

# The Impact of Stair and Elevator Design on Daily Exercise

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## Introduction

The rise in obesity has prompted the medical community to encourage moderate forms of exercise such as stair walking. When integrated into daily routines, stair climbing appears to raise intermittent moderate exercise (Dunn et al.) leading to weight loss and increased bone density. (Bronwell et al...) As a result, studies have focused on ways of increasing stair travel in existing buildings by using promotional signs or banners. (Anderson et al..., Kerr et al...) or by providing , artwork and music in fire stairwells. (Boutelle, et al...)

This study differs in that specific design elements are examined that can potentially increase

stair use. These include the elements within and surrounding the stair such as:

- The stair's visual access from main circulation paths
- Stair placement in relation to nearby elevators
- The elevator's visual access to main circulation paths.
- The impact of slow speed hydraulic or high speed traction elevators
- Building height
- The aesthetics of the stair shape and journey

## Method

Four case study buildings with stairs ranging from two to five stories at two adjacent universities were examined. Stair/elevator combinations were chosen for their visual accessibility, travel convenience and aesthetics. Three of the four buildings were open to the broader campus population while one was occupied mostly by students and instructors. Of the two campuses, the University of Idaho is less populated and consists primarily of three to four story buildings with slow moving hydraulic elevators. Nine miles away, Washington State University's student population is half again larger with buildings that are three to eight stories which use high speed traction elevators. Of the four case studies, two of the buildings' stairs are fire escapes while the other two buildings boasted grand stair cases.

Although the research examines both up and down travel, only those heading in the upward direction are reported because of the higher degree of physical exertion. Therefore, the stair use percentages are conservative. Initial observations were conducted in the spring of 2004

and 2005 followed by three confirmation studies in the summer and autumn of 2005. Observers consisted of architecture and interior design students in their third through fifth years of study.

### Case Study 1: Grand Staircase at the University of Idaho Commons

This stair/elevator combination was chosen because of the stair's high use. The stair is a story and a half and is adjacent to a highly used interior lunchroom court. When seen on a broader campus scale, this stair acts as a critical bridge that links two major parts of the university through the building itself. The adjacent elevator on the other hand is geared more to those who work within. It is slow and has poor visibility because it hides behind the grand stair. It was found that most of its users were the kitchen staff that use it for transporting supply carts up three stories to cater meeting rooms.



**Figure 1** University of Idaho Common Stairway

Predictably, the stair's 97% use overwhelms the elevator's 3% use. These percentages are based on the observations of 243 people going up the

stairs and elevator in late March and early April of 2004 on five separate occasions during the weekdays at ½ hour intervals in the morning, afternoon and evening.

### 97% Stair Use: Contributing Factors and Discussion

The high stair use is attributed to the following:

- The stair-path on the building's main circulation is connected to a campus arterial.
- The elevator is out of sight of the main circulation path and interior court.
- The hydraulic elevator is inconveniently slow.
- Only a story and a half is traversed.
- The stair is wide and inviting.

Of the four case studies, this stair rates the highest use. Similar planning relationships and elements are also repeated in two other successful case studies. However, case study #2 is the exception.

### Case Study #2: University of Idaho Main Library Stair

This four story building was chosen because of its less than ideal stair/elevator relationship. Since the elevator is prominently displayed at the end of the main circulation axis and the fire stairs are partially hidden, it was predicted that most people would choose the elevator. This hypothesis proved false on two separate observations in both the spring of 2004 and summer of 2005.

The 2004 spring study found 65% stair use over the elevator's 35%. Observations were restricted to the first floor at the main point of decision between taking the elevator or stair. However, a one year follow-up study during the summer session in late June yielded even higher percentages (74%) for upward stair travel. This study differed from the first in that all the floors' entry "points of choice" for either stair or elevator were tracked from one outdoor location. This study also proved useful for finding-out how many people traversed up two or more floors.

Here it was found that 60% chose to use the stairs over the elevator.

For the spring 2004 study, both the stair and elevator count totaled 320 for those traveling up. Observations occurred on nine separate occasions during weekday mornings and afternoons. For the following summer study, both the stair and elevator count totaled 43 for those traveling up one or more floors. For those traveling up two or more floors, the count totaled 25. These observations were taken on three separate weekday late afternoons in one hour periods. The afternoon was selected because it was thought that higher elevator use would occur due to the afternoon heat and work fatigue. No such correlation was found.

### 60-74% Stair Use: Contributing Factors and Discussion

Higher stair use was attributed to:

- A slow hydraulic elevator
- The stair fire doors are left open making the stairs more visible when approaching the elevator.
- A pleasant stair journey



**Figure 2** University of Idaho Library Elevator/Stair view at the “Point of Choice”

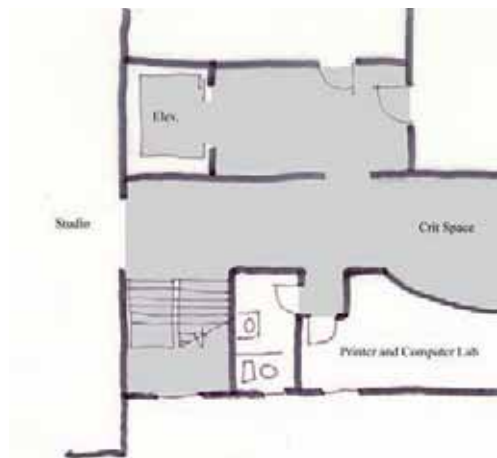
This study confirms that a slow moving hydraulic elevator is a significant deterrent for not taking the elevator. It was often noted that users would impatiently push the elevator call buttons several times, then abandon their wait and start-up the stairs when no elevator movement was detected. One wonders that if the stairs had been as prominently placed as the elevator, would stair use be higher? Whether the pleasant stair journey, which consisted of views of small gardens and campus views, played a decisive factor in its use is hard to determine.

### Case Study #3, Washington State Carpenter Hall

This five story building was chosen because it was thought that the prominent placement of the high speed elevator in combination with the partially hidden stairs would generate higher elevator use. An additional incentive to use the elevator is that the school administration is located on the fifth floor. The hypothesis was supported by observations found on the first floor, but on the next floor, the high speed elevator had less influence.

On the first floor it was found that 57% chose to use the elevator over the stairs. The observations occurred in the spring and fall of 2005 where a total of 91 users were examined traveling up on non-studio days (Tuesday and Thursday) in the early morning, noon and late afternoon for two periods of one hour and one period of one half hour.

Observations on the second floor yielded significantly higher stair results because the elevator is placed out of sight from the main circulation path which probably accounts for its low 19% usage. Second floor observations of 119 students going in the upward direction occurred in both the spring and fall of 2005 on both studio and non-studio days (Thursday and Friday) with four one hour observations and one 1/2hr observation. Early morning, noon and late afternoon times were covered.



**Figure 3** First Floor, Carpenter Hall at WSU Second Floor

### 43–83% Stair Use: Contributing Factors and Discussion

First Floor: 57% elevator use is attributed to:

- The elevator is in clear sight of the main circulation hall and small building café
- The stair is not in sight of the café or most of the main circulation hall.
- The building is five stories high with the school administration located on the fifth floor.
- The elevator is high speed.

Second Floor: 83% stair use is attributed to:

- The stairs are in close proximity and are in clear view of studios and main hall
- The elevator is out of sight and away from the main circulation space.

Since the second floor did not have an inconspicuous place to observe stair and elevator use, the mere presence of the student observers may have increased the stair use.

### Case Study #4: Lighty Student Services Building at Washington State University

This four story building offers a variety of services from new student orientation to routine bill payments. Building users range from older staff to new high school graduates. The building

was chosen because of its two dominating grand stairs which act as focal points in two large four story interior courtyards. Additionally, two high speed traction elevators are hidden between the two main interior courts. The east interior court is brightly day lit by a Kal Wall roof while the west court is dimmer with smaller skylights. Because the two stairs are clearly visible from the interior courts, it was thought that stair travel would overwhelm elevator use.

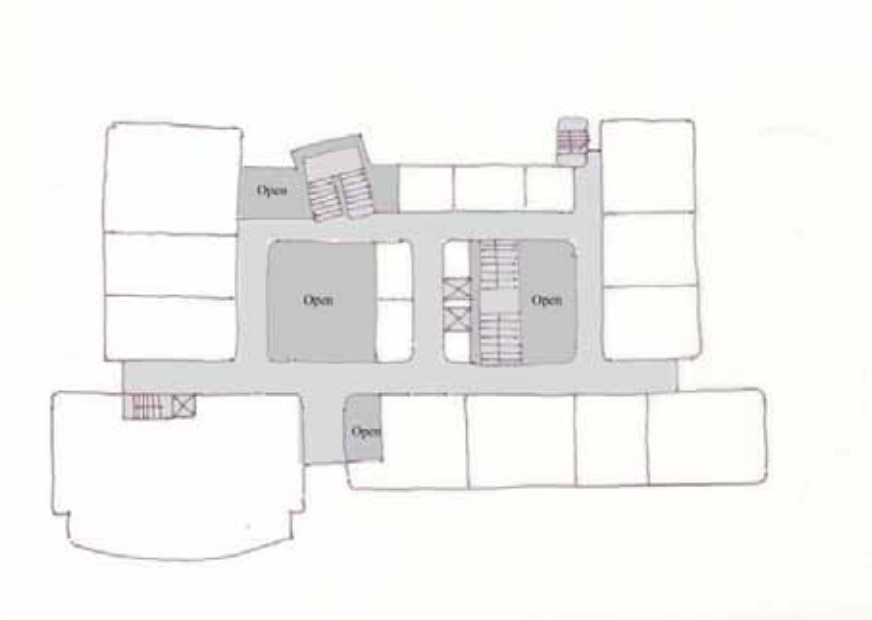
The hypothesis was correct in that 88% chose to use the stairs over the elevator in the upward direction. For those who chose to travel two or more stories up, it was found that 61% used the stairs over the elevator. This figure is similar to the two story stair walkers at the University of Idaho Library who also boasted a 60/40% stair/elevator split.

The study took place during the summer break in late June 2005 on a Thursday, Friday and Monday where 192 people were tracked. Roughly an equal number of younger students and older faculty/staff were counted. Nine observation periods lasted for ½ hour segments for all times of day. Because there was only one observer, the stairs and elevators were examined separately at different times of the day. If the courtyard stairs and elevators were examined at one time, the observation period would have lasted one and a half hours.

### 61-88 % Stair Use: Contributing Factors and Discussion:

High stair use is attributed to:

- The stairs are in plain sight next to the surrounding four story courtyard circulation. One stair is next to a popular snack bar eating area.
- High speed elevators are not immediately apparent from the main circulation paths or interior courts.
- Students are easily oriented upon entering the building because upper floor destinations are spotted from across the interior courts. Appropriately, the stairs fall within the visual path of



**Figure 4** Washington State Lighty Student Services Center Second Floor

most of the upper or lower floor destinations.

- Both stair journeys provide pleasant and dynamic views of either the interior courts or of the outdoors.
- The stairs are well daylighted.

As with the previous case studies, the clear visibility of the stairs in combination with the visual inaccessibility of the elevators accounts for the much higher stair use.

### Conclusion

From all four case studies, it appears that three dominant factors increase stair use.

- If the stairs are in plain sight next to well trafficked circulation and activity areas, then the stairs will be well used.
- Elevators that are mostly out of sight of the main circulation and main interior space are not as well used as stairs that are within sight of the same areas.
- Slow hydraulic elevators, even when prominently placed, appear inconveniently slow in comparison to stairs.

Other probable contributing factors for high stair use:

- Low rise buildings two to four stories in height probably have lower elevator use because the stairs offer a quicker path.
- Stair journeys that have pleasant and interesting journeys probably generate a higher use.

From this study it appears that a slow hydraulic elevator has more impact on increased stair use than a high speed traction elevator has on increased elevator use. Further studies examining the relationship of demographics and stair/elevator design might be conducted to find the impact of planning elements on different age and gender groups. Additionally, since this study focused on two to five story low-rise buildings, future stair use studies on buildings five to seven stories tall could yield different results.

Unfortunately, no aesthetic correlations were found in this study. However, it is believed that if the shape of the stairs and journey are interesting enough, people will go out of their way to

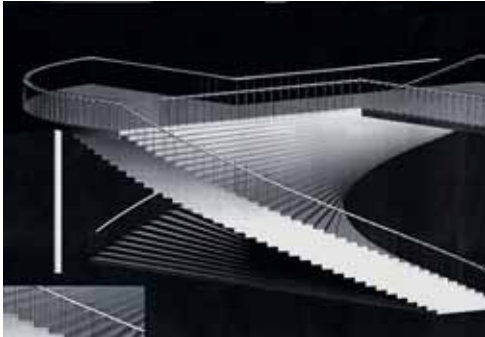
climb stairs. Along these lines, the following projects are designed with the aesthetic intent of providing a pleasant and engaging stair journey. Designed by the fall 2004 second year beginning design students at the University of Idaho, the following project required the design of a stand-alone park stair that would inspire people to engage the stairs through workouts or curious exploration. The objective of the assignment was to create an interesting journey and to be rewarded at the top by a favorable prospect. Students were encouraged to stimulate the users' imagination with playful and engaging forms.

## References

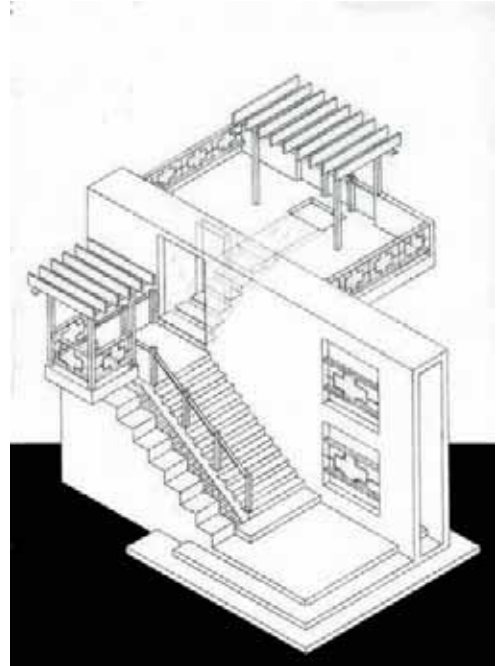
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### Stairs to a Viewing Platform

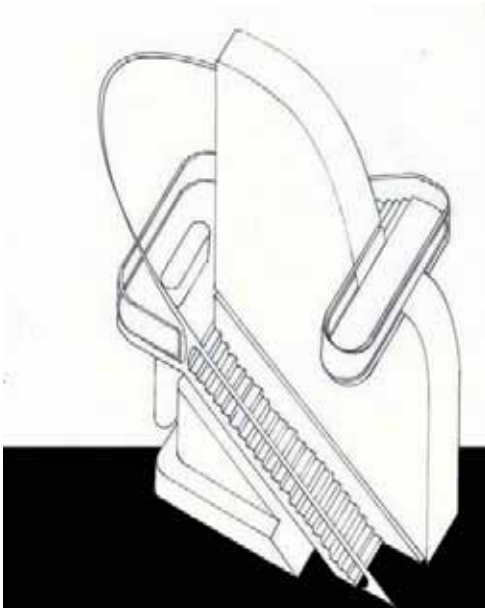
Designed by the 2004 second year design students at the University of Idaho.



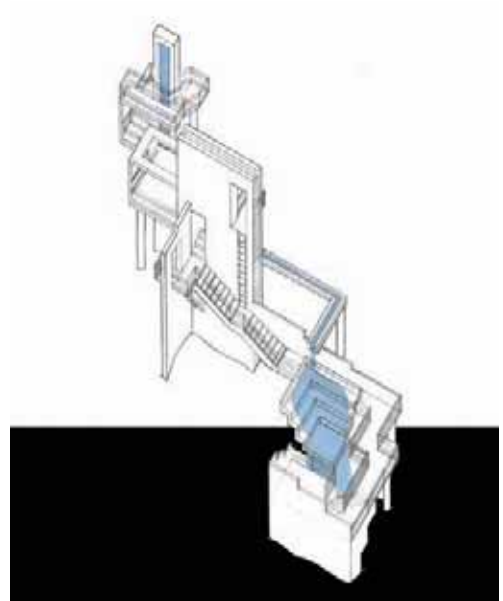
**Figure 5** *Tim Grissom Stair*



**Figure 6** *Tim Grissom Stair*



**Figure 7** *Kira Wisniewski Stair*



**Figure 8** *Kenny Bissegger Stair*