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Transforming Parking Garages Into Affordable Housing

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Introduction

Post-World War I, in 1928, the International Congress of Modern Architecture embraced the Industrial Revolution. The result was big factories, tall housing towers, rapid urbanization, new technologies, and new economic and government models that led to challenges for people and their cities.

On December 10, 1948, the United Nations introduced its Universal Declaration of Human Rights, its Article 25 declares that "everyone has the right to a standard of living adequate for the health and well-being of himself and of his family." Ever-growing cities should be able to provide equitable housing for all; however, the aspiration for equity is a challenge that is difficult to achieve. The primary cause of homelessness is simply the lack of affordable housing, as being define as housing that costs no more than 30% of a household's income. Although government programs such as Housing First offers permanent, affordable housing for the homeless, critics such as Prof. Victoria Stanhope, Ph.D asserts that the program's "public housing units have transformed many communities into slums."[1] The historical failures of Modern Social Housing have resulted in the bulldozing of well-established neighborhoods, densifying the poor, and restricting their access to the city, as seen in the failure of the Cabrini–Green Homes of Chicago.

For housing to be successful and affordable, there needs to be a density of other residences, workplaces, and services with the infrastructure to reach other neighborhoods and communities. This requires new construction projects to fit within current urban development, where space is limited and expensive, or sprawl out into nearby suburbs,

[1] Kohan, Sharam. Is the Housing First Model a National Elusion or Is It the Solution to End Homelessness? Harvard University, 6 Aug. 2014, archive.is/20141019201617/blogs.law.harvard.edu/sharamkohan/is-the-housing- first-model-a-national-elusion-or-is-it-the-solution-to-en

which often lack the required transit infrastructure. This housing crisis is seen in all major cities across the United States, but this capstone focuses specifically on the city of Chicago.

In 2018, the difference in demand for rentals that qualify as "affordable" in the city of Chicago exceeded the supply by about 120,000 units.[2] Affordability is achieved through various means including tax credits and subsidies. But this capstone focuses on how design can give an economic incentive to creating affordable housing within the city.

Architecture and its construction is expensive, so many governments will settle for the bare minimum. If the location of these affordable housing units were already in desirable locations that are close to civic spaces and public transport, then developers and the local government will have an economic motive to provide affordable housing in the heart of Chicago. By taking advantage of the future evolution of urban traffic and transit, affordable housing can be inserted within the city by reusing existing parking garages.

The Parking Garage as Housing

The first step to inserting affordable housing into a dense urban context is finding a site. The most obvious sites are parking lots; large expanses of asphalt that are rarely used to its full potential. Even better are parking garages, whose structure can potentially be reused when constructing housing units. Transforming parking garages will become more economical as the profit margins for parking decrease with the fall of private car ownership.

[2] CTBA. (2018, May 24). A brief overview of Chicago's affordable housing programs. Retrieved from https://budgetblog.ctbaonline.org/a-brief-overview-of-chicagos-affordable-housing-programs-95413a2fb184

Throughout the United States, most noticeably in the most urban areas, there is a decrease in car ownership. This is fueled by the popularity of millennials abandoning the idea of owning a personal car, which stems from a number of factors including environmental concerns and the use of a car as a utility instead of a luxury. This is reflected by the rise of ride-share companies such as Uber and Lyft, and the recent investment by car companies on developing successful self-driving cars. In the next couple of decades the demand and economic benefit for parking lots will decrease and the need for affordable housing within already well-established neighborhoods with the zoning and infrastructure able to support a substantial rise in population will increase tremendously.[3]

The Center of Neighborhood Technology in Chicago conducted a study that focused on the negative effects of the city's zoning codes' minimum parking demands. In this study they noted that parking in Chicago is underutilized and significantly increases housing prices in the city.

> "Better understanding of parking demand and adopting policies to right-size parking can repurpose underutilized space to meet broader development and affordability goals. CNT has found that:
>
> - The cost of an individual parking spot in Chicago can be as much as $37,300, and this bears significant opportunity costs in increased housing prices, constraints on affordable housing development, and the efficient use of land.

[3] Cooke, Julia. "Could Europe's Empty Parking Garages Become Housing?" Curbed, Curbed, 12 Apr. 2016, www.curbed.com/2016/4/12/11395480/parking-garages- housing-europe.

- Parking minimums add time and cost to Chicago-area transit-oriented developments. In particular, this discourages developing affordable housing near transit, where the cost of land comes at a premium.
- On average, one third of off-street residential parking sits empty at night. This is a large and unnecessary gap between supply and demand. We collected this data at more than 41 buildings based on methods CNT developed in the San Francisco Bay Area, Seattle, and Washington, D.C.
- Alternative approaches exist. Recognizing the burden of unused residential parking on project cost and community accessibility, communities and developers are beginning to develop creative, alternative approaches that better align parking supply with demand."[4]

Potential future changes in parking minimums due to a better understanding of parking underutilization could lead to more affordable residential projects with little to no on site parking. This would coincide with a larger decrease in demand of parking in the city.

In 2013, Chicago's Department of Planning and Development counted 91,747 parking spaces in downtown. Which was defined by this study as being between Roosevelt Road and Chicago Avenue, and Halsted and LaSalle streets. Presently, the profit of a parking space in a city usually outweighs the profit for affordable housing in that same area, but this may soon invert. According to Chicago residential developers, "the rate of parking lots disappearing is accelerating." The increase in apartment rents has increased the price of well-located land while, according to developer Alan Lev, "many downtown

[4] Smith, Kyle. Stalled Out: How Empty Parking Spaces Diminish Neighborhood Affordability. (2016). Chicago: The Center for Neighborhood Technology. Retrieved from https://www.cnt.org/sites/default/files/publications/CNT_Stalled Out_0.pdf.

garages are not doing the kind of business they used to, which is indicative of ride-sharing and not as many people owning cars."[5]

This capstone builds on the prediction that the profitability of parking and affordable housing will invert. In 2018, the median monthly rate of a reserved parking spot in Chicago is $547.[6] That same year, the median monthly rent for a one bedroom apartment in downtown Chicago was over $2000, a number that is only expected to rise.[7] Parking garages are already dispersed in a city and as the decline for parking spaces occurs in a city, the use of parking garages should decline with equal dispersity. [8]

The benefit of using the location of parking garages for affordable housing is their dispersity within a city. Due to the current high demand for parking in cities, parking garages are often within walking distances of public transit, commercial venues, and other residences. This proximity is essential for successful dense affordable housing as it promotes walkability to one's workplace. Additionally, the already present structure with near universal unitized dimensions based on a parking space provides the opportunity to propose prefabricated modules that can be inserted into the concrete shells of garages. The units can make use of the already present vertical circulation and utility connections with the garage.

The focus of this capstone was downtown Chicago parking garages. A 2008 study of 15 parking garages in Chicago found that city residents accounted for nearly 50% of

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[5] Ori, R. (2018, March 27). Retrieved from https://www.chicagotribune.com/business/columnists/ori/ct-biz-parking-redevelopment-ryan-ori-20180308-story.html
[6] Vince, J. (2018, April 05). Here's How Expensive It Is To Park In Chicago. Retrieved from https://patch.com/illinois/chicago/here-s-how-expensive-it-park-chicago
[7] Mapping Chicago Neighborhood Rent Prices (Summer 2018). (2018, June 20). Retrieved from https://www.zumper.com/blog/2018/06/mapping-chicago-neighborhood-rent-prices-summer-2018/
[8] Sisson, Patrick. "Why High-Tech Parking Lots for Autonomous Cars May Change Urban Planning." Curbed, Curbed, 8 Aug. 2016, www.curbed.com/2016/8/8/12404658/autonomous-car-future-parking-lot- driverless-urban-planning.

downtown parkers, while Cook county accounts for a total of 75% of all parkers. Furthermore, the majority of people who park in these garages are coming downtown to work. [9] Future affordable residential developments in downtown Chicago would make it possible for more people to live closer to their workplace or to transit, which could reduce the number of workplace parkers. Additionally, less parking spaces means people are more likely to find other means of transportation. The growth of ride-share companies could push many Chicago residents to no longer be able to rationalize the expense of a personal car for their day-to-day lives, futher reducing the demand for parking.

Figure 1. Parking Garages in Downtown Chicago (Vector Map Data From OpenVectorMaps.com)

The map above shows the large number of free-standing parking garages in downtown Chicago. It does not include the numerous parking lots or parking garages that are underground or on the lower floors of a larger building. The ones in red are sites that could potentially be reused for housing. These are chosen based on requirements for a potential implementation of a residential modular system. For this capstone, the requirements for free-standing, multi-level parking garages to potentially be turned into affordable house are as follows:

[9] Sööt, Siim. Survey of Downtown Parkers Chicago IL. (2008). Parking Industry Labor and Management Committee.

- Four open facades, for access to light and fresh air for multiple apartments; as well as for ease of inserting prefabricated units into the structure.
- A central incline ramp, which will be removed to provided more natural light towards the interior of the apartments and allow for cross ventilation.
- Mostly flat levels, for ease of accessibility to each apartment.
- Stair and elevator access that corresponds to the residential zoning requirements.

This specific capstone's proposal is based on a currently operating self-park parking garage located at 205 W Randolph Street Chicago, Illinois.

Precedents

Throughout this capstone various precedent projects, both realized and unbuilt, were used in developing and understanding the adaptability of a parking garage into affordable housing. The development of the module evolved from precedent studies of previous parking space and shipping container size residential unit.

Precedent: SCADpad

Figure 2. SCADpad, Savannah College of Art and Design. Atlanta, Georgia.

SCADpad was an academic project from the Savannah College of Art and Design. This project consisted of fabricating three modular dwellings, each the size of a parking space with an equal sized patio adjacent. Multiple units were set up like a "mini village" in an existing parking garage in Atlanta, Georgia. Although the project was a temporary installation, short-term residents found they were large enough for one person to live in, with one or two periodic visitors.[10] The drawn conclusion was for a permanent residence, an apartment larger than a single parking space would be required, even for one person.

[10] Burns, R. (2014, July 09). Multistorey car park in US transformed into designer micro-apartments. Retrieved January 24, 2019, from https://www.theguardian.com/cities/2014/jul/09/multistorey-car-park-us-designer-micro-apartments-affordable-housing

Precedent: Parking Garage Housing

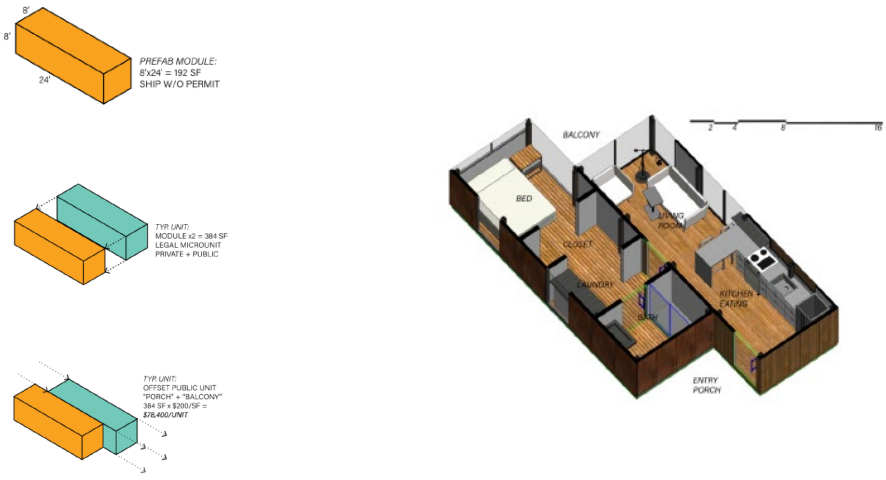


Figure 3. Parking Garage Housing. Austin, Texas. David Richardson Design.

This project is an idea of prefabricated modules the size of a shipping container, 8x24 feet that are shifted and placed next to each other to create a 384 square-foot micro one-bedroom apartment. The idea is these units could be placed in an existing parking garage. [11] This shifting of units is carried out to the proposal, as it allows for exterior "porch" spaces, which is seen in a different successful garage transformation precedent.

[11] Davis Richardson Design. Parking Garage Housing. 2017. Retrieved from https://www.davisrichardson.com/parking-garage-housing-1

Precedent: Gensler Housing Complex

Gensler Housing Complex, Los Angeles, California [12]

Figure 4. The MOD; Los Angeles, California. Gensler.

The MOD is an idea of a cultural center for Los Angeles, that reclaims a parking garage and turns it into civic or public space. This hypothetical project highlights the benefit of using modularity for future construction within parking spaces to allow spaces to adapt for many uses.

The Gensler Research Institute also partnered with engineers, parking designers, and urban planners to conduct an investigation that focused on optimizing today's parking for future use as the presence of driverless cars rise. Their proposals and recommendations include optimizing parking structure's design for ease of reuse and pushing policymakers to alleviate parking requirements from new buildings. [13] Their study's findings help inform this capstone's previous research of the affordability of new housing developments in Chicago.

[12] Peters, A. (2019, January 14). These future-proof parking garages can easily morph into offices or housing. Retrieved January 24, 2019, from https://www.fastcompany.com/90291136/these-futureproof-parking-garages-can-be-easily-turned-into-offices-or-housing

[13] Gensler Research Institute. (2016, March 01). The State of Parking. Retrieved April 15, 2019, from https://www.gensler.com/research-insight/gensler-research-institute/the-state-of-parking

The practicality of reusing a parking garage into housing is supported by previous research and precedent studies of reuse and multi-use developments.

> "The Atlantic Cities reports that "'developers themselves . . . [have] been receptive to the idea [of designing parking decks with an eye toward reuse] . . . perhaps because they see a less car-dependent future and [are] 'worried about building parking garages that don't really have a long-term use'." [14]

Building new parking garages that easily allow future re-purpose or finding existing garages whose structure can be adapted will allow a quick turnover for much needed affordable housing as well as saving "developers time, money, and material waste." [15]

[14] Savannah College of Art and Design. Big Plans | Small Spaces. Retrieved January 24, 2019, from http://scadpad.com/

[15] Jaffe, E. (2013, November 14). We Need to Design Parking Garages With a Car-less Future in Mind. Retrieved April 20, 2019, from https://www.citylab.com/design/2013/11/its-time-design-parking-garages-car-less-future/7583/

Precedent: Broadway Parking Garage

Figure 5. Broadway Parking Garage; Wichita, Kansas. Sheldon Architecture. 2018.

This project is a retrofit of a parking garage into 44 studio apartments with door-side parking. The parking garage was preserved because of the city's belief in its local landmark importance. The project retains the original parking while introducing housing into the site. All of the units are studio apartments, each around 650 square feet and priced at market rate.[16] However, since the garage still functions for parking, the density and thus affordability of transforming a parking garage into apartments is reduced. This most likely reflects that context the project is in, the present and desired density of Wichita, Kansas is of no comparison to that of Chicago, Illinois.

[16] Sheldon Architecture. Broadway Autopark Apartments. 2018. Retrieved from https://sheldenarchitecture.com/portfolio_item/broadway-parking-garage/

Precedent: 12 E. 13th St.

Figure 6. 12 E. 13th St., a former Hertz rental garage; New York, New York. CetraRuddy. 2014.

This project in New York City is an 83-year old that was transformed from a former Hertz rental garage to a twelve-story, eight-unit development of luxury residences with a robotic parking system on the second floor.[17] This gives evidence for the already present interest and acceptance of reusing parking garages as housing. This built project also provides as a precedent an additional possibility of building on top of existing parking garages to increase density of residential units on site, which was not explored in this capstone.

[17] CetraRuddy. 12 East 13th. 2014. Retrieved from http://cetraruddy.com/project/12-east-13th

Precedent: 1111 Lincoln Road

Figure 7. 1111 Lincoln Road, Mixed-Use Garage; Miami Beach, Florida. Herzog and de Meuron. 2010.

This project was built to accommodate a variety of functions, including parking, retail, and residences, into a single structure. The parking garage was built for its profitability, but the unusual design was to be able to create a civic space within the parking garage. Although not an example of a reuse project, it does provide evidence for a potential coexistence and gradual shift of a building's function from parking to civic space, and even residences.[18]

[18] Malone, D., & Peiser, R. (2014, September 12). The Making of Miami Beach's Mixed-Use Garage. Retrieved April 10, 2109, from https://urbanland.uli.org/planning-design/making-miami-beachs-mixed-use-garage/

The Process and the Proposal

To begin creating a module, the first constraint is to define the overall dimensions that would relate and could be used in nearly all parking garages. The presence of a standardized parking space sizing of nine feet by eighteen feet provided a decent dimension constraint. The module began with 90-degree, nine by eighteen-foot parking spaces, but through capstone have found that even if the parking is angled, the module can still fit while maintaining a placement that is perpendicular to the exterior facade. Therefore, the angle of the current painted parking spaces is ignored but their impact on the total depth available is noted through the module studies.

For each apartment, the module is doubled in width and then if space is available, is also doubled in length. With each new parking spot sized addition, 160 square feet is added to the apartment. The depth is dependent on whether the parking is single or double bays. The module also shifts in plan to created two exterior “porches,” one in the interior entry and one on the exterior. The prefabricated units create long-term livable space that while modest, does not strive to be micro housing. The units are intended to sit next to each other, along an internal single loaded corridor. The units are to be inserted perpendicular to the facade, aligned similarly to the parking spaces from which the dimensions derive.

The proposed modules are prefabricated units that is 9 x 9 x 18 and 9 x 9 x 36 feet. The benefits of prefabricating the units is affordability due to decreased on-site construction time. The parking space-sized module also allows for easy transport, even within an urban context. Due to using the existing parking garage structure, the modules

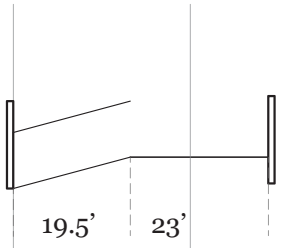
need to only be self-supporting, which each apartment being composed of two modules that are placed and connected on site. The apartment's utilities would be accessible from the interior circulation space outside of the unit would run in between the finished floor of the apartment and the concrete floor of the parking structure.

Single bay parking is able to be turned into modest studio size apartments that use two parking spaces worth of space. While double bay parking can be turned into either one or two-bedroom apartments that use four parking spaces worth of space. In order to turn the parking garage to housing, the best suited parking garages have a central ramp access that would be removed during the adaptation to create a light well. In addition, the elevation would need to be altered to allow the units to be placed within the garage's structure.

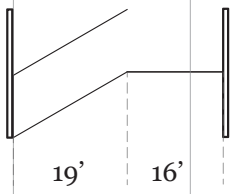
The following diagrams are this capstone's proposal of inserting prefabricated modules into a parking garage to create various types of residential units.

STUDIO APARTMENT
324 sq ft
2 Parking Space-Sized, Prefabricated Modules
Single-Bay Parking (1 row of parking stalls with one-way access aisle)

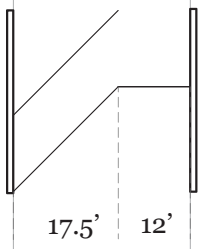
Minimum parking dimensions for:



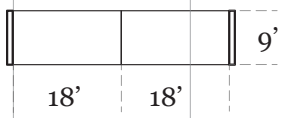
75 degree parking



60 degree parking

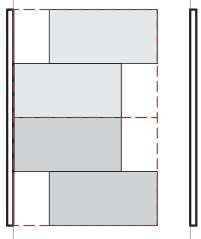


45 degree parking



90 degree parking

30’
Minimum depth required for 6’ of circulation

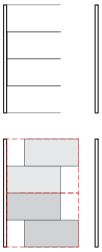


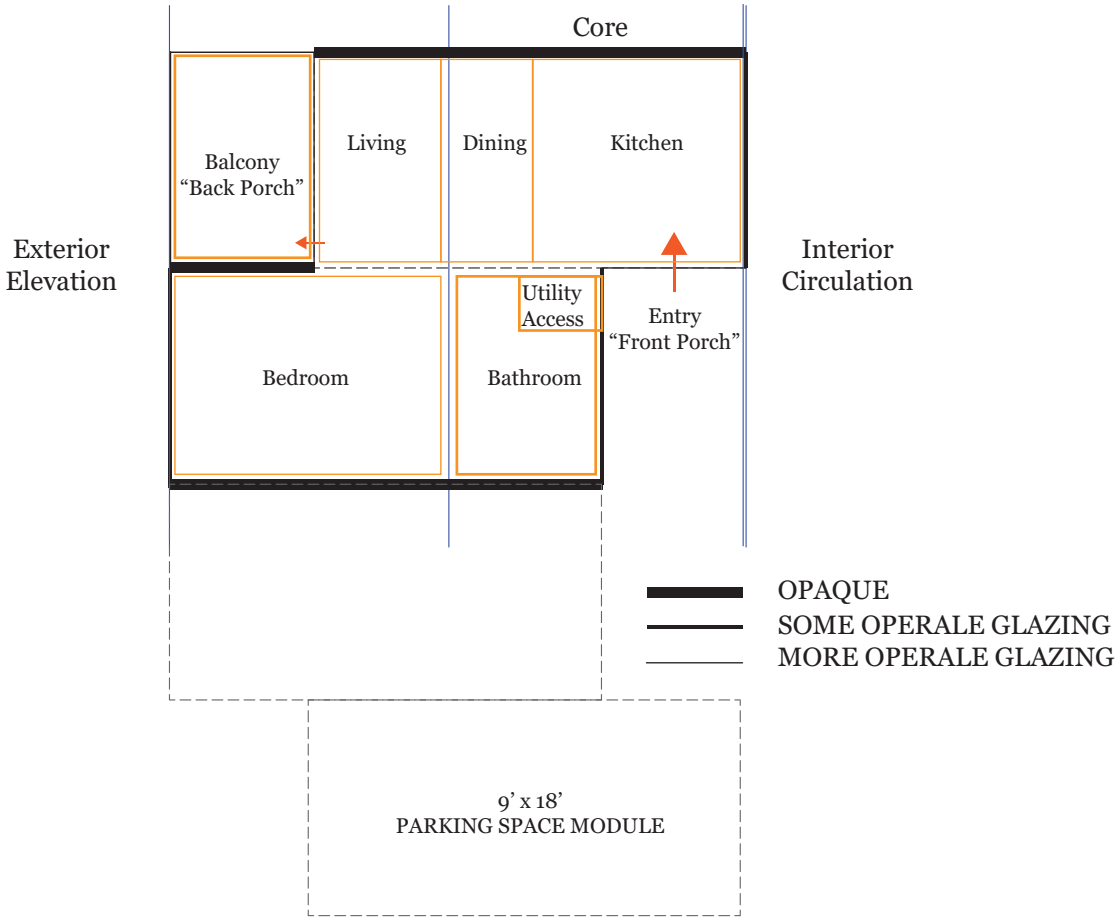
Module fits all parking layouts

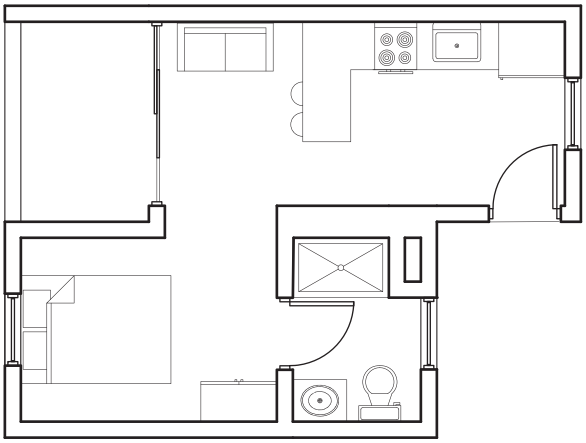
Minimum measurements taken from Julia McMorrough’s *The Architecture Reference + Specification Book*

STUDIO APARTMENT

324 sq ft
2 Parking Space-Sized, Prefabricated Modules
Single-Bay Parking (1 row of parking stalls with one-way access aisle)



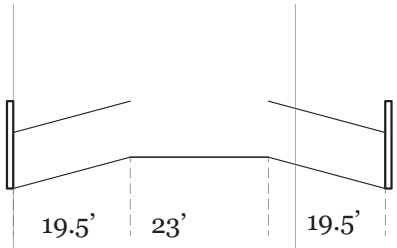




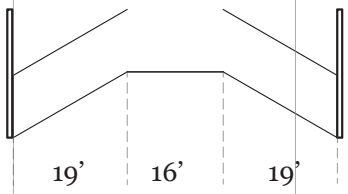
ONE BEDROOM APARTMENT

648 sq ft
4 Parking Space-Sized, Prefabricated Modules
Double Bay Parking (2 rows of parking stalls with one-way access aisle)

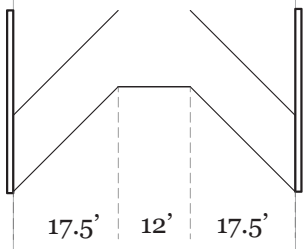
Minimum parking dimensions for:



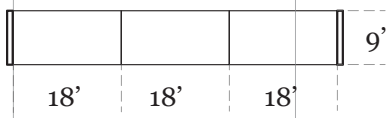
75 degree parking



60 degree parking

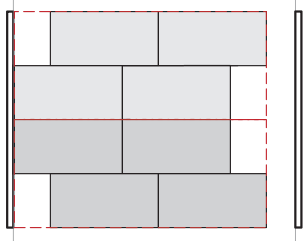


45 degree parking



90 degree parking

48’
Minimum depth required for 6’ of circulation

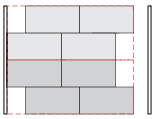


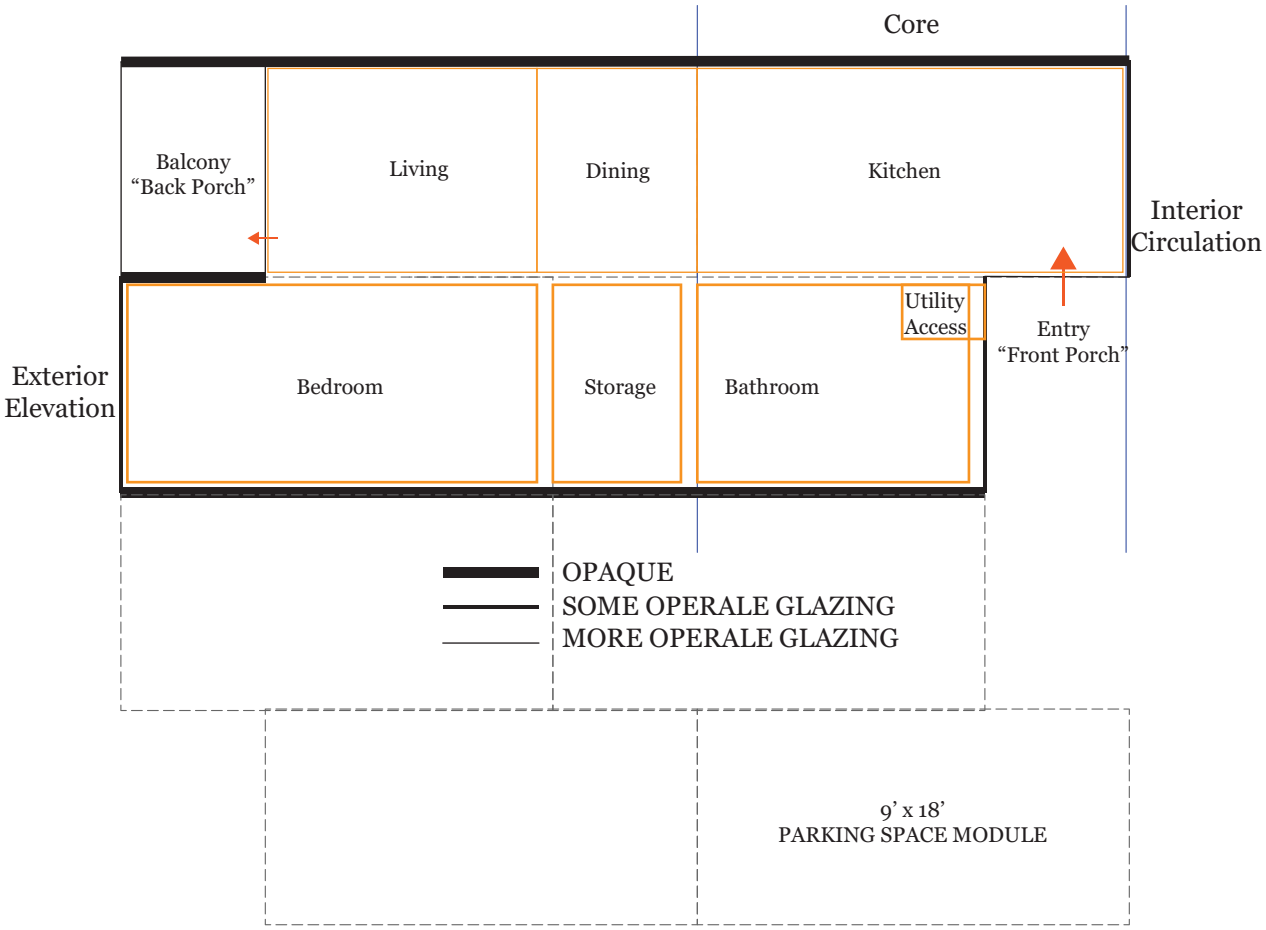
Module fits all parking layouts

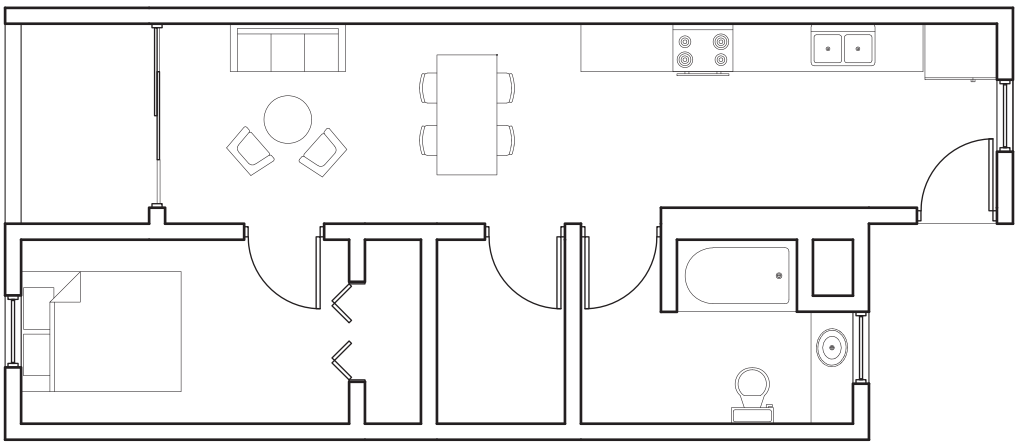
Minimum measurements taken from Julia McMorrough’s *The Architecture Reference + Specification Book*

ONE BEDROOM APARTMENT

648 sq ft
4 Parking Space-Sized, Prefabricated Modules
Double Bay Parking (2 rows of parking stalls with one-way access aisle)

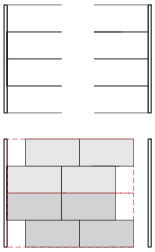


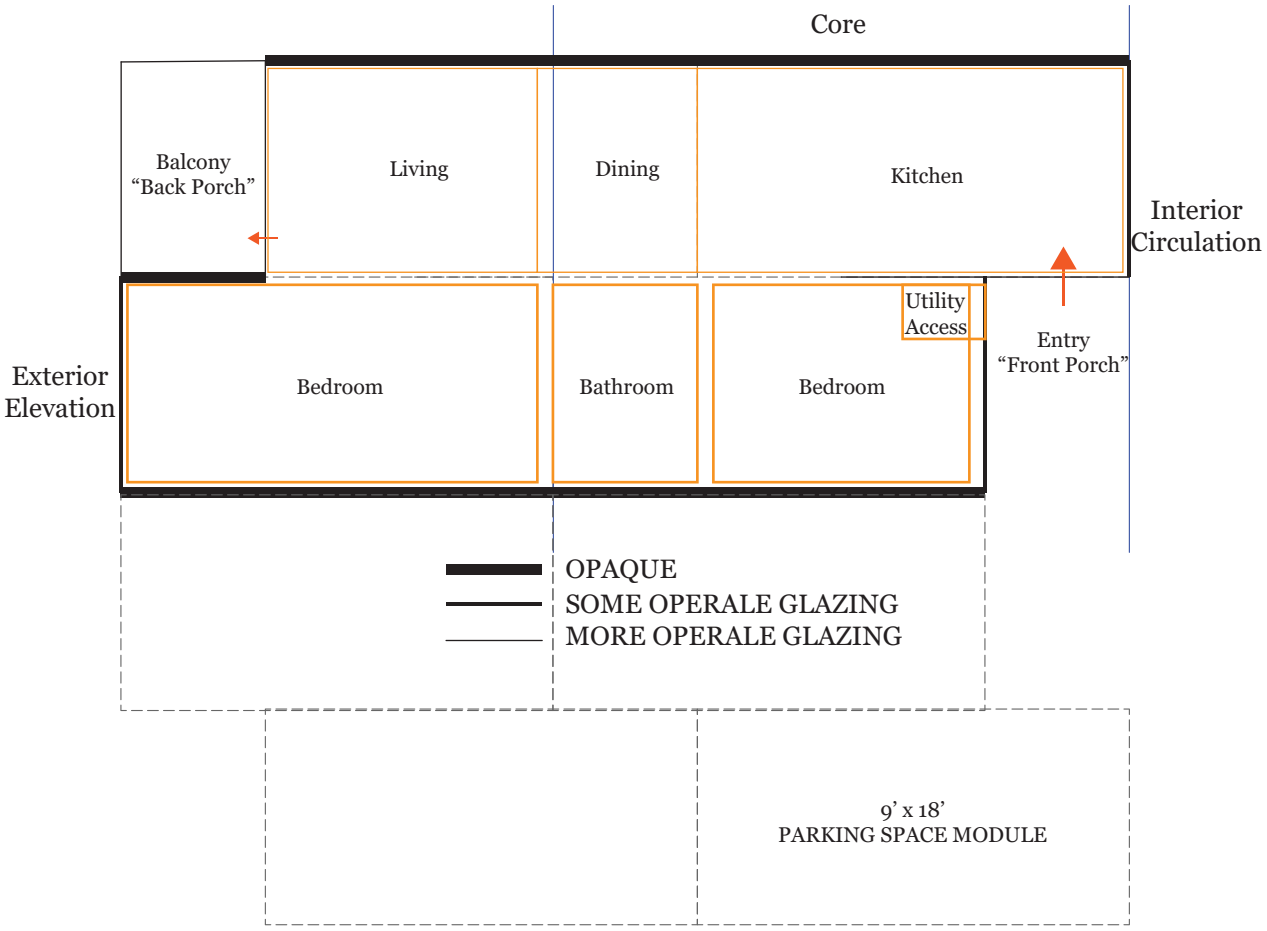


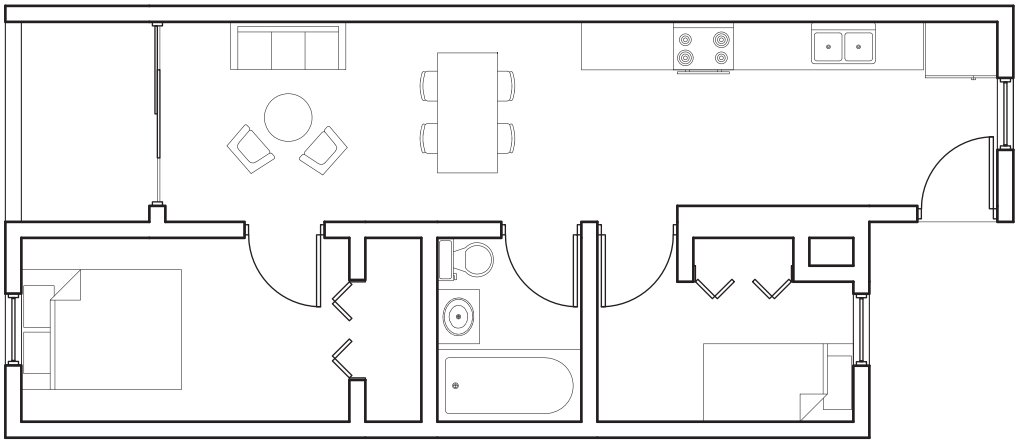


TWO BEDROOM APARTMENT

648 sq ft
4 Parking Space-Sized, Prefabricated Modules
Double Bay Parking

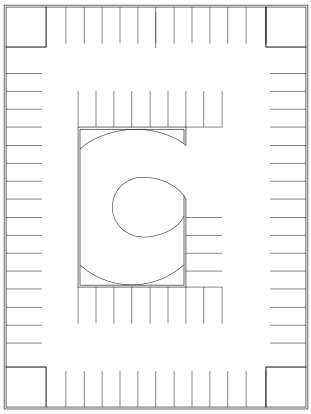






PROPOSED:
PARKING GARAGE TRANSFORMATION

EXISTING PLAN

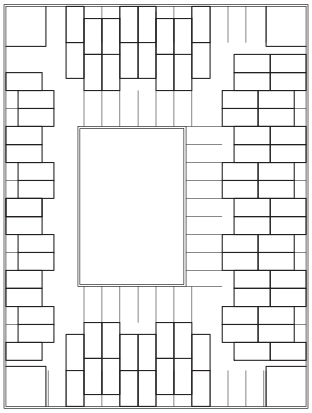


Capacity:
75 vehicles per level
450 vehicles total

Central vehicle ramp

Corner vertical circulation

PROCESS PLAN

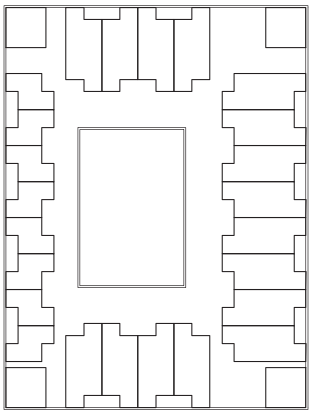


Remove interior ramp to create a large central light-well.

Insert 9'x18' prefabricated modules.

Create vertical utilities connections along corner circulation.

REUSE PLAN



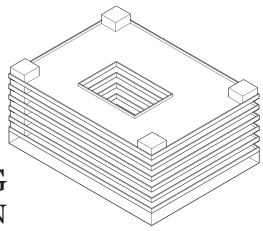
24 Apartments
8 Studios
16 One/Two Bedrooms

36-64 residents

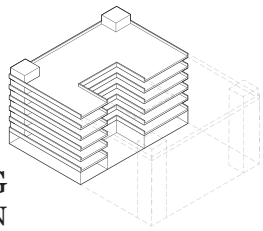
Corner and interior ciculation, with space not used by modular apartments becoming community space.

Dimensions based on the parking garage at 205 W Randolph Street, Chicago, Illinois.

PROPOSED:
PARKING GARAGE TRANSFORMATION



EXISTING
AXON

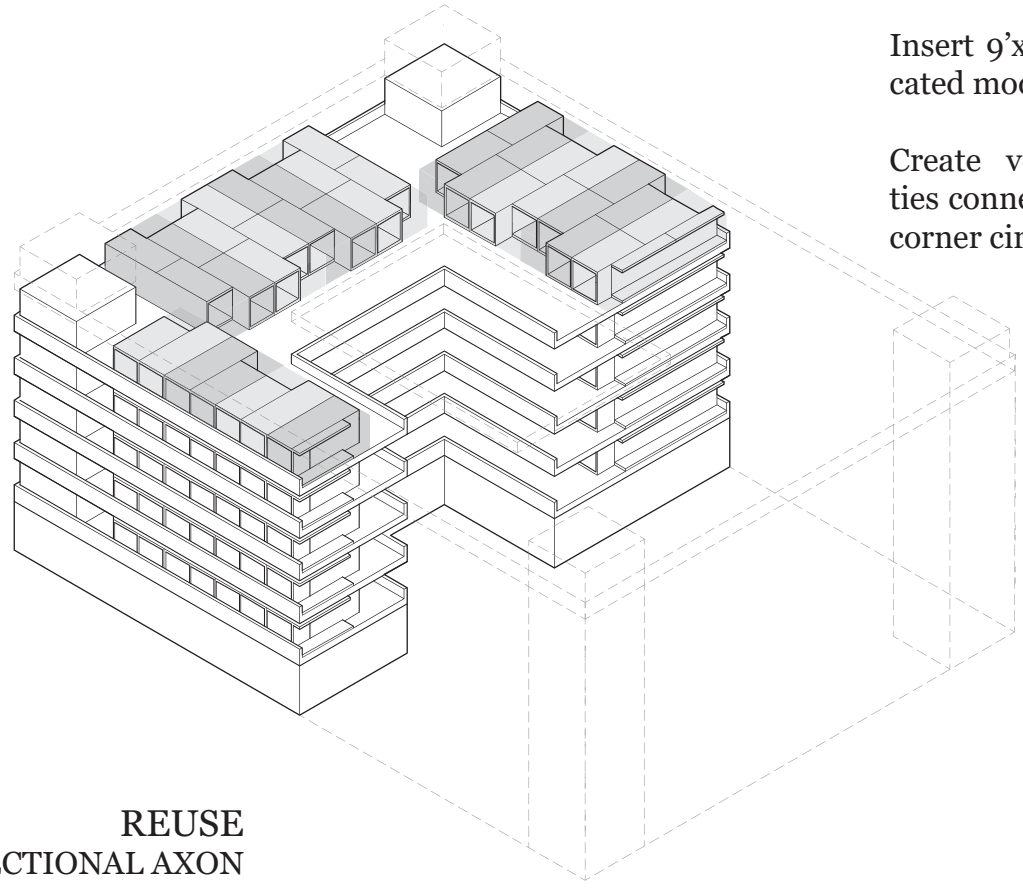


EXISITNG
SECTIONAL AXON

Remove interior ramp to create a large central light-well.

Insert 9'x18' prefabricated modules.

Create vertical utilities connections along corner circulation.



REUSE
SECTIONAL AXON

120 Total Apartments
40 Studios
80 One/Two Bedrooms

200-320 residents

Corner and interior ciculation, with space not used by modular apartments becoming community space.

Dimensions based on the parking garage at 205 W Randolph Street, Chicago, Illinois.

Conclusion

The capstone was developed on the growing trend of driverless cars and their possibility to revolutionize a city's need for numerous parking garages. By taking advantage of the future evolution of urban traffic and transit, affordable housing can be inserted within the city by reusing existing parking garages. This capstone's idea could help fill the need of disperse and connected affordable housing in downtown Chicago, IL. It offers an example proposal for providing affordable housing in downtown Chicago while opening up the conversation for other ideas.

However, it will most likely be some time before driverless cars flood the street of American cities. Future study would need to continue to document growing trends and a more detailed focus on zoning and policy makers on the acceptance of parking garage reuse in the public sector would need to be included. In addition, a deeper study is needed on reaching affordability beyond trying to reduce future construction costs would be beneficial to the overall understanding this proposal's viability.

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Figure 1. Parking Garages in Downtown Chicago (Vector Map Data From OpenVectorMaps.com)

Figure 2. SCADpad, Savannah College of Art and Design.

Figure 3. Parking Garage Housing. Austin, Texas

Figure 4. The MOD; Los Angeles, California

Figure 5. Broadway Parking Garage; Wichita, Kansas. Sheldon Architecture. 2018.

Figure 6. 12 E. 13th St., a former Hertz rental garage; New York, New York. CetraRuddy. 2014.

Figure 7. 1111 Lincoln Road, Mixed-Use Garage; Miami Beach, Florida. Herzog and de Meuron. 2010

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