 3'9" tall parapet added to the building's overall height
WEST SECTION:

* shown cut through the enclosed executive offices

* an acoustical ceiling attached to the bar joists of the enclosed office provided a ceiling height of around 9'

* two rows of partially translucent panels allowed natural light into the ground floor and mezzanine level executive offices

* as mentioned earlier, a 3'9" parapet added to the facade's height

SECTION

I opted for a single section perspective for the final presentation instead of the three smaller sections I had used during the design development stage.

* the section perspective slices through the building at the open office area, showing the relationship between the two level enclosed executive offices; the 34' high atrium and main circulation spine of the building; and the one level open office area

* the mezzanine level overlooked the atrium space where large potted trees and other plants incorporated the idea of interior landscaping

* notice that the semi-circular form of the atrium was repeated in the shape of the custom lighting fixtures

* inactive files were stored in the basement level of the building core of the new headquarters
Site Plan
Cummins Engine Company has been producing diesel engines in Columbus since 1919 when the company was founded. One of the company's earliest machine shops was in part of the Cerealine complex which will be restored as part of the headquarters building. Today, Cummins is the leading producer of high horsepower diesel engines for on-highway trucks and the full range of industrial applications, including construction, mining, logging, agriculture, marine, bus and generator set equipment. More than 22,000 persons are employed at Cummins' facilities in the U.S., the United Kingdom, India, Japan, Brazil and Mexico.

The current plans by Cummins include construction of a new corporate headquarters which will provide convenient work space in a central location. This new office headquarters in downtown Columbus is part of Cummins' effort to assist the community in improving the central business area. The structure, in effect, will be an extension of the modern architecture found elsewhere in the central city. It will extend, too, the vitality and economic stability which is already an integral part of downtown Columbus.

The building will be in keeping with the low profile of the central city. Externally, the corporate headquarters occupies roughly half of the three block site. The other half is devoted to a downtown park-like atmosphere consisting of a visitor arrival plaza, a reflecting pool and a landscaped lawn. The existing old cereal mill is constructed of brick and will be renovated to serve as the company's corporate museum and visitor reception area. The triangular shaped floor plan of the new headquarters is designed to partially encircle the existing mill and draw attention to the building as an unique feature of the complex. The construction materials utilized in the new building consists of a modular panel system which wraps the building like an outer skin and displays a "high tech" image representative of the modern technology utilized in manufacturing the company's main product - diesel engines. Internally, an effort will be made to provide a pleasant and efficient work atmosphere geared to the needs of employees. The building is designed to accommodate 1,000 persons. Employee parking is located to the west of the office site with employees entering the new headquarters via one of three underground tunnels. Once inside, the building is zoned primarily for either enclosed or open spaces. Enclosed spaces include executive offices, restrooms, an auditorium, food preparation, executive dining, boardroom, and on the basement level squash courts, showers/lockers, and files/storage. Open spaces include the cafeteria area (also used for night and community functions), the large open office area and the 700' long interior street-like atrium which not only serves as the main circulation axis for the building but also as a separation element between open and enclosed spaces.

Abstract
Conceps
Basement Plan

1 - Recreation Room
2 - Service Tunnel
3 - Service Elevator
4 - Food Storage
5 - Files/Storage
6 - Employee Entrance Tunnel
7 - Museum Storage
8 - Showers
9 - Squash Courts
Ground Floor Plan

1- Employee Entrance
2- Private Dining
3- Food Selection Area
4- Food Preparation/Dishwashing
5- Auditorium
6- Main Reception Area
7- Executive Office
8- Executive Secretary
9- Cafeteria
10- Corporate Museum/Visitor Reception
11- Open Office Space

+ atrium  c- Conf. Rm.  L- Lounge
Mezzanine Plan

1 - Outdoor Terrace
2 - Chairman of the Board
3 - President
4 - Private Kitchen
5 - Executive Dining
6 - Reception
7 - Executive Office
8 - Executive Secy.
9 - Executive Lounge
10 - Boardroom

c - Conf. Rm.
Partial Elevations

Wall Sections
Section Perspective
This book is far more than a summary of my thesis project; it represents a fitting conclusion to several long years of formal architectural study. Although the college years are over for awhile, my informal architectural education will continue for the rest of my life.

The designing of a corporate office headquarters has indeed been a challenging experience. While researching the seemingly endless amount of material available on office design, I came across several quotations which I thought were appropriate in expressing the ideas, feelings and in essence, the spirit of the ever changing evolution of office design. Some of these quotations appear at the beginning of this book, signifying the fact that design begins with thoughts and ideas along with a distinctive need for a particular project, and proceeds step by step as one translates the programmatic requirements into a three dimensional architectural expression.

As office design evolves, it becomes increasingly more sophisticated and demanding. Presently, employees involved with office environments have a higher level of education and a broader range of experiences and hopes than those in the past. The evolving attitudes and expectations that new office workers bring with them proves that today, more than ever before, employees feel they have the right to take part in decisions affecting their jobs. Researchers are finding that the great mass of people is indeed rich with unminned nuggets of human potential and that what is needed more is the actual implementation of some of those ideas and ideals of these individuals. In summary,

WHAT ARCHITECTURE IS REALLY ALL ABOUT ... IS PEOPLE!

Kevin Eugene Thompson
January 22, 1981
If you believe...
from the Wiz

If you believe
Within your heart you'll know
That no one can change
The path that you must go

Believe what you feel
And know you're right because
A time will come around
When you'll say it's yours

Believe that you can go home
Believe that you can float on air
Then click your heels three times
If you believe, then you'll be there...

Believe in yourself
Right from the start
Believe in the magic
That's inside your heart
Believe all these things
Not because I told you to.

But believe in yourself...
If you believe in yourself...
Maybe you can believe in me too.
Evaluation

Three to four weeks after move-in, the working group and an appropriate specialist should conduct an employee attitude survey. A questionnaire should be designed which encompasses all elements of the open-landscape environment—psychological, physical, and functional—including but certainly not limited to the following: workplace location, group location, access to people and information, effectiveness and productivity, identity, status, visual and acoustical privacy, lighting and temperature, furniture and equipment, special facilities, filing system, plants, and color and graphics. This questionnaire should be distributed to all users, and should allow a range of answers to each question in order to register degrees of positive and negative feelings.

Approximately six months after move-in, a similar employee attitude survey should be conducted and summarized in a second report. The purpose of the two surveys is to analyze the users’ immediate and postadjustment responses to the open landscape, and to compare the two. Usually, the initial responses are positive and the second are even more so. The surveys are also helpful in pinpointing any adjustments that need to be made.
Feedback from employees and reactions to their working environments are very important criteria in helping employers make proper management decisions in the future. The following are some comments and reactions obtained from a survey taken from employees of the John Deere Corporation, Moline, Illinois, after they had moved into their new corporate headquarters designed by Eero Saarinen. Positive responses include:

+ the building changed the thinking of a lot of employees
+ the building created an enormous sense of pride among employees
+ the building’s image drew many well-qualified applicants which was one of John Deere’s most important goals and program requirements
+ the company established an art lending library
+ status was handled by architect Saarinen by simply changing the office size module
+ a full scale mock up of office furniture was useful in designing the layout of the building
+ the design created a new awareness or consciousness among the employees in reference to how they perceived their own relationship with their fellow office workers

Buildings are for people to enjoy. The most important thing any specific building can do is respond to human needs—physical, emotional, and intellectual.
The summary also included some negative responses such as:

- no allowance for personal touches (the company has a strict aesthetic policy in regards to what can be displayed at the individual work stations)
- denied privacy as a result of the open office layout, for example: many workers complained of the problem of secretaries overhearing and openly discussing important executive material
- no lounges or meeting areas
- lack of temperature and humidity control, extreme dryness produces tension in the air, a possible solution might have been to install thermopane windows to keep windows from fogging and to raise the humidity a little.
- temperature studies have shown that women prefer warm offices while men seem to like colder ones
- use of bright florescent ceilings
- absence of color
- specialized forms (such as first aid) cannot be accommodated in standardized rooms

A follow up and final evaluation showed:

- employees still expressed concern over the lack of temperature control
- some felt the parking lot was located too far away

however,

- most people felt they worked in a beautiful surrounding
- the dress code improved with the presence of the new office environment
- the caliber of personnel improved with the new facilities
- the employees exhibited a new sense of pride for their job and their environment
- the company's corporate image grew stronger
- most all workers agreed that the building set a new precedence and guide for future office building design
A. Introduction
In the fall of 1979, Steelcase, Inc., commissioned Louis Harris and Associates, Inc., to conduct a second major survey of office workers to expand upon the findings of The Steelcase National Study of Office Environments: Do They Work?, conducted for Steelcase in 1978. This follow-up survey, with interviews conducted from January 1 through January 31, 1980, provides information on the attitudes of office workers and the various factors in the office that contribute to their comfort and productivity on the job.

Moreover, as you will see when reading through this report, this new study builds upon the findings of the 1978 report, and relates any changes of attitudes among office workers and executives relative to the wide variety of factors affecting the office environment.

The content of this survey was developed by Louis Harris and Associates with the help and expertise of Steelcase staff members. Louis Harris and Associates was solely responsible for the questionnaire design, field work, analysis, and observations in this report.

This report contains a summary of findings, a detailed analysis of findings, summarized tabular results, and an appendix with methodological descriptions including explanations of the sample design and field methods.

B. Study Design
This study is based on in-home interviews with a national cross section of 1,004 office workers working full-time for six months or more in offices of 25 or more employees, and with 203 executives who have responsibilities for office planning in major corporations. In-depth interviews of approximately 50 minutes were conducted with office workers of different levels -- managers to secretaries -- who are 18 years or older and living in urban and suburban areas of the top 100 metropolitan population areas of the United States. The questionnaire design was based on findings from a focus group interview with 15 qualifying office workers.

C. Rationale and Objectives
The growth of white collar employment and the accompanying technology continues to be dramatic. If the growth of technology is to continue at a rapid pace, industries will need accurate and timely data about the needs of the people who use their products.

The primary concern of this study is to obtain information which can contribute to the understanding of the relationship between perceived comfort and job performance. Secondly, the study builds on information about the needs of office workers that was uncovered in the 1978 survey.
The study was devised to assist industry managers, planners, and designers by providing them with detailed information about the comfort and productivity of office workers.

The specific objectives of the study were:
- To determine the attitudes and perceptions of office workers towards the factors in the office that contribute to their physical comfort;
- To determine the degree of communication between office workers and executives and the degree of management concern for office workers' comfort;
- To ascertain current measures undertaken by managers of Fortune 1300 corporations to improve their employees' on-the-job performance, particularly in relation to their physical comfort;
- To obtain some indication of the future of some productivity measurement in the office.

D. Study Organization
This study is organized into six specific chapters, as follows:
I. Productivity and Comfort
II. Office Conditions and Comfort
III. Energy Conservation, Office Temperatures, and Air Circulation
IV. Lighting
V. Office Chairs
VI. The Future

Note: The terms business executives, executives, and office decisionmakers are used interchangeably in this report to describe the sample of 203 opinion leaders. They are persons responsible for the physical office environment, and who are involved in maintaining the facility and its services and in policymaking regarding the use and type of equipment. They may or may not be responsible for employee relations.
The terms office workers and employees refer to the cross section of 1,004 persons employed in offices. They may be managers, professionals, secretaries, or clerical workers, and their job may be at the level of a senior manager, middle to upper middle manager, supervisor, or regular worker.
E. Eight Major Findings

1. While more office workers perceive their pay to be inferior to that of blue-collar workers than perceive it to be better, substantial majorities feel that in their physical comfort on the job and in their ability to communicate with management, they are better off.

Sixty-nine percent of office workers perceive that they are better off than other types of workers when it comes to physical comfort on the job, while only 5% feel they are worse off. Sixty-five percent perceive their general surroundings on the job to be superior. In comparison, only 23% perceive that they are better off in terms of pay, while 37% feel they are not as well compensated as blue-collar workers.

Majorities of office workers also feel they are better off, in terms of their ability to communicate with management, and in terms of their status in society (although 40% perceive their status to be about equal to that of workers in other types of jobs). A plurality feel they are better off in terms of their relationship with management.

Ten percent of office workers are not satisfied with their relationship and ability to communicate with management relative to other types of workers, and this 10% includes a greater proportion (11% to 15%) of younger workers aged 18-29, workers in pool type offices, clerical workers, and government workers who feel they are worse off than other workers in their relationship with management or in their ability to communicate with management.

2. While most office workers have not had their productivity measured in any job they may have held, and a high 56% would consider such measurement very difficult or impossible, a 55% majority personally favor having how much work they produce on the job measured.

Most office workers (58%) feel confident that they produce about the same amount of work as workers in other types of jobs, and 17% consider themselves more productive. Ten percent feel they may be less productive, and another 10% volunteer that they can't be compared to other types of workers.

A surprising high 41% of office workers have held a job where their work output was measured, but more (53%) have not. Moreover, while 41% feel that measuring their work might be very or somewhat easy, 45% consider it somewhat or very difficult, and 14% feel it would be impossible to measure their output.

Despite this, a 55% majority favor having their work measured while 35% oppose it. More likely to consider it difficult or impossible to measure their work are older office workers (40 years of age or older) office workers who spend less than half their time sitting at a desk, and senior managers. In fact, 30% of executives, managers, and supervisors claim it would be impossible to measure their productivity, although a high 65% would favor such measurement if it were instituted. Resistance to measurement of productivity is highest among clerical workers, who favor it by a slim margin of 48-40%.

One key to measurement of productivity must be incentive. Fully 67% of office workers feel that those who produce more in a day should be rewarded for their productivity. Most (57%) feel that they should be rewarded with pay raises, although 19% feel promotions are acceptable rewards, and 20% volunteer that pay raises, promotions, and other rewards should be given to these workers. Fully 95% of the office planning executives interviewed agree that rewards should be given for productivity. While 40% perceive pay raises as the most appropriate reward, 45% volunteer that all types of incentives—pay, promotion, and others—should be made available to productive employees.

3. Knowing that if you produce more in a day, you'll be paid better is considered by more office workers (48%) to contribute a great deal to improvement in productivity than any of the other nine possibilities tested, but a high 45% feel that more comfortable heat, air conditioning, and ventilation would contribute a great deal to productivity. Another 26% feel it would contribute somewhat.

Fully 71% of office workers feel that improvements in the temperature and circulation of the air in their offices would contribute to helping them produce more work in a day than they do now. 67% feel the same way about pay incentives.

Sizeable majorities also cite more quiet when you need to concentrate on the job (67%) and more encouragement from managers and supervisors (66%) as having the potential for contributing to improved productivity. Smaller majorities add more experience with your job (59%), better or more office equipment (54%), more desks and ties that store papers where you can easily find them (53%), and more stability in the office and less moving around of people (51%). Forty-six percent also feel that a more comfortable chair with good back support would contribute to productivity, a greater 53% feel it would do so only a little or not at all. Similarly, better lighting is perceived by 57-41% to have little potential for contributing to productivity.

The 203 executives with office planning responsibilities who were interviewed for this study are most likely to identify more encouragement from managers and supervisors, more experience with their job, and pay incentives as the top three potential contributors to improved office worker productivity.

4. The Carter Administration's energy regulations have had a noticeable effect on the comfort of office employees. Most office workers and planning executives feel these regulations should stand as they were enacted, but a sizable number feel that they should be changed to a more comfortable temperature range, and about 4 in 10 office workers have suffered noticeable discomfort over the past summer and current winter.

A high 71% of office workers and 93% of executives with office planning responsibilities report that their employees and companies have complied with the Carter Administration's energy conservation regulations restricting office temperatures to no more than 65 de-
measures for office buildings should consider not only temperature, but also such factors as humidity and type of heating and air conditioning systems of a building,” a significant majority agree (by 76-21%) that “really significant energy conservation in non-residential buildings will occur only when buildings are designed with energy savings in mind.”

A 70-22% majority agree that the “present regulations generally have had a positive effect on energy conservation in office buildings,” despite the fact that by 57-42%, these executives tend to agree that “the energy conservation regulations as they now stand will adversely affect employee productivity.”

5. Having the right temperature and a place to work when they need to concentrate without distractions are two factors perceived to be important to office workers comfort that many do not have.

Office workers are by and large satisfied that they now have ten of twelve factors affecting office comfort that they were asked about. However, while a 66% majority of office workers feel that the right temperature affects their comfort a great deal and this factor ranks fourth in importance to them, a much smaller 43% are now satisfied that they are working with a temperature that is right for them. Similarly, while 61% feel that having a place to work when you need to concentrate without distractions affects their comfort a great deal and 63% feel it is important for them to have this as part of their job, a smaller 51% feel that they can now work somewhere without distraction.

When asked at the beginning of the interview what two or three things they would change to make their offices more comfortable for them, a relatively high 13% mentioned other temperature regulation, another 10% to 12% mention more heat or more cooling, and comments related to ventilation, stuffiness, and draftiness make up another 5% to 7% of mentioned improvements. Temperature and air circulation as a general category pull the majority of the responses to this question.

Similarly, among the 70% of office workers who have complained about some type of discomfort, fully 55% mention a complaint related to temperature or air circulation. Almost all the other most desired improvements and complaints are generated by crowding and the need for bigger office space, noise, and lack of privacy. These, of course, are closely related to absence of a place to work without distractions.

While a 62% majority of men working in offices are now satisfied with the temperature of their offices, a 53% majority of women are not. A 55% majority of secretaries are unhappy with the temperature of their working environment. While as a group, executives, managers and supervisors are satisfied, professionals are divided, and clerical workers are more often dissatisfied. In general, office workers who spend more time in their workplaces or sitting at their desks are more likely to be uncomfortable with the temperature.

While 67% of office workers in conventional offices say they have a place to work when they need to concentrate without distractions, 52% in open plan offices and 68% in pool type offices do not. As a group, clerical workers are the most affected by this problem. Fifty-six percent do not have a place to concentrate on their work. Majorities of executives, managers, and supervisors (91%), professionals (57%), and secretaries (52%) do have such a place.

The office planning executives interviewed for this study are remarkably accurate in their perceptions of what most office workers do and do not have that affects their comfort on the job. However, 55% think most office workers have the right temperature for them (while 55% of the office workers disagree), and they underestimate the effect of the entire range of possible conditions affecting comfort. This is particularly important in the case of a place to work without distractions. While 61% of office workers feel that having such a place contributes a great deal to their comfort, a relatively smaller 46% of executives feel it affects employee comfort a great deal.

6. Two factors felt by over 7 in 10 office workers to affect their personal comfort a great deal are good lighting and a comfortable chair. Substantial majorities of office workers say they now have both of these.

Fully 85% of office workers feel that good lighting affects their comfort on the job a great deal, and a nearly identical 84% say they now have good lighting. While 73% of office workers feel that having a comfortable chair affects their com-
fort a great deal, an even greater 84% say they now have a comfortable chair.

Most executives with office planning responsibilities are aware of the importance of lighting and chairs to the comfort of office workers. Eighty-three percent feel lighting affects office workers' comfort a great deal, and 82% feel a comfortable chair does the same.

Looking in more detail at office workers' satisfaction with the lighting in their offices, it can be seen that a substantial 81% feel their lighting is about right, not too bright nor too dim, and 88% feel very or somewhat comfortable with their office lighting as it is now set up.

Similarly, 73% are satisfied with the chair they now have, and 89% feel it is very or somewhat well designed for someone in their job. In most cases, however, office workers recognize that other office workers in their office who perform different jobs than they do, have chairs that are not very different from their own, while their supervisors and the management of their companies have chairs that are very different. If given a choice, most office workers would choose what looks like an executive (37%) or managerial chair (28%) for their own office or work space; they would choose a particular chair because it looks comfortable (43% of replies), has arm support or back support, and is well padded, as well as having mobility and wheels.

In fact, the most important features of a chair to office workers are correct seat height, overall comfort, good lower back support, wheels for mobility, a swivel base, and adjustable seat height. The features for which some office workers perceive an unfilled need is adjustable back height. 57% consider this very important, but a smaller 48% currently have a chair that adjusts in this way.

By far the most important features to most office workers in terms of helping them get their jobs done are good lower back support and wheels for mobility, and these are the two areas where office workers would be most willing to spend more money.

A 56% majority of office workers have experienced back strain or a tired back. While most office workers attribute this something they did off the job (40%) or to stress at work (24%), 28% of that 56% majority, however, would attribute the strain to an uncomfortable office chair.

A final indication of the importance of the chair to office workers is the fact that 26% of office workers would take a smaller raise with a specially designed chair for back support and comfort, rather than a larger raise with no comfort improvements. However, the majority (56%) would choose the larger raise. Only two other office improvements are preferred over a larger raise by more than 1 in 4 office workers: 30% would choose control over air conditioning and heating in their offices; and 27% would choose general improvements in comfort over the larger raise.

7. A 53% majority of office workers feel improvements in comfort would enhance their productivity, and 48% feel they would contribute towards better quality in their work.

A clear 79% majority of office workers feel that their immediate supervisor is very or somewhat concerned with their comfort on the job, and a similar 73% feel that way about top management. They also feel by 73-24% that management is concerned about the way comfort affects their job performance, and a 58% majority feel it affects their job performance a great deal.

More specifically, by 53-40% of office workers feel that improvements in comfort could lead to their producing more in a day than they do now, and by 48-46%, they feel that improved comfort could improve the quality of their work. The ways in which quality might improve, as volunteered by office workers, are: better concentration on the job (32%), increase of productivity (27%), fewer errors (20%), increased efficiency (17%), and increased motivation (17%).

An even higher 75% of office executives feel that their companies are very concerned about employee comfort on the job. They are in close agreement with office workers about the effect of comfort on job performance. Fifty-seven percent feel it affects job performance a great deal and another 40% feel it affects job performance somewhat. Larger majorities of executives than office workers, however, feel that more comfort would lead to improvements in productivity (63-31%) and in quality of work (59-34%).

Office workers would most often like to get involved in decisions about getting whatever they need to feel comfortable in their job (91% feel it is very or somewhat important for them to have a say in this) and in deciding the most comfortable working temperature for their job (88% consider this very or somewhat important). Another 85% consider a say in having a place to work without distraction important; 83% feel that decisions about the amount of space they need for their job and the type of office furniture they have should include them. Nearly 3 in 4 want a say in the type of desk surfaces and filing equipment they use and in having a place to relax.

A majority of office workers now have at least some say in getting whatever they need to feel comfortable in their job. However, a majority (53%) have no say at all in deciding the most comfortable temperature for their job, although 86% consider this important. Fewer office workers now have a voice in other office decisions than would like to, and while this is most serious in temperature considerations, it also has an impact on lighting (where there is a gap of 54 percentage points between the number who have at least some say and those who consider it important to be involved) and in choosing an office chair (where a gap of 49 percentage points exists between perceived need for and actual say in the decision).

Over 6 in 10 executives feel it is very or somewhat important for office workers to have a say in each of these decisions. And correctly, they perceive that most office workers now have no say in temperature decisions (because the energy regulations deny this choice), but that most do have a say in their overall comfort.

From the executive's viewpoint,
one area where they overestimate how much say office workers have is in choosing their chairs, while 45% of executives estimate that most office workers have a lot of say or some say in this area, a much smaller 26% of office workers actually have a voice in choosing their chair.

8. Since the 1978 study, there seems to have been a dramatic decrease in the use of conventional offices and an increase in the use of the open plan and bullpen types of offices. According to this new 1980 study, 29% of the office workers report they work in a conventional office, down ten percentage points from the 39% who reported it in 1978. The percentage of workers working in the open plan type of office has increased from 30% in 1978 to 36% in 1980, while increases in the bullpen or pool type of office show percentage gains of 14% to 20% during the same period.

While increases in open offices were forecast by executives surveyed in the 1978 study, such major percentage swings in just two years indicate an even more accelerated use of open offices than was anticipated.

F. Conclusion

The second Steelcase National Study of Office Environments adds some significant dimensions to previous findings about office worker's satisfaction with and role in shaping their office surroundings. It can be seen first that office workers draw strong connections between their comfort in the office and their job performance, just as they do between their overall satisfaction with their surroundings and job performance. A majority feel that improvements in their comfort on the job will add to their productivity, and both office decisionmakers and the office workers affected by their decisions recognize that there is a potential for fewer errors and more concentration if comfort is improved.

Even more importantly, most office workers, even if they have never had experience with work measurement and even though important segments consider work measurement very difficult and perhaps impossible for their jobs, are personally in favor of having their productivity measured. An essential key to this support, however, lies in the assumption that more productive workers are rewarded — through pay raises, promotions and other rewards. If measurement of their productivity will open up new recognition for them, office workers are in favor of it. Clerical workers, however, are most resistant to this — perhaps because the likelihood of rewards seems more remote to them. Managers in offices will want to approach this neglected group carefully when instituting work measurement procedures.

While pay incentive is still the strongest stimulus to productivity, more comfortable heat, air conditioning, and ventilation is a continuing demand among office workers, who feel it is very important to them, who want to have a say in deciding their most comfortable temperature, who feel a more comfortable temperature would contribute to their productivity a great deal, and who feel they do not now have the right work temperatures.

The effect of the Carter Administration's energy conservation regulations for office buildings has been to make "temperature conscious" groups of office workers even more sensitive to temperature problems by taking away what measure of choice they had in the matter. While extreme discomfort is not felt by a majority of office workers, the fact that a majority have dressed differently, that some groups (particularly secretaries and clerical workers) suffer more than others, and that most executives perceive a negative impact on office productivity, indicates that these regulations have had a profound and not entirely benign influence on comfort in the office environment.

Nevertheless, more office workers stand by the need for the regulations as they are now than suggest that they be changed to reflect a more comfortable temperature range, and most executives feel they have had a positive effect on energy conservation.

The other element of discomfort to which office workers are powerfully attuned is the unmet need for a place to work when they need to concentrate without distractions. As was found in the first study, the need for quiet and privacy is a deeply felt one, and one which many office workers feel is unfilled. Confirmed in this study is the fact that not only was it felt that this affects productivity (67% feel more quiet would contribute to their productivity) but it is a cause for complaints about physical discomfort and inhibits job performance. And again, this unfilled need is less prevalent among office workers in conventional offices than among those in open plan or pool type offices, although clerical workers in pool type offices suffer by far the most. The common problem of office crowding in inflationary times has had a measurable impact.

Smoking also has an effect on worker comfort and productivity. Forty-five percent of the non-smoking employees surveyed said they were bothered by those who smoke near them. Persons who are most bothered by smokers are professionals and those employed in the health and educational fields.

On the positive side, what is more reassuring is that both good lighting and a comfortable chair, given top priority by office workers for adding to their comfort, are widely available to office workers, and are not causes for dissatisfaction. A significant number of office workers are attracted by chairs that are specially designed for orthopedic support, but very few attribute back strain or tiredness that they might experience to an uncomfortable office chair.

Overall, office workers are given far more say in the factors in the office which affect their personal comfort than they are in the larger decisions about office planning that were asked about in the first national study. Nevertheless, this study confirms that most office workers want to be involved in all decisions that affect them, and for good reasons; they perceive that their involvement will contribute to their productivity and general job performance, and to improving the offices in which they work.
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