

PROMOTING ACTIVITY

HOW DESIGN CHOICES INFLUENCE PHYSICAL ACTIVITY

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ABSTRACT

Project Description: The primary focus of this study is to determine how design decisions may influence human behavior. Specific characteristics of four recently built student residences at the University of British Columbia (UBC) will be evaluated. Each residence is a tower typology of roughly the same size and scale. Different design characteristics are present in each tower staircase. With all other factors being equal, the project aims to see which design characteristics encouraged the most stair use by students. A secondary goal is to engage with a key client to collaboratively undertake mutually beneficial research, as a pilot for a general aspiration to learn from our work and provide added value to our clients.

Methods: Four staircases from four different student residence towers at the University of British Columbia were studied for a one week period. Stair use was measured using a magnetic circuit counter which recorded every time a door was opened and closed.

Measure: The stairs were evaluated based on characteristics defined in five categories. Appeal, Convenience, Comfort, Legibility and Safety. The use of each stair was then measured for a one week period. As the stairs were almost identical or contained only minor differences in four of the five categories, It was predicted that any variation in use between the different configurations could be attributed to differences in the 'Appeal' category which represents design characteristics of the stairwell.

Results: The data was collected and regularized to the overall population of each tower. The data was then compared to the characteristics of each configuration to determine which factors had the greatest influence on stair usage.

Discussion: Our findings indicated that the greatest stair use corresponded with stairs that featured daylight and views, combined with a visual connection to social gathering spaces resulting in a 'social reward' for users.

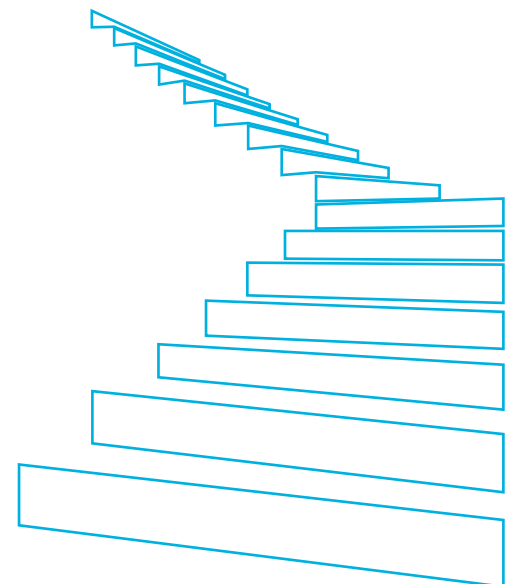
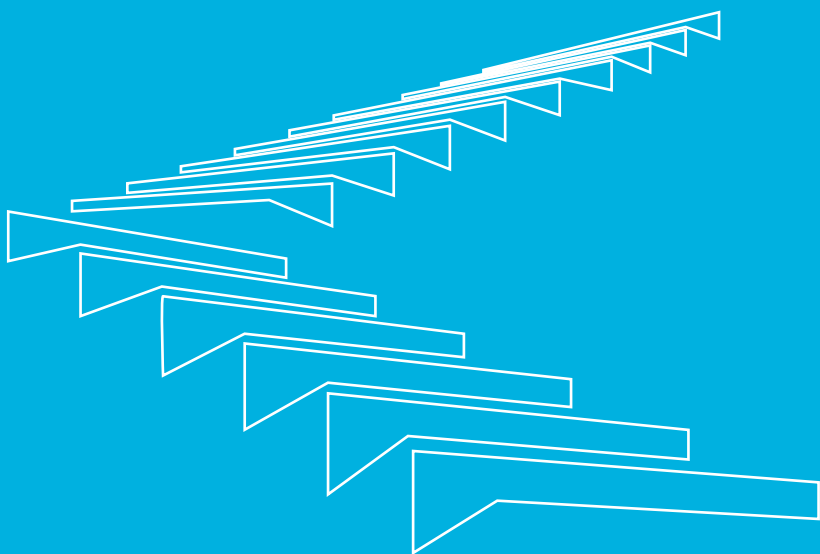


TABLE OF CONTENTS

ABSTRACT	1
TABLE OF CONTENTS	2
SECTION 01. INTRODUCTION	4
SECTION 02. METHODS	8
SECTION 03. MEASURE	14
SECTION 04. RESULTS	22
SECTION 05. DISCUSSION	28
SECTION 06. NEXT STEPS	32
APPENDIX A . STAIR CONFIGURATIONS - PHOTOS	33
APPENDIX B . STAIR CHARACTERISTICS	37
APPENDIX C . STAIR DIAGRAMS	41
APPENDIX D .REFERENCES	55



1.0 INTRODUCTION

Sedentary behavior has been identified as a risk factor for a variety of chronic health conditions. As designers of the built environment, architects have the ability to influence human behavior in many ways, and have the potential to promote physical activity ‘by design’. Evaluation tools such as the WELL standard recognize the importance of human health and role architectural design plays in promoting fitness.

While designing Orchard Commons (completed in 2016) (Figure 1.1 Appendix A), a mixed-use facility at the University of British Columbia housing over 1000 students, an important goal set by the steering committee and design team was to promote physical activity and social connections through design. To support this aspiration, we were deliberate to position all the stairs in the building on the perimeter, and ensure they featured large windows to allow residents to connect with the outside world, and instil a sense of generosity to the space. Our instinct was that these design decisions would result in a greater likelihood that the stairs would be used.

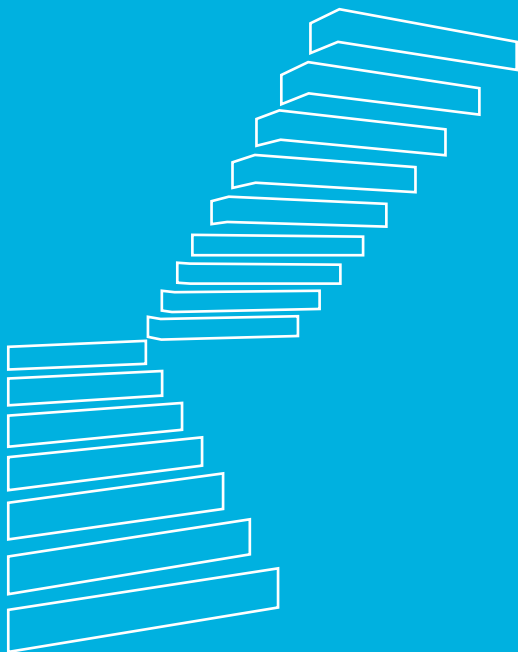
A defining feature of Orchard Commons are the residence lounges found in each of the two residential towers. The lounges are three-storey interconnected spaces that act as a type of living room for three floors of student residents. While the lounges in the two buildings are almost identical, there is one key difference between them. In the north tower, Braeburn House, there is an exit stair that passes by the lounges – a glass wall separates the stair from the lounge (Figure 1.2, Appendix A). In the south tower, Bartlett House, this connection with the residence lounges does not exist – the stair only has windows to the outside world for most of its run, and some glazing into the elevator lobby and corridor (Figure 2.2, Appendix A).

The adjacency of the stair to the lounges in the north tower is important. Our assumption during design was that the opportunity to travel up and down in the building while getting a peek into the other floor lounges would be a powerful enticement to encourage residents into the stair. There is a long history of stairs being used as a device ‘to see and be seen’. The expectation was that the social reward that was enabled by this configuration, and characteristics of the space, would act to influence behavior. The fact that the two towers, more or less identical in most ways, have this key difference makes a comparative analysis straight-forward.

While the design choices around the stairs were a priority at Orchard Commons, exit stairs in general are typically treated in a obligatory way, and often feature very little beyond the minimum building code requirements. Exit stairs in tall student residences at UBC generally do not include windows, nor a relationship with ‘social spaces’. As such, the conditions found at Orchard Commons are remarkable. The two towers at Orchard Commons will be compared to two other residential towers on campus that feature more conventional arrangements of exit stairs.

Ponderosa Commons (Figure 3.1 Appendix A), a mixed-use student residence on campus completed in 2015 (Kuwabara Payne McKenna Blumberg Architects and Hughes Condon Marler Architects) features a conventional exit stair with no glazing or views. Brightly coloured exit doors were used to differentiate the stairs from the rest of the corridor (Figure 3.2, Appendix A)

Brock Commons (Figure 4.1, Appendix A), a dedicated upper year and graduate student residence, completed in 2017 (Acton Ostry Architects), features an exit stair that has a small slot window with views to the exterior and a “narrowlite” door that allows overlook into the main corridor (Figure 4.2, Appendix A)



2.0 METHODS

A requirement of conducting research at the University is for proposals to be reviewed and approved by the University Research and Ethics Committee. This proposal was unobtrusive, and the university was supportive of the endeavor as long as no personal information from the students was collected.

Through evaluating a range of technologies capable of recording human occupancy (infrared occupancy sensors, cell phone tracking, cameras), we arrived at using a simple magnetic switch device with integral digital counter. The benefits of the device were that they were simple, easy to install, compact, and cost-effective. Limitations of the device include the fact that they were only employed to measure door movements, and were not capable of determining the number of people associated with each door use. Our assessment was that the simple measure of door uses was a reasonable representation for use in general, as by default, the building code demands that the doors in question remain closed unless in use. A future limitation includes the fact that the count recorded was cumulative over the study period, and not distinguished by time of day or other variables. While the device did not allow for high-fidelity information (number and characteristics of users, and time of use), it did provide simple results with a reasonable cost.

A sample device was ordered and tested at the Perkins and Will Vancouver office over two separate one-week intervals. For the first week, the device was installed above the door which was opened and closed a set number of times to test the overall accuracy of the device. For the second week the counter was allowed to run in order to obtain a full weeks count and to ensure that the device would not reset itself during that time. Satisfied with the results, more counters were ordered to be installed in the towers.

To avoid tampering with the reset button on the device and to be as inconspicuous as possible, protective covers were 3D printed and painted to match the buildings door frames. The devices and covers were installed with double sided tape to avoid any permanent damage or need for tools on site.

Student Housing and Hospitality Services (SHHS) provided information about the buildings, the inhabitants, and other characteristics that may influence use. (Table 2.1 - Tower Characteristics) Building plans as well as demographic information for each tower was provided. SHHS was also able to confirm if there were any elevator

disruptions over the course of study, as well as provide the social calendars for all towers. This enabled the ability to regularize the data, and determine if any events contributed to irregular stair use. For example, if an elevator was out of service, or if a fire drill was conducted, we would expect an increase in stair use.

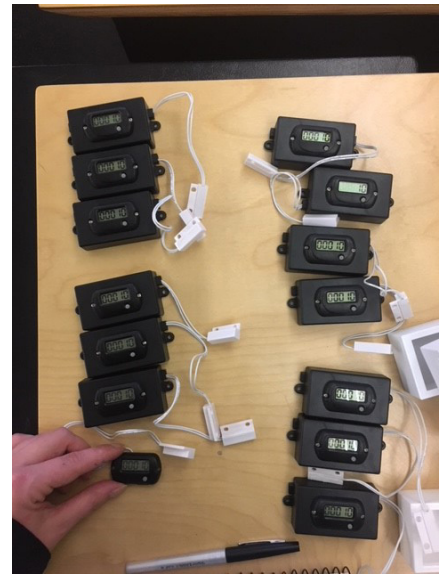
PHOTOS - MOCK UP TESTING



1.



2.



3.



4.



5.

1. Device Housing exterior
2. Device Housing Interior
3. Device testing
4. Mock up
5. Mock up

TABLE 2.1 - TOWER CHARACTERISTICS

ORCHARD COMMONS

Tower 1 - Braeburn House

Residential floors : **2-19 (17 floors)**

Residents in building : **539**

Residence Type: **Connected singles sharing an ensuite bathroom, plus some private rooms with ensuite bathroom, a handful of tiny one-bed apts**

Student demographic: **First year students, new to UBC**

Tower 2 - Bartlett House

Residential floors : **3-20 (17 floors)**

Residents in building : **508**

Residence Type: **Connected singles sharing an ensuite bathroom, plus some private rooms with ensuite bathroom, a handful of tiny one-bed apts**

Student demographic: **First year students, new to UBC**

PONDEROSA COMMONS

Tower 3 - Spruce House

Residential floors : **5 to 17**

Residents in building : **169**

Residence Type: **Suite style (Studios, shared 2-bed apts; shared 4-bed apts)**

Every floor has 5 studios, 1 four-bedroom unit, and 2 two-bedroom units

Student demographic: **Upper year and grad**

***may have more residents in building as studio units have option to add an 'additional'**

BROCK COMMONS

Tower 4 - Tallwood

Residential floors : **2 to 18**

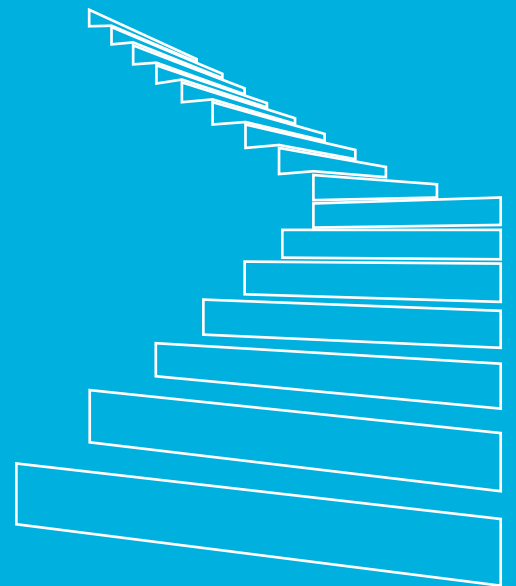
Residents in building : **404**

Residence Type: **Suite Style (Studios and shared 4-bed apts)**

Every floor has 16 studios, and 2 four-bedroom units

Student demographic: **Upper year and grad**

***may have more residents in building as studio units have option to add an 'additional'**



3.0 MEASURE

Four stairs in four student residences were measured and analyzed - Spruce House at Ponderosa Commons (2015), Braeburn House at Orchard Commons (2016), Bartlett House at Orchard Commons (2016), and Brock Commons (2017).

Each stair was analyzed using a series of characteristics to determine the similarities and differences between each stair configuration. The study compared the stairs using five different criteria: Appeal, Convenience, Legibility, Comfort and Safety¹. The prediction was that given the towers similarities in four of the criteria (convenience, legibility, comfort and safety) any increase in usage from one stair configuration to the other could reasonably be attributed to differences in the appeal, or design aspects of the stair.

The five criteria were measured as follows:

Appeal

Interior Finishes:

Describes the level of finishes applied to each stair. Stairs were ranked as either “basic” with minimal finishes (unfinished concrete or standard paint only) or “enhanced”, with upgraded finishes or purposeful designs (murals etc). All of the stairs studied were classified as basic stairs.

Stair articulation:

Determines if the stairs were basic or distinct in form. All of the stairs studied were basic exit stair configurations. All layouts were 180 degree turn switchback stairs.

Interior and Exterior Views:

Views were described by the following sub-categories: Minimal or Full view, and Standard or Exceptional view.

Minimal or Full view: This characteristic was related to the amount of glazing. “Minimal view” was classified as a small window where one would have to purposefully pause to see out. “Full view” correlated to a full height window or sidelight where one would experience the view just by passing by.

1. Nicoll, Gayle, 2007.

TABLE 3.1 - STAIR CHARACTERISTICS

See Appendix B for charts from all levels

GROUND LEVEL				
	Stair 1 Figure 1.2	Stair 2 Figure 2.2	Stair 3 Figure 3.2	Stair 4 Figure 4.2
See Appendix A				
Appeal				
Interior Finishes	Basic	Basic	Basic	Basic
Stair appeal (articulation)	Basic	Basic	Basic	Basic
Interior Views	4	3	0	1
Exterior Views	0	0	0	2
Connection to destination	2	0	0	2
Convenience				
Proximity	Adjacent	Adjacent*	Adjacent	Adjacent
Visually/physically accessible	2	0	1	2
Number of stairs in tower	2	2	2	2
Number of elevators in tower	3	3	2	2
Residents per elevator	180	169	85	214
Elevator Speed	1.60	1.53	2.25	1.89
History of elevator disruption	None	None	None	None
Comfort				
Overall stair width	1150	1150	1140	1125
Tread depth	280	280	290	300
Riser height	180	180	175	170
Number of steps between landings	8	8	7.5	8
Legibility				
Identification Signage	basic	basic	basic	basic
Visibility of stair from main path of travel	Yes	Yes	Yes	Yes
Differentiation of stairwell from surroundings	none	none	Yes	Yes
Safety				
Uniformity and intensity of lighting	Basic	Basic	Basic	Basic
Visibility of tread edge	Yes	Yes	Yes	Yes
Slip resistant treads	Yes	Yes	Yes	Yes
Maintenance Level	High	High	High	High
Presence of hazards or graffiti	None	None	None	None
Security surveillance/devices	None	None	None	None

	Characteristic with large variation that may strongly affect findings
	Characteristic with small variation that may slightly affect findings
	Characteristic no or negligible variation that should not affect findings

*While the elevator core was adjacent, the elevator for this building was not accessible at this level.

Standard or Exceptional View: This characteristic rated the quality of the view from the window. A standard view would be inward to a corridor, or outward to an adjacent building or alley. An exceptional view would be inward towards a social space or outward towards a scenic view or people oriented space below.

Ranking was based on a 0-4 rating where: a stair has no views (value = 0), minimal standard views (value = 1), minimal exceptional views (value = 2), Full standard views (value = 3), Full Exceptional views (value = 4).

Convenience

Proximity:

Describes the distance between the stair and elevators. For the purposes of this study, all of the staircases selected were adjacent to elevators, and as such, neither was significantly advantaged nor more convenient. Of the stairs studied, all of the stair entrances were directly adjacent to the elevators, with the exception of Stair 4 (Brock Commons, Tallwood Tower). In this example, the elevator lobby was adjacent, but was turned 90 degrees from the main corridor. (Appendix B, Table 3.1).

Visually/physically accessible:

Measures whether there are any barriers to accessing the stair at each level. Ranking was based on a 0-2 rating. No accessibility, meaning the stair is exit only and cannot be re-entered at that level (value = 0); limited accessibility meaning there are barriers to accessing the stair and adjacent spaces (for example, anything restricting direct access such as an additional door or corridor) (Value = 1); full accessibility meaning unrestricted access (value = 2).

****All of the towers required key or pass cards access to the main entrance. None of the stairs allowed exterior re-entry at ground level unless it was through an additional door located inside, beyond the key card access. Of the stairs studied, only Orchard Commons Bartlett House did not have full and unrestricted access. It did not have the ability to re-enter the stairwell at ground level.**

Number of stairs in tower:

The number of stairs contained in each tower. All towers studied had two exit stairs.

Number of elevators in tower:

The number of elevators in each tower. The number was regularized by the population of each tower.

TABLE 3.2 - STAIR DIAGRAMS

See Appendix C for full size diagrams



Elevator speed:

The speed from ground level to the top of the tower, divided by the number of storeys. Shown as floors per second. While there was variation between the towers, the tower with the slowest elevator also had the least stair usage, indicating that this is not a significant determining factor in usage.

History of elevator disruption:

Measures if there were any disruptions over the duration of the study that may have caused a spike in stair usage. Information was provided by maintenance staff.

ComfortOverall stair width:

Measured in mm. The differences measured between the stairs was minimal and considered negligible

Tread depth:

Measured in mm. The differences measured between the stairs was minimal and considered negligible

Riser height:

Measured in mm. The differences measured between the stairs was minimal and considered negligible

Number of steps between landings:

Overall counts. This characteristic is related to the overall floor to floor height of each tower. The variance between the stairs was minimal, +/- 1 risers and considered negligible.

LegibilityIdentification Signage:

Describes whether stair signage is “basic”, defined as just the code required exit stair signage or “enhanced” defined as any signage or posters nearby that encourage inhabitants to take the stairs. Enhanced signage has been found to have some impact on increases in stair usage². None of the stairs studied had any form of motivational signage.

Visibility of stair from main path of travel:

Measures whether the stair is immediately visible from the main corridor or lobby. All of the stairs studied

2. Lewis & Eves, 2012.

were on the main path of travel.

Differentiation of stairwell from surroundings:

Measures whether the stairwell is differentiated from other doors along the corridor in any way to signify its usage. The stairwells in Orchard Commons have no differentiation. The door and door frame were the same colour as the other residential doors down the corridor (Towers 1 and 2). The exit stair doors at Ponderosa Commons is differentiated with a bright red door and frame. The residential doors in the corridor have a yellow door and frame (Tower 3). The exit stairs at Brock Commons are differentiated by a different door material. The residential doors are a wood veneer while the exit stair doors are a black painted steel. Both the residential doors and exit stair doors have a black painted steel frame.

Safety

Uniformity and intensity of lighting:

All stairs studied met the requirements of the British Columbia Building Code 2012. Any differences measured between the stairs was minimal and considered negligible.

Visibility of tread edge:

All of the stairs studied had a visible tread edge differentiated with contrasting paint.

Slip resistant treads:

All of the stairs studied had slip resistant treads.

Maintenance Level:

All of the stairs studied are maintained by Student Housing and Hospitality Services (SHHS). They all appeared to have similar levels of maintenance.

Presence of hazards or graffiti:

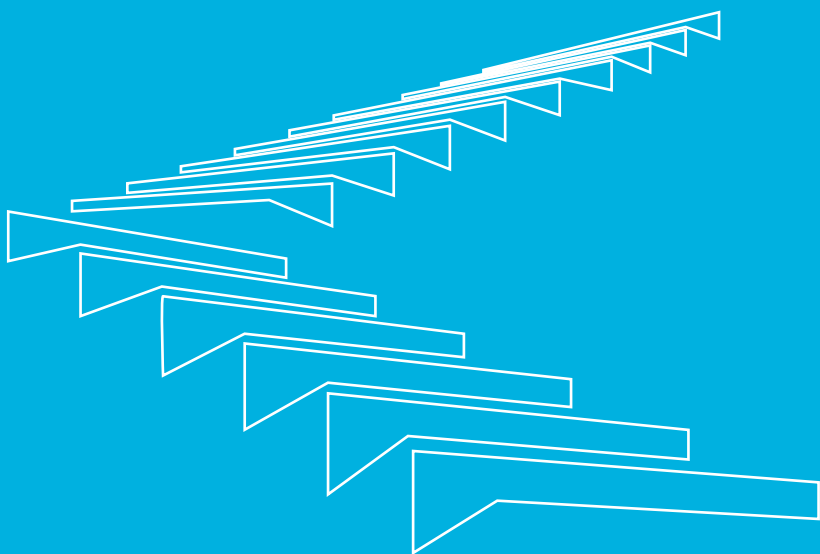
No hazards or graffiti were identified in any of the towers.

Security surveillance/devices:

None of the towers studied had any form of security surveillance or devices.

The characteristics of each stair configuration was then compared against the overall stair usage. This was measured by the frequency of use in each stairwell, regularized by the overall population of each tower. To measure usage, a battery-operated magnetic counter device was installed in each stair at the top, mid, and ground level. The functionality of this type of sensor is limited to measuring each time a door is opened and closed, and is unable to measure the number of people passing through the door with each operation.

Data was collected over a one week period. On the ground level, when the stairwell had more than one door, both the entry and exit doors were measured, and the numbers added together for the ground level total. (Table 3.2 – Stair Diagrams – Appendix C)



4.0 RESULTS

Three data sets were recorded over three, week-long periods, in April, 2018 (Test 1, Test 2, and Test 3)

All results use the following notation:

Stair 1 = Tower 1 - Braeburn House, Orchard Commons

Stair 2 = Tower 2 - Bartlett House, Orchard Commons

Stair 3 = Tower 3 - Spruce House, Ponderosa Commons

Stair 4 = Tower 4 - Tallwood House, Brock Commons

While the subject towers are alike in age, height, and program, the overall size of the towers differs, with some towers housing more students per floor than others. In order to compare the data collected, the results were normalized by dividing the number of uses by the overall population of each tower.

Test 1

Counters were installed at three locations in each of the four stairs: at ground level, mid level, and at the top level. Data was collected simultaneously at each installation over a one week period (refer to Table 4.1). Door uses were recorded, and were then normalized by the population of each building for comparison.

Table 4.1 – Stair Usage - Test 1

TEST 1				
	Stair 1	Stair 2	Stair 3	Stair 4
Number of Uses				
Ground Level	N/A	N/A	65	N/A
Mid Level	N/A	189	4	46
Top Level	N/A	240	N/A	238
Tower Population	539	508	169	404
Use Regulated by Population				
Regulated - Ground level	-	-	0.38	-
Regulated - Mid Level	-	0.37	0.02	0.11
Regulated - Upper Level	-	0.47	-	0.59
Average number of uses	-	-	-	-

The findings were limited, as four devices failed in the field yielding no results, and additional two devices were removed and not retrieved.

Test 2

A second test was conducted using the same methods as in Test 1 to gather more reliable data (refer to Table 4.2).

Table 4.2 – Stair Usage - Test 2

TEST 2				
	Stair 1	Stair 2	Stair 3	Stair 4
Number of Uses				
Ground Level	1808	981	86	847
Mid Level	N/A	149	14	33
Top Level	N/A	206	12	225
Tower Population	539	508	169	404
Use Regulated by Population				
Regulated - Ground level	3.35	1.93	0.51	2.10
Regulated - Mid Level	-	0.29	0.08	0.08
Regulated - Upper Level	-	0.41	0.07	0.56
Average number of uses	-	0.88	0.22	0.32

Ground level

Data collected at this level was successfully gathered in each tower. Stair 1 exceeded the usage of the other towers. Stair 2 and 4 had similar use, while Stair 3 featured the fewest uses.

Due to differing configurations between the towers, the differences between the stairs could be attributed to many factors. Stair 2 only allows exiting at ground level, while Stairs 1, 3, and 4 allow both entry and exit. This restriction of Stair 2 would, presumably, reduce its use. Moreover, Stair 3 serves two 'ground' levels by virtue of the planning of the building and site (at Level 01 and 02). There is no stair access at level 01, only elevator access. At level 02, there is stair access, but no elevator access. Since there is no choice at the point of entry at either level, this would heavily influence stair usage at the lower levels in this tower.

Stair 1 and Stair 4 both have choice at the point of access, and both have exit and entrance capabilities. In this case, the usage in stair 1 was more than 1.5 times higher than the usage in stair 4. This indicates the higher usage in Stair 1 which could be attributed its design characteristics.

Top Level

At the top level, Stair 4 had the highest usage, far exceeding Stair 3 and narrowly surpassing Stair 2. Stair 1 had a faulty device at this level for this test, and no results were recorded. Similar to the ground level, the difference in use can be attributed to many factors due to the different configurations between the towers. A key consideration is that Stair 2 and Stair 4 both have a social lounge located on the top level of the tower. This was attributed to “Connection to destination” in the stair characteristics analysis (Appendix B) which fell under the ‘Appeal’ criteria. There is a key difference between the two lounges - the lounge in Tower 4 is open 24 hours, with unrestricted access for students, while the lounge in Tower 2 is locked and is restricted to access only when the space is booked. As such, the Tower 4 lounge is as a destination amenity for the building, likely drawing attendees from throughout the building.

Mid Level

Measuring the mid level of the towers provides the best comparison between the overall design of the different stairs. Outlying differences due to configuration (convenience factors) and connection to destinations are minimized at this level. Measurements from these levels are not influenced by students travelling to any one destination, but instead provide a general idea of overall stair use. In all towers, the only significant variation in characteristics surrounds interior and exterior views.

At mid level, where convenience factors have been eliminated, the data shows Stair 2 (the stair configuration of Orchard Commons) being used four times more than the other configurations. This indicates that the more extensive appeal factors provided from interior and exterior views influenced activity. However; due to the device failure at the upper level in Stair 1, the data was unable to reveal any additional findings that would characterize the social benefits the interior view to the social lounge offers.

While there was variation between the towers regarding elevator speed and the number of residents per elevator, Stair 3 and Stair 4 had slower elevator times, with Tower 4 having the most students per elevator. This would imply a reduction in elevator service which could cause an increase in stair usage, however; this is not what the data showed. In both of these towers, the stair usage was significantly lower at the mid levels than what was recorded at Stair 2.

The findings indicate that the inclusion of daylight and views do correspond with greater use, and the inclusion of a social reward further increases use.

Test 3

Having already concluded that the additional access to light and views corresponds with increased stair use, a final test was conducted comparing the two stair configurations of Orchard Commons. The key variable in this test is the connection with a social reward. The configuration of Stair 1 brings the stair immediately adjacent to the residential lounges with a glass separation, while Stair 2 does not feature a visual connection to the lounges.

This final test occurred during the last exam week of the semester. Some students had already moved out, resulting in lower numbers overall than in previous tests.

To provide greater detail in the test, stair use at more levels were recorded (refer to table 4.3)

Table 4.3 – Stair Usage - Test 3

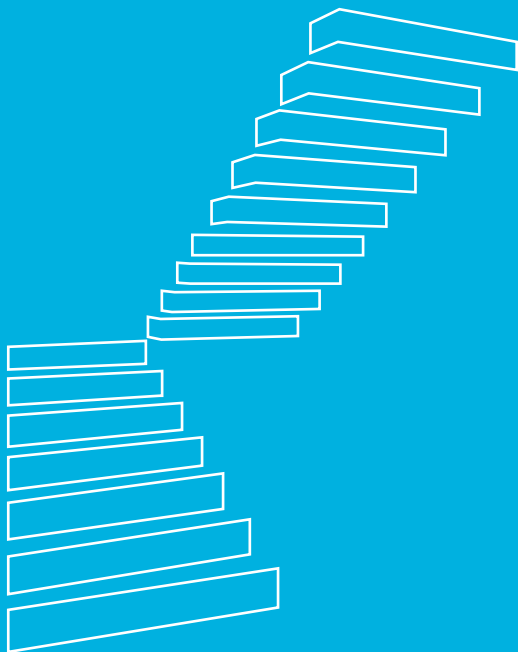
TEST 3		
	Stair 1	Stair 2
Number of Uses		
Ground Level	1582	838
Level 9	187	119
Level 10	194	120
Level 18/19	152	99
Level 19/20	125	85
Tower Population	539	508
Use Regulated by Population		
Regulated - Ground level	2.94	1.65
Regulated - Level 9	0.35	0.23
Regulated - Level 10	0.36	0.24
Regulated - Level 18/19	0.28	0.19
Regulated - Level 19/20	0.23	0.17
Average number of uses	0.83	0.50

In this test, all levels of Stair 1 demonstrated greater use than Stair 2. All characteristics of these two stair configurations were identical except for the additional “social reward” provided by Stair 1. This confirms that the social element to “see and be seen” provided by this configuration does correspond with an increase stair usage.

Overall, the usage of Stair 1 was 1.5 times higher than that of Stair 2.

Extenuating Circumstances

A last key qualification concerns the influence the configuration of the lounges has over the use of the main exit stairs in each building, and is relevant for each of the three tests conducted. In Stair 1 and 2, additional ‘convenience’ stairs are found in each of the three-level lounges found throughout the towers. Through the inclusion of these additional vertical circulation routes, trips between floors within each three-level lounge do not require accessing the exit stairs. As a result of these ‘competing routes’ that characterize the buildings containing Stair 1 and 2, the findings for do not capture all possible trips between floors. By virtue of this, our expectation is that the actual number of trips between floors by stair would be greater than recorded. Regardless of this distinction, the data revealed significantly greater stair use in Stair 1 and 2 over stairs 3 and 4, despite the fact that all possible trips between floors were not captured.



5.0 DISCUSSION

The act of design is not benign - the decisions made about the configuration of a building or space can have profound influence over human behavior. Creating spaces that allow for inhabitants to have a greater opportunity to choose healthier habits should be a serious consideration for designers. In our experience designing Orchard Commons, themes around promoting activity, creating settings for social interaction, and creating intuitive wayfinding were goals pursued both by the design team, and steering committee. As designers we typically rely on intuition, or other forms of analysis to arrive at design decisions. Seldom are we equipped with objective evidence or other supporting data to justify design strategies. The reality is that the majority of choices we make as designers are often subjective, at least to a degree. The goal of this study was to determine if recognized characteristics across similar building types could be evaluated in an objective way to measure different human behavior. The findings may be used to support design proposals design teams may make in subsequent projects.

Our findings indicate meaningful characteristics associated with the configuration of stairs where the promotion of physical activity is concerned. The stairs that can be considered to be most 'generous' exhibited significantly greater use. While our intuition led us to believe that this would likely be the case, the measurements taken in the field have confirmed the fact. Stair 3 can be considered as the most basic configuration - an undifferentiated stair with no special characteristics. Stairs of this type predominate in most buildings. Our findings indicate that creating stairs of this type does little to create conditions that can promote activity.

Limitations

While the results are promising, further measurement would be a benefit to gain greater comprehension.

A basic limitation of the recording method used is that door operation cycles were measured as an indication of use. Counting door operation does not have the resolution of determining the number of people passing through the door. We assessed this method to be a fair measurement as, by default, the exit doors are required to be closed, meaning to access the stair, the door must be opened. To collect more accurate data, a means of recording the number of people using the stair would be required. For the purposes of this study we assessed that door use was a reasonable approximation of use in general, although it failed to have the resolution to determine a user count.

While cost-effective, the data collection devices used in the study had a significant failure rate. Although we were able to gather meaningful data, a longer duration trial using a more robust device would improve the consistency of the data.

Subtle differences between the stair and building configuration influence the results.

Lessons Learned.

While apparently simple on the surface, in practice the collection of data across different buildings simultaneously is problematic. Operational variation, differences in configuration, and population characteristics all influence results. Isolating variables to the minimum aids in the analysis of the data.

Although a testing period was conducted prior to collection of results in the field, we still had several device failures. At the same time, some devices were removed, despite our effort to conceal them and attach them securely. Mechanically fastening the devices, rather than using an adhesive, would increase the likelihood of the devices remaining where placed. More robust devices are available, but with a greater cost. The desire to capture data across multiple locations simultaneously means a significant number of devices are required. Fewer devices could be used, but at the expense of having the data set be uniform to time, date, and duration of use.

Last, while our observations and measurements were configured to be as objective as possible, there is a subjective element to the analysis. Where interpretation of characteristics were required, we made efforts to describe the process of evaluation. A further level of comprehension could be gained through gathering user's impressions in the form of a survey or interview.

Although the study was limited, we do recognize a number of considerations that can be useful to designers.

Guidance to designers.

1. Place them right.

- Stairs that are placed in obvious locations are more likely to be used.
- Make stairs land at ground level, and at a place that is essential.
- Access to stairs on typical upper floors should be as conveniently located as possible, ideally more recognizable than the elevators.

2. Provide daylight and connection to the outdoors.

- The simple inclusion of daylight in stairs helps overcome negative sentiment associated with what are often 'utilitarian' features.
- Although remarkable views are not a reality of all buildings, a visible connection to the setting is a benefit and a comprehension of the time of day and weather.
- Consider including an operable window to allow fresh air and an acoustic connection to the setting.

3. Rewards.

- Having stairs that enable visual social connections has benefits.
- Stairs may lead to a social destination, or ideally, connect a series of social space in a repetitive way
- Passive surveillance overed by transparency to occupied spaces is a comfort, and helps overcome negative sentiment..

4. Think beyond structure and safety.

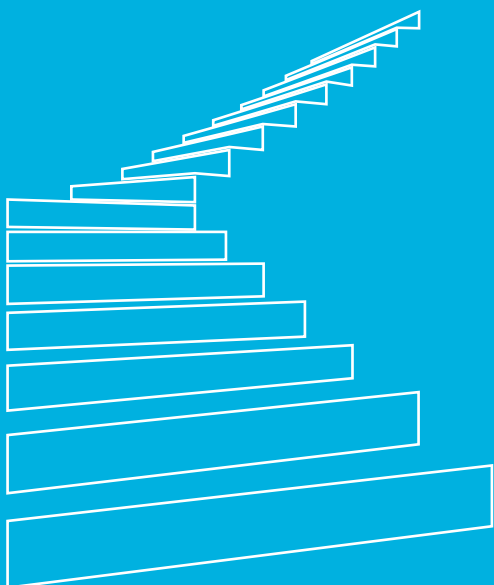
- While exit stairs are fundamentally required for safe egress, and often are a key part of the structural strategy for a building, we should expect more.
- Think of stairs not as building infrastructure, but as a social device that enriches experience and health

STAIR USE INCREASES 4X THROUGH INCLUSION OF DAYLIGHT AND VIEWS



STAIR USE INCREASES 6X THROUGH INCLUSION OF DAYLIGHT AND VIEWS WITH A SOCIAL REWARD.





6.0 NEXT STEPS

We recognize an important opportunity to advance the work begun in this report. A key intention is to share the findings through a number of means - both within the Perkins+Will community, with our client, and more broadly. The results discovered in this study have also provoked us to pursue further investigation. Next steps we foresee include the following:

1. Prepare Blog entry for Perkinswill.com

The findings should be shared with our P+W teams, and our clients. A Blog entry for the website is underway for publication this summer.

2. Share findings with UBC SHHS, and Move UBC.

As collaborators in our study, we intend to share our findings with UBC SHHS to help Influence future practice on campus. Further engagement with Move UBC will be sought to publicize findings and to more broadly influence the University community..

3. Further study.

We recognize a benefit in gathering further data to gain greater comprehension and consistency. We can also learn more using similar methods by increasing the number and types of buildings studied. Opportunities to collect data from other buildings should be considered.

APPENDIX A - STAIR CONFIGURATIONS - PHOTOS

TOWER 1, 2 ORCHARD COMMONS

Tower 1, Braeburn House

Tower 2, Bartlett House

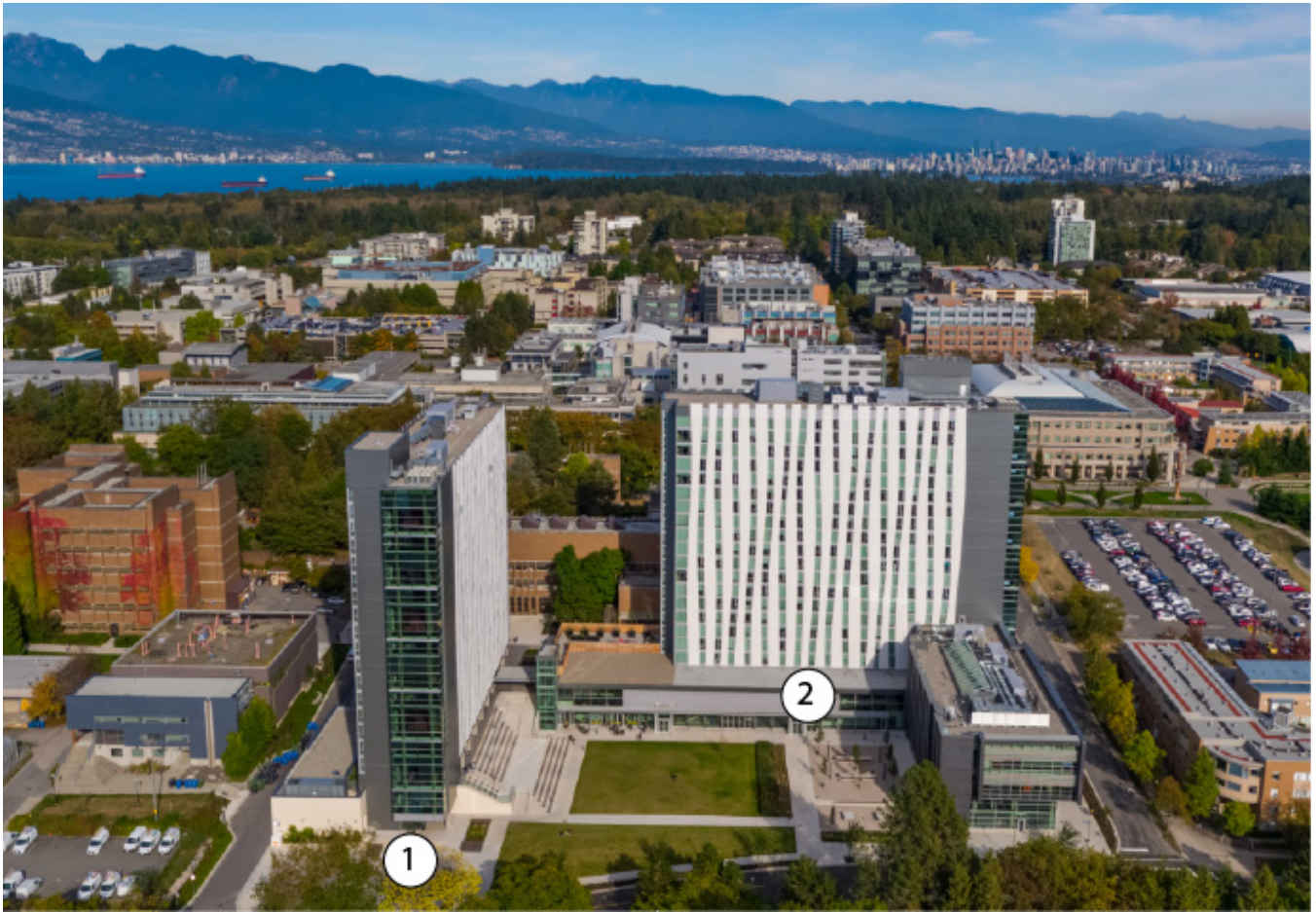


Figure 1.1 - Orchard Commons, 2016. Perkins+Will (Credit: The Sky Guys)



Figure 1.2 - Configuration 1 – Orchard Commons, Braeburn House. Adjacency of glazed exit stair to student lounge. (Credit: Michael Elkan)

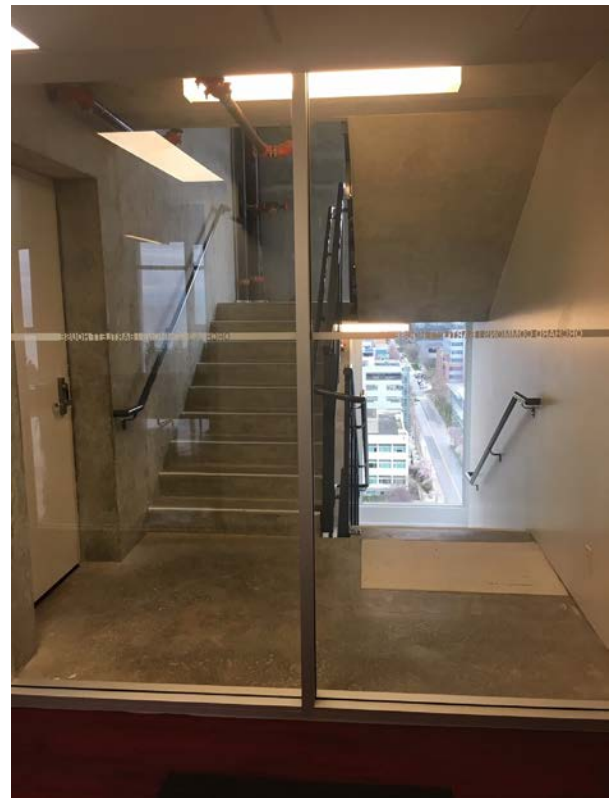


Figure 2.2 - Configuration 2 – Orchard Commons, Bartlett House. Adjacency of glazed exit stair to Main Corridor.

TOWER 3: PONDEROSA COMMONS, SPRUCE HOUSE

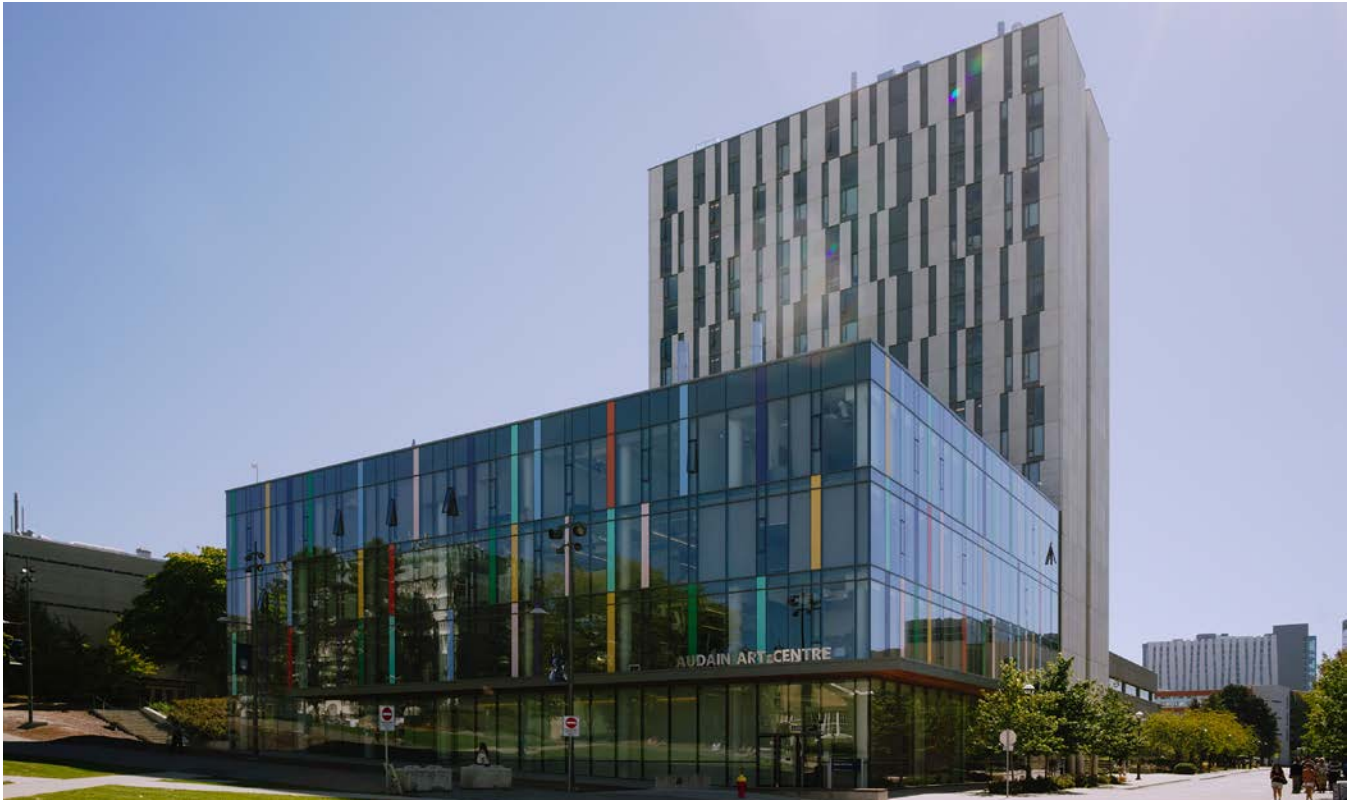


Figure 3.1 - Ponderosa Commons Phase 2, Spruce House 2015. KPMB + HCMA Architects

(Credit: Dllu [CC BY-SA 4.0 (<https://creativecommons.org/licenses/by-sa/4.0>)], from Wikimedia Commons)



Figure 3.2 - Configuration 3 – Ponderosa Commons, Spruce House. Adjacency of exit stair on main corridor, no glazing.

TOWER 4: BROCK COMMONS



Figure 4.1 - Brock Commons – Tall Wood House, 2017. Acton Ostry Architects.

(Credit: naturallywood.com)



Figure 4.2 - Configuration 4: Brock Commons, Tall Wood House. Adjacency of exit stair on Main Corridor. Minimal interior and exterior glazing.

APPENDIX B - STAIR CHARACTERISTICS

GROUND LEVEL				
	Stair 1 Figure 1.2	Stair 2 Figure 2.2	Stair 3 Figure 3.2	Stair 4 Figure 4.2
See Appendix A				
Appeal				
Interior Finishes	Basic	Basic	Basic	Basic
Stair appeal (articulation)	Basic	Basic	Basic	Basic
Interior Views	4	3	0	1
Exterior Views	0	0	0	2
Connection to destination	2	0	0	2
Convenience				
Proximity	Adjacent	Adjacent*	Adjacent	Adjacent
Visually/physically accessible	2	0	1	2
Number of stairs in tower	2	2	2	2
Number of elevators in tower	3	3	2	2
Residents per elevator	180	169	85	214
Elevator Speed	1.60	1.53	2.25	1.89
History of elevator disruption	None	None	None	None
Comfort				
Overall stair width	1150	1150	1140	1125
Tread depth	280	280	290	300
Riser height	180	180	175	170
Number of steps between landings	8	8	7.5	8
Legibility				
Identification Signage	basic	basic	basic	basic
Visibility of stair from main path of travel	Yes	Yes	Yes	Yes
Differentiation of stairwell from surroundings	none	none	Yes	Yes
Safety				
Uniformity and intensity of lighting	Basic	Basic	Basic	Basic
Visibility of tread edge	Yes	Yes	Yes	Yes
Slip resistant treads	Yes	Yes	Yes	Yes
Maintenance Level	High	High	High	High
Presence of hazards or graffiti	None	None	None	None
Security surveillance/devices	None	None	None	None

	Characteristic with large variation that may strongly affect findings
	Characteristic with small variation that may slightly affect findings
	Characteristic no or negligible variation that should not affect findings

*While the elevator core was adjacent, the elevator for this building was not accessible at this level.

MID LEVEL				
	Stair 1 Figure 1.2	Stair 2 Figure 2.2	Stair 3 Figure 3.2	Stair 4 Figure 4.2
See Appendix A				
Appeal				
Interior Finishes	Basic	Basic	Basic	Basic
Stair appeal (articulation)	Basic	Basic	Basic	Basic
Interior Views	4	3	0	1
Exterior Views	4	4	0	2
Connection to destination	0	0	0	0
Convenience				
Proximity	Adjacent	Adjacent	Adjacent	Adjacent
Visually/physically accessible	2	2	2	2
Number of stairs in tower	2	2	2	2
Number of elevators in tower	3	3	2	2
Residents per elevator	180	169	85	214
Elevator Speed	1.60	1.53	2.25	1.89
History of elevator disruption	None	None	None	None
Comfort				
Overall stair width	1150	1150	1140	1125
Tread depth	280	280	290	300
Riser height	180	180	175	170
Number of steps between landings	8	8	7.5	8
Legibility				
Identification Signage	basic	basic	basic	basic
Visibility of stair from main path of travel	Yes	Yes	Yes	Yes
Differentiation of stairwell from surroundings	none	none	Yes	Yes
Safety				
Uniformity and intensity of lighting	Basic	Basic	Basic	Basic
Visibility of tread edge	Yes	Yes	Yes	Yes
Slip resistant treads	Yes	Yes	Yes	Yes
Maintenance Level	High	High	High	High
Presence of hazards or graffiti	None	None	None	None
Security surveillance/devices	None	None	None	None

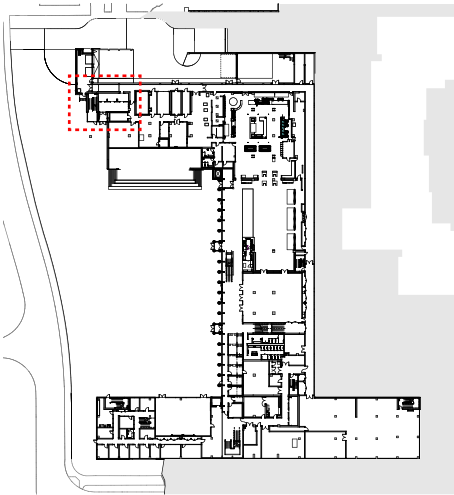
	Characteristic with large variation that may strongly affect findings
	Characteristic with small variation that may slightly affect findings
	Characteristic no or negligible variation that should not affect findings

TOP LEVEL				
	Stair 1	Stair 2	Stair 3	Stair 4
See Appendix A	Figure 1.2	Figure 2.2	Figure 3.2	Figure 4.2
Appeal				
Interior Finishes	Basic	Basic	Basic	Basic
Stair appeal (articulation)	Basic	Basic	Basic	Basic
Interior Views	4	3	0	1
Exterior Views	4	4	0	2
Connection to destination	0	2	0	2
Convenience				
Proximity	Adjacent	Adjacent	Adjacent	Adjacent
Visually/physically accessible	2	2	2	2
Number of stairs in tower	2	2	2	2
Number of elevators in tower	3	3	2	2
Residents per elevator	180	169	85	214
Elevator Speed	1.60	1.53	2.25	1.89
History of elevator disruption	None	None	None	None
Comfort				
Overall stair width	1150	1150	1140	1125
Tread depth	280	280	290	300
Riser height	180	180	175	170
Number of steps between landings	8	8	7.5	8
Legibility				
Identification Signage	basic	basic	basic	basic
Visibility of stair from main path of travel	Yes	Yes	Yes	Yes
Differentiation of stairwell from surroundings	none	none	Yes	Yes
Safety				
Uniformity and intensity of lighting	Basic	Basic	Basic	Basic
Visibility of tread edge	Yes	Yes	Yes	Yes
Slip resistant treads	Yes	Yes	Yes	Yes
Maintenance Level	High	High	High	High
Presence of hazards or graffiti	None	None	None	None
Security surveillance/devices	None	None	None	None

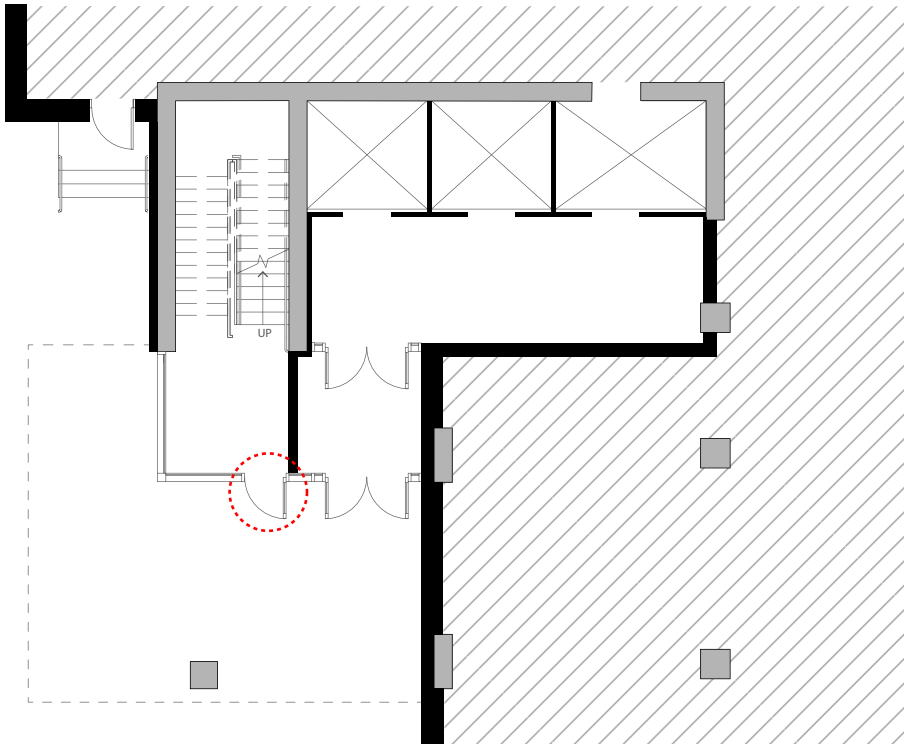
	Characteristic with large variation that may strongly affect findings
	Characteristic with small variation that may slightly affect findings
	Characteristic no or negligible variation that should not affect findings

APPENDIX C - STAIR DIAGRAMS

STAIR 1 - BRAEBURN HOUSE, ORCHARD COMMONS - LEVEL 1

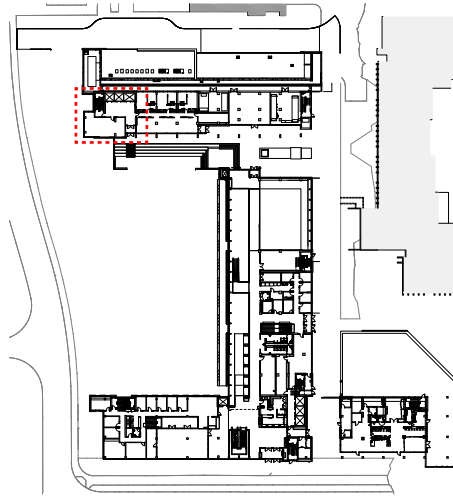


Stair 1

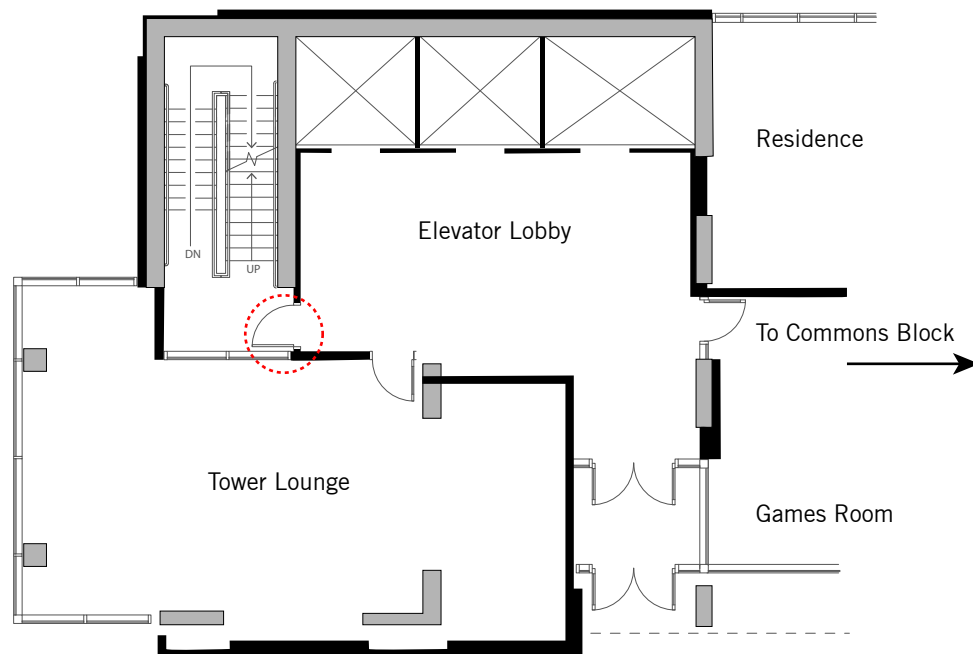



Counter Location

STAIR 1 - BRAEBURN HOUSE, ORCHARD COMMONS - LEVEL 2

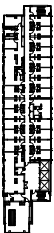
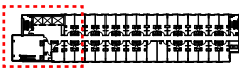


 Stair 1

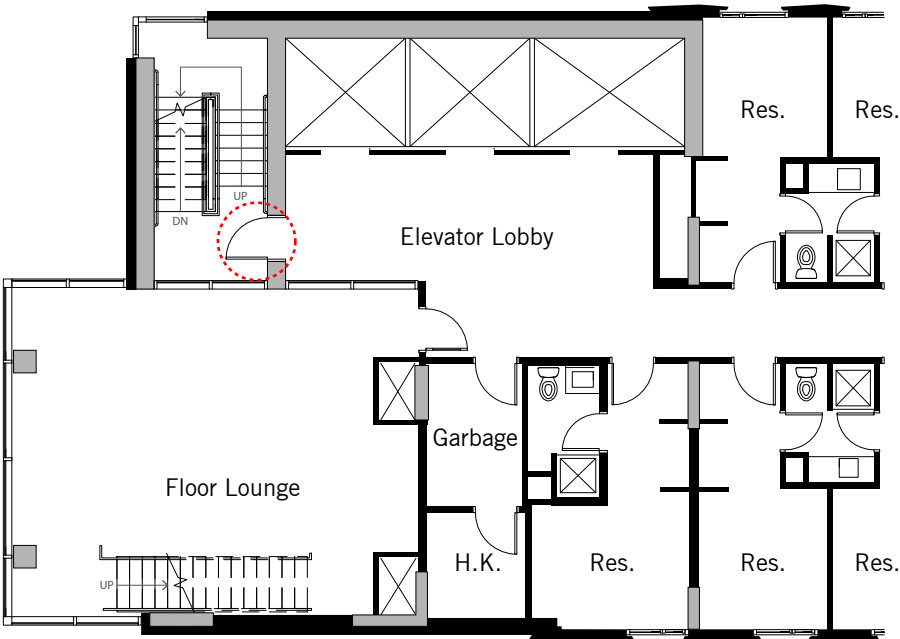


 Counter Location

STAIR 1 - BRAEBURN HOUSE, ORCHARD COMMONS - LEVEL TYPICAL (3-19)

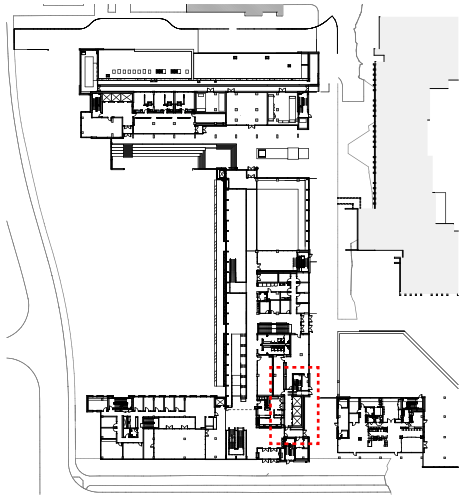


Stair 1

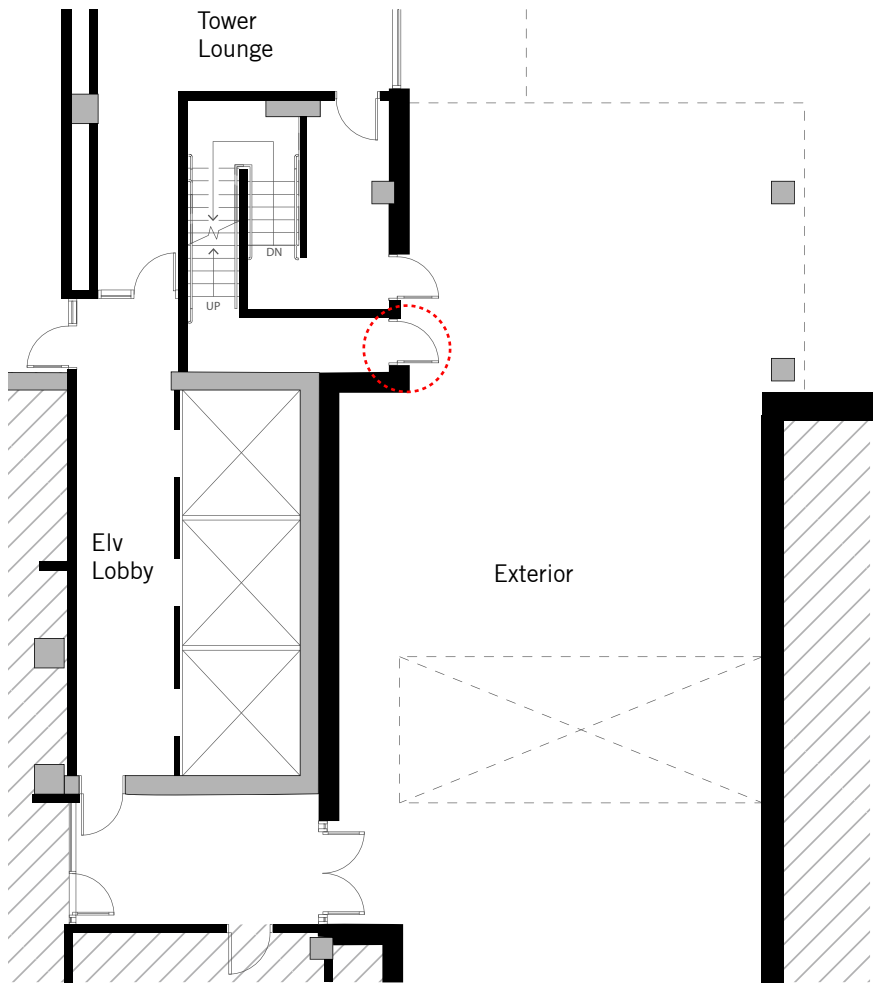



Counter Location

STAIR 2 - BARTLETT HOUSE, ORCHARD COMMONS - LEVEL 2



 Stair 2

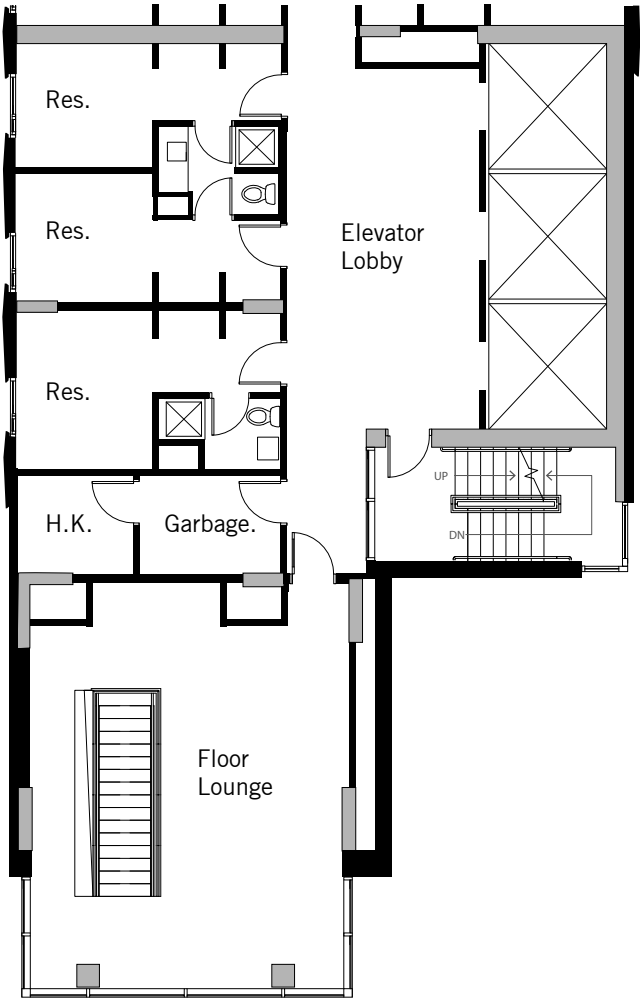



 Counter Location

STAIR 2 - BARTLETT HOUSE, ORCHARD COMMONS - LEVEL TYPICAL (3-19)

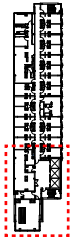


 Stair 2

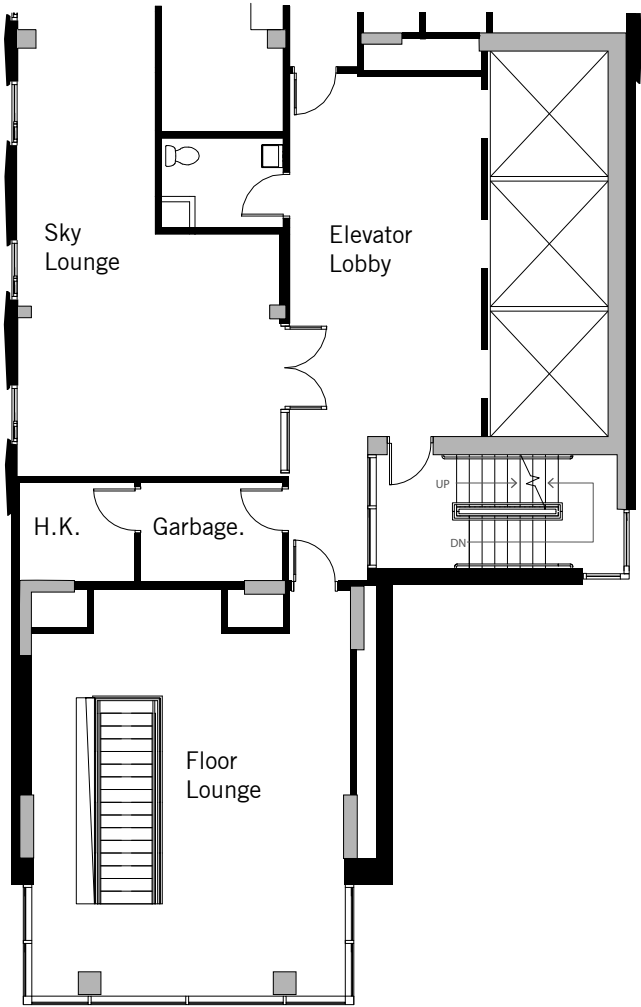


 Counter Location

STAIR 2 - BARTLETT HOUSE, ORCHARD COMMONS - LEVEL 20

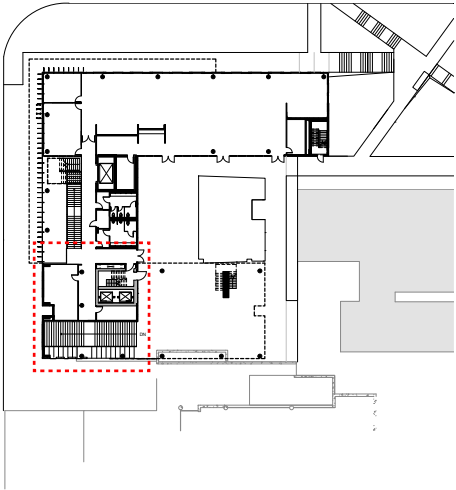


Stair 2

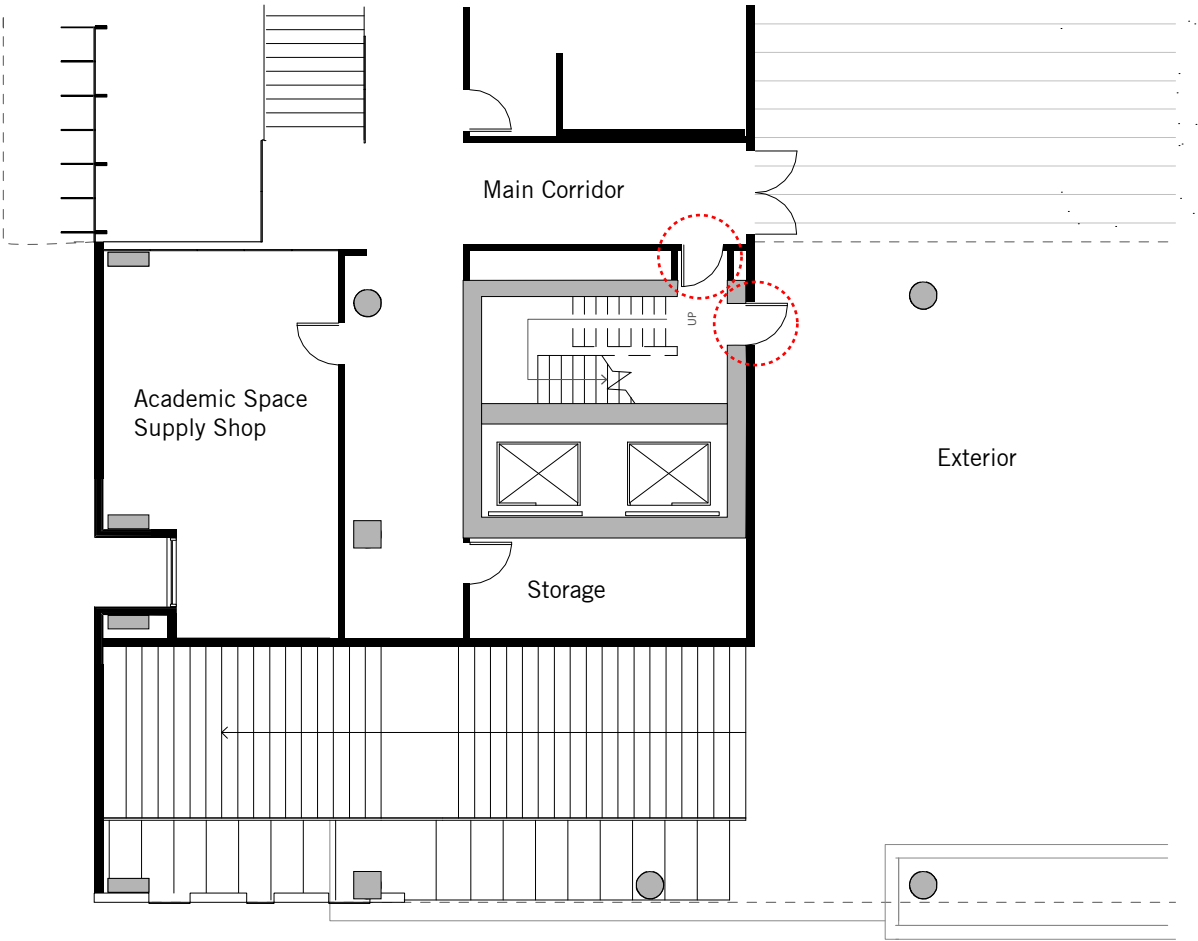



Counter Location

STAIR 3 - SPRUCE HOUSE, PONDEROSA COMMONS - LEVEL 2

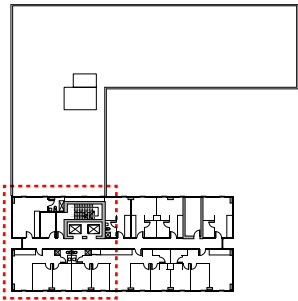


 Stair 3

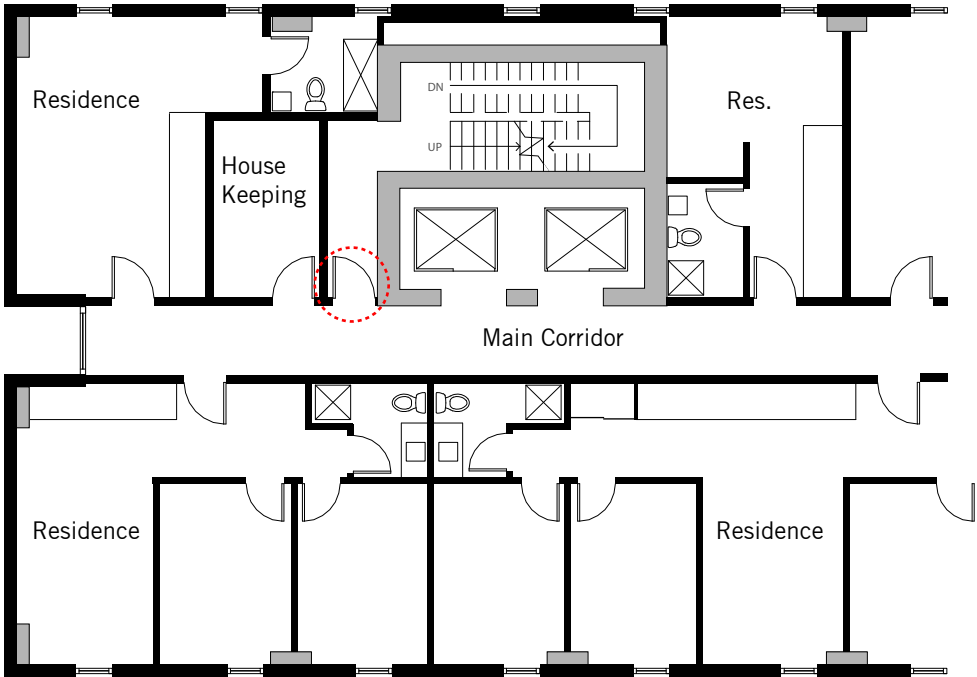



 Counter Location

STAIR 3 - SPRUCE HOUSE, PONDEROSA COMMONS - LEVEL 5-17

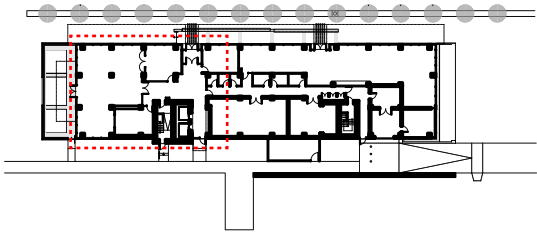


 Stair 3

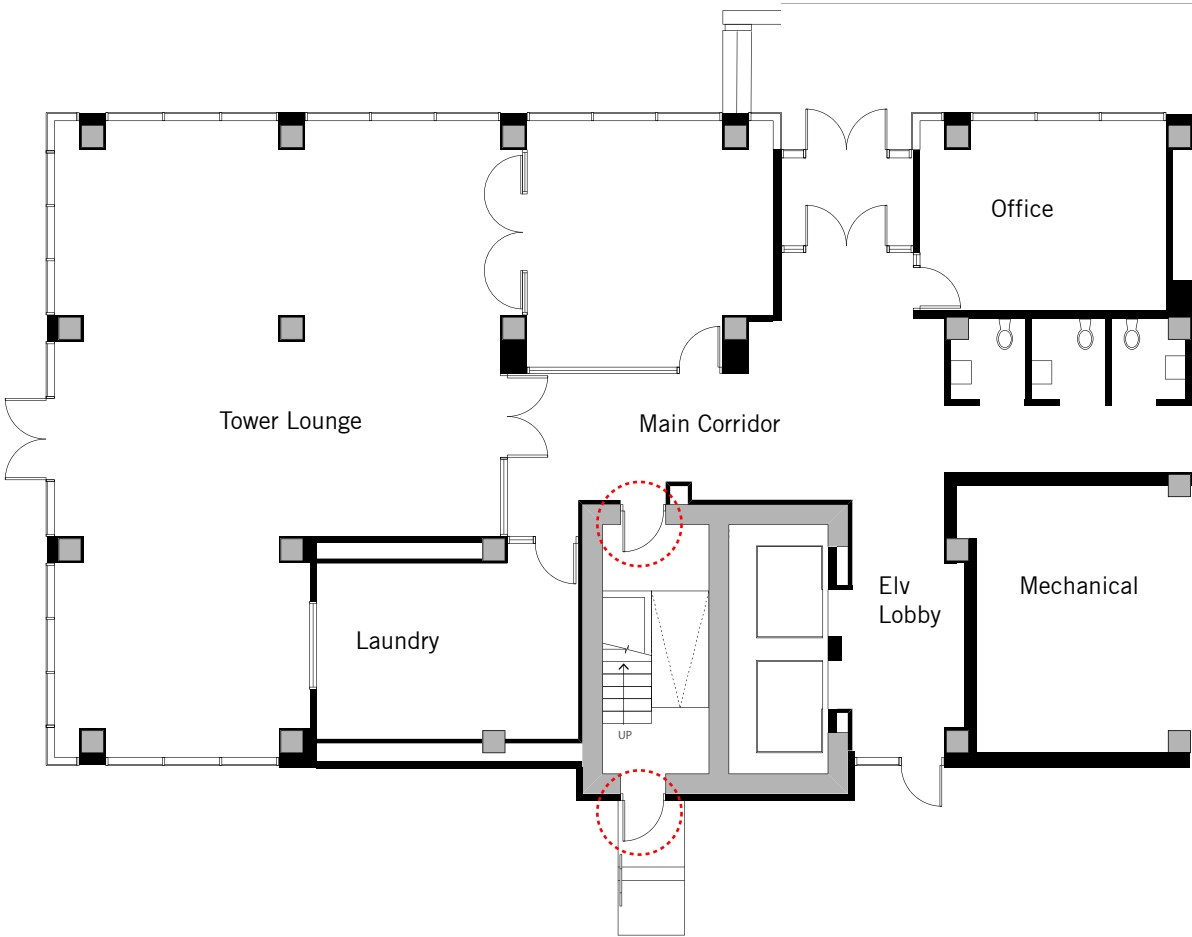



 Counter Location

STAIR 4 - TALLWOOD HOUSE, BROCK COMMONS - LEVEL 1

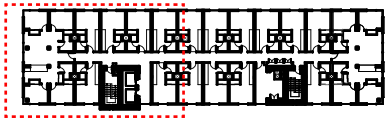


 Stair 4

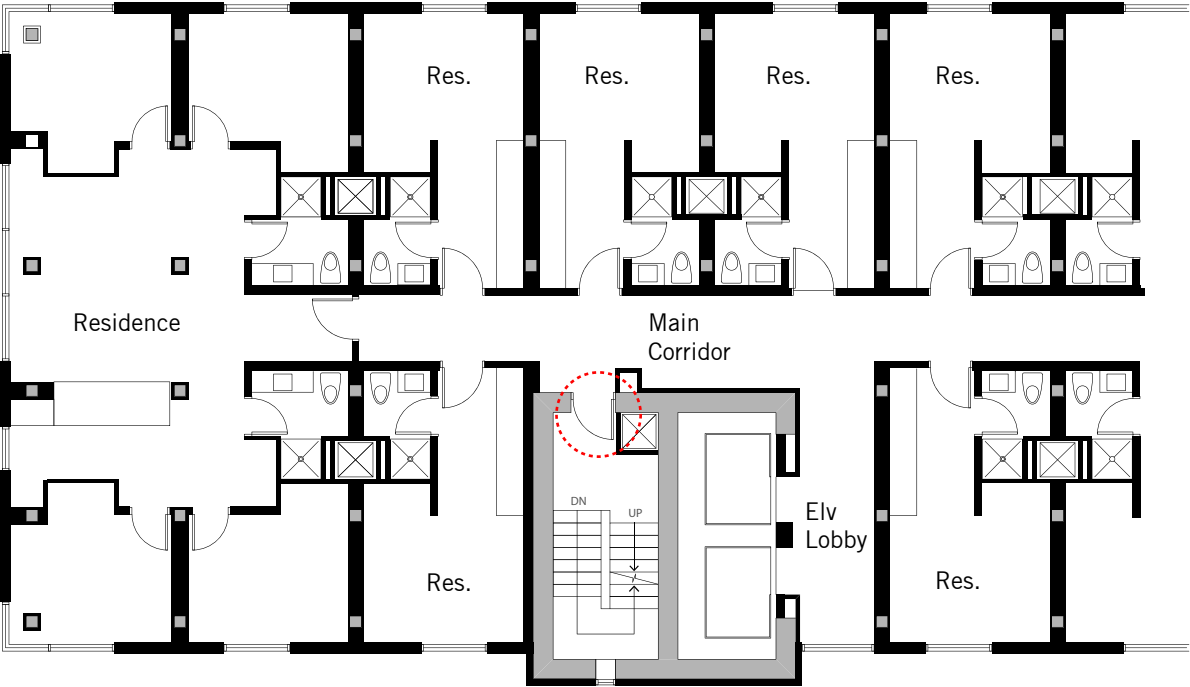


 Counter Location

STAIR 4 - TALLWOOD HOUSE, BROCK COMMONS - LEVEL 2-18

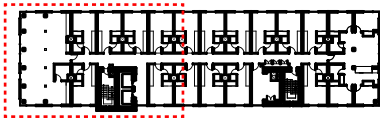


Stair 4

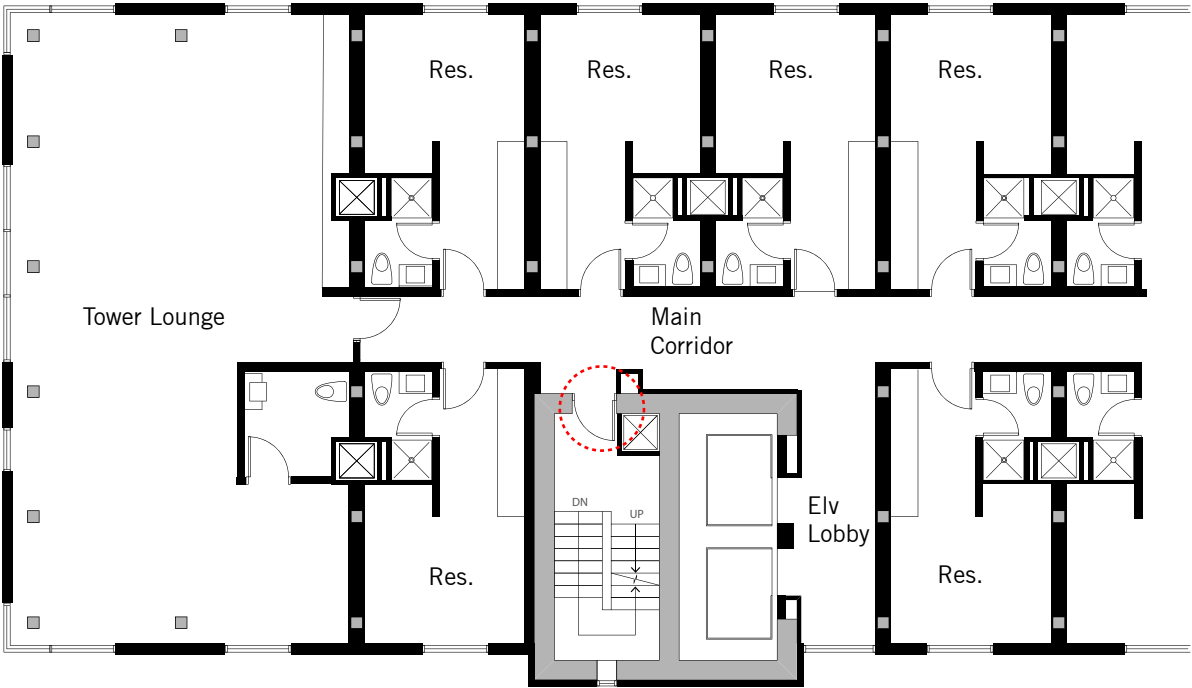



Counter Location

STAIR 4 - TALLWOOD HOUSE, BROCK COMMONS - LEVEL 19



 Stair 4



 Counter Location

APPENDIX D REFERENCES

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