

# Technocraft:

## Community Fabrication in Rainier Beach

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## **Abstract**

### **Technocraft**

Community Fabrication in Rainier Beach

The shift toward personal digital fabrication is rooted in access and technology. As access has grown, a movement has formed using digital fabrication technologies to “hack” or modify mass produced goods, which has united people through a fundamental belief in open source information sharing and a global support network. Defining “hacking” as an interface with an existing network, this thesis takes an analytical approach to determine where access to and education of personal digital fabrication technologies will have the greatest impact. Seeking points of intervention, the focus of the project was to evaluate potential sites using a number of criteria: access, education, economy and community.

Given the constraints, a site was decided upon in the Rainier Beach neighborhood. Viewing access on the city scale as a physical and infrastructural issue, proximity to a light rail station is an important consideration. Educationally, there is a concentration of technology-based programs aimed at residents in South Seattle, but few of them address the important

connection to the physical world. Within existing programs, digital fabrication will act as the physical manifestation of digital principles. Economically, the city has recently upzoned parcels adjacent to light rail stations and along MLK, and the new connection to downtown has made the neighborhood more desirable to commuters. However, budgetary constraints have delayed many transit oriented development projects and rising commercial costs have left a surplus of vacant buildings and empty lots. Despite the rich cultural diversity of Rainier Beach, the neighborhood lacks a strong community core. Physically divided by the linear infrastructures of light rail and high voltage towers, the area has an indiscernible character that is enhanced by its location between industrial spaces to the south and suburban development to the north.

This thesis proposes a new center for technology in craft in the Rainier Beach neighborhood. The goal is to provide an alternative to the ubiquitous three-over-one mixed-use development that would fit comfortably within the city's urban plan. Accepting the potential value of the site in a better economic climate, the proposal will have a temporal nature and be designed for disassembly with minimal site impact. Given the nature of such a facility, as well as the DIY culture that it caters to, flexibility is an important consideration within the design. The goal of the project is not to invent a new modular building system, but to create a network that allows for expansion as the institution grows or mobility as the context demands.





## Table of Contents

List of Figures	iii
Chapter 1: Introduction	1
Chapter 2: Education	7
Chapter 3: Economy	17
Chapter 4: Community	23
Chapter 5: Site Analysis	29
Maps	37
Network Analysis	40
Site Photos	43
Chapter 6: Program Analysis	49
Chapter 7: Making	57
Chapter 8: Case Studies [Prefabs, Assemblies, Armatures, Reuse and Hacks]	67
Prefabs	69
Assemblies	70
Reuse	75
Hacks	76
Chapter 9: Design	81
Chapter 10: Conclusion	99
Image Credits	103
Bibliography	109



## List of Figures

1.	Fablab Amsterdam	4
2.	Fablab Kenya	4
3.	Makerfaire San Francisco	5
4.	Jigsaw Renaissance makerspace, Seattle, WA	6
5.	Fablab San Diego	7
6.	TAF locations	12
7.	TAF classroom	12
8.	RecTech locations	13
9.	RecTech video class	13
10.	Digital Connectors national network	14
11.	Digital Connectors resources	14
12.	Nela Park MC2 STEM High School Fablab	14
13.	Fablab Mt Elliot	15
14.	Metrix Create:Space, Seattle, WA, interior	19
15.	Tech Shop, San Francisco, CA: workshop	20
16.	Tech Shop, San Francisco, CA: computer stations	20
17.	Makerfaire San Francisco	23
18.	Linguistically-isolated household map, Rainier Valley	24
19.	Tech Shop community	24
20.	Illutron coffee raft	25
21.	Illutron floating sauna	25
22.	FabAcademy video conferencing network	26
23.	3D model of low cost laser	26

24.	Prototype of low cost laser	26
25.	Hackerspaces global network	27
26.	Site within city scale	29
27.	Zoning map of surrounding site	30
28.	Vacant parking map along light rail corridor (in purple)	31
29.	Aerial site photo, existing context	32
30.	Site photo from Trenton St and MLK Way	32
31.	Detail of zoning on site	33
32.	Site: Light rail line	36
33.	Site: Bus routes	36
34.	Site: Bicycle/Pedestrian Routes	36
35.	Future Land use map	37
36.	Map of linear infrastructures	38
37.	Network Analysis: City scale	39
38.	Network Analysis: Valley scale	40
39.	Site Sections	41
40.	View/Panorama Key	42
41.	View from Trenton St and MLK Way	43
42.	View from Henderson St and Trenton St	43
43.	View from berm adjacent to site	44
44.	View N-facing from Chief Sealth Trail	44
45.	View from Light Rail Plaza/Bike Lockers to Chief Sealth Trail/Site	45
46.	View from Chief Sealth Trail adjacent to site	46
47.	Trenton St elevation	46
48.	View from Henderson St and MLK Jr Way	47
49.	Organizations and associated tools	50
50.	Equipping a Fablab	50
51.	Base program for campus	53
52.	Matrix listing programmatic elements with spatial characteristics	55
53.	Boston FabFi public wifi project signal reflector	57
54.	Laser cut pieces pre-assembly for Fabfi reflector	58
55.	Kenya FabFi reflector mounted on existing tower	58

56.	Nela Park MC2 STEM High School Fablab facility	59
57.	Hand-drawn plans for a Hydrogen generator from Lorain Community College's Fablab	59
58.	Hydrogen generator prototype, built in Lorain Community College's Fablab	59
59.	Facilities at the textile-based makerspace, The Workroom	60
60.	Various components for little-Bits circuitry	60
61.	Kit assembly for little-Bits	61
62.	Detail of little-Bits assembly	61
63.	RepRap desktop 3D printer	61
64.	Self-replicating components to build a RepRap printer, printed by RepRap printer	62
65.	Ikea hack: bent legs from POANG chair coupled with vintage banker seat and seatback	62
66.	Ikea BJURSTA table hacked into twin highchair (in progress)	63
67.	Twin highchair hack (final product)	63
68.	<i>fences for sitting</i> . 1999. Andreas Bergmann, drawings	65
69.	<i>fences for sitting</i> . 1999. Andreas Bergmann, installation photo	65
70.	Nomadic Museum, Shigeru Ban	68
71.	Theater Het Amsterdamse Bos, Catherina Scholten	68
72.	Spacebuster, Raumlabor	68
73.	Yosemite House, Anderson Anderson Architects	69
74.	Organic Urban Living Module, Anderson Anderson	69
75.	eHab, Eric Cobb Architects, render view	69
76.	eHab, Eric Cobb Architects, components diagram	70
77.	Loblolly House, Kieran Timberlake	70
78.	Loblolly House, Kieran Timberlake, frame assembly	71
79.	Mobile Museums, Public Art Lab, Gruber +Popp, aerial	71
80.	Mobile Museums, Public Art Lab, Gruber +Popp, install	71
81.	RDF 181, Rotor, installation view	72
82.	RDF 181, Rotor, interior view	72
83.	RDF 181, Rotor, kit of parts	72
84.	<i>Add-on: 20m Altitude</i> , Peter Fattinger, Veronika Orso, Michael Rieper	73
85.	Trailer Cage, Archigram	73
86.	Theater Het Amsterdamse Bos, Catherina Scholten	74
87.	Nomadic Museum, Shigeru Ban, interior	75

88.	Nomadic Museum, Shigeru Ban, exterior	75
89.	Platoon Kunsthalle Seoul, Graft Architects, exterior	76
90.	Platoon Kunsthalle Seoul, Graft Architects, interior	76
91.	Mobile Linear City, Vito Acconci	76
92.	House up a Building, Vito Acconci, install views	77
93.	House up a Building, Vito Acconci, install view	77
94.	Spacebuster, Raumlabor	78
95.	Spacebuster, Raumlabor	78
96.	Spacebuster, Raumlabor, inside the bubble	79
97.	Birds Eye view of proposed campus design	81
98.	Construction components exploded axonometric diagram: foundation, frame, landscape	82
99.	Helical pile installation diagram	83
100.	Site approach diagram: pixilation, accessing a network/creating a network	84
101.	Programmatic quadrants based on use	85
102.	Hybridization of programmatic quadrants	85
103.	Hierarchy of Permanence diagram	86
104.	View from Chief Sealth Trail into amphitheater	88
105.	Birds Eye view of proposed campus design	89
106.	Ground level plan	90
107.	Level 2 plan	91
108.	Level 3 plan	91
109.	North-South section	92
110.	Construction perspective from top of berm adjacent to site	92
111.	Completed perspective from top of berm adjacent to site	93
112.	View into amphitheater as temporary mist park	94
113.	View from Chief Sealth Trail at S Henderson St	95
114.	View from gallery entrance at S Henderson S	96
115.	View from north of water retention/garden area adjacent to Chief Sealth Trail	97
116.	View from gallery entrance at S Henderson S, the space between	100





## Chapter 1: Introduction

There is a growing movement to return to the tradition of making that has long been a part of American culture.<sup>1</sup> Unexpectedly, one of the driving forces behind the trend is a new era of digital technologies in the form of personal fabrication. In recent history, society has experienced two digital revolutions to date. The first was the digital revolution in communications technologies, which resulted in the expansion of mobile communications that now has over five billion users globally according to the U.N. telecommunications agency. Then came the digital revolution in computation, which has resulted in the prolific use of personal computers such that the number of personal computers in households is forecasted to reach two billion by 2014.<sup>2</sup> The next digital revolution will come in the form of personal digital fabrication, which refers to the field of physical manufactured goods. As the ability to fabricate goods becomes more accessible, there will be a shift from manufacturing as

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1 Lupton, Ellen. 2006. *D.I.Y.: Design It Yourself*. New York: Princeton Architectural Press. 18-22.

2 Shiffler III, George. "Forecast: PC Installed Base, Worldwide, 2004-2012," Gartner, 10 April 2008. ID Number: G00157113. [http://www.gartner.com/DisplayDocument?ref=g\\_search&id=644708&subref=simplesearch](http://www.gartner.com/DisplayDocument?ref=g_search&id=644708&subref=simplesearch)

mass production to a more individualized production process.<sup>3</sup>

The shift toward personal digital fabrication is rooted in access and technology. As the tools of manufacturing have become more available and the technologies more advanced, a greater number of users are beginning to take advantage of the smaller scale manufacturing process. Currently, the majority of personal use of digital fabrication technologies manifests itself in two ways. One direction comes in the form of the “fab lab concept,” which is an organized network of fabrication laboratories (fab labs) that allow people to produce creations for a single user base. Fab labs target underserved communities and enable a person or a group of people to invent new products that have a single target user base: themselves.<sup>4</sup> The other trend in personal digital fabrication comes via the informal network of hacker- or makerspaces that represent communities of consumers fed up with the current disposable culture. A movement has formed using digital fabrication technologies to “hack” or modify mass produced goods.<sup>5</sup> Both of these approaches have more in common, though, than the same set of tools. Both groups are united through a fundamental belief in open source information sharing and a global support network.

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3 Troxler, Peter, Open Content in the Creative Industries: A Source for Service Innovation? (March 19, 2009). Supporting Service Innovation Through Knowledge Management, Wolf, Patricia, Sami Kazi, Peter Troxler and Ralf Jonischkeit, eds., Bristol: KnowledgeBoard, Zurich: Swiss Knowledge Management Forum, 2009. Available at SSRN: <http://ssrn.com/abstract=1597357>

4 Gershenfeld, Neil A. 2005. Fab: the coming revolution on your desktop--from personal computers to personal fabrication. New York: Basic Books.

5 Balka, Kerstin, Christina Raasch, Cornelius Herstatt (2009). “Open Source beyond software: An empirical investigation of the open design phenomenon” (Paper presented at the R&D Management Conference 2009, Feldafing near Munich, Germany 14-16 October 2009).

Although the primary focus of both fab labs and makers is on making and creating, one of the ideal byproducts of the process is the engagement and empowerment of a community. Whether this happens through the process of learning a new skill or collaborating with others on a project, each of the organizations is invested in the formation or strengthening of a community through making and sharing.

While access to personal digital fabrication technologies will one day be abundant, the existing programs are most successful when they are built upon a strong base.<sup>6</sup> By targeting an area with an existing educational infrastructure, fab labs are able to expand upon a curriculum or community focus. Similarly, hackerspaces are often formed through a common interest in gathering in a space to share knowledge and tools. Both of the models function primarily in an environment where there is a need for innovation and outlet for creative energies.

This thesis takes an analytical approach to determining where access to and education of personal digital fabrication technologies would have the greatest impact. The proposal is to design a new center for technology in craft in the Rainier Beach area of the Rainier Valley in Seattle. With the addition of the light rail line, which travels down the middle of Martin Luther King, Jr Blvd, the neighborhood is in a transitory state. The city has grand rezoning plans for the southern end of Rainier Valley, and the proximity to downtown have made

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<sup>6</sup> Mangels, John. "Fabrication labs let student and adult inventors create products, solve problems." The Plain Dealer, June 18, 2009.



1. Fablab Amsterdam



2. Fablab Kenya

the neighborhood more desirable to commuters. However, due to the economic downturn, many of the transit oriented development projects have been delayed, which has left a surplus of vacant buildings and empty lots.<sup>7</sup> The proposal is to examine three elements essential to a strong neighborhood: education, economy and community. This analysis led to the site as well as the opportunity to enrich the community through a new intervention. The project will be a unique hybrid of an education-based fab lab and a member-based maker-space that will build upon the success of existing technology based programs in the area and act as a community and entrepreneurial incubator for the area.

### Defining the Intervention

This chapter will discuss the present status of the Rainier Valley and how a new digital fabrication and craft center will build upon existing programs and engage the community as a whole. Organizations and spaces for technology and craft in general tend to facilitate use through three main avenues of interest: education, economy and community. As mentioned in the previous section, various organizations focus on different uses of digital craft. Within the Rainier Valley, there are ample opportunities to engage each aspect, and this thesis proposes that it is possible to design a space that can serve not only serve each of the user groups but can respond directly to the changing needs of such an organization as well as the neighborhood.

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7 Pryne, Eric. "New light rail clears way for an MLK makeover." The Seattle Times, April 20, 2008, sec Business.

## Identifying the Tools

In order to clarify the different organizational models that will be referred to throughout the document, it will be helpful to clearly define the scope of the present communities that are centered on the use of digital fabrication technologies within a community of users.

\_Fab Lab:

The Fab Lab project has grown out of the Center for Bits and Atoms at MIT, where founder Neil Gershenfeld taught a class titled “How to Make (Almost) Anything.” From a single class, the movement to use digital fabrication technologies has grown to a global network that has over 50 branches in places that range in diversity from inner city Boston to rural Kenya. The primary goal is to bring these technologies to underserved communities so that they may use their unique circumstances and needs to drive innovation. Fab labs are an interesting model because they are required to house and maintain the same core programs and equipment, which enable the lab to design, fabricate and test individual solutions.

While each lab has a number of tools that it must contain, there is the freedom and ideal that each one should grow to fulfill its own needs. Inline with the FabLab Charter, it is also paramount that each branch participate in the global community through online documentation of their projects and information sharing regarding their processes.<sup>8</sup>

\_Hackerspaces and Makerspaces:

The member-based workshops are formed out of the desire that people with similar inter-

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8 The Fab Lab website, accessed July 22, 2011, <http://cba.mit.edu/projects/fablab/>.



3. Makertaire San Francisco



4. Jigsaw Renaissance makerspace, Seattle, WA

ests to come together in a collective workspace. The collectives form around the idea of making as well as “hacking” products. The term “hacking” often has negative connotations associated with illegal software programming, but it is used in this sense as a consumer modification. Because hackerspaces are less formalized than fab labs, they vary greatly in size and interests. Even within the Seattle area, which has at least five such organizations, certain groups focus on hardware and fabrication while others center on software and programming. The common bond is that members agree on the importance of making through a combination of technology, science and craft. However, one of the most valuable characteristics of these collectives is the community that is nurtured within the process of making and sharing. A number of the spaces also hold interaction with the greater community as an important goal. Most spaces invite those without experience to join in classes or open houses. Within Seattle, spaces Jigsaw Renaissance and Metrix Create:Space view themselves as an asset to the surrounding area. They offer regular classes to foster an intergenerational means of learning and creating. Hackerspaces also offer a greater cultural connection because they are part of a global network. The community has been growing and becoming increasingly more active with events like the Maker Faire which originated in San Francisco and has expanded domestically to a number of cities, such as Detroit and New York City, and internationally to cities, such as Cairo and Manchester. Hackerspaces.org tracks the number of spaces existing and planned worldwide and there are currently hundreds of groups in existence. Although groups are already present within the greater Seattle area, many cities have more than one hackerspace due to the variety in scale and specific interests of the members.

## Chapter 2: Education

Digital fabrication holds a huge potential as an educational instrument. While many educational programs, particularly those aimed at youth, focus on technology, few of them offer a connection to the physical world. Digital fabrication offers the physical connection that makes technology education something tangible. The production of these abstract thoughts provides opportunities to make concrete connections that further enhance students' understanding and experience useful in many of the fields that technology education focuses on, such as engineering and mathematics.<sup>1</sup>

### The Digital Divide

The role of technology in everyday life is continually expanding. The impact is felt in all areas, from health, education, economy, agriculture, etc, but the utilization of technology is not equally distributed through all geographies and populations. This asymmetrical distribution places certain populations in the position to gain social or economical advantages.

<sup>1</sup> Lynn Bell et al, "A Special Editorial: Educational Implications of the Digital Fabrication Revolution," TechTrends 54(2010): 2-5.



5. Fablab San Diego

The term often used to describe this disparity is the “Digital Divide,” which this thesis will define as “the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communications technologies (ICTs)”.<sup>2</sup> The divide does not only refer to a lack of physical access, but it is also an inequality in the access to the necessary information and knowledge to participate as a digital citizen. This disparity in knowledge is often determined by social factors, such as age, gender, educations, income and ethnicity.<sup>3</sup>

Based on citywide surveys of ICT access and use conducted by the City of Seattle Department of Information Technology, Seattle residents have relatively high rates of access to computers and other information technologies. The study shows that the percentage of residents with computers in the household is 76%, while the national average was just above 50%. Seattle residents that own computers also have higher rates of internet access at 93%. This means that almost three quarters, 72%, of the overall population have internet access at home; compare this percentage to the national average of 42% of American households with internet access. Although the city has generally high rates of accessibility to ICT in comparison with the rest of the nation, demographic analysis shows that there is still a disparity when income, education and ethnicity are factored into the equation.<sup>4</sup>

<sup>2</sup> Patricia, J.P. (2003) ‘E-government, E-Asean Task force, UNDP-APDIP’. From: <http://www.apdip.net/publications/iespprimers/eprimer-egov.pdf>.

<sup>3</sup> Rice, Ronald (2002), Primary Issues in Internet Use: Access, Civic and Community Involvement, and Social Interaction and Expression, London: In L. Lievrouw & S. Livingstone (Eds.), pp. 105–129.

<sup>4</sup> Community Technology Program (Seattle, Wash.). 2009. 2009 Resident Survey Report, Part Of City Of Seattle’s IT Indicators Project: Information Technology Access and Adoption in Seattle. Seattle, WA: The Dept.

Income is the strongest predictor of access to ICT. As a person's income increases, so does his access to and use of technology. Residents that earn less than \$30,000 are only two-thirds as likely to have internet access in their home compared to those making \$40,000 and above. The only exception to this analysis is that living in a Spanish-speaking household outweighed income as a factor; even with increased income, Latinos are less likely to be computer users.<sup>5</sup>

Similar to income, education is also a positive predictor of having access to ICT. Residents with no college education were one third less likely to be computer users. It is important to note that the effect of education was separate from that of income: regardless of income, residents with more education were more likely to be computer users and have home access to the internet. Less than half (44.6%) of the Latino/Hispanic households and only about two-thirds (66.6%) of African Americans have Internet at home compared to almost 90% of Caucasians.<sup>6</sup>

Another important population that the study examined through focus groups is that of immigrants and refugees. The focus groups revealed that our immigrant residents with limited English skills are less connected. They are less likely to have home computer or Internet access (59%, 45%), or Internet access via a mobile device (10%). They are also less likely to be computer (67%), Internet (58%), or email (62%) users or be comfortable with email

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5 Ibid.

6 Ibid.

attachments (34%). Forty-three percent of the immigrant focus group participants check their email daily. Forty-four percent of the same groups assessed their computer skill as “none or not very skilled” and another 30% selected “know what I need to know,” so about three-fourths of the participants in the immigrant focus groups have modest computer skills. Participants are about as likely to have cable TV as the phone survey respondents and somewhat less likely to have a cell phone (74%). Only 53% have a land line telephone.<sup>7</sup>

By analyzing the demographic data that the City’s Department of Information Technology has found with census data by zip code, one is able to arrive at the largest concentration of underserved residents. By comparing the demographic statistics by zip code within the city of Seattle, it is clear that the zip codes with the largest concentration of factors that effect ICT resources (targeted income level, education level and race/ethnicity statistics) are zip codes 98118 and 98106. This conclusion was found by examining numbers based on both population and percentages of residents that fit the aforementioned criteria. The 98118 zip code contains the neighborhood of Rainier Valley and the 98106 zip code encompasses the neighborhoods of Delridge and Highland Park.

Many of the statistics were comparable between the two zip codes, but 98118 was chosen due to the higher population as well as external factors, such as cultural diversity, immigrant and refugee populations, and proximity to the light rail as a connector to the rest of the city and communities to the south.

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<sup>7</sup> Ibid.

98118

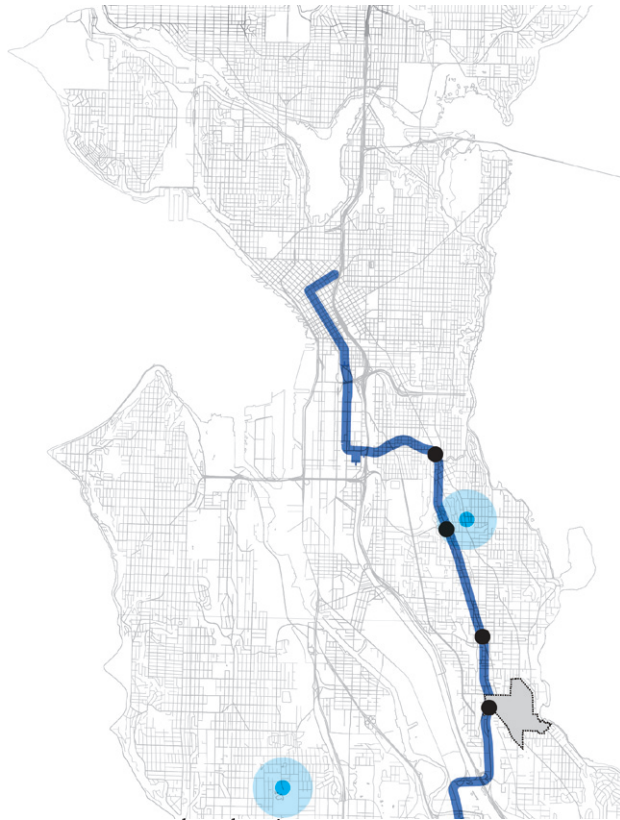
With a population of just over 40,000 residents, the Rainier Valley has just over 32% of households earning less than \$30,000, which was the amount cited by the Dept of IT study. Just under 24% of residents had achieved a Bachelors degree or higher. The most populated races were identified as Asian (34.1%), White (26.9%), Black/African American (26.0%), and Hispanic or Latino (7.2%). There were also 6.5% of residents that identified as two or more races.

Due to a large population of underserved communities, the Rainier Valley has a concentration of institutions and organizations looking to provide greater ICT access and education. There has long been a citywide campaign to provide computer access in public libraries, and many residents that do not have home access to computers use the library system on a daily basis.<sup>8</sup>

The majority of the programs in the Rainier Valley are a point of physical access for participants, but, generally, there is also a large component of capacity building for underserved communities. The following section will examine the existing programs as a base for the proposed intervention. Programs will be evaluated by their intent, locations and target user group(s).

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8 Ibid.



6. TAF Academy locations



7. TAF classroom

## Technology Access Foundation

The Technology Access Foundation is an organization founded by a former Microsoft employee and a Mental Health professional in 1996 to bring technology education and college preparation to underserved children of color. The curriculum is focused on Science, Technology, Engineering and Math (STEM) and uses a Problem-Based Learning (PBL) approach to teaching. While the classes were originally offered in the Central District neighborhood, the organization has grown and is now comprised of four main programs that include:

\_TechStart is an afterschool program for students in grades K-8 that is free to bring “innovative classroom techniques and cutting-edge technology to reinforce fundamental skills in an after-school environment.” It currently serves over 300 students in twelve locations in South Seattle, Highline and Federal Way.<sup>9</sup>

\_TAF Academy originated through a partnership with Federal Way Public Schools to create a 6<sup>th</sup>-12<sup>th</sup> grade school with a STEM focused curriculum. The TAF Academy opened in the fall of 2008 and is an interesting model of a public/private partnership where the TAF contributes its financial resources as well as professional connections in the form of professional mentorships and internship programs to prepare students for college and the workplace.<sup>10</sup>

\_Quasar is an internship program affiliated with the TAF that has grown out of a professional partnership with Puget Sound businesses to provide teens with job training and to place them in professional internships in technology-based fields.

9 Technology Access Foundation website, accessed July 22, 2011, <http://www.techaccess.org/>.

10 TAF Academy website, accessed July 22, 2011, <http://schools.fwps.org/taf/index.html>.

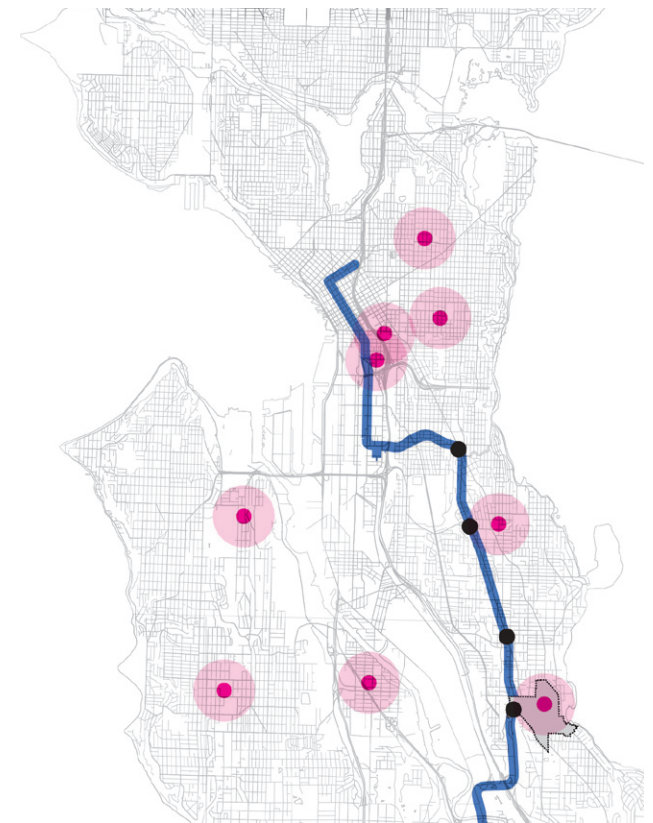
\_Teach21 is a training program for public school teachers that will educate them on Problem-Based Learning techniques, how to apply technology in the classroom and “small school culture-building.” The program will evolve with the TAF Academy network and is expected to be implemented by 2014.

### RecTech

RecTech, whose name is derived from “Recreational Technology”, is a technology based program that was founded in 1991 and is run by the RecTech Coalition, which is comprised of Seattle Parks Department staff and volunteers, with support from the Seattle Department of Information Technology and South Seattle Community College. The centers are located in twelve local community centers in Central and South Seattle and provide “programs that effectively use technology for education, recreation and community services for children, youth, adults, and neighborhoods” (see Figure 8).<sup>11</sup>

The focus is on computing and multimedia education in the form of workshops and open lab hours. The programs vary from basic computing skills and social networking to digital photography and music production, and include worker retraining programs. While the majority of RecTech programs are youth focused, there are a number of classes that target other age groups with the goal of improving quality of life, neighborhoods and the city as a whole.

<sup>11</sup> Seattle Parks and Recreation website, accessed July 22, 2011, <http://www.seattle.gov/parks/rectech/>.



8. RecTech locations



9. RecTech video class



10. Digital Connectors national network



11. Digital Connectors resources



12. Nela Park MC2 STEM High School Fablab

## Digital Connectors

Participants in the year long academic service program, ages 14-21, work to increase their ICT knowledge, engage the community by promoting technology to residents, and gain entrepreneurial and leadership skills. The program awards participants with a small monetary stipend, a laptop and the opportunity to build a multimedia portfolio. The classes meet in the Tech Center at the Rainier Vista Boys and Girls Club located in the north end of the Rainier Valley.

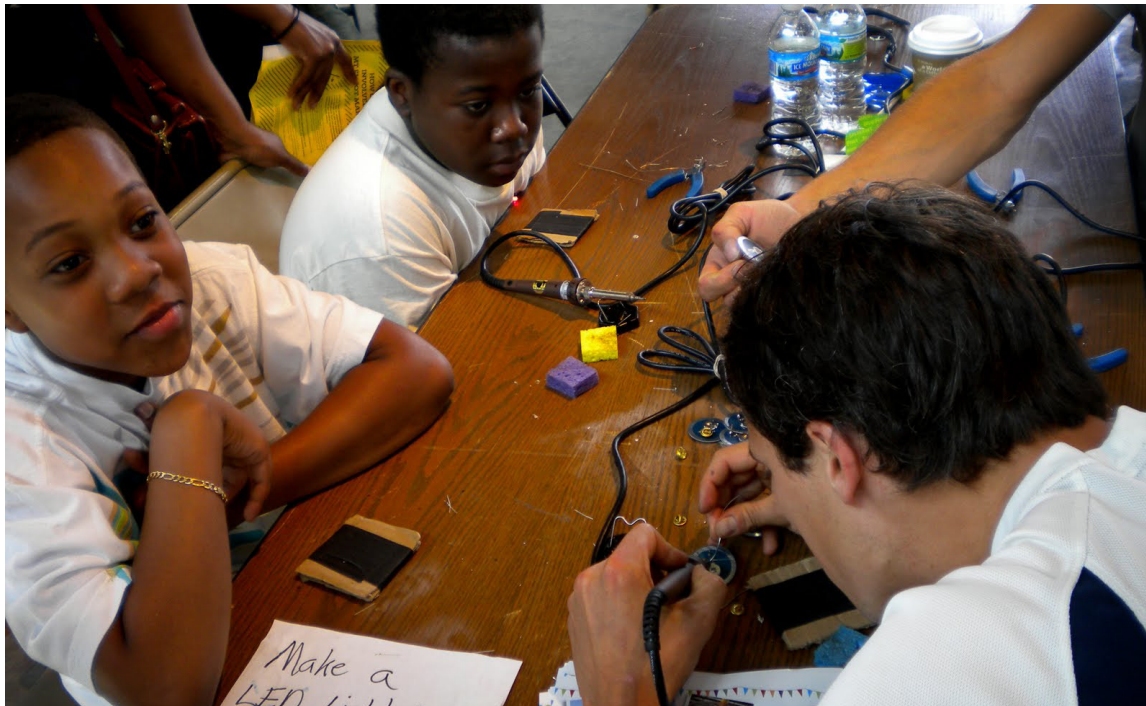
## Fab Labs and Education

Of the different organizational models for digital craft, fab labs offer the best precedent in regards to an educational component. The majority of labs exist within an educational environment or with a partner institution, so there are documented benefits to allowing students access to digital fabrication technologies.<sup>12</sup> The fab labs have the ability to expand upon the existing curricula of programs aimed at underserved communities. The Society of Manufacturing Engineering stated that personal digital fabrication will offer “revolutionary changes for both manufacturers and the everyday consumer.” The Society lists personal fabrication as one of the key Innovations that Could Change Engineering, noting that the U.S. Department of Education has identified this kind of innovation as a key to future prosperity.<sup>13</sup> By providing a place where the conceptual ideas and analysis of engineering and mathematics are given a physical form, learners are encouraged to use problem solving

<sup>12</sup> The Fab Lab website, accessed July 22, 2011, <http://cba.mit.edu/projects/fablab/>.

<sup>13</sup> “A Special Editorial: Educational Implications of the Digital Fabrication Revolution”. 2010. TechTrends : for Leaders in Education & Training. 54 (5): 2.

skills and innovative responses that reinforce the educational focus of programs like TAF's TechStart or TAF Academy, which are based on a STEM curriculum.



13. Fablab Mt Elliot



## **Chapter 3: Economy**

As industrial processes move away from the grand scale of Fordist-based mass production, digital fabrication reimagines the manufacturing process to provide small scale production in the form of single run, rapid prototyping. The smaller scale of operations allows individuals the opportunity to enter into the manufacturing field and provide more specialized products to consumers.

### **Fabricating Community**

Within a community context, particularly one that is representative of a lower income population, it is important to consider how community intervention can benefit a local economy. Many articles have been published on the potential innovation and product development that access to small scale manufacturing equipment will bring, but few refer to the business model that can arise out of the movement toward personal fabrication. Consider the two primary organizational models: fab labs are often grant funded through either government or philanthropic means, and hackerspaces are membership based and often have

nonprofit status that can be supported by claimed individually or by larger organizations.<sup>1</sup> With all of the prototyping that is available with access to such tools, it is interesting to see how the maker movement can spur the economy and appeal to inventive entrepreneurs.

The business environment within the Rainier Valley is an interesting study because it is hub of small business activity. The Retail Development Strategy for Seattle's Office of Economic Development makes several key observations about the Rainier Valley and highlights the fact that there is a highly active entrepreneurial community within the neighborhood stating that it "plays an important role as an independent business incubator." The area has a high number of small businesses in comparison to the rest of Seattle, but they face difficulties in marketing and expanding beyond the area.

Since it has been established that there are a number of small businesses within the neighborhood, it is important to know who the users would be in a small business context. The Development Strategy details the abundance of auto-related businesses that will gradually disappear in the coming years. The report advises that it will be important to preserve the skilled jobs in the area, so the hope is that the digital fabrication facilities can act as a new outlet for workers come with a developed skill set and knowledge.

### **An Open Source Community**

To discuss economy and profit within an open source or open design community can be

<sup>1</sup> Troxler, Peter. "Commons-based Peer-Production of Physical Goods Is there Room for a Hybrid Innovation Ecology?" (Paper presented at 3rd Free Culture Research Conference, Berlin, Germany October 2010).

complicated because it functions so differently from normal businesses where information sharing is not the standard practice and intellectual property rights are highly important.<sup>2</sup> As fab labs and maker- and hackerspaces grow in popularity, business is beginning to be discussed. In regard to fab labs, the FabLab Charter states that “commercial activities can be incubated in fab labs but they must not conflict with open access, they should grow beyond rather than within the lab, and they are expected to benefit the inventors, labs, and networks that contribute to their success.”<sup>3</sup> A study has shown that the majority of fab labs operate as infrastructure for students, and that they rarely reach out to other possible users, such as the general public, companies or researchers.<sup>4</sup> As for hackerspaces, an interesting development is the commercialization of the workshop. Two precedents that illustrate the wide range of spaces are Metrix Create:Space, a small scale local hackerspace, and Tech Shop, a large scale chain that operates on the hackerspace model.

#### \_Metrix Create:Space

Metrix Create:Space is located in a basement level space in the Capitol Hill neighborhood. It was founded in 2009 and is a unique study in that has a retail component. Described as “part techshop, part hackerspace and part coffeeshop,” Metrix has a membership base but is open to the general public. The space is located in the heart of a commercial strip and has incorporated the model of a coffee shop as a gathering place, so it generates exposure for

2 Chesbrough, H., 2006. “New Puzzles and New Findings.” In: Chesbrough, H., Vanhaverbeke, W. & West, J., eds. Open Innovation: Researching a New Paradigm. Oxford: Oxford University Press, pp. 25.

3 The Fab Charter (August 30, 2007). The Fab Charter, accessed July 22, 2011, <http://fab.cba.mit.edu/about/charter/>.

4 Menichinelli, Massimo. “An interview with Peter Troxler about Open Design and Fab Labs,” May 4, 2011. accessed July 22, 2011, <http://www.openp2pdesign.org/2011/fabbing/an-interview-with-peter-troxler-about-open-design-and-fab-labs/>.



14. Metrix Create:Space, Seattle, WA, interior

both the technology and the makerspace movement.



15. Tech Shop, San Francisco, CA: workshop



16. Tech Shop, San Francisco, CA: computer stations

The business operates by offering access to cutting edge technologies in hardware programming, hacking and both analog and digital fabrication. The facilities include a laser cutter, 3d printer, soldering room, workshop, tool loan and a vending machine that sells hardware components. In addition to the use of facilities and technology, Metrix offers regular workshops on electronics programming, sewing, laser cutting and 3d printing. It is actively engaged in the promotion and access of new technologies through educational partnerships with local high schools. The organization is also working to develop new open source technologies through a partnership with the University of Washington Solheim Lab in the Mechanical Engineering Department.<sup>5</sup>

#### \_Tech Shop

Tech Shop began out of the Bay Area, and functions as a for-profit business that profits from membership dues. Building upon the health club model of members paying for access to equipment that they could not afford on their own, Tech Shop has expanded the scale of the typical makerspace and has begun to grow as a business that caters to small business growth. They have the same community of innovators and tinkerers, but they also offer business counseling to help small scale product designers (and makers) to navigate the process of transforming their creations into small businesses.<sup>6</sup> They have also begun to partner with other businesses, such as Autodesk, to provide greater access to tools and technolo-

<sup>5</sup> Metrix Create:Space website, accessed July 22, 2011, <http://metrixcreatespace.com/>

<sup>6</sup> Tech Shop website, accessed July 22, 2011, <http://techshop.ws/index.html>

gies. The software giant has started to offer Tech Shop members free licenses and training in its Inventor program, which is a 3d modeling software that is specific to digital fabrication.<sup>7</sup> Tech Shop is a good case study for the Rainier Valley because one of the first branches to open outside of the Bay area was in Detroit, which was established by a partnership between the Ford Motor Company and Tech Shop to tap into the pool of unemployed auto workers in the area.<sup>8</sup>

#### Small Business Incubator

The two models offer potential economic benefits for a number of reasons. Both cater to users with no previous experience through a range of regularly offered classes that build upon one another and through scheduled trainings to guide users in the how the machines function. However, possibly one of the strongest aspects of entrepreneurial support comes in the form of a more traditional service. Tech Shop has a built in small business incubator that functions by offering counseling services to its member that go beyond the act of making and prototyping. One of the main functions is to help people form businesses from their creations, so members can find information about patents and tax regulations. Not unlike some non-profit hackerspaces, such as Jigsaw Renaissance in the First Hill neighborhood of Seattle, Tech Shop also offers a space for co-working and private offices to keep businesses close to the tools they need when starting fine tuning a prototype.

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7 Gustin, Sam. "Democratizing Design: Autodesk's CEO Carl Bass Announces 123D." Wired, May 3, 2011. <http://www.wired.com/epicenter/2011/05/democratizing-design/>

8 Vance, Ashlee. "D.I.Y. Detroit: A Hands-On Approach to Fixing the Auto Industry," July 30, 2010, accessed July 22, 2011, <http://bits.blogs.nytimes.com/2010/07/30/diy-detroit-a-hands-on-approach-to-fixing-the-auto-industry/>



## Chapter 4: Community

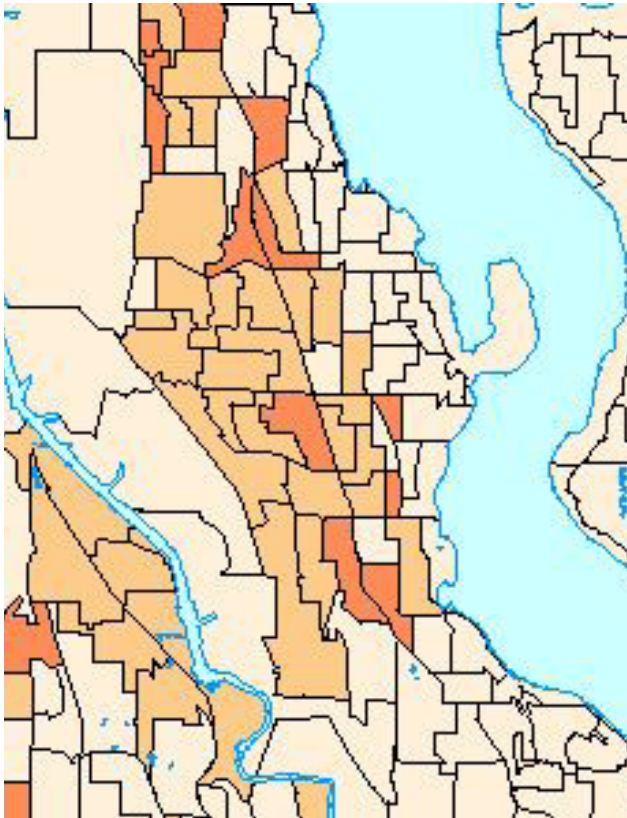
This chapter will describe how personal digital fabrication facilities empower communities. The models that have been previously described, fab labs and hackerspaces, each have a community based focus, and they are united in the idea that the act of making can bring people together through a sense of purpose and accomplishment. One difference is that the two approach their engagement with the community from different angles.

### Local Benefit

Fab labs view community building as something that comes from providing people with the tools and training to develop products that are specific to their needs. There is a satisfaction that comes from the completion of a physical product, but the effect becomes amplified when that product satisfies the needs of a person or a community. Using the digital fabrication tools and learning new skills gives people self confidence and the ability to bring their particular vision to fruition.



17. Makerfaire San Francisco



18. Linguistically-isolated household map, Rainier Valley



19. Tech Shop community

One benefit for the local community would be the issue of access, which is not only in reference to the location of the tools but also the ability to convey information to other cultures. Given the high number of immigrants and those living in language isolated households, the communication tools of the fab lab network would be very useful to incorporate a larger number of users (see Figure 18). The software and interface development goes beyond the foreign language translation and involves social, cultural and cognitive issues that make western software platforms like Windows less intuitive to eastern cultures.<sup>1</sup>

As member-based workshops, hackerspaces have a built in community of people with similar knowledge and interests. The one commonality in all of the hundreds of spaces in existence is that members thrive in the group setting. A number of innovative inventions have been documented in various publications, and one element that is discussed in each project is how community interaction is an integral part of the process of making. Even in someplace like a Tech Shop, which is a more corporate version of a hackerspace, the common space is essential. People join places of making not only for access to the tools and equipment, but for the community of the other individuals that are drawn to the same ideals.

Another factor in the communal aspect of hackerspaces is gathering and sharing. Many spaces normally host events where members are invited, but there is also a draw for those without any affiliation to the collective. The largest examples would be Makerfares, which are sponsored by Make magazine and have a growing presence in a number of cities. These

<sup>1</sup> Mikhak, B., Lyon, C., Gorton, T., Gershenfeld, N., McEnnis, C., & Taylor, J. FabLab: An Alternate Model of ICT Development. (Paper presented at the Development By Design, Bangalore, India December 2002).

larger events are indicative of smaller spaces and individuals connection to the larger community, but there are also examples of how gatherings take place on a smaller scale. Many hackerspaces and makerspaces regularly host open events that include movie nights, workshops and parties. The social network that these spaces create and foster is difficult to quantify, but there is a common thread in hackerspaces to share what is being made and invite those outside the collective to participate in how something is used. A good example is the Copenhagen hackerspace Illutron, which is made up of artists that focus on creating works with a public element. They take part in many music festivals and even design public works, such as a floating sauna or a coffee raft (see Figure 20, 21), with the slogan: “No money. No profit. Just to make people smile.”<sup>2</sup>

Spaces for making, regardless of the model, also contribute to the greater community beyond offering educational opportunities such as low cost workshops, which are common at both Jigsaw Renaissance and Metrix Create:Space in Seattle. Many spaces also focus on building relationships with the community through making. A good example is that HacDC, a well known space in Washington, DC, has been working to create a publicly accessible wifi hub for surrounding residents and businesses.<sup>3</sup> A project of this type would be easily translatable to Rainier Valley because there has been a city project to offer free wifi on the commercial strip of the Columbia City neighborhood. The program has had an impact on

commercial businesses revenues and has even attracted more businesses to the area.<sup>4</sup> The

2 Illutron website, accessed August 2, 2011, <http://www.illutron.dk/posts/54>

3 Musgrove, Mike. “Where Tinkerers Take Control of Technology,” The Washington Post, April 19, 2009.

4 City of Seattle Department of Information Technology. Seattle Wi-Fi Pilot Project: Evaluation Report, 10-13, by David Keyes with Ken LeBlond. November 2006. Accessed July 22, 2011, <http://www.seattle.gov/html/citizen/docs/Seattle%20Wi-Fi%20Evaluation%20Report.pdf>



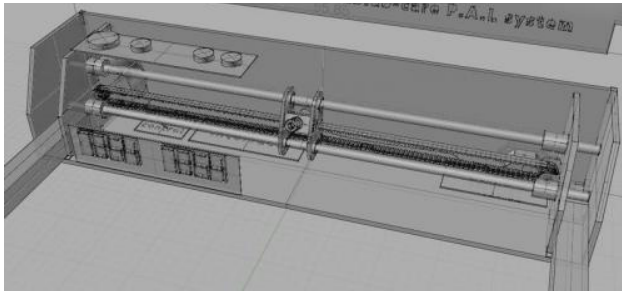
20. Illutron coffee raft



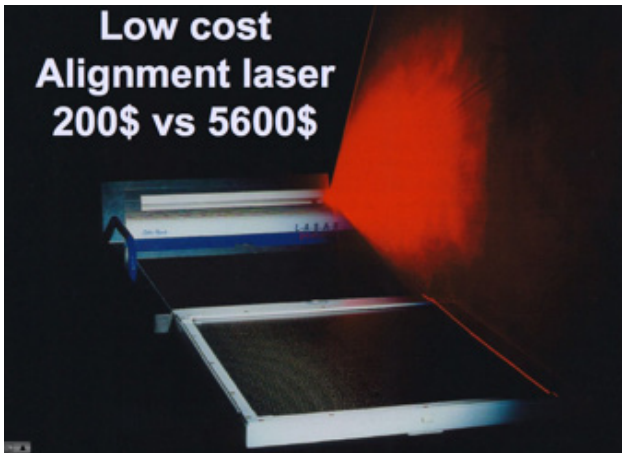
21. Illutron floating sauna



22. FabAcademy video conferencing network



23. 3D model of low cost laser



24. Prototype of low cost laser

benefits to existing commercial businesses as well as the potential to draw new businesses to the area would be in line with what the neighborhood plans, specifically in the Rainier Beach area, have targeted as one of the goals to improving the neighborhood.<sup>5</sup>

### Global Network

While the concept of community building can reference what is happening in the immediate vicinity, both fab labs and hackerspaces are part of a much larger movement that ties into a global network through open source information sharing. The fab lab charter states that participation in the online community is essential. Information sharing through documentation contributes the creation of a greater global community and to the growth of fab labs as individual entities. The process of communication is formalized through a video conferencing network that is hosted at MIT and used for meetings, conferences and educational opportunities through the Fab Academy.<sup>6</sup> The communications allow for sharing as well as troubleshooting projects, which creates a base that can inform projects in other locales and uses the collective knowledge to solve individual problems. Collaborative projects can range from a local focus to a more universal focus. A great example of the potential abilities of global connectivity is exemplified in the development of a laser system for aligning prosthetic limbs. The design was a digital collaboration between fab labs in Amsterdam, Norway and two in India, which led to the creation of a system that could be built in fab labs in any country to allow for the proper alignment of prosthetic limbs for a fraction of the cost for a mass produced alignment laser.<sup>7</sup>

5 City of Seattle. 2010. Neighborhood plan updates 2010: Rainier Beach. Seattle, WA, May 2010.

6 Fab Academy website, accessed July 22, 2011, <http://www.fabacademy.org/>

7 Waag Society's Fablab Amsterdam website, accessed July 22, 2011, <http://fablab.waag.org/node/2221>

Although the global network of hackerspaces is more extensive than that of fab labs, it is more difficult to quantify the products because the communication and documentation are less formalized. The growth of these spaces is easy to see through documentation online at site like [www.hackerspace.org](http://www.hackerspace.org) and through recent press in major periodicals such as the New York Times. Although the collaborative production is less easily identified, there are interesting developments that may have great impacts on how the individual spaces collaborate through a more connected network. A good example is the Agora Link Network, which is the “North American arm of an Open Research Network developed and maintained originally by a coalition of US hackerspaces.” The goal is to create a more formalized network to share ideas and resources to lead to more collaborative projects between various geographical regions, and the number of partners currently number over 50 from various locations across the US. The project is not focused solely on North America, and it has partner projects with the intention of connecting member spaces in a more globalized context for the creation of a new creative marketplace.<sup>8</sup>

8 Agora Link website, accessed May 11, 2011, <http://www.agoralink.org/>.



25. Hackerspaces global network

### Adaptive Design

Other than the intrinsic benefits of the activities and community available through hackerspaces and fab labs, there is also the ability to respond to the context. Fab labs and hackerspaces typically reflect the users' interests, both in activity and form. Having a space that the neighborhood views as representative of its interests will be a great benefit while the community is growing and evolving in the coming years. The facility will also be a common gathering place and act as a truly public space that is both utilized and informed by local residents.

## Chapter 5: Site Analysis

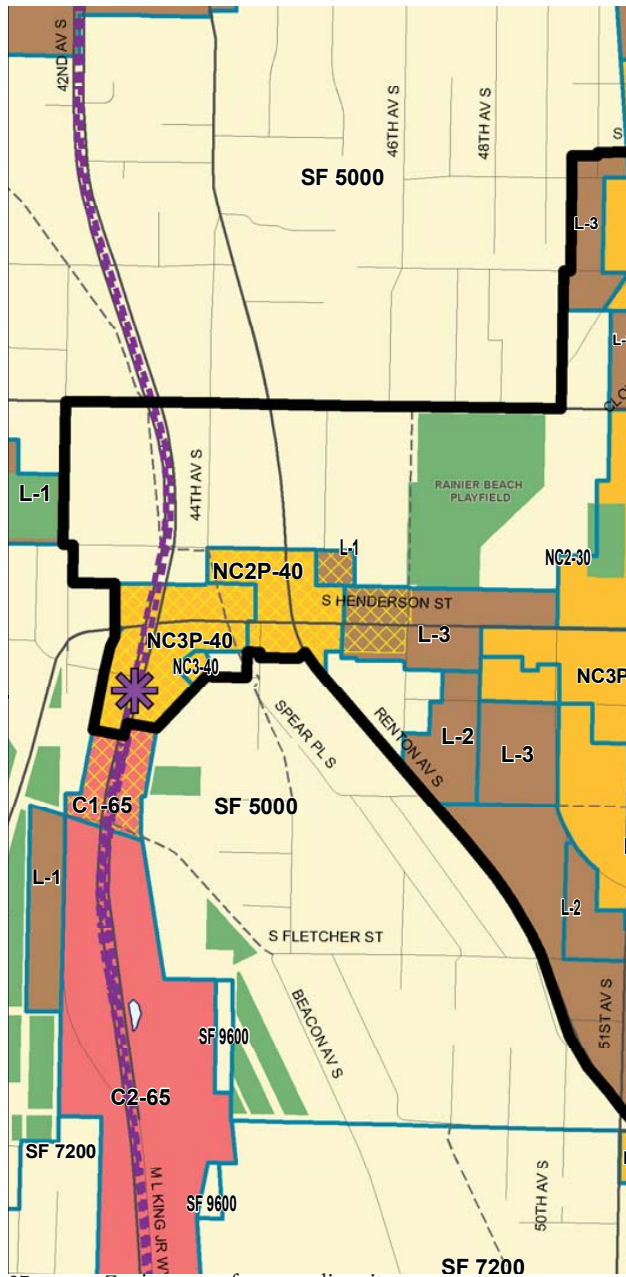
### Rainier Beach

Within the Rainier Valley, Rainier Beach is the southernmost area. The neighborhood encompasses a few smaller neighborhoods and is located just north of Tukwila. It extends from Martin Luther King, Jr Blvd to the shore of Lake Washington. The area was once marshland, but the land dried up with the construction of the Lake Washington Ship Canal. Historically, the neighborhood grew economically with the construction of an interurban railway that ran along Rainier Ave from Renton to downtown Seattle. Development stalled when the railway closed in 1937, and over time the economic trouble resulted in a low income area with high crime rates until the mid-90's. Then, through a city funded revitalization program, the neighborhood improved. The area has recently been reconnected to downtown with the construction of the light rail, which has brought an increase of attention to the area as well as a population increase.<sup>1</sup>

<sup>1</sup> City of Seattle Department of Neighborhoods. North Rainier Valley Historic Context Statement. Seattle, WA, May 2004.



26. Site within city scale



27. Zoning map of surrounding site

Rainier Beach is classified under the City of Seattle’s Comprehensive plan as an residential urban village, which it defines as an area that is meant to “provide goods and services for its residents and surrounding communities but may not provide a concentration of employment.” The recently updated zoning has expanded the commercially zoned area surrounding the light rail station to both “NC3P-40” “NC2P-40,” which is Neighborhood Commercial 3 and 2, respectively, with a 40-foot base height limit and a designated pedestrian zone.<sup>2</sup> This is in accordance with the desires outlined in the Neighborhood Plan for Rainier Beach.<sup>3</sup>

The neighborhood plan for Rainier Beach envisions an increase of both commercial and residential density with the addition of the light rail, but the reports on housing and business growth have not been as high as anticipated.<sup>4</sup> While commercial rents in Rainier Beach are lower than other parts of Seattle, it has higher average rents than many users can pay. This represents a discrepancy between the perceived value of land by commercial property owners and what the economic climate of the area can currently sustain.<sup>5</sup>

### Why Rainier Beach

Rainier Beach is an ideal place for a new center for digital technology in craft for several reasons. The first is that the light rail offers a greater connection to the rest of Seattle. The

2 Seattle Department of Construction and Land Use. Seattle Land Use Code: Title 23 of the Seattle Municipal Code. Seattle, WA, 1982.

3 City of Seattle. 2010. Neighborhood plan updates 2010: Rainier Beach. Seattle, WA, May 2010.

4 Ibid.

5 Vander Sluis, John. “Mixed Use Alternatives for Rainer Beach Economic Development: Low Impact Production Businesses.” Masters thesis, University of Washington, 2010.

western portion of the neighborhood lies within a half mile of the light rail station, which provides access to downtown Seattle in 25 minutes, and SoDo, Tukwila, and SeaTac airport within 15 minutes.<sup>6</sup> Figure xx identifies the location of the light rail station, overlaid with quarter mile and half mile buffers to indicate the distance most people are willing to walk to light rail.<sup>7</sup>

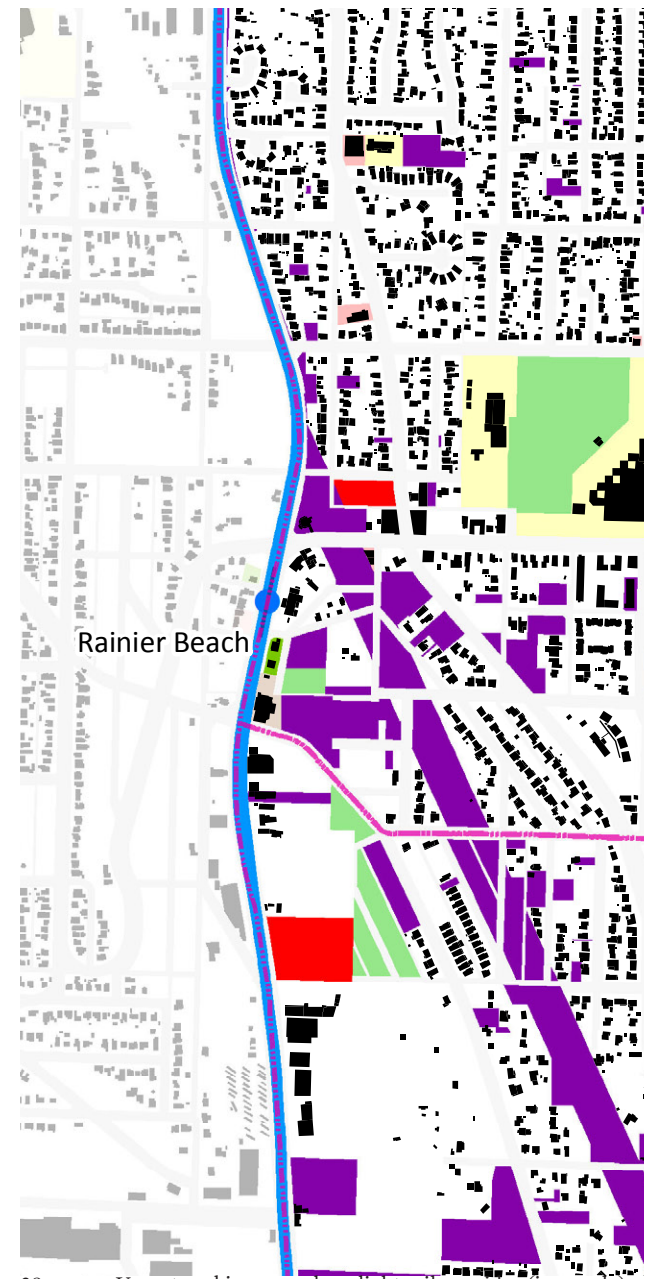
With the number of vacant lots in the area (see Figure 28), it is possible to site the proposed design in close proximity to the light rail station, which will expand the accessibility and visibility of the program. Also, an increased connection to the downtown and the existence of an active small business community can allow for the growth of a strong commercial network to benefit the area as a whole.

The proximity to the industrial areas south of the station can also be viewed as a positive aspect. The new facility can build upon a history of production and manufacturing in the area, so the center can relate contextually to existing conditions. There is also the potential to tap into the manufacturing businesses as a source of revenue for rapid prototyping of new products and services, which can also help to increase the commercial density as desired by the neighborhood plan.

Finally, locating the center as close as possible to the light rail station will fulfill the desire

<sup>6</sup> Sound Transit website, accessed June 6, 2011, <http://www.soundtransit.org/Riding-Sound-Transit/Schedules-and-Facilities/Central-Link-Light-Rail.xml#time>

<sup>7</sup> Stakeholders Committee. "Envision Midway Collaborative Planning Project", Overview of High-Capacity Transit Station Location Criteria (State of Washington, City of Kent, and City of Des Moines, n.d.), 1, <http://www.envisionmidway.com/Documents/Transit%20Oriented%20Development.pdf>



28. Vacant parking map along light rail corridor (in purple)



29. Aerial site photo, existing context

for a more visually active and engaging environment at the station, which was cited as a problem both in the neighborhood plan and in the economic analysis report. The ability to create a place that is visually active as well as physically active will enhance the neighborhood as well as empower the community.

### Site

The selected site is a series of vacant parcels northeast of the Rainier Beach light rail station. By siting the facility in this location, the proposal aims to take advantage of the underused areas directly adjacent to the light rail, green belt and commercial opportunities. The facility will have access to the pedestrian and bike traffic of the Chief Sealth Trail, the bus and auto traffic of Henderson, existing commercial districts of Henderson and Renton, and the prospect to continue the path that runs directly from the underused plaza at the north-

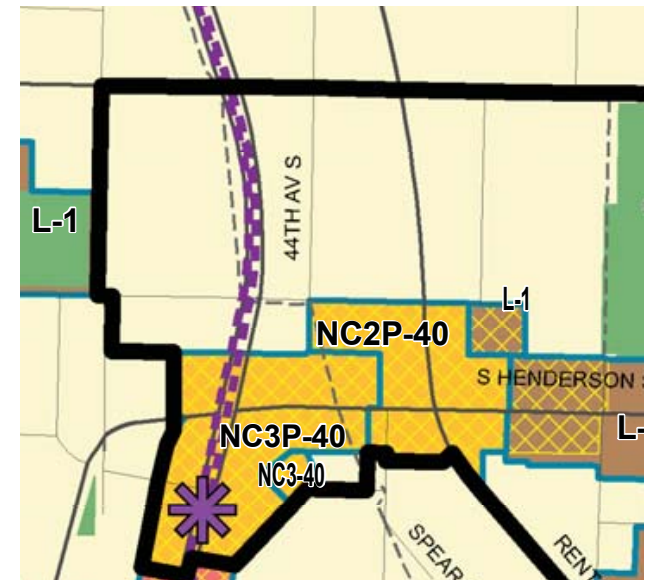


30. Site photo from Trenton St and MLK Way

east corner of Henderson and MLK.

The particular site, like the Rainier Beach station, lies at an interesting junction in the valley. It is a unique area lying at the border of industry and suburb, with an almost rural quality. Due to previous zoning regulations, south of the site has been traditionally for industrial uses, while north of the site is primarily single family residences. It is the place where a number of infrastructures cross: light rail, bus, car, bike and pedestrian are all served by major routes directly adjacent to the plot. Given the availability of access to the site and to downtown, as well as the current zoning, there is an enormous amount of commercial potential in the location. There is also the possibility to create a greater physical connection from the light rail station to the commercial areas by connecting to and extending the existing pedestrian paths. By bringing foot traffic through the site and creating a more public presence, the facility can engage a larger user group.

The site is currently zoned as neighborhood commercial, a combination of NC2P-40 and NC3P-40 depending upon the parcel (see Figure 31). The neighborhood commercial zoning prefers more profitable activities, such as retail, but it allows for a degree of light industrial activity. Current Seattle building code allows for up to 25,000sf of “craft work,” which is described as “Includes pottery and candle making, production of orthopedic devices, motion picture studios, printing, creation of sculpture and other art work, and glassblowing.” It also limits the square footage of “light manufacturing” to 10,000sf, which it describes as “assembly of clocks, electrical appliances, or medical equipment; production of finished goods,



31. Detail of zoning on site

such as jewelry, clothing or cloth, toys, furniture, or tents, from materials that are already refined, or from raw materials that do not need refining.”<sup>8</sup>

A previous study of Rainier Beach for potential types of low-impact production businesses concluded that two types would be acceptable for the neighborhood. One is an artisan or craft based business, such as woodworking or glass blowing, which would have a larger production area and a smaller storefront retail area. The other type is an incubator style business that would appeal to a wide range of users who were ready to move their businesses out of their residences.

Due to the both the desires of the neighborhood plan as well as the economic analysis, the areas surrounding light rail stations are destined to have an increased density in residences surrounding the light rail stations. While there are no developments currently under construction, it is understood that the recent up zoning as well as future land value will create ideal circumstances for a lucrative development property. This is not likely to happen in the immediate future, particularly with the current over-supply of commercial properties along Martin Luther King, Jr. Way.<sup>9</sup> Based on these points, the proposed intervention has chosen a series of leased vacant commercial properties with the intention that the design includes a degree of mobility to allow for relocation in the event that the parcels become too valuable to house such a facility.

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<sup>8</sup> Seattle The Department of Construction and Land Use. Seattle Land Use Code: Title 23 of the Seattle Municipal Code. Municipal code 23.47A.004 and 23.84A Seattle, WA, 1982.

<sup>9</sup> City of Seattle’s Office of Economic Development. “Retail development strategy for Rainier Valley,” Community Land Use and Economics Group, LLC, December 2009.

## **Diagramming the Site**

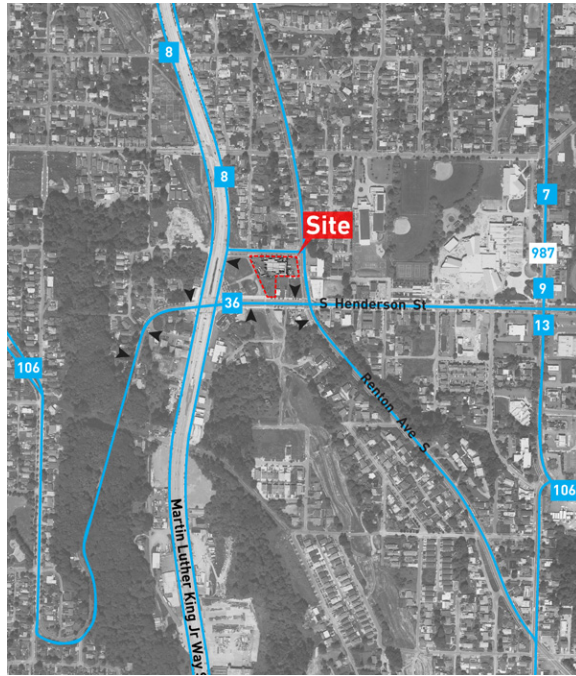
In deciding how the site can be best used, the proposal analyzes users' and surrounding residents' physical access and sensory interaction with the new facility. The following diagrams highlight the new light rail track, major bus routes, and pedestrian and bike paths (see Figures 32-34). As the proposed intervention is designed with future zoning and density in mind, it is necessary to understand and anticipate both the zoning intentions of the city as well as current infrastructures in place (see Figures 35, 36). Rainier Beach, particularly near the chosen site has a steep grade change in places, with topography being an important land feature (see Figure 39). Considering that the facility is seen as a new public amenity, the analysis also considered views to the site from surrounding roads, pathways and hilltops (see Figures 41-48).

### Network Analysis

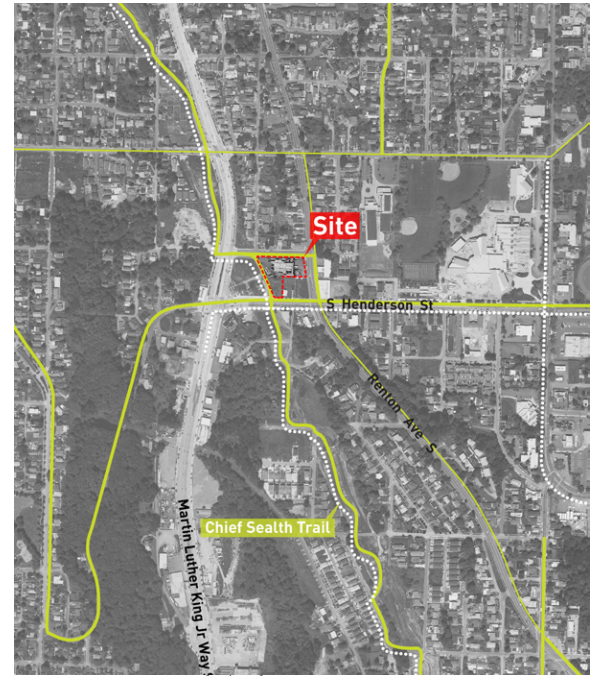
To define potential points of intervention, both socially and organizationally, it was necessary to map existing networks. Beginning at the city scale and working down to the neighborhood scale, it is possible to identify institutional connects, places of social gathering, and potential small businesses that would be able to relocate to take advantage of the tools and services available in the new facility (see Figures 37, 38).



32. Site: Light rail line



33. Site: Bus routes



34. Site: Bicycle/Pedestrian Routes

■ Light Rail

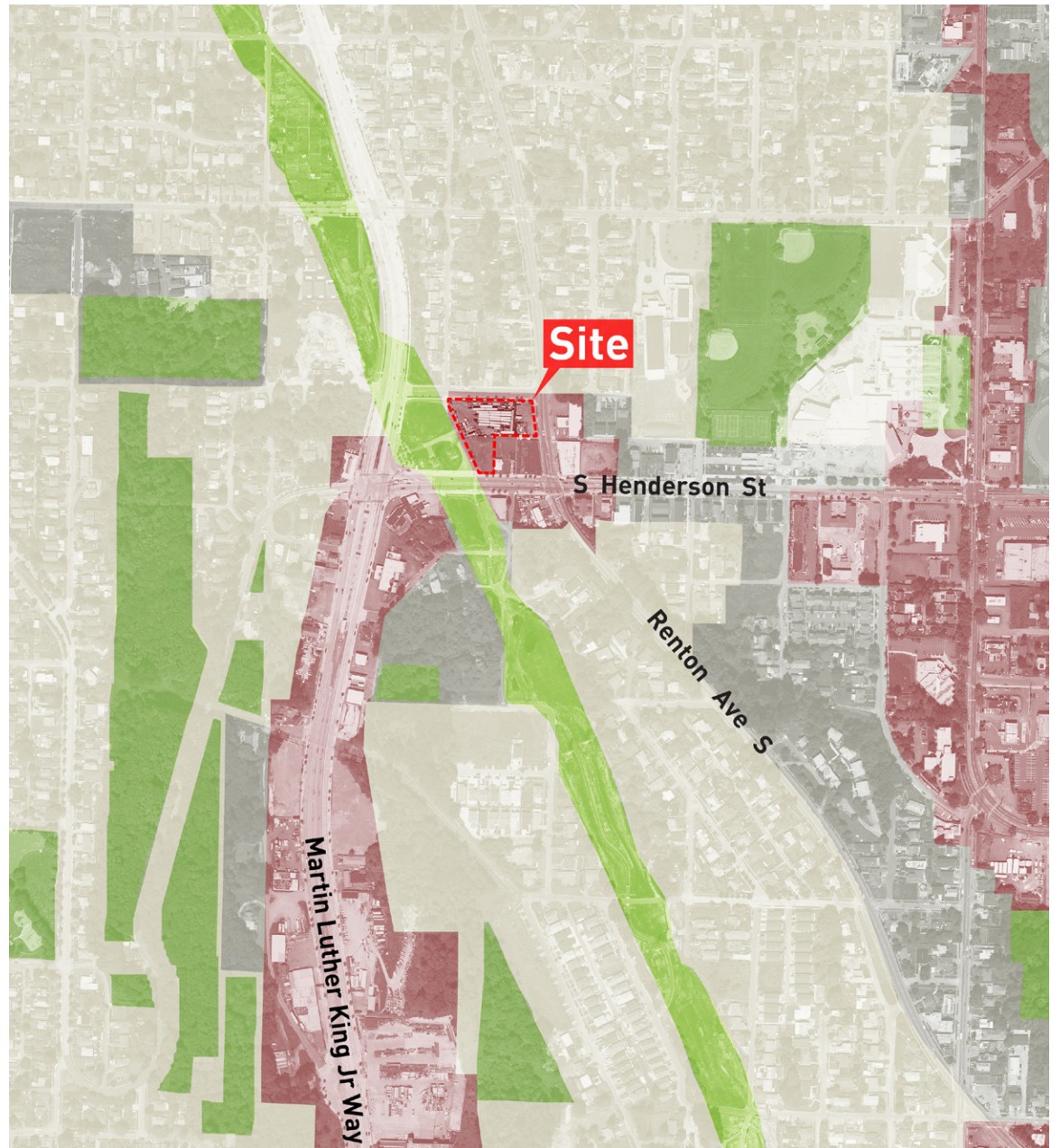
# Bus Route/Number

■ Bicycle

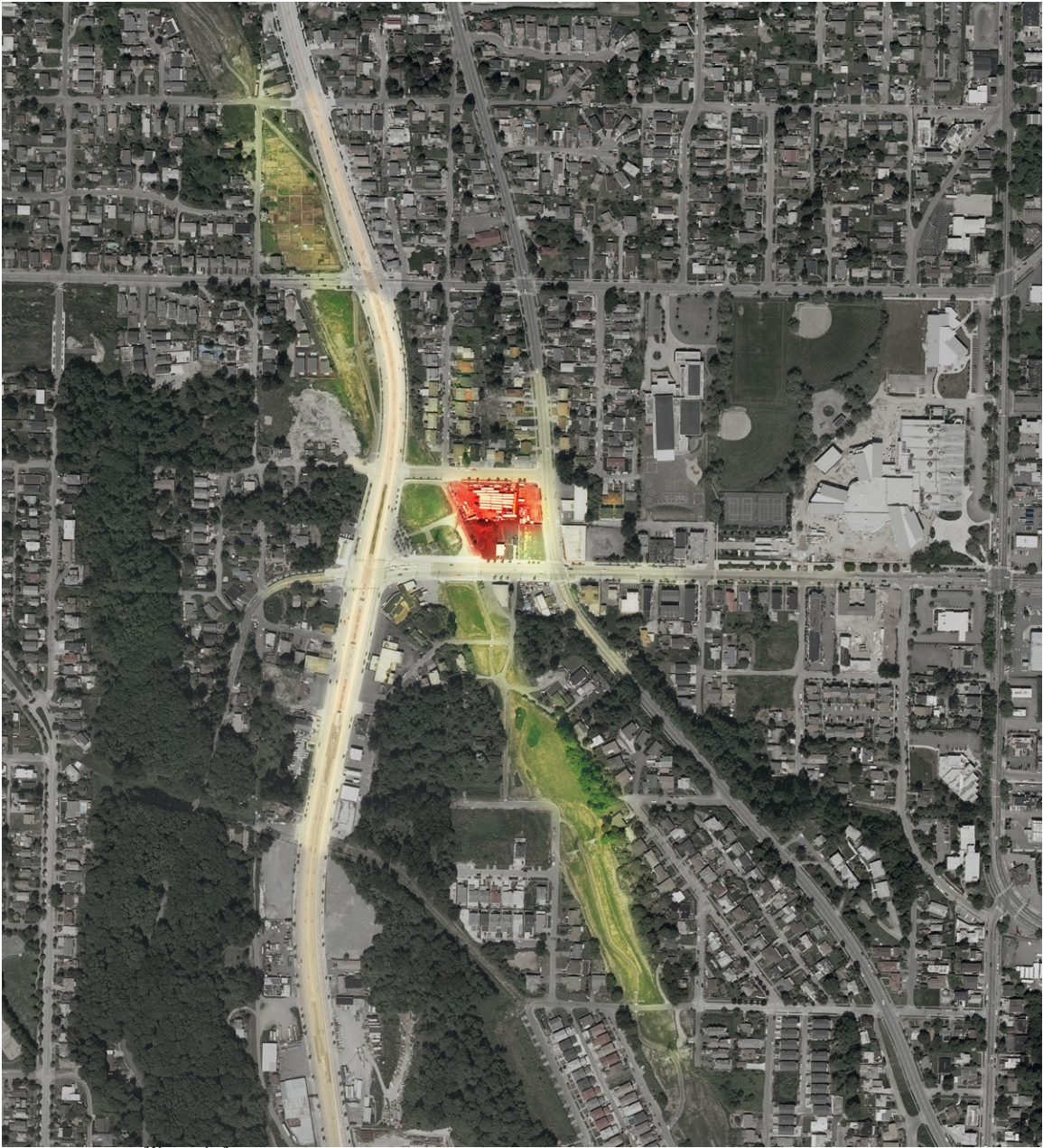
▶ Bus Stop

○ Pedestrian Zone

- Commercial/Mixed Use
- Multi-family Residential
- Single Family Residential
- City Owned Open Space



35. Future Land use map



Green Belt/High Voltage



Transit Lines

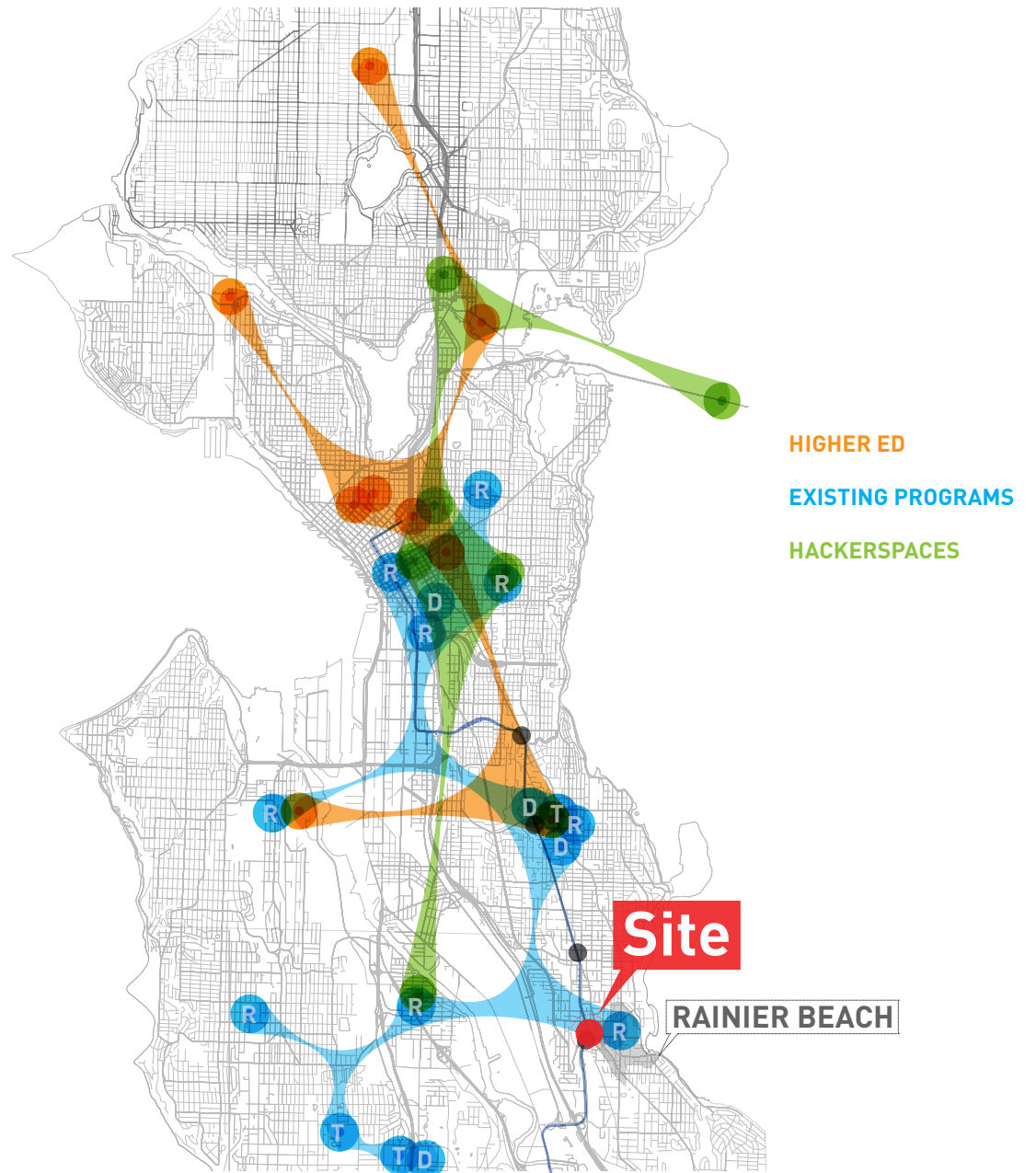


Commercial Zones

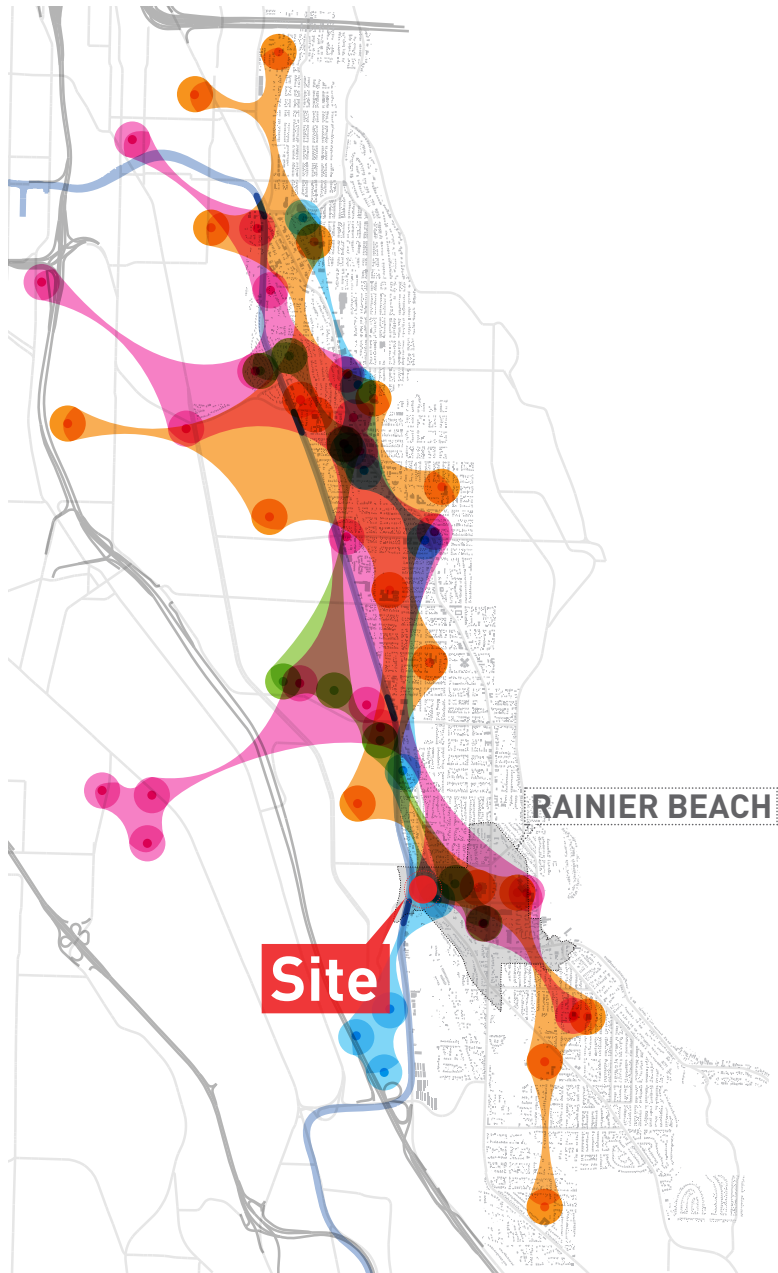


Site

36. Map of linear infrastructures



37. Network Analysis: City scale



SCHOOLS

COMMUNITY ORGS

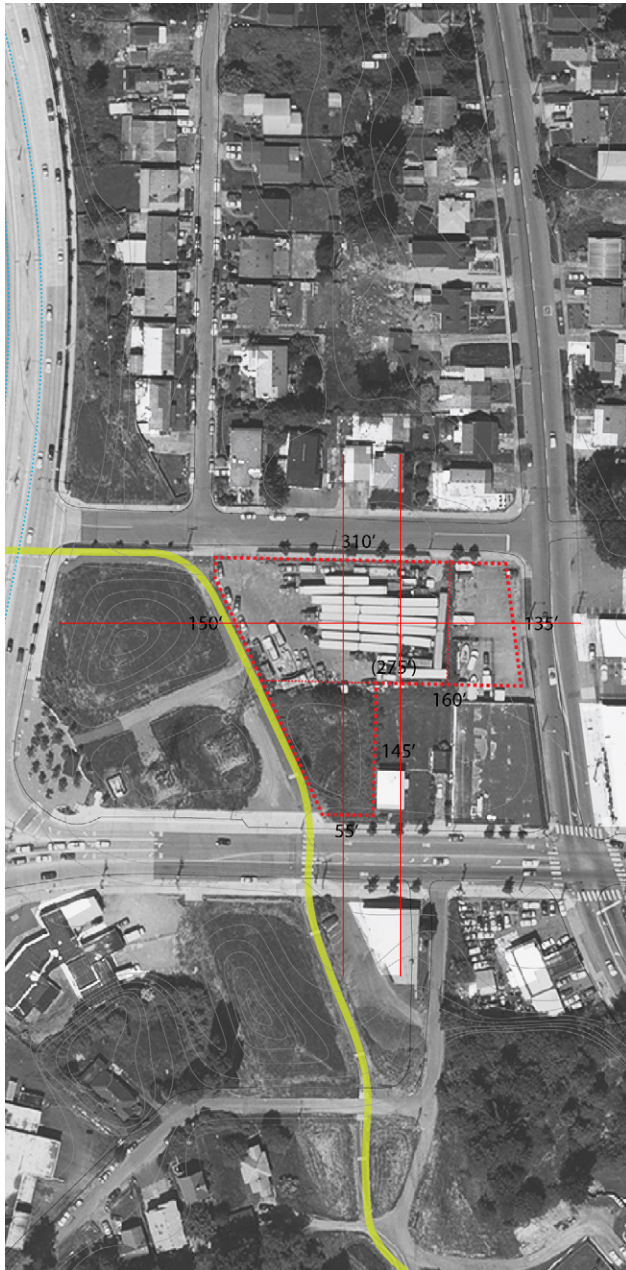
PUBLIC HOUSING

CREATIVE ORGS/BUSINESS

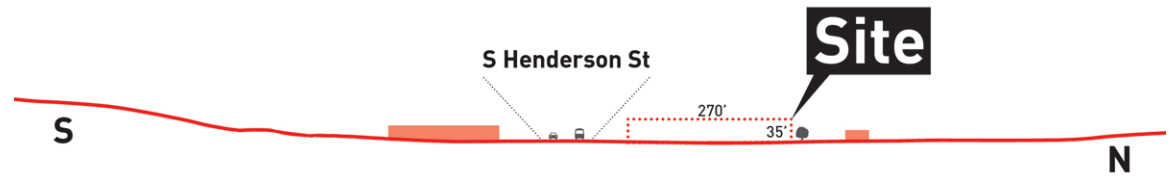
RAINIER BEACH

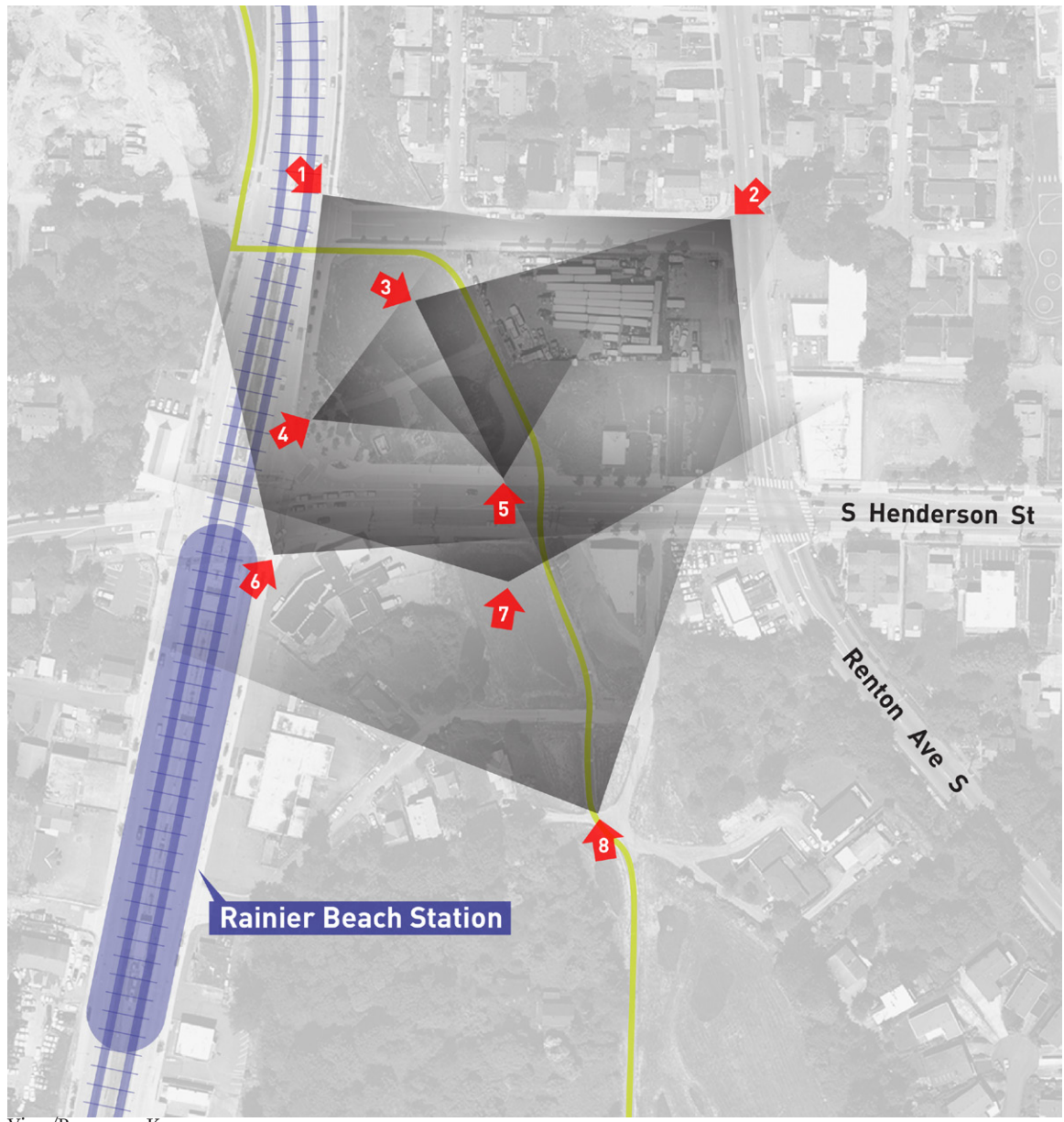
Site

38. Network Analysis: Valley scale



39. Site Sections





View/Panorama Key



41. View from Trenton St and MLK Way



42. View from Henderson St and Trenton St



43. View from berm adjacent to site



44. View N-facing from Chief Sealth Trail



45. View from Light Rail Plaza/Bike Lockers to Chief Sealth Trail/Site



46. View from Chief Sealth Trail adjacent to site



47. Trenton St elevation



Henderson St

48. View from Henderson St and MLK Jr Way





## **Chapter 6: Program Analysis**

### **Program**

The program can be split into four main categories, the first three have been discussed in detail in previous chapters: education, economy and community. The final category is the core of the facility: making.

The educational component is comprised of workshops and classes affiliated with the previously examined programs. The student groups include youth participants from grades K-8, young adults, and adults who may wish to learn a new skill or process. In order to facilitate the educational needs, the center will need ample classroom spaces. The class size will vary from younger students, which will have approximately eight to twelve students to more generalized adult classes, which will number up to fifteen or twenty (numbers are based on identified fab lab classes both domestically and internationally). To accommodate these classes, the program will include both small classrooms, which will teach initial skills

Orgs	Tooling Elements
<b>Fab Lab 2.0</b>	Epilog Laser 24"x12" Closed Loop ShopBot Up! 3D Printer milling machine 8"Xx6"Yx2-3/8"Z hand tools computers (1/machine) computers (multiple for ed/co) printers (large format and office) programming tools mat'ls: wood, acrylic, etc books
<b>Makerspace</b>	
<b>Jigsaw Renaissance</b>	3d printer (reprint) small woodshop multitouch table workbenches  conference room coworking facilities kitchen
<b>Metrix Create:Space</b>	laser cutter 3d printer: makerbot 3d printer: reprint workshop soldering room tool loan coffee shop classroom
<b>Hackerbot Labs</b>	CNC mill vacuum former makerbot cnc embroidery chem lab electronics: high voltage
<b>Tech Shop</b>	large metal shop large wood shop soldering room vinyl cutter automotive shop electronics shop hand tools lathe large milling machine 4-axis CNC milling vacuum forming plasitics shop 3d printer laser cutter (60watt) 3d scanner painting shop (powder coating and spray hood) CNC plasma cutter welding (MIG, TIG, Spot) Shopbot CNC router table saw (sawstop) computer stations offices classroom/lecture kitchen

49. Organizations and associated tools

**Where it starts: The PC**  
Fab lab users start by designing the product or parts they want to make, using a desktop computer. The design software is meant to be easy to use. Some fab labs use software developed at MIT, while others use commercial programs such as CorelDRAW or Google SketchUp.

**Vinyl cutter**  
**What it does:** Uses a precisely controlled blade to cut lots of thin materials. It can cut vinyl for signs, T-shirt screens and decals, as well as slicing cloth, cardboard, and thin metals such as copper sheets, which can be used to make electrical circuits.  
**Size:** 33.7 in. x 12.4 in. x 9.4 in.  
**Cost:** \$1,995

**ShopBot**  
**What it does:** This computer-guided router makes complicated cuts in wood. It can carve intricate designs for furniture and elaborate lettering for signs. It can also cut panels for cabinetry.  
**Size:** 120 in. x 79 in. x 68 in.  
**Cost:** \$10,890

**3-D printer**  
Not every fab lab has this expensive machine. It's able to "print" three-dimensional objects, such as parts or prototypes, by heating plastic powder and spraying or extruding it into layers that build up the proper shape.  
**Size:** 48 in. x 31 in. x 55 in.  
**Cost:** Approximately \$30,000

**Roland Modela**  
**What it does:** A tabletop-sized milling machine that can drill holes and mill small parts and prototypes from a designer's plan. Can also scan a part and then replicate it.  
**Size:** 18.8 in. x 15.1 in. x 12.1 in.  
**Cost:** \$4,495

**Epilog laser cutter**  
**What it does:** Its carbon dioxide laser can cut through plastic and other materials as much as a quarter-inch thick. Can also engrave text, graphics and photos on lots of material, such as wood, glass, marble and leather.  
**Size:** 34.5 in. x 26 in. x 16 in.  
**Cost:** \$16,000 to \$20,000

SOURCES: MIT Center for Bits and Atoms fab lab program; Lorain County Community College fab lab program

TEXT BY JOHN MANGELS, GRAPHIC BY REID BROWN | THE PLAIN DEALER

50. Equipping a Fablab

and programming classes, and large classrooms, which can function as informal lecture halls for smaller presentations.

The economical component contains spaces for a range of small business growth. There will be space for both the formation of new businesses, which includes office space with access to storage, tools and a lounge. In addition, the facility will enable the expansion of existing businesses, which requires larger workspaces for production and repair of products, retail space for sales and commercial storefront space to encourage existing businesses to relocate. Some of the potential existing craft- and education-based businesses include Bike Works, BioLyle's Biodiesel Workshop, Screamer Inc, and Certified Jean. There will also be offices and meeting rooms for small business consultation services, such as those provided by Tech Shop that helps small businesses form and grow, in order that the space act as a small business incubator. The users could also include entrepreneurs working to develop a specific product or those that work remotely looking for a coworking environment. The small office spaces provide a number of desks in a single room for individuals, but there may also be the option to rent an entire suite of desks for a single business. The basis for this style of desk or office rental is both local makerspace Jigsaw Renaissance as well as the larger scale Tech Shop, who both offer a variety of options for independent workers and growing small businesses.

The community component will incorporate both spaces for gathering and spaces for sharing. There will ideally be a mix of truly public space that is accessible at all times, and more

secured spaces for tools and work areas. By providing public access, the space will be more inviting and open to those not normally drawn to such facilities. Open spaces will be flexible in use and offer venues for various events throughout the year. The spaces for sharing refer to a gallery to display what is being made within the site. The exhibition space is particularly important in this setting. Due to the public nature of the site as a zoned pedestrian area as well as the goal of community building, it is necessary to let people know what is being made to generate interest and dialogue. In addition to reaching out to the greater surrounding community, there will also be places to foster community growth within the space. Many makerspaces have particular amenities that are adjacent to the work area to support a collaborative environment. These elements include a kitchen, lounge, vending area, or café, which create informal gathering places for people to share ideas and problem solve project difficulties.

The bulk of the program will be spaces for making and hacking. These activities require a certain degree of flexibility to respond to the interests of user groups. The program has been derived by examining the tools and functions that exist in the different types of organizational models described in earlier chapters. The tools and equipment differ because each organization is targeted to a different user group. The defining elements come from the facilities list for a fab lab (version 2.0), the local hackerspaces in Seattle and the larger Tech Shop in the San Francisco area (see Figure 49). Many hackerspaces also receive tools on loan or work with companies to do testing projects, which reinforces the need for open flexible spaces.

<b>storage</b>				
		tool storage	2000	1
		material storage	1000	1
		educational storage	500	1
		member storage	500	1
<b>display</b>				
		gallery/exhibition	800	1
		retail/commercial	800	1
<b>educate/incubate</b>				
		small classroom	200	3
		lecture	1000	1
		communal gathering	2000	1
		offices/coworking	400	3
<b>create</b>				
	<b>low tech_clean</b>	workshop	2000	1
		hand craft	800	1
	<b>low tech_dirty</b>	wood shop	3000	1
		metal shop	1000	1
		spray booth	200	1
	<b>high tech_clean</b>	laser cutter/micro mill	150	1
		electronics shop	300	1
		programming/scanning	300	1
	<b>high tech_dirty</b>	cnc plasma	150	1
		cnc router	150	1
		cnc mill	200	1
<b>total</b>			17450	

51. Base program for campus

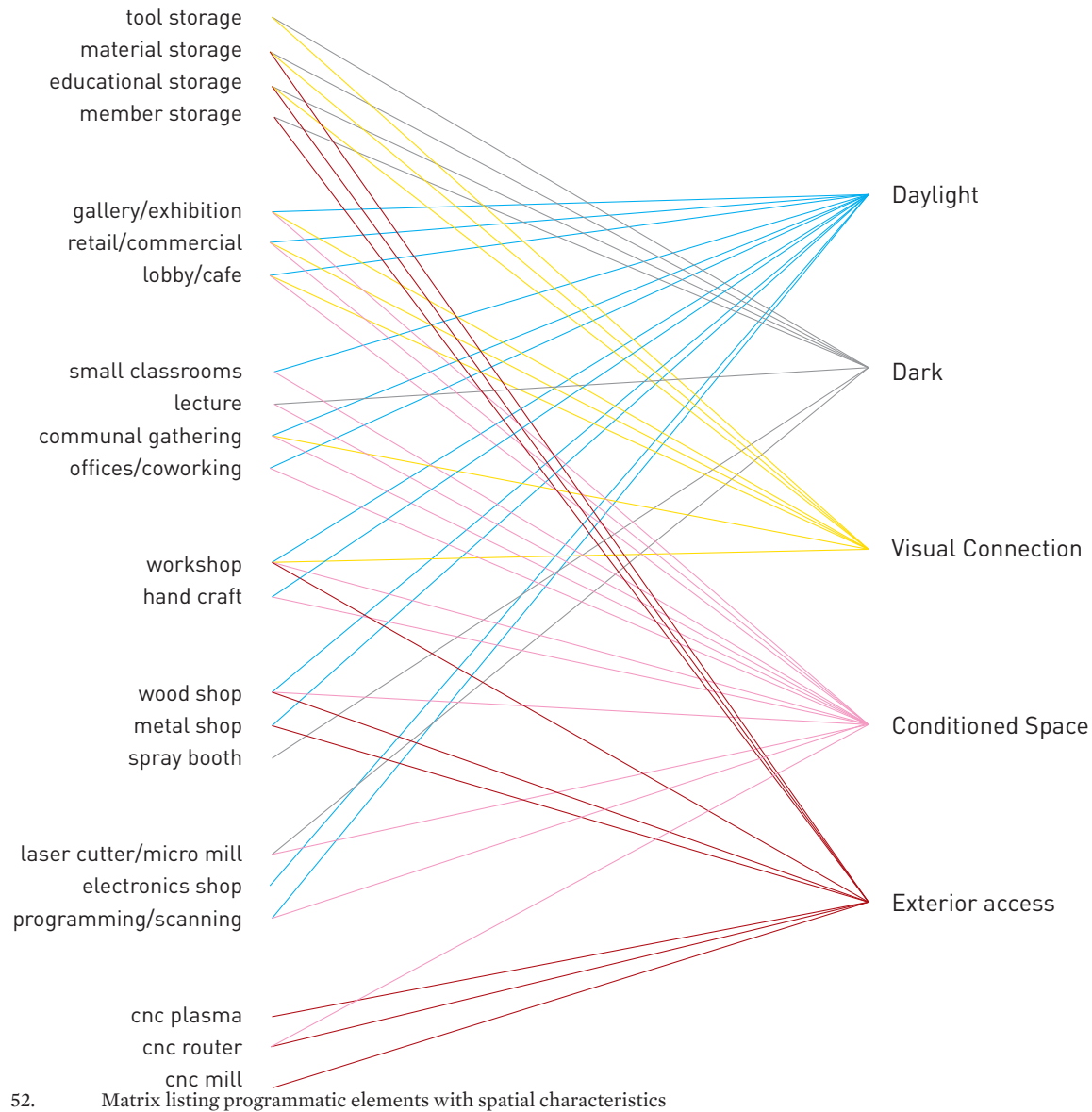
Digital fabrication requires a number of support spaces and equipment to allow for work on a variety of scales and mediums, as well as a large storage component for all of the various classrooms, businesses and individual users. The tooling component can be categorized as places for high technology tools or low technology tools. The high tech tools are based in the ability to create a digital model and have it export to a machine that makes the object described by digital data. The tools include the basic fab lab requirements (see Figure 50) as well as some other machines that are in use by local hackerspaces, such as a 3d printer, which has widely applicable uses, and CNC embroidery, which pertains to adjacent clothing businesses (see Figure 51).

The low tech tools are those that only require a human operator as an interface. The spaces would include a variety of hand tools as well as some larger power tools, such as a vacuum former, band saw and table saw. The larger tools are invaluable in any kind of fabrication and can increase the efficiency of materials and the digital tools. The low tech category also includes tools that are essential to the creation of high tech products, such as a well equipped soldering area for the creation of circuits necessary for electronics fabrication.

In addition to use, certain spaces require various spatial elements. Due to the variety of tooling and equipment with such a building, determining programmatic needs is of utmost importance. There is also the desire to provide well daylit, naturally ventilated spaces to areas such as the main workshop or gathering spaces. The various electronic and digitally

based machines also require more strict climate control for certain programmatic elements

(see Figure 52).



52. Matrix listing programmatic elements with spatial characteristics



## Chapter 7: Making

In order to better understand how the proposed intervention will be introduced and utilized by the community, it is important to examine the various forms of making from a technical standpoint. This chapter will document the different types of spaces in terms of what is being created to understand how space influences making. The analysis will detail: the tools in use, the scale of the work, and how the products contribute to the open source ideal.

### Fabbers

Because fab labs focus on providing personal digital fabrication technologies to communities with the hope that these technologies will be used to respond to specific problems for that locale. Often the answers benefit other labs as well, or the initial response becomes a platform to respond to similar problems within other communities. A good example is the FabFi project, which started in a fab lab in Jalalabad, Afghanistan and has branched out to



53. Boston FabFi public wifi project signal reflector



54. Laser cut pieces pre-assembly for Fabfi reflector



55. Kenya FabFi reflector mounted on existing tower

other countries. The project creates a highspeed wireless internet signal from found materials and off the shelf electronics using the tools found in any fab lab.<sup>1</sup>

Fab labs have a minimum requirement for tools, and can function in spaces as small as a mobile trailer. The list is designated by the Center for Bits and Atoms at MIT and currently includes<sup>2</sup>

A lasercutter, to create an assembly of 3d structures from 2d parts

A larger (4' x 8') CNC milling machine, for making furniture- (and house-) sized parts

A signcutter, to produce printing masks, flexible circuits, and antennas

A micron resolution milling machine to make three-dimensional molds and surface-mount circuit boards

Programming tools for low-cost high-speed embedded processors

From these tools, labs are able to fabricate various sizes of wifi reflectors to fit their needs. The original design tested CNC cut plywood and lasercut acrylic frames that ranged from four feet to eighteen inches in size and used chicken wire or window screen mesh to create the reflective dish (see Figure 54).

Like many projects developed in fab labs, the wifi reflector benefits a large community outside of Afghanistan. Communities have fabricated similar projects based on the open source design that the fab lab has made available. Often the later versions are adjusted to be site specific using materials that are readily accessible. For example, the project has been

1 The FabFi website, accessed July 22, 2011, <http://fabfi.fablab.af/>

2 The Fab Lab website, accessed July 22, 2011, <http://cba.mit.edu/projects/fablab/>.

so successful in Kenya that it has blossomed into multiple locations with a variety of business models that are all run by locals. The blossoming network supplies connectivity to local residents, schools and internet cafes. It has also led to the creation of new educational networks and international partnerships to continue to develop reliable technologies and build social capital.<sup>3</sup>

Not all fab lab projects take place on the community scale, though. Many projects are born from community members simply taking an interest in the possibilities that the fab lab affords. A good example is found in one of the Cleveland fab labs, which are both connected to educational institutions. The majority of the time and energies are spent with the students from the affiliated schools, Lorain County Community College and the newly formed Nela Park MC<sup>2</sup> STEM High School, but they offer 35 hours per week of free access to people in the community. The projects that come out of the limited use range from products for an online knitting supply site to a hydrogen generator that will connect to a car engine and help power a vehicle.<sup>4</sup>

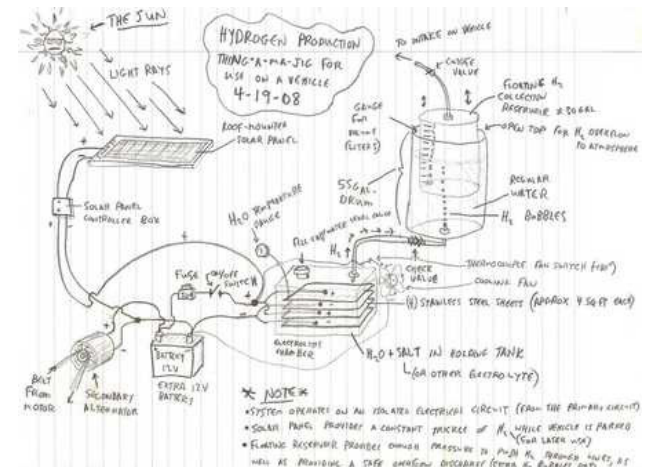
## Makers

Within the maker movement are two types of creation: “making” and “hacking.” The two are not segregated or oppositional, and they will often take place in the same workshop, even side-by-side. The difference is between product creation (making) and product modi-

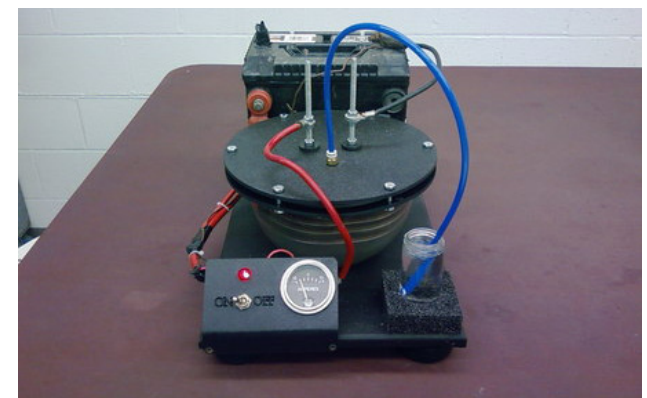
<sup>3</sup> FabFi Blog; “The Hump - Bringing it all Together;” blog entry on April 28, 2011, <http://fabfi.fablab.af/blog/>  
<sup>4</sup> Mangels, John. “Fabrication labs let student and adult inventors create products, solve problems.” The Plain Dealer, June 18, 2009.



56. Nela Park MC<sup>2</sup> STEM High School Fablab facility



57. Hand-drawn plans for a Hydrogen generator brought to Lorain Community College’s Fablab



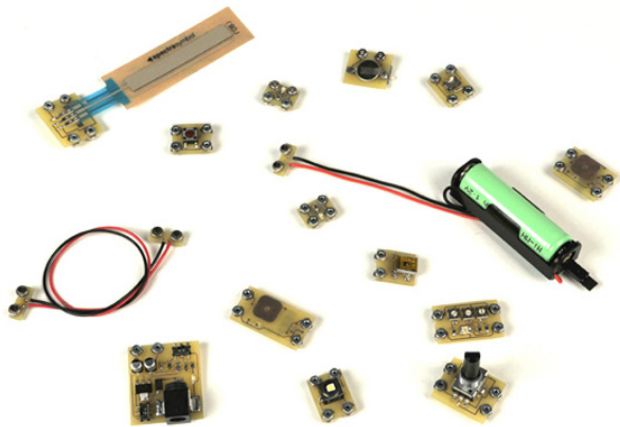
58. Hydrogen generator prototype, built in Lorain Community College’s Fablab



59. Facilities at the textile-based makerspace, The Workroom

fication (hacking). There is no clear line, but it may be helpful during the design process to distinguish between the two methods as well as the products that come from each pursuit.

Within the label of “makers,” the projects and interests vary immensely. That is how many larger cities can support a number of makerspaces or hackerspaces without competition. In some cases, members even join two different spaces because each one would offer a different community or social influence upon the work that member are doing. There are spaces that focus specifically on coding and programming while others will focus more on craft and more tangible forms of making. A good example of a non-programming based collective is The Workroom, a Toronto-based makerspace that is focused on textiles (see Figure 59). As opposed to the more typical Arduino classes that many spaces offer, The Workroom has classes in sewing and textile-related skills. Instead of a CNC mills and routers, they have a Gocco printer and a mini laser cutter. They also coordinate events for local designers to sell their products as well as selling fabrics and stocking various sewing equipment.



60. Various components for little-Bits circuitry

Another good example of making as product creation is the circuit system called “little-Bits,” which is “a growing library of pre-assembled circuits that snap together with tiny magnets.”<sup>5</sup> The components are small circuits that allow people with little to no electronics experience to build complex structures. The modules themselves can be constructed with basic electronic components and a limited number of tools, which include a micron milling machine to create the circuit boards, laser cutter, soldering and programming tools, and a

5 The Little Bits website, accessed July 22, 2011, <http://littlebits.cc/about>

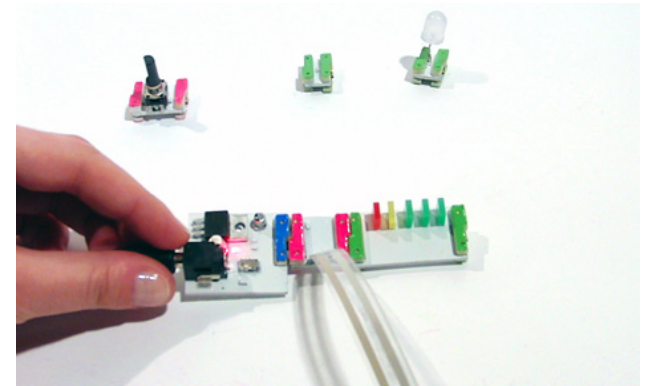
3d printer to create the cases. The makers see the use of the product as something that will be an introductory tool for electronics education and the speed of building circuits will enable the use of electronics in prototyping, which is normally prohibitive due to time constraints.<sup>6</sup>

The end products are roughly the size of a Lego block with various wires and knobs attached depending on the particular function. The fifty modules are divided into four categories: power, input, output and wire. The use of magnets not only allows for quick connection, but they provide a level of safety because the poles repel if one tries to connect the circuits the wrong way.

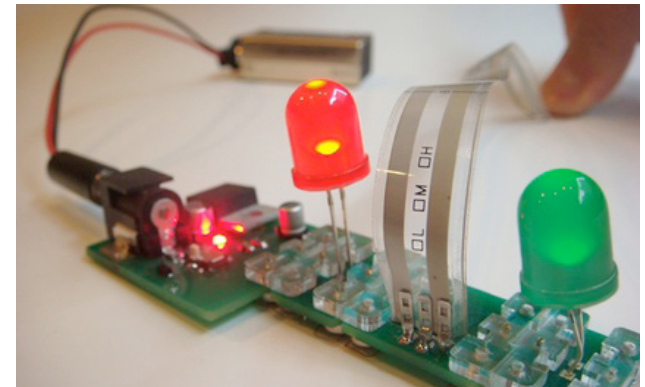
The development contributes to the open source community by publicizing how all of the circuits are made. The creator of littleBits, Ayah Bdeir, is part of the recent movement toward “open source hardware,” which uses the open source ideals by including information about mechanical drawings, schematics, bill of materials and circuit layout data.<sup>7</sup> Bdeir even opens up design to the community by hosting a forum entitled “dreamBits,” which includes people in the design process by asking which components they would find most helpful or interesting.<sup>8</sup>

Along the same lines of littleBits is a machine that many makerspaces and hackerspaces

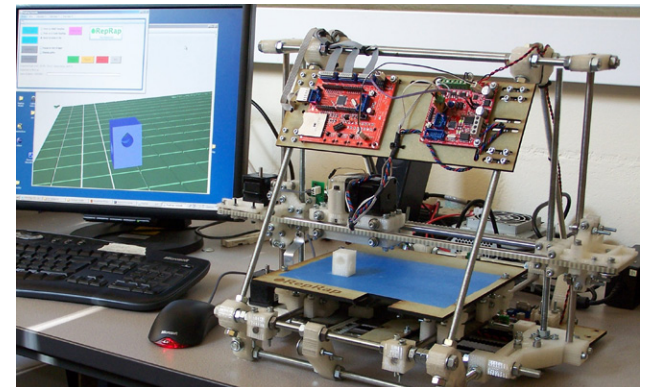
6 Giridharadas, Anand, “The Kitchen Table Industrialists,” The New York Times, May 13, 2011.  
7 Open Source Hardware Wiki (OSHW), accessed July 22, 2011, <http://freedomdefined.org/OSHW>  
8 The Little Bits website, accessed July 22, 2011, <http://littlebits.cc/dreambits>



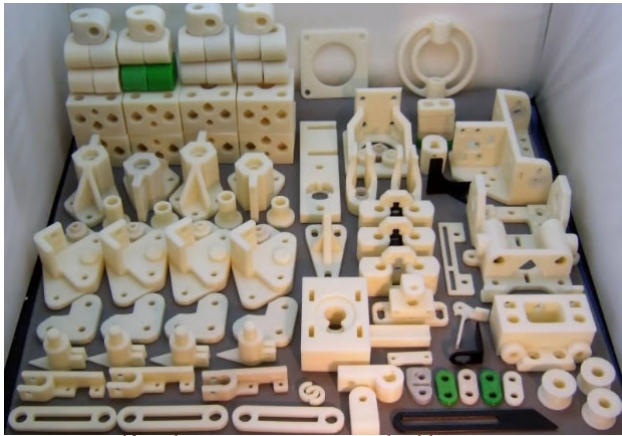
61. Kit assembly for little-Bits



62. Detail of little-Bits assembly



63. RepRap desktop 3D printer



64. Self-replicating components to build a RepRap printer, printed by RepRap printer



65. Ikea hack: bent legs from POANG chair coupled with vintage banker seat and seatback

own: a RepRap 3d printer (see Figure 63). The RepRap is an open source, desktop printer that has gained popularity for a number of reasons. It was the first low cost 3d printer and pioneered the 3D open source movement. All of the unique components are made of plastic, which make up about 60% of the entire machine (see Figure 64), the rest of the components are easily found off the shelf electronics and fasteners. The benefit of this makeup is that the machine is able to self replicate, which contributes even greater to the idea of an open source community that shares knowledge and experience. Along with sharing how to build the machine, the RepRap wiki page has a forum where users can download printable files or request new files to be shared. The site currently has a couple of dozen projects, but other sites, such as Thingiverse.com, have over 1100 items currently tagged with the term “RepRap.”<sup>9</sup>

### Hackers

The term “hacking” has gained notoriety as a malicious use of or intrusion into a software platform, but the term did not start in the realm of software. The original definition came from the MIT Tech Model Railroad Club (TMRC), who defined it as “a project without constructive end.” It was in reference to their experiments in model train technology, which included manipulating the electronic controls of model train systems using computer mainframes. One member eventually used the system to invent the first videogame, Spacewar.<sup>10</sup> Otto von Busch states a modern definition in the context of the maker movement:

<sup>9</sup> The RepRap wiki site, accessed August 1, 2011, [http://reprap.org/wiki/Available\\_Files](http://reprap.org/wiki/Available_Files).

The Thingiverse website, accessed August 1, 2011, <http://www.thingiverse.com/tag:reprap>.

<sup>10</sup> The Tech Model Rail Club of MIT website, accessed July 22, 2011, <http://tmrc.mit.edu/history/>.

A hack creates new understandings and interfaces to an existing system - which opens new action spaces beyond yes/no or good/bad dichotomies. Hacking is not revolutionary or futuristic in its utopianism, but instead pragmatic, starting from the here-and-now, and using the DIY can-do mentality and open source approach.<sup>11</sup>

While much of the focus within the maker movement involves electronics and programming, the concept of hacking also translates into a more “low tech” practice. Rather than highlight a single product hack or modification, it is worthwhile to see how the open source approach can gain momentum. There is a sizeable population of makers that have chosen focus on one home furnishings company: the Sweden based Ikea.

Represented by a strong presence online and as a part of several gallery and design showcases, Ikea hacking has become a common practice in DIY circles. The popular website [www.ikeahackers.net](http://www.ikeahackers.net) currently has 14,154 Facebook likes and 2,182 twitter followers, and the projects range from lighting to art work to furniture.<sup>12</sup> The tools range from simple hand tools to more serious powertools. While there is little mention of digital fabrication or programming, the hacks are rooted in the idea of making and open source information sharing. The two projects in this section are both furniture related as it seems a medium that could begin to translate to the built environment (see Figures 65-67). Each project is uploaded to the site with before and after photos as well as instructions on the process.

A good example of a hack in a building related context is the project by designer Andreas

11 Krasner, Elizabeth, “Hackcess,” Volume, September 2010, 28.

12 Ikea Hackers website, accessed on June 5, 2011, [www.ikeahackers.net](http://www.ikeahackers.net).



66. Ikea BJRSTA table hacked into twin highchair (in progress)

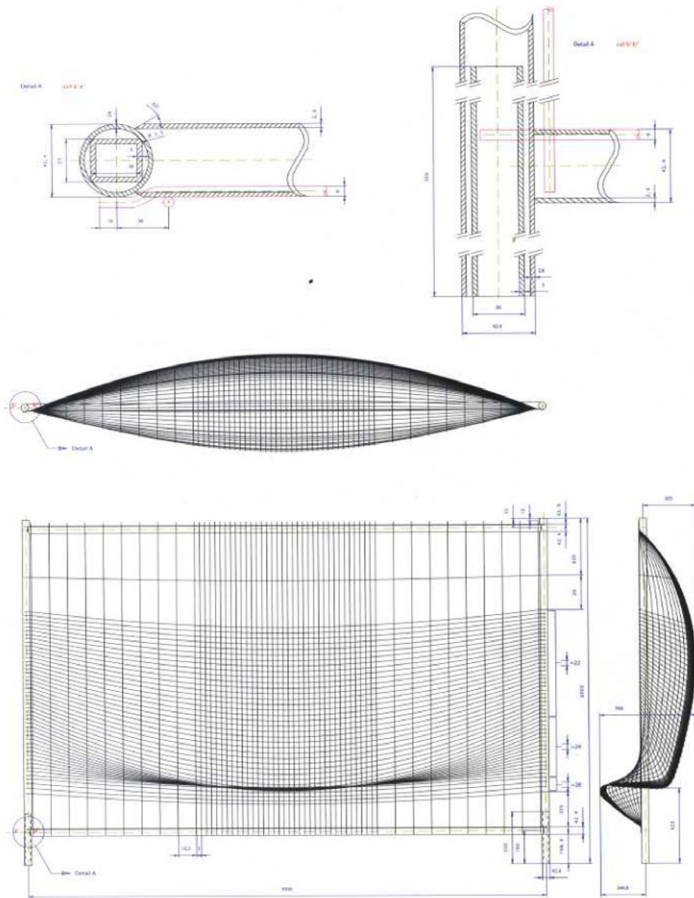


67. Twin highchair hack (final product)

Bergmann of Berlin, who developed a hack for the modular fencing systems used on many large building sites. Although part of the reasoning for the fences is public safety, Bergmann looked to convert the fencing system from simply a barrier into an object that could offer pedestrians another experience. His design, titled the “Bauzahn,” takes the typical fencing module and deforms the mesh so that it becomes a bench (see Figures 68, 69). While retaining its original function, the fence now offers “a transitory moment of stillness” to passers by.<sup>13</sup>

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13 “Talking Cities: The Micropolitics of Urban Space,” Exhibition website, accessed August 1, 2011, [http://talkingcities.org/talkingcities/pages/158\\_en.html](http://talkingcities.org/talkingcities/pages/158_en.html)



68. *fences for sitting*. 1999. Andreas Bergmann, drawings



69. *fences for sitting*. 1999. Andreas Bergmann, installation photo



## Chapter 8: Case Studies

The particular case studies have been chosen because they all have one element in common: they all represent the idea of building for impermanence. The Rainier Valley is in a state of transition. With the addition of the light rail and connection to both downtown and the airport, there is an expectation of expansion. However, the current economic state has caused the area's development to stall. The hope is that the economy will rebound and that the Rainier Valley will be a vibrant place of new density, but there is no timeline and the future is unknown. Based on the economic state as well as the need for immediate development around the light rail stations, the proposed intervention is an architecture of impermanence. While most buildings are meant to stay in one place for their lifetime, the case studies look to examples of built projects that have the ability to be disassembled and moved to another location, projects that adjust to the needs of the users, and projects that are mobile by nature.



70. Nomadic Museum, Shigeru Ban



71. Theater Het Amsterdamse Bos, Catherina Scholten



72. Spacebuster, Raumlabor

## Prefabs, Assemblies, Armatures, Reuse and Hacks

Due to the ever changing nature of such a facility, as well as the DIY culture that it caters to, flexibility will be an important consideration within the design. This proposal questions how to create flexible spaces beyond designing open floor plans. To build upon the concept of hacking as defined by Otto von Busch, this thesis takes the approach that improvements will not come in the form of futuristic technologies but from an innovative reuse of existing parts. The goal of the project is not to invent a new modular building system, but to create a network that allows for growth as the institution expands or mobility as the context demands.

Especially with the spaces of smaller digital tools, storage and display, such a center requires the ability to shift and move components as new programs and processes require. One other design consideration concerning the user group is to incorporate opportunities for customization and modularity within elements of the building systems. Possibilities could include spatial elements such as panel systems used to divide larger open spaces, aesthetic elements such as LED or responsive wall systems, or bio elements such as living systems that can be customized by the users.

The following case studies are representative of several means of accomplishing flexibility in design. Each one has the possibility of portability to differing degrees, but they each take a different approach. The included studies are important because they are representative of existing technologies that respond to a desire for flexibility in the built environment, which

are grouped by assembly, modularity, mobility and adaptability. Of course, many of the examples could fit into multiple categories, but the intent was to find the most important aspect to aid in the specific design.

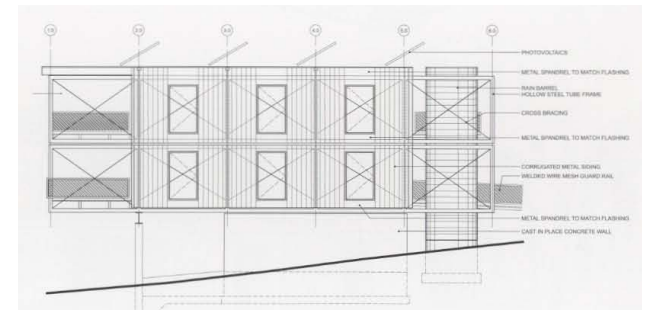
## Prefabs

\_The Yosemite House [Anderson Anderson]

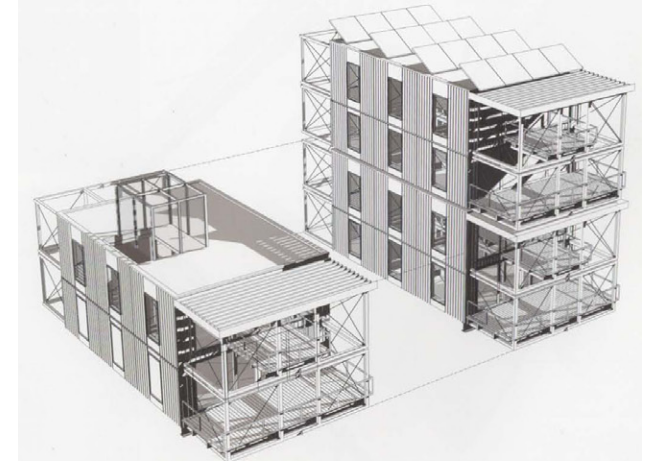
The Yosemite Cabin is a vacation house in a remote location that required a unique design to be transported using methods that would not accommodate commercially available modular housing units. The result is a modular steel frame system using an infill of SIPs panels with a steel skin. The vision is that the house functions as an inhabitable truss with the cross bracing, which is necessary for transport, removed in spaces that require a more open floor plan. The modular framing unit was based on what a four-wheel drive flat bed truck is be able to carry into the remote wilderness, but the frame had to be strong enough to be cantilevered out over a creek to deal with the steep site. Viewing the frame as an prototype, the designers built upon the original unit and have developed a system that they have been able to apply to a variety of projects, including multifamily housing as well as high-rise penthouses.

\_eHAB [Eric Cobb]

eHAB is a small cabin, which can be fabricated as either a studio or one bedroom structure. Engineered for the most extreme environments, the primary volume is built almost to completion within a factory and then transported and installed onsite by local contractors. .



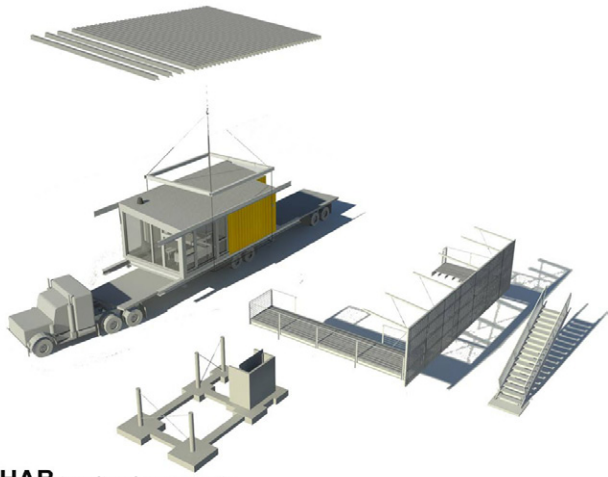
73. Yosemite House, Anderson Anderson Architects



74. Organic Urban Living Module, Anderson Anderson



75. eHab, Eric Cobb Architects, render view



**eHAB** transit and components

76. eHab, Eric Cobb Architects, components diagram

The main volume is shipped already insulated and clad. The structure is high performance steel, a material chosen due to the recycled content, longevity and structural qualities. The unit has the potential to accept various power sources, such as wind or solar, as well as integrated rain catchment and composting sanitary systems, all of which can be integrated during fabrication within the factory. An added benefit, given the extreme engineering, high performance materials, and the high standard of construction, is that eHAB can be used through multiple relocation cycles. The first unit was installed in August 2011 in Seattle.

## Assemblies

\_Loblolly House [Kieran Timberlake]



77. Loblolly House, Kieran Timberlake

The Loblolly House, named for the pines on the site, is a 2200 sf single family residence that is located on the Chesapeake Bay in Maryland. It has been designed as a kit of parts composed of readymade and prefabricated components. The design process was conceived as a combination of four elements: “the scaffold, the cartridge, the block and equipment.” The aluminum scaffold, a system of members and connectors, serves as both structure and the connection points for the cartridges, blocks and equipment. The entire system can be assembled using only a wrench.

The foundation is a series of wooden piles driven into the ground at a variety of slight angles. Their form was inspired by the vision of a treehouse and references pier construction as well as the surrounding forest. The prefabricated systems are placed on top of the piers to elevate the structure above the ground. The cartridges are large panels that com-

prise the floor and ceiling panels. These house the systems, both structural and mechanical, which are all fabricated offsite and then transported to the site for assembly. The house also has an innovative glazing system of an interior set of folding glass doors and an exterior set of polycarbonate hangar doors, so the envelope becomes a dynamic element to control air flow as well as shading.

Due to the scaffolding system and prefabricated components, the house has the ability to be quickly assembled and disassembled for reconstruction at a different site. The architects were also adamant in the design process that the system have the ability to be reconfigured. The resulting design is one that is easily constructed and has the flexibility to conform to future needs or a different site.

Mobile Museums (Public Art Lab, Gruber +Popp)

In 2004, Public Art Lab and Gruber + Popp developed the project of Mobile Museums that toured Berlin, Vienna, and Barcelona between the months of April to June. Through the use of individual structures as a network of large scale components, the designers set out to frame urban spaces (see Figures 79). The “buildings” were designed for easy transportation and installation by using only trucks and standard forklifts.

The individual components were designed by various artists who were given a standard-



78. Loblolly House, Kieran Timberlake, frame assembly



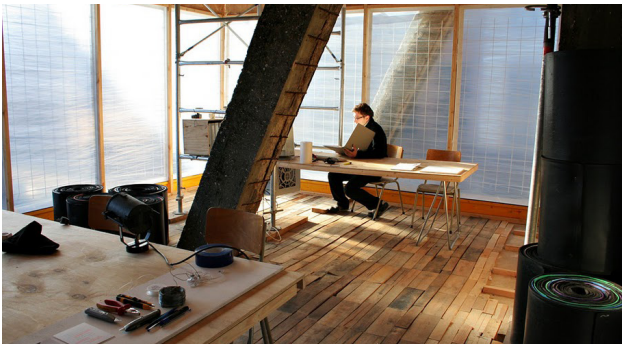
79. Mobile Museums, Public Art Lab, Gruber +Popp, aerial



80. Mobile Museums, Public Art Lab, Gruber +Popp, install



81. RDF 181, Rotor, installation view

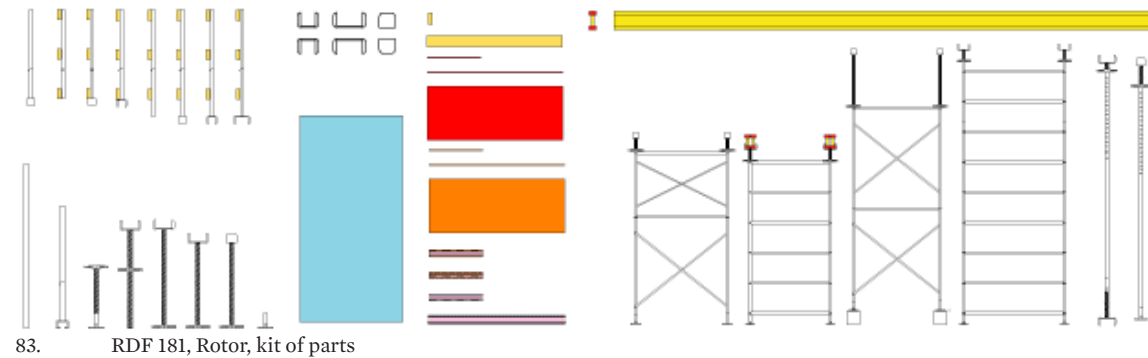


82. RDF 181, Rotor, interior view

ized kit of parts, which included recycled PVC panels. They were required to work within the given constraints to conceive of an occupiable installation while considering the importance of both the interior and exterior experiences of the user. They were instructed to design an “individual museum,” and the size of the final product was limited to 10 square meters. By taking over public spaces, such as urban squares, the project aimed to reinterpret the traditional vision of a museum as a static place (see Figure 80).

### \_RDF 181 (Rotor)

RDF 181 was designed as the temporary headquarters of the non-profit Rotor. The designers had the intent of building a temporary facility by using only waste materials that would be easily dismantled for reuse after the timeframe had ended. The structure was built on a piece of land that was slated for development, so the design had to be quickly constructed and easily taken apart (see Figure 81).



83. RDF 181, Rotor, kit of parts

The structure is set among a system on concrete buttresses, which pierce the structure and become an interior element (see Figure 82). The design does not actually rely on the buttresses for structural integrity, it instead occupies the voids that the designers saw as “dead space” in the built environment. The actual system of assembly is composed of typical scaffolding system components, small steel beams and various panels (see Figure 83). To attest to the clarity of the system, it was assembled in twelve days and deconstructed in only three.

### Armatures

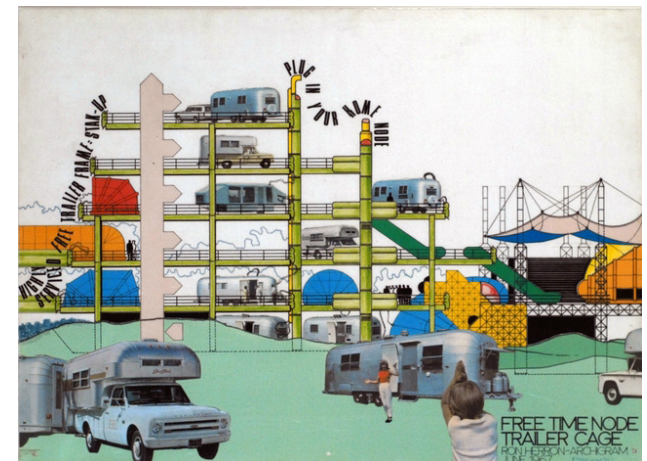
*Add-on: 20m Altitude* [Peter Fattinger, Veronika Orso, Michael Rieper]

*Add on: 20m Altitude* is a temporary art installation that took place in Vienna’s Wallensteinplatz for six weeks in the summer of 2005 (see Figure 84). It was meant as bridge between sculpture and architecture in that it could be occupied by the general public. The structure is composed of a scaffolding system and a number of containers, trailers and various enclosures, which were all connected by a system of planks. The entire structure was accessible and unprogrammed with the intention that the visitors interpret it as they desire. With over 18,000 visitors a day, the lower levels were used as a playground, the tower became a view-point and the upper deck was a nightclub.

*Add-on* is interpreted as an adaptation of both a simple scaffolding structure, but also that its open ended function resulted in a variety of uses by the general public. The design used a traditional building system, albeit one for the construction of buildings and building systems, and treated it as an armature for smaller units. The armature idea is one that has



84. *Add-on: 20m Altitude*, Peter Fattinger, Veronika Orso, Michael Rieper



85. Trailer Cage, Archigram



86. Theater Het Amsterdamse Bos, Catherina Scholten

some history, such as Archigram's Trailer Cage (see Figure 85), but Add-on is an important case study because the structure was a draw for people that then became engaged in determining its function.

Other than the social interpretation and the effect that it had on the program, Add-on is also an applicable case study because it took an off-the-shelf prefabricated system, the scaffolding, and developed custom joints to expand how the structure could be applied. The individual units, many of which were reused caravans or trailers, were adapted to fit the system specifications. These individual designs then plugged into the adapted, or hacked, building system.

\_Theater Het Amsterdamse Bos [Catherina Scholten]

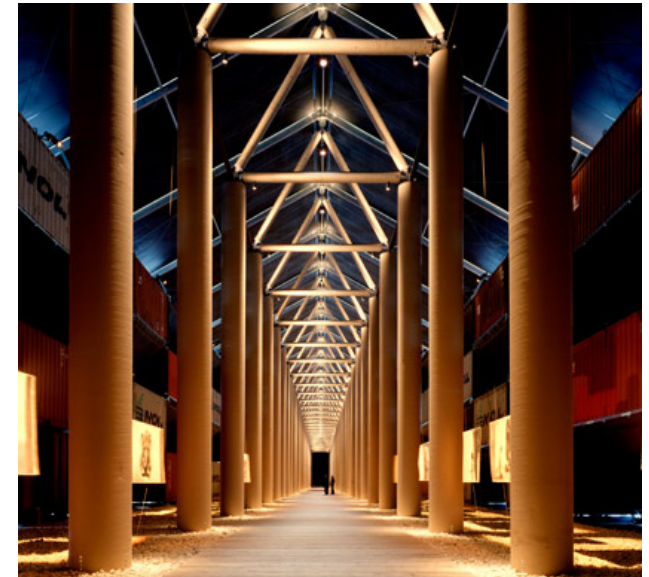
The stage design for a production of Anton Chekov's play "Ivanov" was designed by Catherine Scholten to be used for an open air production outside of Amsterdam. The assembly is created from trailers that are built on top of containers and interconnected with stairwells and gantries. The design uses larger components, similar to the Mobile Studios to frame the space, which in this case is meant as a showcase for the theater production. In addition to the semicircular collection of components, the open ended form includes the seating area, or the audience itself, to complete the theater (see Figure 86).

## Reuse

\_Containers Untouched: Nomadic Museum [Shigeru Ban]

Shigeru Ban's design for a travelling museum to house the photography exhibit by artist Gregory Colbert is a study in reuse of storage containers that have not been modified. The use of shipping containers is not a unique concept in the field of architecture, but Ban's use is of interest because of the scale, which essentially treats them as giant building blocks, and its ability to be reconfigured as it travels to different sites. The structure is composed of approximately 150 containers, but the exact number is dependent on the arrangement of the museum. The exhibit requires 12 containers to transport the structural elements, but the rest of the containers are found within the current city. The form is essentially a long corridor, which can be configured as two structures, as in New York, or as one long corridor, as in Santa Monica. The containers are stacked offset in a checkerboard pattern, which is an efficient use of the container and creates dramatic effects at night (see Figure 88). Between the containers, an opaque tarp is stretched that is white on the exterior and black on the interior to accentuate the photographs on display.

The interior columns and roof trusses are composed of recycled paper tubes, a common theme in Ban's designs. The tubes seem to be more of a way to divide the interior volume than to satisfy the necessary structural requirement, which could be supported by the containers. Spatially, however, they create a nice division of space and contribute to the quality of the linear experience (see Figure 87).



87. Nomadic Museum, Shigeru Ban, interior



88. Nomadic Museum, Shigeru Ban, exterior



89. Platoon Kunsthalle Seoul, Graft Architects, exterior



90. Platoon Kunsthalle Seoul, Graft Architects, interior



91. Mobile Linear City, Vito Acconci

### \_Containers Customized: Platoon Kunsthalle Seoul [Graft Architects]

An interesting place for “subculture” activities, designed for “cultural movements beneath the radar creates a dynamic space where new ideas are born and presented.” It is the second of three similarly styled complexes by Platoon, which runs cultural and communications based projects. The structure is made up of 28 storage containers, the majority of which have been modified to respond to the desired program. The complex is designed to be able to be taken down and transported to another location if necessary, but it is not mobile by nature.

The design itself is not especially unique in how it is using containers, but the design fits well for the context of activity and exhibition. The customization of the containers is similar to the many houses or smaller projects have adapted them, such as the removal of one end or wall to be replaced with glazing or a railing. However, there are nice moments, such as the bar/café on the ground floor and the reuse of the doors as a railing on the rooftop level (see Figures 89, 90).

### Hacks

Mobile Linear City and House up a Building [Vito Acconci]

The artist Vito Acconci creates work that ranges from design to installation and performance art to landscape architecture. For the purposes of this thesis, the most interesting work is what he has done in the form of architecture. The two specific works are Mobile

Linear City (1991) and House up a Building (1996).

Mobile Linear City (see Figure 91) is a system of six housing units that telescope to become the size of a single semi trailer, which can then be hauled from site to site. The floor is steel grating and the cladding is corrugated steel. Each unit contains panels that fold down into tables, desks and seating. The sections are separated by dividing walls that are either reflective or translucent, and the smallest unit contains bathing facilities as well as a kitchen. The ability of the unit to collapse in on itself in the style of a Russian doll makes it a unique study in the realm of truly flexible and reactive spaces.

House up a Building (see Figures 92, 93) is an installation that was exhibited on the side of Alvaro Siza's Centro Gallego de Arte Contemporanea in Santiago de Compostela, Spain. The structure has the same material palette of the Mobile Linear City, but it has a more parasitic support structure. Each platform is assembled with a metal rod that runs from the awning to the floor that supports seating, and the roofs overlap one another to provide continuous coverage from the rain or shade from the sun. While the unit is not so mobile, the track system allows it to attach to an existing structure. The potential of the track system to be built into a building system holds an interesting possibility for the creation of a reconfigurable system of furniture or workspaces.

\_Spacebuster [Raumlabor]

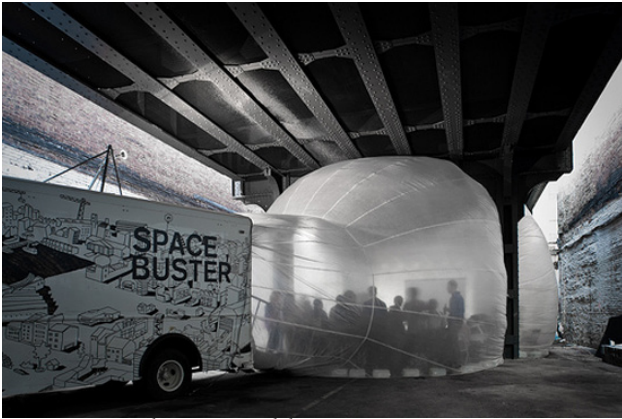
Spacebuster is an inflatable plastic structure that is contained within a large cargo van and



92. House up a Building, Vito Acconci, install views



93. House up a Building, Vito Acconci, install view



94. Spacebuster, Raumlabor



95. Spacebuster, Raumlabor

deployed “at places of underestimated potential, so-called non-spaces or un-spaces; spaces that seem to have forfeited their urban functions” (see Figure 95). The design is an interesting approach to a temporary pavilion because it can be transported and reused in almost any environment. It is most interesting when inflated in a more restrictive setting when the existing conditions impact the shape of the bubble (see Figure 94).

The pavilion can hold up to eighty people and has been used for a variety of events that range from parties to discussions to cinematic events. The idea is one that has been evolving for years as the designers have created similar structures in museums and exhibition spaces. The primary interest is that the program for the event is on display and that the activity becomes a catalyst for the surrounding context.

The inflatable structure is composed of a specially designed translucent plastic that is contained along with a compressor and air lock within the white van. Relative to the proposal is that the system is based on an existing structure, but only as a vehicle for mobility. The project is both an adaptation of the van and is adaptable to the surrounding context, both physically and programmatically.



96. Spacebuster, Raumlabor, inside the bubble



## Chapter 9: Design

### An Architecture of Impermanence

The new facility for digital craft in Rainier Beach offers a solution to occupy several vacant and underused sites adjacent to the new light rail station. As mentioned earlier, the thesis takes into consideration future land values and proposes a temporary intervention that is adaptable to the needs and interests of the community.

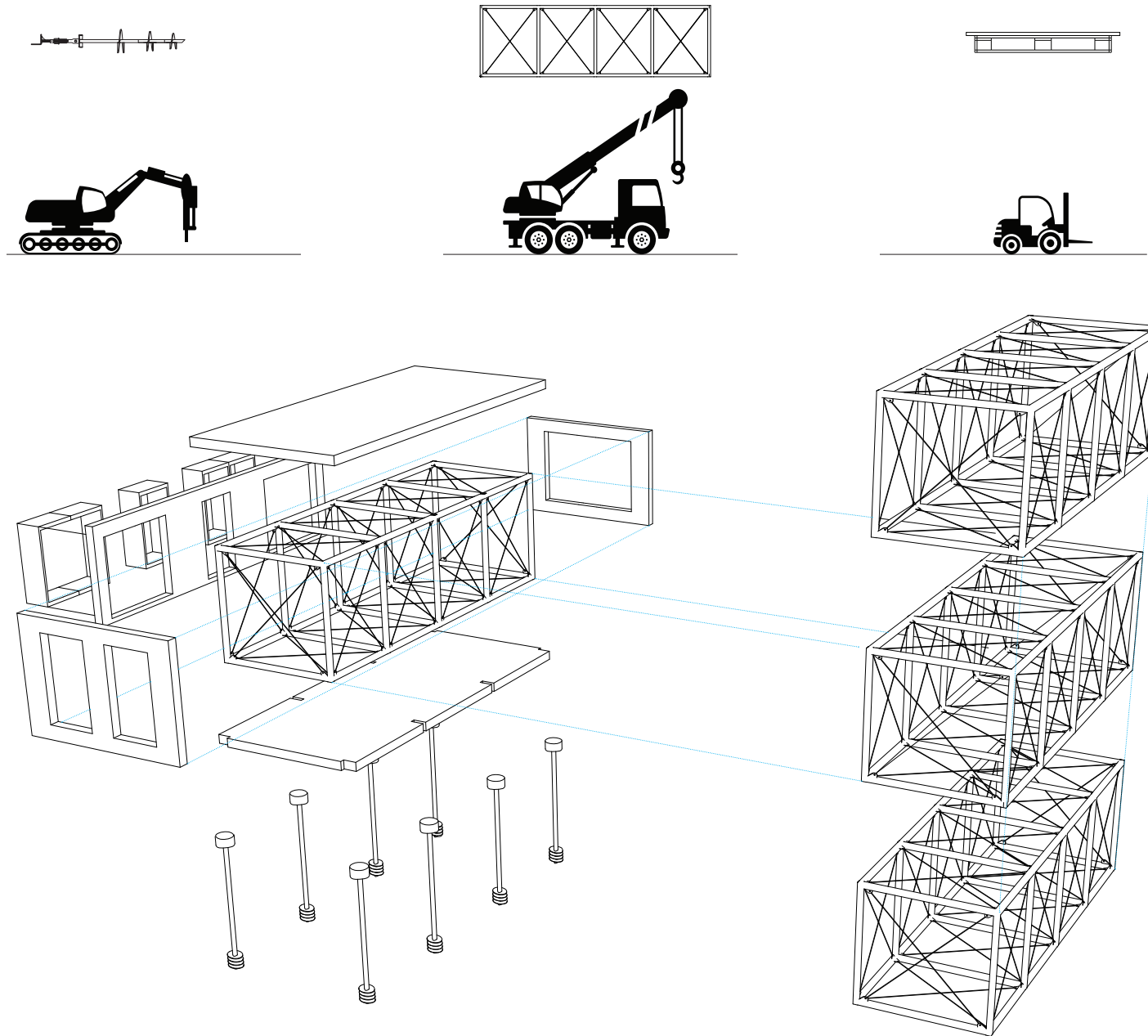
### Systems of Assembly

In order to address the different concerns arising from both site and programmatic needs, the design proposes a series of components based in current technologies that could work together and complement one another. The primary parts of the assembly are: frame, foundation and landscape.

The process began with an interest in prefabrication as a basis for something that could



97. Birds Eye view of proposed campus design



98. Construction components exploded axonometric diagram: foundation, frame, landscape

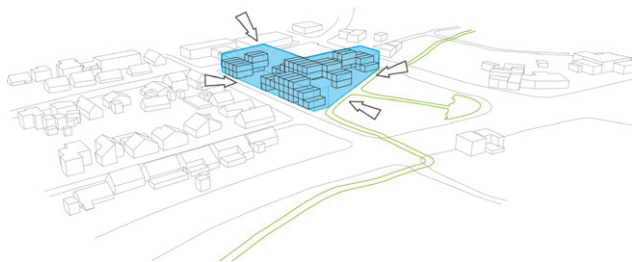
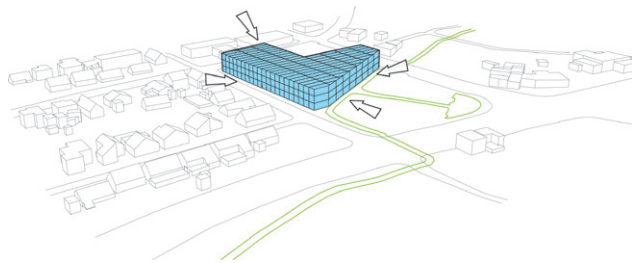
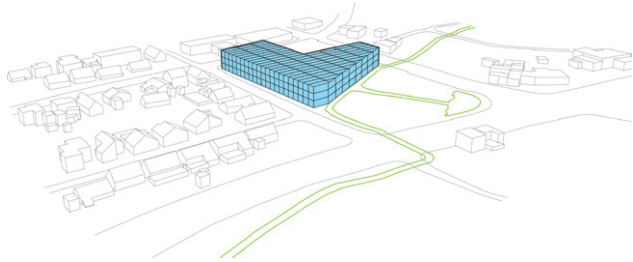
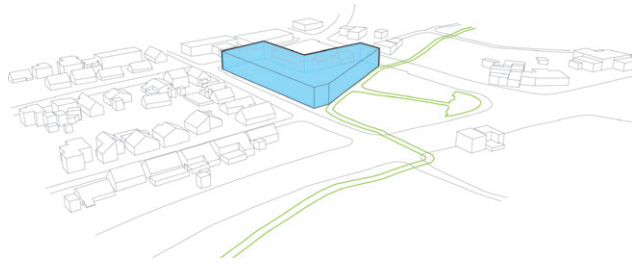
be assembled, modified and removed based on the needs of the user and the surrounding context. Building on the constraint of mobility, a frame system is used. To dimension the frame, the size is limited by tractor trailer load capacity as transport by truck is the simplest option. Using a module size for typical prefab units discussed in the previous chapter's case studies, the dimensions range from 14'-16' in width and vary in length up to 60'. The most direct application was to apply the typical dimensions with a grid imposed on the site, the module of 40' x 15' x 12' (L x W x H). The rectangular brace frame is composed of 6" x 6" square HSS with vertical and horizontal members at every 10' with steel rods running diagonally in each bay. The interior members and rods may be removed to open spaces depending on the structural and spatial needs of the assembly.

To infill the frame, SIPs panels are used as enclosure for the activities that require a conditioned space. The arrangement of openings is in response to interior program and connection to adjacent users. This allows for the customization of the spaces as tools change or new businesses move in.

The frame sits on a temporary foundation of helical piles, which are used in both permanent and temporary structural applications. The piles are driven into the ground using specialized equipment similar to a giant drill (see Figure 99). The foundation is set in a grid that matches every other vertical member in the prefab frame, so that the spacing is 20' x 15'. The primary reason for choosing the piles is their speed and ease of application, as well as the fact they can be removed with little affect on the surrounding land. They can also be



99. Helical pile installation diagram



100. Site approach diagram: pixelation, accessing/creating a network

reused and recycled in another building application. There is also the possibility of sourcing the piles from previously used foundations due to the excess of temporarily used piles that currently exists.

The landscape is developed from a “palletized” paver system using the common pallet dimension of 3’ x 4’, which fits within the grid of the frame. The pallets can be stacked and reconfigured easily with forklifts and pallet jacks to accommodate new pathways through the site or special events. By applying different surface to the pallets, they can be used to define a staging area or an exterior workspace outside of the enclosed workshops.

#### Pixelation

While working through different options of arranging program within the site, the frame is seen as the base module. Placing the individual unit in a field, the concept of pixelation is applied to the building block form. This idea makes it possible to start from a solid array built out to the extents of the site and then begin to remove units, or pixels, as the need arises. The factors driving the formation and assembly of the units is a response to the surrounding site context and the needs of the program.

The composition is first a response to the surrounding site. The mass is carved away to create a continuous path from the existing routes. There are a few primary routes that cross the site connecting to existing paths and commercial areas, along with a number of other

smaller paths being more temporary. The main connections are to the plaza at the corner of Henderson and MLK, the commercial zone at Renton and Trenton, and the commercial area on Henderson where the Chief Sealth Trail crosses the street. The goal is to connect into the existing infrastructures and use the site as an extension to draw the public into the space (see Figure 100).

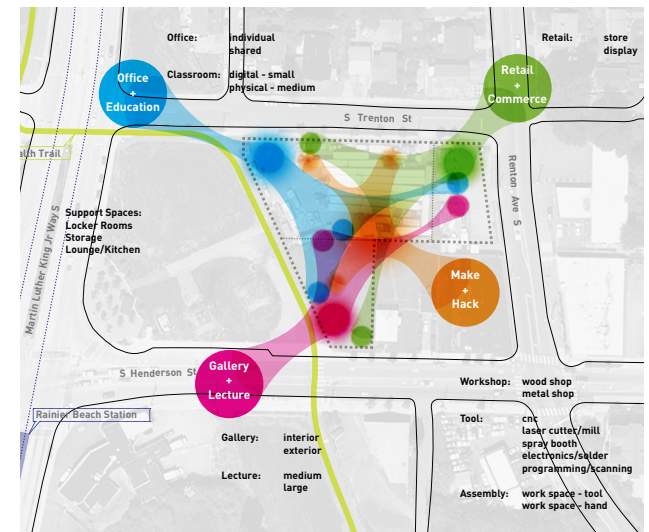
The next step in composing the space is the programmatic arrangement. Based on the four program categories, education, economy, community and making, the site is initially divided into quadrants (see Figure 101). The functions are placed into respective areas determined by the required access and exposure, whether it is immediate access in the case of the gallery and retail component of economy or decreased exposure as is necessary with some of the tooling and fabrication areas due to zoning requirements. The primary zone for making is placed in the center as it is a necessary part of the other three. Although the quadrants help in organizing the site and program, they are not bound by hard lines. The programmatic elements are hybridized so that there are parts of each element present throughout the site (see Figure 102). In this way, new connections can be established and various groups can interact to create a more vibrant atmosphere of collaboration and community.

### Volumetric Response

Distributing the program and carving out pathways determines the campus in plan, but

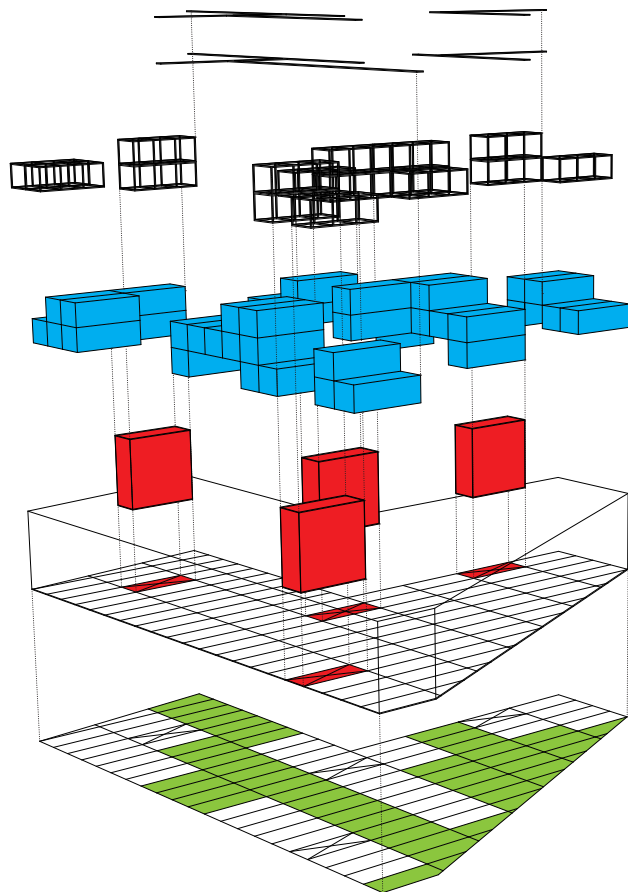


101. Programmatic quadrants based on use



102. Hybridization of programmatic quadrants

the volumetric composition ensures that the facility responds in section to the surrounding structures. One of the problems with a proposed three-over-one development is that it would appear out of context when adjacent to all of the surrounding one- and two-story buildings. By being considerate of different adjacencies, which vary from commercial storefronts to single family residences, the new campus can create a dialogue with the existing typologies. The vertical makeup of the various components is restricted to two levels in response to the single family residences, and builds up to three levels where there is a greater concentration of activity in the making and hacking area.



103. Hierarchy of Permanence diagram

#### Infrastructures

In order to design a complex that can be adaptable and flexible, developing a system for how the various infrastructures are housed and distributed is one of the most important tasks. The approach developed as a hierarchy of permanence, which used a series of cores to house the necessary support functions for such a facility (see Figure 103). There are four cores, one in each of the quadrants, which include power hookups, ventilation and ductwork, rest rooms and vertical circulation. The cores also contain features that do not necessarily tie into the city grid, such as heat exchangers, composting toilets and photovoltaic panels. The infrastructural cores all have the same basic layout and form, with the exception of the one located in the making area, which houses administration offices for security and oversight of the site in place of the stair. The main entry stair is an exterior stair adjacent to the primary core in the making area.

In order to connect the vertical units to one another, and make the entire complex accessible on each level, a series of catwalks connects each core to the other. Other than providing accessibility, the catwalk system creates balconies and decks off of the individual upper units. These “porches” act as informal gathering places for conversation and collaboration between different areas.

The palletized paver landscape also ties into the infrastructural distribution system by providing an ideal space to house all of the powerlines, ducts, cables and pipes necessary for such a facility. The “cubby” space acts similar to traditional subfloor systems, except that access to the systems is much easier due to the mobility of the pallets. The accessibility is also able to provide remote power and water supply points to facilitate temporary venues and projects that happen outside of the built units.

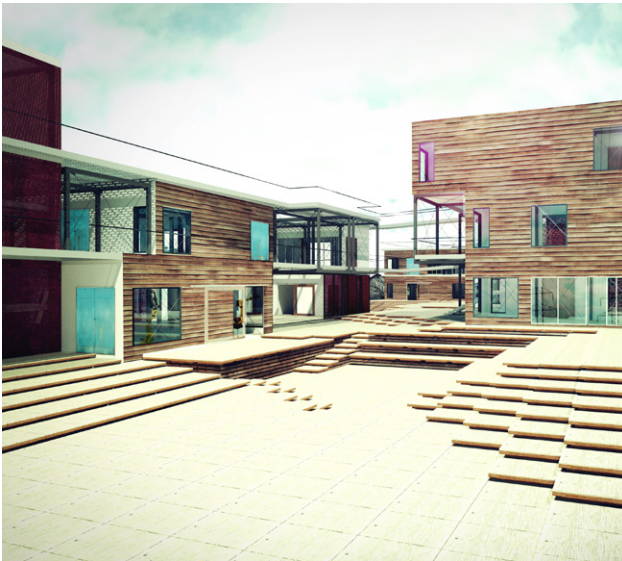
#### Enclosure

There are varying degrees of exposure within the design. The complex is primarily workspace, so there is minimal need for conditioned space. The larger, open workspaces on the ground level are created by pulling apart the more enclosed areas and connecting frames on upper levels to create a series of work “pavilions.” They are essentially open rooms with tools, work tables, and access to storage units. The workspaces are minimally enclosed by sliding partition walls to provide security. The effect is that the work areas are open and accessible to users and classes. They are also connected to exterior spaces for larger scale assemblies and have a direct visible presence on pathways through the site. When partition

walls are open, the boundary between exterior and interior is difficult to discern. The more specific tool and shop areas, which hold more of the specialized and power tools are more enclosed with walls to contain noise and dust. They may also be conditioned depending upon the requirements of the equipment within. The next degree of enclosure is represented by the offices and electronic workspaces, which could be fully conditioned if required.

#### Materiality

Regarding the materiality of the complex, material scale is a concern. The materials are chosen to avoid alienating the structures from the surrounding palette and context. With wood being the primary siding and rainscreen material, the buildings respond to the smaller scale structures that border the site and create a tactile, welcoming environment for pedestrians (see Figure 104).

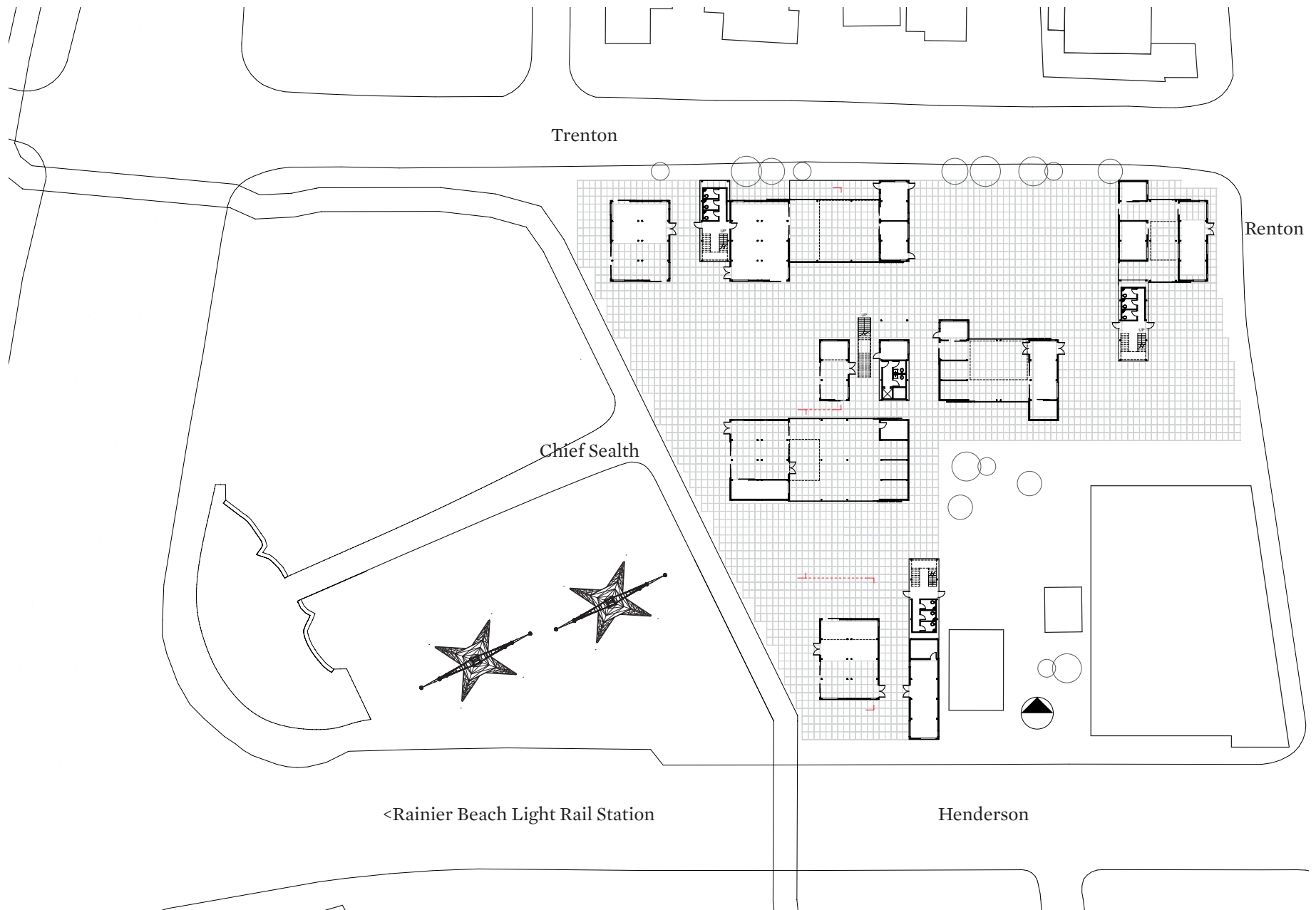


104. View from Chief Scalth Trail into amphitheater

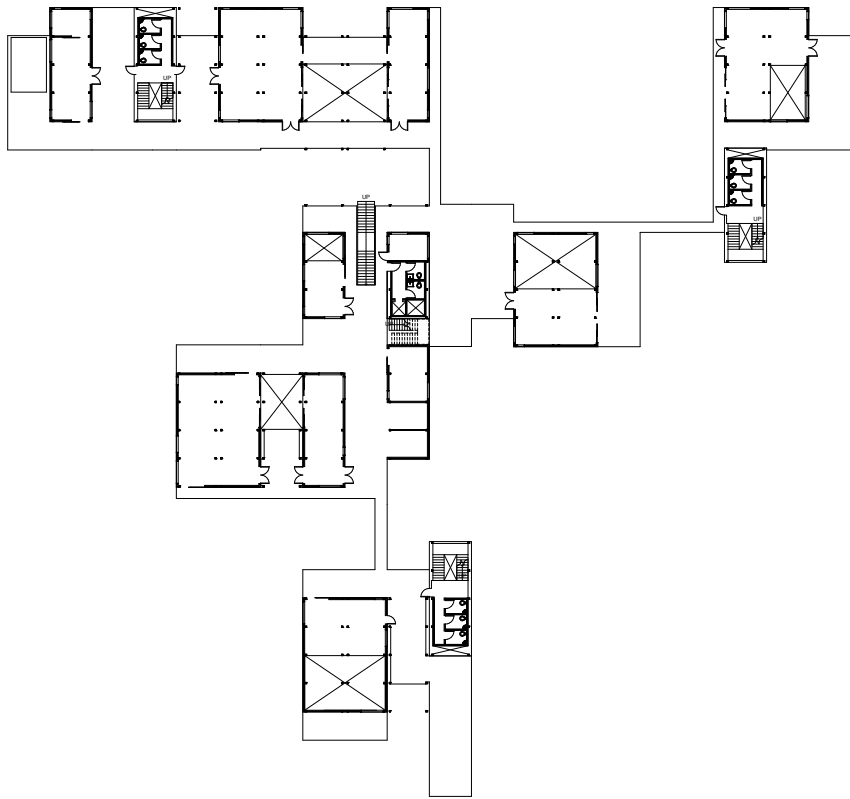
The cores are treated differently to distinguish them from the places of work and creation and act as wayfinding devices. While the towers are the most permanent structures on the site, they are clad in a perforated Corten steel screen to make them visually lighter. The rusted steel is chosen as a reference to the industrial past, and future, of the area.



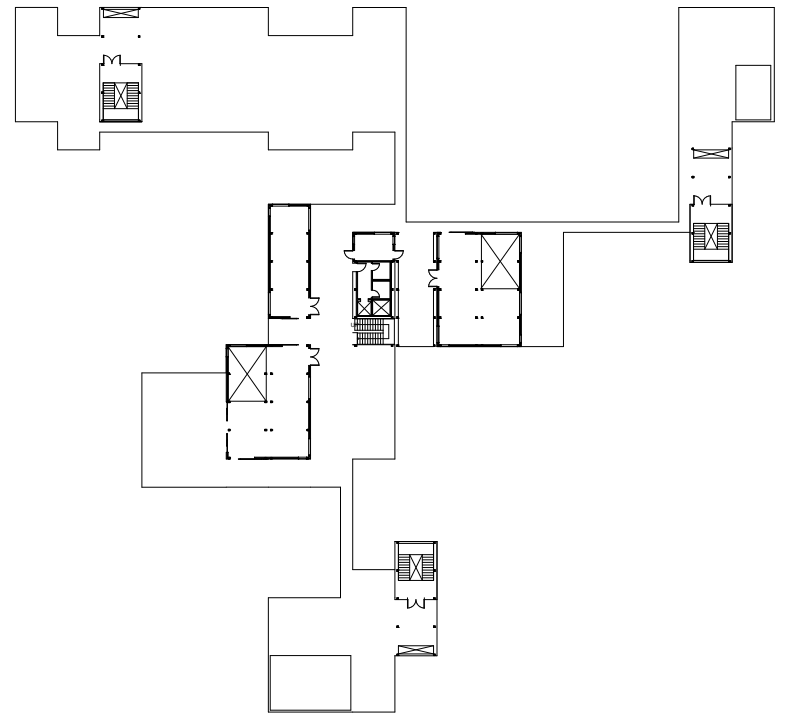
105. Birds Eye view of proposed campus design



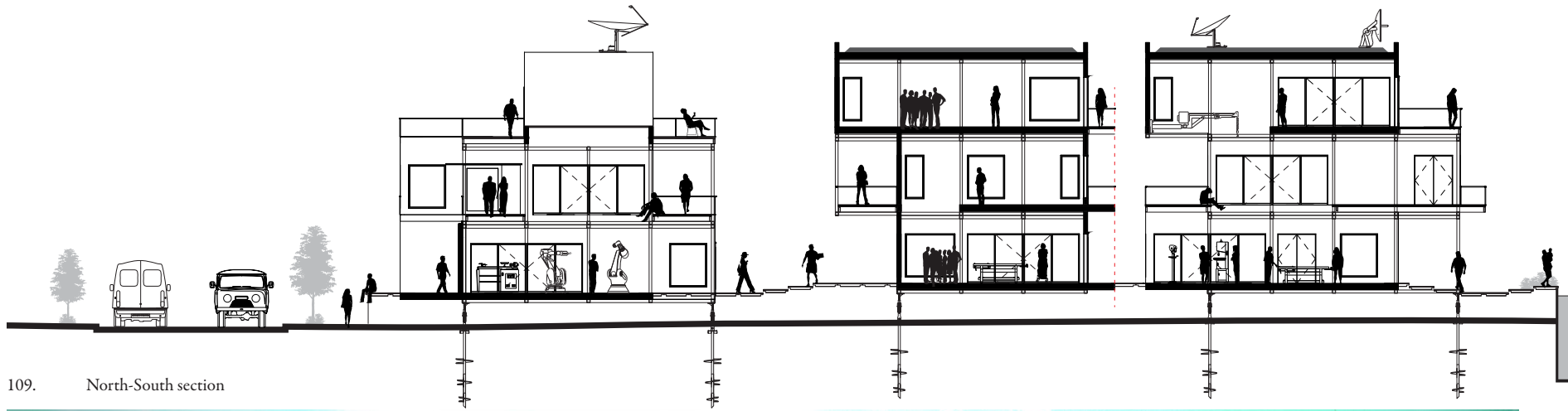
106. Ground level plan



107. Level 2 plan



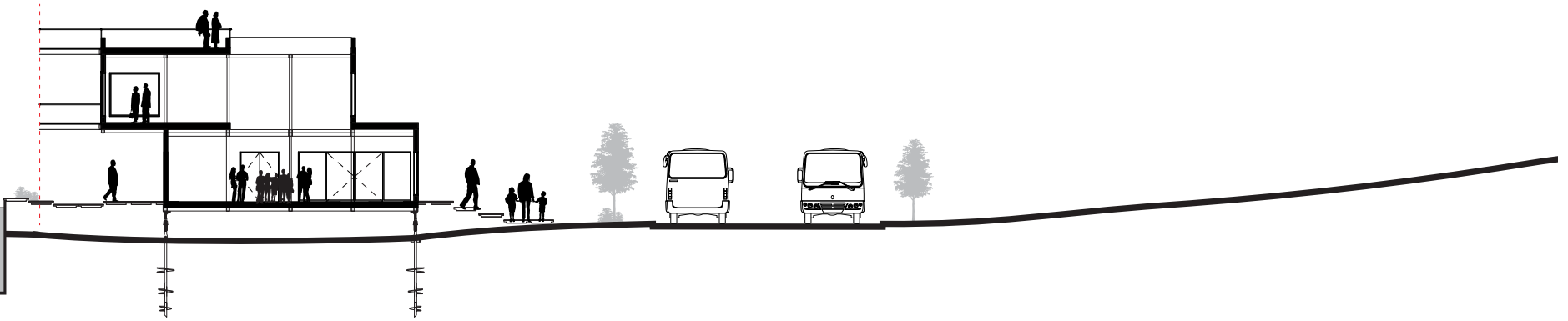
108. Level 3 plan



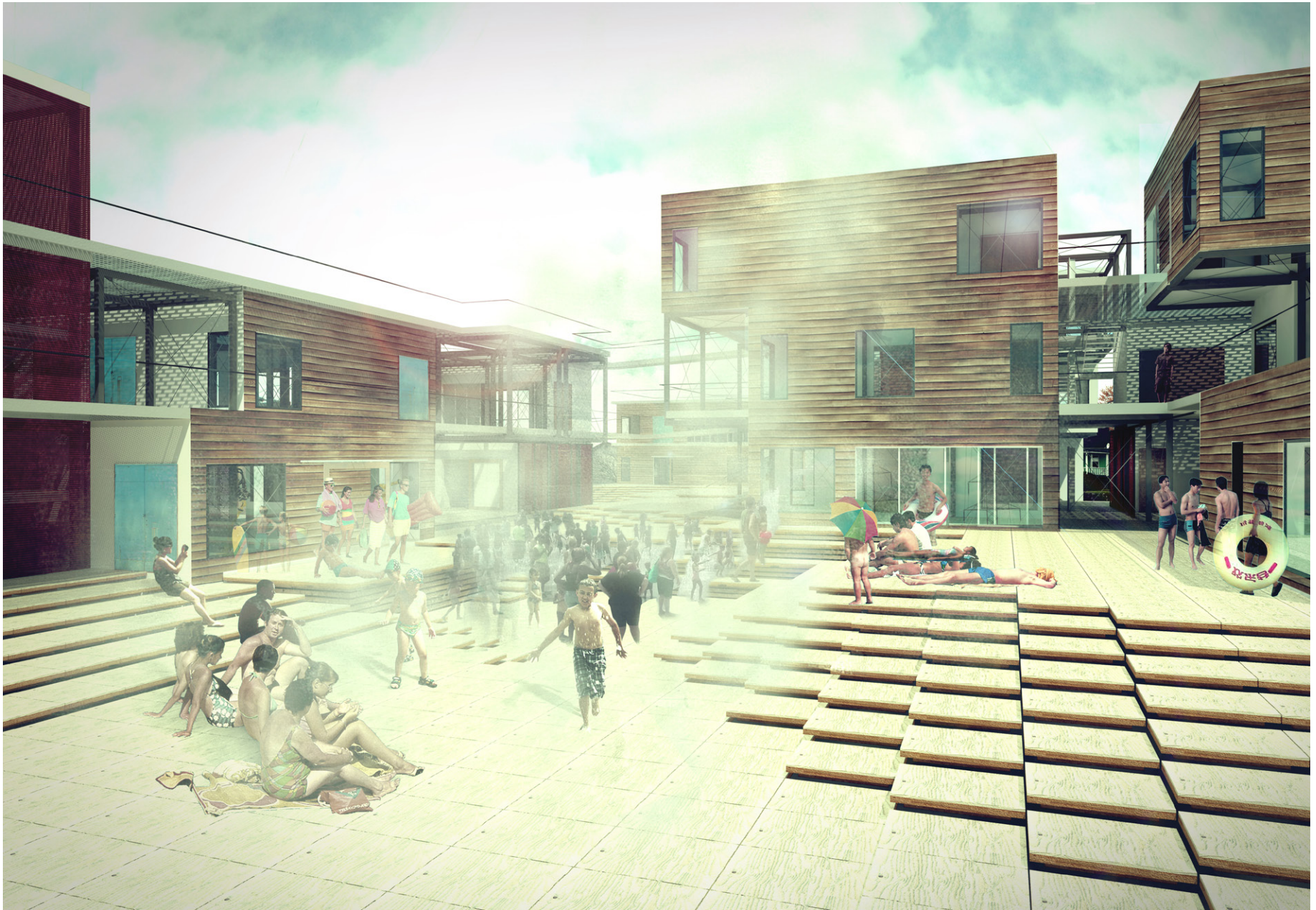
109. North-South section



110. Construction perspective from top of berm adjacent to site



111. Completed perspective from top of berm adjacent to site



112. View into amphitheater as temporary mist park



113. View from Chief Sealth Trail at S Henderson St



114. View from gallery entrance at S Henderson S



115. View from north of water retention/garden area adjacent to Chief Sealth Trail



## Chapter 10: Conclusion

### A New Alternative

The design of a new facility for digital craft in Rainier Beach is driven by an investigation for something other than the typical three-over-one development that is most common in Seattle's transit-oriented development. The site has great potential due to its proximity to the light rail, undeveloped real estate, and short commute to downtown. Plans have been placed on hold to develop the surrounding areas due to lack of funds. This proposal views the time of stalled development as an opportunity to suggest an alternative to cultivate a new community. The goal is to provide a framework that can be adopted by local residents and create a common identity that is inclusive of the diversity that makes the area so unique.

The difficulty in designing a system that can be configured and reconfigured in nearly innumerable combinations is that it is difficult to represent. Each person will impose their ideals

on the proposal, which is intrinsic in an open-ended kit of parts, but it makes the project discussion tend toward individual preferences. The final review did bring up a number of observations. There was interest in the spatial exploration being more about the spaces leftover when the framing units were pulled apart to create passages and connections (see Figure 116). There were also comments regarding the responsive landscape's ability to become more of a feature. The landscape could become something more dynamic and varied in height. The reviewers would have liked to see more configurations explored rather than representations of the campus at a particular moment in time to give a better idea of flexibility within the design.



116. View from gallery entrance at S Henderson S, the space between

Ultimately, the focus of the thesis is about the potential of the project and the system. To find a program applicable to residents of such diverse cultural roots is not an easy task, but the variety of interpretations and uses of digital fabrication could provide the community with a new way to interact and come together. The proposal explores an alternative to the mixed use units that have been built in nearby Rainier Valley neighborhoods. Given that the site, and Rainier Beach in general, is undergoing such great change, the present is the ideal time to reexamine a proper response. The design is meant to tread lightly and have the ability to be removed without any permanent infrastructure, but the hope is that it would be adopted by the community and be incorporated into future developments when the area inevitably becomes more valuable to investors. Although there is also the realistic view that, should the facility not be absorbed into a larger development, it has the ability to be transported to a different locale or be reused as individual elements. While a future development will surely change the face of Rainier Beach, by establishing a connection to existing economic, educational and structural networks, the project looks toward the potential of architecture to foster change, intellectual growth and social development.



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1.	Fablab Amsterdam <a href="http://blog.modk.it/2010_08_01_archive.html">http://blog.modk.it/2010_08_01_archive.html</a>	4
2.	Fablab Kenya <a href="http://afrinnovator.com/blog/2011/10/28/taking-a-look-at-hardware-innovation-in-africa-part-2-of-hardware-hubs/">http://afrinnovator.com/blog/2011/10/28/taking-a-look-at-hardware-innovation-in-africa-part-2-of-hardware-hubs/</a>	4
3.	Makerfaire San Francisco <a href="http://blog.makezine.com/">http://blog.makezine.com/</a>	5
4.	Jigsaw Renaissance makerspace, Seattle, WA <a href="http://www.jigsawrenaissance.org/">http://www.jigsawrenaissance.org/</a>	6
5.	Fablab San Diego <a href="http://www.fablabsd.org/">http://www.fablabsd.org/</a>	7
7.	TAF classroom <a href="http://www.jolkona.org/projects/48">http://www.jolkona.org/projects/48</a>	12
9.	RecTech video class <a href="http://www.pugetsoundoff.org/blogs/rectech-rainier">http://www.pugetsoundoff.org/blogs/rectech-rainier</a>	13
10.	Digital Connectors national network <a href="http://blog.comcast.com/">http://blog.comcast.com/</a>	14
11.	Digital Connectors resources <a href="http://blog.comcast.com/">http://blog.comcast.com/</a>	14
12.	Nela Park MC2 STEM High School Fablab <a href="http://mc2stemhs.wordpress.com/">http://mc2stemhs.wordpress.com/</a>	14
13.	Fablab Mt Elliot <a href="http://newstrategiesdmc.blogspot.com/2010/07/fab-plan-jeff.html">http://newstrategiesdmc.blogspot.com/2010/07/fab-plan-jeff.html</a>	15

14.	Metrix Create:Space, Seattle, WA, interior <a href="http://bbot.org/blog/archives/2010/02/10/mo_like_casual_space/">http://bbot.org/blog/archives/2010/02/10/mo_like_casual_space/</a>	19
15.	Tech Shop, San Francisco, CA: workshop <a href="http://toolmonger.com/">http://toolmonger.com/</a>	20
16.	Tech Shop, San Francisco, CA: computer stations <a href="http://badatsports.com/">http://badatsports.com/</a>	20
17.	Makerfaire San Francisco <a href="http://blog.makezine.com/">http://blog.makezine.com/</a>	23
18.	Linguistically-isolated household map, Rainier Valley	24
19.	Tech Shop community <a href="http://daneomatic.com/wp/category/culture/">http://daneomatic.com/wp/category/culture/</a>	24
20.	Illutron coffee raft <a href="http://illutron.dk/">http://illutron.dk/</a>	25
21.	Illutron floating sauna <a href="http://illutron.dk/">http://illutron.dk/</a>	25
22.	FabAcademy video conferencing network <a href="http://fablab.waag.org/content/fab-academy">http://fablab.waag.org/content/fab-academy</a>	26
23.	3D model of low cost laser <a href="http://fablab.waag.org/taxonomy/term/427">http://fablab.waag.org/taxonomy/term/427</a>	26
24.	Prototype of low cost laser <a href="http://fablab.waag.org/taxonomy/term/427">http://fablab.waag.org/taxonomy/term/427</a>	26
25.	Hackerspaces global network <a href="http://globalguerrillas.typepad.com/globalguerrillas/2010/10/links-26-october-2010.html">http://globalguerrillas.typepad.com/globalguerrillas/2010/10/links-26-october-2010.html</a>	27
27.	Zoning map of surrounding site <a href="http://www.seattle.gov/DPD/cms/groups/pan/@pan/@plan/@proj/documents/web_informational/dpdp019239.pdf">http://www.seattle.gov/DPD/cms/groups/pan/@pan/@plan/@proj/documents/web_informational/dpdp019239.pdf</a>	30
31.	Detail of zoning on site <a href="http://www.seattle.gov/DPD/cms/groups/pan/@pan/@plan/@proj/documents/web_informational/dpdp019239.pdf">http://www.seattle.gov/DPD/cms/groups/pan/@pan/@plan/@proj/documents/web_informational/dpdp019239.pdf</a>	33
50.	Equipping a Fablab <a href="http://www.cleveland.com/science/index.ssf/2009/06/fabrication_labs_let_student_a.html">http://www.cleveland.com/science/index.ssf/2009/06/fabrication_labs_let_student_a.html</a>	50

53.	Boston FabFi public wifi project signal reflector <a href="http://scripts.mit.edu/~emu/fab/?p=648">http://scripts.mit.edu/~emu/fab/?p=648</a>	57
54.	Laser cut pieces pre-assembly for Fabfi reflector <a href="http://scripts.mit.edu/~emu/fab/?p=1551">http://scripts.mit.edu/~emu/fab/?p=1551</a>	58
55.	Kenya FabFi reflector mounted on existing tower <a href="http://scripts.mit.edu/~emu/fab/?cat=41">http://scripts.mit.edu/~emu/fab/?cat=41</a>	58
56.	Nela Park MC2 STEM High School Fablab facility <a href="http://mc2stemhs.wordpress.com/">http://mc2stemhs.wordpress.com/</a>	59
57.	Hand-drawn plans for a Hydrogen generator from Lorain Community College's Fablab <a href="http://www.cleveland.com/science/index.ssf/2009/06/fabrication_labs_let_student_a.html">http://www.cleveland.com/science/index.ssf/2009/06/fabrication_labs_let_student_a.html</a>	59
58.	Hydrogen generator prototype, built in Lorain Community College's Fablab <a href="http://www.cleveland.com/science/index.ssf/2009/06/fabrication_labs_let_student_a.html">http://www.cleveland.com/science/index.ssf/2009/06/fabrication_labs_let_student_a.html</a>	59
59.	Facilities at the textile-based makerspace, The Workroom <a href="http://blog.ponoko.com/">http://blog.ponoko.com/</a>	60
60.	Various components for little-Bits circuitry <a href="http://littlebits.cc/">http://littlebits.cc/</a>	60
61.	Kit assembly for little-Bits <a href="http://littlebits.cc/">http://littlebits.cc/</a>	61
62.	Detail of little-Bits assembly <a href="http://littlebits.cc/">http://littlebits.cc/</a>	61
63.	RepRap desktop 3D printer <a href="http://reprap.org/wiki/Mendel">http://reprap.org/wiki/Mendel</a>	61
64.	Self-replicating components to build a RepRap printer, printed by RepRap printer <a href="http://reprap.org/wiki/Mendel">http://reprap.org/wiki/Mendel</a>	62
65.	Ikea hack: bent legs from POANG chair coupled with vintage banker seat and seatback <a href="http://www.ikeahackers.net/2010/10/spring-back-bankers-chair.html">http://www.ikeahackers.net/2010/10/spring-back-bankers-chair.html</a>	62
66.	Ikea BJURSTA table hacked into twin highchair (in progress) <a href="http://www.ikeahackers.net/2010/12/ultimate-twin-highchair.html">http://www.ikeahackers.net/2010/12/ultimate-twin-highchair.html</a>	63
67.	Twin highchair hack (final product) <a href="http://www.ikeahackers.net/2010/12/ultimate-twin-highchair.html">http://www.ikeahackers.net/2010/12/ultimate-twin-highchair.html</a>	63
68.	<i>fences for sitting</i> . 1999. Andreas Bergmann, drawings <a href="http://05liveproject2008.blogspot.com/2008_10_05_archive.html">http://05liveproject2008.blogspot.com/2008_10_05_archive.html</a>	65

69.	<i>fences for sitting</i> , 1999. Andreas Bergmann, installation photo <a href="http://05liveproject2008.blogspot.com/2008_10_05_archive.html">http://05liveproject2008.blogspot.com/2008_10_05_archive.html</a>	65
70.	Nomadic Museum, Shigeru Ban <a href="http://www.nyc-architecture.com/CHE/CHE-037.htm">http://www.nyc-architecture.com/CHE/CHE-037.htm</a>	68
71.	Theater Het Amsterdamse Bos, Catherina Scholten <a href="http://crunch22.blogspot.com/2008/02/containers-and-caravans.html">http://crunch22.blogspot.com/2008/02/containers-and-caravans.html</a>	68
72.	Spacebuster, Raumlabor <a href="http://www.archidude.com/inflatable-enclosures/">http://www.archidude.com/inflatable-enclosures/</a>	68
73.	Yosemite House, Anderson Anderson Architects Anderson, Mark, and Peter Anderson. 2007. <i>Prefab prototypes: site-specific design for offsite construction</i> . New York: Princeton Architectural Press.	69
74.	Organic Urban Living Module, Anderson Anderson Anderson, Mark, and Peter Anderson. 2007. <i>Prefab prototypes: site-specific design for offsite construction</i> . New York: Princeton Architectural Press.	69
75.	eHab, Eric Cobb Architects, render view eHab publication material, from architect	69
76.	eHab, Eric Cobb Architects, components diagram eHab publication material, from architect	70
77.	Loblolly House, Kieran Timberlake <a href="http://www.KieranTimberlake.com/featured_projects/loblolly_9.html">http://www.KieranTimberlake.com/featured_projects/loblolly_9.html</a>	70
78.	Loblolly House, Kieran Timberlake, frame assembly <a href="http://www.KieranTimberlake.com/featured_projects/loblolly_9.html">http://www.KieranTimberlake.com/featured_projects/loblolly_9.html</a>	71
79.	Mobile Museums, Public Art Lab, Gruber +Popp, aerial <a href="http://vagueterain.net/journal11/endlicher-kagel/01">http://vagueterain.net/journal11/endlicher-kagel/01</a>	71
80.	Mobile Museums, Public Art Lab, Gruber +Popp, install <a href="http://www.publicartlab-berlin.de/">http://www.publicartlab-berlin.de/</a>	71
81.	RDF 181, Rotor, installation view Press packet from architect	72
82.	RDF 181, Rotor, interior view Press packet from architect	72
83.	RDF 181, Rotor, kit of parts Press packet from architect	72

84.	<i>Add-on: 20m Altitude</i> , Peter Fattinger, Veronika Orso, Michael Rieper <a href="http://www.publicartvienna.at/files_e/pressebilder.html">http://www.publicartvienna.at/files_e/pressebilder.html</a>	73
85.	Trailer Cage, Archigram <a href="http://www.artnet.com/magazine_pre2000/features/abercrombie/abercrombie4-14-4.asp">http://www.artnet.com/magazine_pre2000/features/abercrombie/abercrombie4-14-4.asp</a>	73
86.	Theater Het Amsterdamse Bos, Catherina Scholten <a href="http://crunch22.blogspot.com/2008/02/containers-and-caravans.html">http://crunch22.blogspot.com/2008/02/containers-and-caravans.html</a>	74
87.	Nomadic Museum, Shigeru Ban, interior <a href="http://www.skyscrapercity.com/showthread.php?t=339545">http://www.skyscrapercity.com/showthread.php?t=339545</a>	75
88.	Nomadic Museum, Shigeru Ban, exterior <a href="http://mocoloco.com/art/archives/000902.php">http://mocoloco.com/art/archives/000902.php</a>	75
89.	Platoon Kunsthalle Seoul, Graft Architects, exterior <a href="http://inhabitat.com/platoon-kunstjalle-seouls-shipping-container-subculture-art-center/">http://inhabitat.com/platoon-kunstjalle-seouls-shipping-container-subculture-art-center/</a>	76
90.	Platoon Kunsthalle Seoul, Graft Architects, interior <a href="http://inhabitat.com/platoon-kunstjalle-seouls-shipping-container-subculture-art-center/">http://inhabitat.com/platoon-kunstjalle-seouls-shipping-container-subculture-art-center/</a>	76
91.	Mobile Linear City, Vito Acconci <a href="http://arqueologiadelfuturo.blogspot.com/2011/02/el-coche-como-arquitectura-iv-1991_24.html">http://arqueologiadelfuturo.blogspot.com/2011/02/el-coche-como-arquitectura-iv-1991_24.html</a>	76
92.	House up a Building, Vito Acconci, install views <a href="http://archrecord.construction.com/features/interviews/0718acconci/ss7/6.asp">http://archrecord.construction.com/features/interviews/0718acconci/ss7/6.asp</a>	77
93.	House up a Building, Vito Acconci, install view <a href="http://archrecord.construction.com/features/interviews/0718acconci/ss7/6.asp">http://archrecord.construction.com/features/interviews/0718acconci/ss7/6.asp</a>	77
94.	Spacebuster, Raumlabor <a href="http://www.archdaily.com/20435/raumlabor-spacebuster-touring-around-new-york/">http://www.archdaily.com/20435/raumlabor-spacebuster-touring-around-new-york/</a> Spacebuster, Raumlabor	78
95.	Spacebuster, Raumlabor <a href="http://www.archdaily.com/20435/raumlabor-spacebuster-touring-around-new-york/">http://www.archdaily.com/20435/raumlabor-spacebuster-touring-around-new-york/</a> Spacebuster, Raumlabor	78
96.	Spacebuster, Raumlabor, inside the bubble <a href="http://www.archdaily.com/20435/raumlabor-spacebuster-touring-around-new-york/">http://www.archdaily.com/20435/raumlabor-spacebuster-touring-around-new-york/</a> Spacebuster, Raumlabor	79
99.	Helical pile installation diagram <a href="http://www.griptide.com/products/helical-pier-system.aspx">http://www.griptide.com/products/helical-pier-system.aspx</a>	83



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