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Infrastructure as Fabric: Integrating Autonomous Vehicle Highways in Urban Environments

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Abstract

In an age of advancing transportation technology, the redevelopment of I-81 in Syracuse will be a local condition set as a blueprint for infrastructural solutions at large. This will be done through increased density and a pedestrian friendly environment to repair urban fabric and sprawl. The project accepts highways and viaducts not as barriers of the city but as a seam – an anchor that the city develops around. This research paper will first lay out the scenario to which new infrastructure can succeed in positively reshaping the urban environment. Secondly, this paper will dive deeper into the effects of highways on cities through the history of I-81 and its influence on the redevelopment of Syracuse, especially the 15th Ward. Architectural design decisions will be made based upon what is considered feasible for the city of Syracuse as it assesses current proposals to renovate the highway.

Executive Summary

Beginning in the 1950s and 60s cities entered a new phase of transportation with the implementation of highways and infrastructure networks. Once considered a beacon of modernism to run straight through the heart of a city, they brought great economic development at the expense of splitting existing communities and previous networks of transportation. This created a serious shift in the urban development of cities nationally.

Today, two related events in cities are occurring. The first is the slow replacement process of the interstate networks that have reached the end of their structural lifespans. They have effectively split cities into forced artificial districts, so new options and solutions to better integrate replacement structures into the urban environment have been proposed.

The second related event occurring today is a technological revolution with the development of autonomous vehicles. This new system of transportation brings its own series of opportunities to shape the built environment, as driverless cars become more widespread. It's conceivable that autonomous vehicles can shape the way we live with safer and more efficient means of transportation, but the full potential of the new transportation cannot be realized without implementing significant changes to the urban fabric. Urban fabric is the physical form and organization of cities and towns.

Both the rebuilding of decrepit infrastructure and the rollout of autonomous vehicles can occur as separate events, but to fully realize the potential of both they must be in relationship to each other as well as the urban environment. Infrastructure needs to address both current and future requirements for new modes of transportation. Infrastructure should be regarded not as a system of transportation planning and engineering, but should be read as objects of spatial content, which are areas with architectural implications.

In an age of advancing transportation technology, it is important to keep in mind what makes a good city, which is a dense and pedestrian friendly environment. The goal is to increase

the density of buildings in the center of the city by reusing dead zones and to enhance area-wide mobility across the site by improving alternate networks of transportation, including pedestrian and bicycle routes. The redevelopment of I-81 in Syracuse will be a local condition set as a blueprint for infrastructural solutions at large. This will be done through increased density and a pedestrian friendly environment to repair urban fabric and sprawl within the city of Syracuse.

The research of the project will dive into the history of Syracuse's neighborhoods most affected by the construction of I-81 as well as into the current proposals for the replacement options, including looking at several case study cities that underwent similar highway replacement decisions. This research will be an influence in the architectural decisions of the project.

What is the problem? The problem is not the highway, it is the way we think about highways. Instead of thinking of the highway as a barrier between parts of the city, if we accept it and make it integral then we can address some of the problems that it has caused. This project accepts infrastructure not as a divider of the city but as a seam – an anchor that the city develops around.

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Chapter 1

Introduction

In the mid-20th Century cities entered a new phase of transportation with the implementation of new highways and infrastructure networks that brought great economic development at the expense of splitting existing communities and the city's previous networks of transportation. At the time considred a beacon of Modernism, this created a serious shift in the urban development of cities nationally.

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Both the rebuilding of infrastructure and the rollout of autonomous vehicles can occur as separate events, but to fully realize the potential of both they must be in relationship to each other as well as the urban environment. Infrastructure needs to address both current and future requirements for new modes of transportation and should be regarded not as a system of transportation planning and engineering, but should be read as objects of spatial content.

The city that has a potential for an architectural intervention in infrastructure replacement is Syracuse. What is Syracuse today? It's a city with a gash of a highway and a high quantity of parking surrounding it. This causes artificial divides and forced districts within the city. This

problem is not isolated to Syracuse. Other major and mid-size cities with an interstate highway running through it have this same problem. This thesis is a flexible methodology and framework that can be tailored to the specific requirements of each city.

Chapter 2

Hybridizing Infrastructure

Infrastructural systems are the enduring forms of urban evolution, expanding as cities expand to accommodate more monofuntional requirements, which overwhelms the urban landscape. Its immediate presence ends up shaping our built environment and in turn our urban lives.[1] Monofuntional infrastructure has its limitations, while hybrid infrastructure is resilient and able to offer a new mode of urban experience. For example, specialized services can be connected to major urban centers, and become accessible to less affluent and diverse communities via new lines of rapid mobility infrastructure.

Infrastructure should do more than deliver mono-functional services, it should be at the heart of the next generation's public sphere. Infrastructure should not have a limited agenda, but should yield to hybrids and multiple programs. New, robust infrastructure should become a local amenity with the goal of creating more livable, sustainable, and dynamic communities. New forms

of collective social infrastructure should be offered for services and spatial products within a system of intensified connectivity. The goal is to enhance area-wide mobility, to improve access to key destinations, and to improve connectivity of alternate modes of transportation, including pedestrian, bicycle, and transit.

At certain moments infrastructure can become more than a means of transportation, it can become public space. It's imperative to design in the public interest with forms of coexistence rather than looking to maximize one logic only (auto or rail use only, pedestrian only, etc.). Projects are meant to emphasize human-powered mobility, and that through the structure and organization of the system all can benefit. This project seeks to give an underutilized area in Syracuse a second life as a result of changes to infrastructural systems for greater public benefit.

Infrastructure Case Studies

Research for an infrastructural solution is based upon the four options laid out for the redevelopment of a nearly two-mile stretch of I-81 in Syracuse. City and state officials are looking into proposals for a trench highway, a tunneled highway, a relocation east with a boulevard replacement based on the street grid plan, or a rebuilding of the current highway to today's federal transportation standards for viaducts. The options presented here through case study cities will show which option is best for the city of Syracuse moving forward.

The open trench option idea was inspired by Cincinnati's 1995 replacement of Fort Washington Way (I-71) and I-75. The highway was modified to reduce negative impacts of the superstructure and its right-of-way footprint. Long, sloped embankments were replaced with vertical walls, and increased pedestrian sidewalks along widened streets above with new landscaping allowed for improved access to the riverfront of the city, which contains a waterfront park and stadiums of the Cincinnati's sports teams.

The positive effects of the trench modifications led to more connectivity and access between both sides of the highway, improved aesthetics to reduce the visual barrier, and it led to a reduction in noise pollution and the reduced footprint opened up space for parks and public spaces. The negative effects of the trench modification were the drainage and maintenance issues. Applied to Syracuse, there would be concerns about flooding and drainage as well as snow and garbage removal. Some Cincinnati residents felt there was minimal or no improvement over the existing condition of Fort Washington Way. For cost it is somewhat high with depressing a highway, and Cincinnati benefited from already having most of the highway depressed while Syracuse would have to build a whole new form. In the context of Syracuse, a depressed highway would continue to depress the value of the corridor and would potentially discourage investment and further degrade adjacent neighborhoods.

The second option presented is the relocation of the highway, modeled after Providence's mid-2000's replacement of I-195, known as "The I-Way." The replacement was able to enhance greenspace and improve waterfront access. With a strong focus on urban design, the city opened up development in the old footprint of the highway, able to reconnect neighborhoods to downtown and enable an attractive redevelopment of the urban core.

The relocation project did have some local impacts with eminent domain as well as economic and social disruption to the neighborhoods and businesses surrounding the new highway. For Syracuse, people feel there are no viable alternative routes for I-81 through the city, and relocation would be too costly a project for the city to undertake. Moving the Interstate function east to I-481 would simply shift the problem or a barrier to another neighborhood in Dewitt and take away Interstate travel from the city.

The third option is to reconstruct the highway to today's federal standards with an improved design, similar to Milwaukee's approach in the 2008 completion of the Marquette Interchange of I-94, I-43, and I-794. The project had noise and aesthetic impacts and affected

pedestrian movement, and the new highway structure emphasized clean lines and bright colors, as well as allowing for artwork along the embankments and substructure. The successful aesthetics allowed for public art and other visual amenities, making the highway less of a barrier. The Interstate functions remained, and the same conditions kept traffic off of local streets and maintained access to key destination sin the city. The project benefited significantly from public involvement and was the most cost-effective option.

Cons of the reconstruction of the Marquette Interchange were similar to the concerns of the old elevated highway. Aesthetics were greatly improved, but there was still a physical and psychological barrier, as well as air and noise pollution. The highway continues to occupy valuable real estate, and many people felt the opportunity was missed to improve the community and quality of life with new green space or major alterations by placing a focus on the human-scale of the city, not the car-scale.

The fourth option for improvement is based upon Boston's Big Dig, the 2007 tunneling of I-93 through downtown from nearby neighborhoods. The central lanes were replaced with a surface roadway and public parks, and a transit system upgrade to provide an alternative to car travel. As one of the most congested cities in America, the project prioritized pedestrian and street level mobility and significantly reduced traffic at the street level. The quality of life in the city greatly improved by creating new green space and reducing noise levels. While the highway was removed there was no sacrifice to mobility or connectivity.

The most glaring negative to a tunnel highway is cost. The Big Dig was extremely expensive and ran up to five times the initial cost of the project. A mid-size city like Syracuse would need better momentum towards economic growth to warrant such an expensive project. Another example of this is Seattle, where a current project to replace the Alaskan Viaduct Way has slowed to a crawl, after a scheduled 14 months of tunnel boring has ballooned to four years, including two years and two billion dollars' worth of costs to repair the boring machine. In

application to Syracuse, a tunnel doesn't fit the geography or climate of the area, and the city can't afford a multi-billion dollar project for tunnel boring. The tunnel would have to be ventilated, and most of the university and hospital commuters, two large traffic demographics for the city, wouldn't even use the tunnel based on the proposed entry and exit ramps.[2] From an economic standpoint, a smaller portion of that bill could be used for highway replacement and the rest for investment in the current institutions that drive the local economy.

The last option for highway redevelopment would be to completely remove the elevated highway and instead replace it with a grid plan street-level boulevard, modeled after the city of San Francisco. Completed between 1999 and 2005, the Central Freeway was removed and replaced by a multiway boulevard with central traffic lanes, tree line medians, walking paths, parking, slower lanes, and commercial investment surrounding the boulevard. It is similar in volume and viaduct length to the previous highway and takes half of the traffic the old freeway took. It became a more visually appealing environment and led to significant redevelopment and the revitalization of the downtown area. It was the most cost-effective solution in the long run as maintenance costs for the road are less expensive than those associated with a highway.

Despite those significant improvements, traffic operations on the boulevard increased travel times, which caused significant congestion downtown and shifted the traffic burden to other highways and local streets. Safety also became a concern because a long, heavily trafficked boulevard would actually reduce walkability and provide ales safe environment for pedestrians. With the rollout of autonomous vehicles, the plausible the amount of cars on the road will actually increase, causing more traffic problems at the street level.[3]

Feasibility and Technological Progression

Fixing or rebuilding the current failing infrastructure networks up to 2017 federal standards for highways and viaducts will only provide an ephemeral solution to an ever-occurring

issue plaguing cities. This would just kick the can down the road until the bridges need to be fixed again for evolving federal standards.

The nature of cars has changed tremendously since the highway's conception, including shifts in car weight, traffic volume, and a shift to the service economy. However, infrastructure rebuilding projects only catch up to the snapshot of transportation at the time of construction, never getting ahead of the issue.

The nature of automobiles will continue to change as technology and society progresses. Therefore, viaducts shouldn't get rebuilt to 2017 standards, they will be rebuilt to the standards of 2030 and beyond.

Based on the development of the I-81 viaduct alternatives, the two options most likely to be chosen from are to rebuild the viaduct to new federal standards, or the grid plan option. The other two options, the tunnel and the open-air trench, are not feasible due to the overwhelming expense, drainage and maintenance issues including snow removal, existing infrastructure lines running below grade that would need to be rerouted, and they wouldn't correspond with the geography and climate of Syracuse. Another option brought forward, the relocation of I-81 through 481 or another side of the city, is not feasible for costs to demolish then rebuild a new highway, the economic and social disruption caused be redevelopment and eminent domain, and the impact on traffic operations. This project will include a partial rebuilding of the existing I-81 viaducts to autonomous vehicle standards.

Of the two most realistic options, the grid plan option is least feasible due to the increased traffic from bringing the high volume of cars to street level. It also doesn't solve the issue of promoting foot and bicycle traffic and might actually discourage it with the increased traffic. Snow plows would also face more difficulty with the increased traffic on the streets.

Chapter 3

History of Syracuse Infrastructure

Syracuse grew increasingly due to its location as the center of the state as well as dependence on its resources that the economy was based off of, including salt. To transport goods as well as people west to Buffalo and east to Albany and eventually New York, new infrastructure lines were designed for the accompanying needs of Syracuse and the surrounding areas.

The Erie Canal and the railroad lines sprang up in the decades of the mid-1800s. These infrastructure lines ran through the center of the city in relation to the main streets of Syracuse as well as the surrounding landscape. The Erie Canal ran east to west and the train lines both east to west and north to south with all lines intersecting at the center of Downtown Syracuse. These networks influenced the surrounding streetscape, as new roads and the city grid were built in relation to the train network and the Erie Canal.

As the city evolved, the infrastructure lines changed with it, growing in tandem with the economic and social forces of Syracuse and Upstate New York. While the systems of infrastructure were monofunctional services, they ran in relationship to each other and to the context of the city. These megaregional constructs made the city accessible to all the residents of Syracuse and the surrounding areas.

The conception of the interstate systems of I-81 and I-690 were completed in the mid-

1960s. I-81 was deemed necessary to insure the city's economic and social health and to remain as the crossroads of New York State. In most places running through the city the transportation networks were not constructed as arbitrary lines; they were drawn up in relation to the existing lines of infrastructure in the city including major roadways and train lines as well as in regards to the landscape.

While not conceived of as a consequence, the bulky elevated viaducts ran through communities and areas of economic importance in the city, with off-ramps peering off into locations not in relationship to the importance of the streetscape below, and the highway system as w hole slowly eroded the city fabric. Over the decades this created a growing social and economic divide in the city of Syracuse. Syracuse University, one of the main economic generators of the city, was effectively cut off from the Westside and Downtown. The northern side of the city became its own district, separate from the southern side of the I-81 and I-690 interchange.

The highways were designed based off of existing infrastructure lines but still resulted in a furthering divide of the city. The elevated viaducts created a dark side underneath that effectively served as a symbolic wall to the unified growth of the city. As the highway's traffic volume increased due to the rise of more commuters and travelers in the growing suburbanization of Upstate New York, older infrastructure lines became disused and eventually obsolete. The Erie Canal was no longer of economic importance as transportation evolved and became more efficient, but the train lines in the city also receded to the outskirts of the city, including the movement of the main train station to the north side of Syracuse.

The fixed population of the city also began to spread over twice as much terrain. "From 1982 to 1997 the Syracuse metropolitan area grew by only 2% in terms of population, but it sprawled to cover 43% more land."[4] Sprawl is a serious issue that can be attributed to real estate as well as to highways that create travel over greater urban distances yet simultaneously creates a barrier between focal points of a city. Increased density of developments within blocks

of each other can mitigate the issue of urban sprawl.

Chapter 4

Erasure of the Urban Fabric: The History of the 15th Ward

Today the elevated highway separates the university and hospitals from downtown, with dark and clogged streets underneath, surrounded by parking lots and unused space. This area used to be a dense neighborhood in the middle of the city as a strong community, but the 15th Ward district was razed for the construction of I-81 and large-scale urban projects.

Post-World War II, many African-Americans moved to Northern cities, where in Syracuse they settled in the 15th Ward, a neighborhood adjacent to downtown, forming a tight-knit community. Through the 1956 Federal Highway Act, the state approved a $500 million bond for a project that would raze the ward and erect I-81, essentially bisecting downtown. The city chose the area because it was the least costly option for the city to buy for redevelopment through eminent domain. Essentially separating Syracuse in two and destroying a close-knit community was not of concern to local leaders because it was argued that the city would grow through

construction and for people to easily commute to downtown from outlying areas.

As an unintended result, poverty increased in the city and many residents fled to the suburbs and nearby towns. In 1969, Syracuse's poverty was 72nd in the nation of cities with a population of 100,000 or more. Today the city has some of the highest concentrations of poverty for minorities, particularly African-Americans. Upper- and middle-class city residents moved to the suburbs as a result, many of them white. From 1950 to 2010, the white population in Syracuse fell almost 70 percent while the black population grew from 4,500 to 42,000.[5]

Long-time Syracuse residents have seen most black-owned small businesses disappear over the years. These neighborhoods with the highest concentrations of poverty tend to have worse schools, fewer businesses (there not being enough consumers with disposable income to sustain them), and more violence. "There are no supermarkets here, just small convenience stores that advertise that they sell cigarettes and accept food stamps."[6] Urban sprawl is a serious concern for the city, covering more land with less usage.

The highway did contribute to the city's demise, but it is not the primary reason. The city was seriously impacted by economic conditions, the decline of manufacturing, and the closure of major plants, including Carrier in the mid-2000s.

Chapter 5

The Future of Infrastructure

Numerous portions of I-81 and I-690's elevated viaduct series are severely deteriorated due to age and wear and are nearing the end of their useful service life. "This is particularly evident in the metropolitan Syracuse area, where the infrastructure is deteriorating and there are many highway design features that are non-standard by today's standards."[7] 60% of I-81 and I-690 bridges are classified as 'functionally obsolete:' lane widths, load carrying capacity, clearance, approach roadway alignments don't meet current bridge standards. 9% of bridges are classified as 'structurally deficient' in need of rehabilitation or are restricted to light vehicles.

According to the I-81 Corridor Study by the New York State Department of Transportation, it is recommended that all bridges from the 1950s and 1960s era be replaced rather than rehabilitated due to their overall age and condition due to use and climate effects. Currently, the traffic conditions in Syracuse are subpar, as the I-81/I-690 Interchange has sections where the accident rates reach five times the statewide average within a 1-2 mile span. The non-standard design features in this area contribute to the above average rates. This proposal will seek to alleviate traffic conditions through smart design and the implementation of autonomous vehicles.

Autonomous vehicles will have profound impacts on the form of our urban environments, fundamentally reshaping infrastructure and the land use in cities. The full potential of the new transportation cannot be realized without implementing significant changes to our current city environment.

With cars being able to drive themselves, this will lead to decreased car ownership and the ability to create an autonomous shared fleet system. Autonomous vehicles have the ability to bridge the divide between public and private transportation, with the implementation of a shared fleet system, which could run at a public transit-like organization. Autonomous vehicles, along with driver-led cars, can operate in both urban and suburban contexts, on highways or country roads, and any type of infrastructure supportable for automobiles. This proposal will focus on the urban

implications of autonomous vehicles, particularly in Syracuse.

As previously stated, the real barrier to autonomous vehicles is in infrastructural rather than technological progress. Autonomous driving provides a plethora of advantages, from reduced traffic congestion on roads, mitigated emissions, to improved safety with the reduction and eventual elimination of human error in driving.

Chapter 6

Moving Forward: Approach to Integrating AV Infrastrucure in Urban Environments

What is Syracuse today? It is a city with a gash of a highway and an absurd quantity of parking surrounding it. This causes artificial divides and forced districts within the city. This problem is not isolated to Syracuse. Other major and mid-size cities with an interstate highway running through it have this same problem (Cincinnati, Pittsburgh, Providence, etc.) Open land is scarce in cities, but what happens when it becomes available over time? Autonomous vehicle technology has the potential to mitigate infrastructure's footprint and parking structures as they increase in usage. This thesis will provide a flexible methodology and framework that can be tailored to the specific requirement of each city.

In an urban environment, there are three distinct domains. The city fabric as a whole, the infrastructure of a city, and the adjacent spaces to the infrastructure. Cities flourish. They grow and develop over time. Infrastructure is stagnant or in slow decline, a snapshot of the city at the time of construction. The spaces surrounding the infrastructure are dead space. It's unused or

unwanted, often seas of parking lots.

Cities grow and evolve over time. They are organic and continually undergoing operations and transitions. Why does infrastructure not respond to the inherently changing city?

The objective of this project is to mend city fabric to match developing needs and the strategy of doing so is to advance the city through low rise and high density surrounding and within union of the city's infrastructure. Development should be approached on the different planes of the city: the ground, the viaduct, and the air in span.

The ground deals with the existing fabric to redevelop blocks and streets with community stores. Ground program will also support and benefit AV technology and organize with the preexisting fabric as open space allows. This is important because new infrastructure will offer a lot of empty ground and unused structure. Parking lots will become vacant, and parking garages will become abandoned structures. The city will benefit from low rise and high density to encourage mixed-use areas and pedestrian traffic around the site. Repurposing can also create a character of place and join better with the densification of streets and blocks – facilitating a community-based and context approach to Syracuse's development.

At the viaduct level, the highway plane above allows for the efficient travel of vehicles without interfering with the ground context. The old infrastructure can be partially spared and repurposed for new transportation: foot traffic, to increase circulation within the city and ease of access to the site.

Above the viaduct would be the last zone of the city to be developed. By increasing density on the ground with commercial developments, housing and residences can be above the ground commotion and the highway lines. As the city develops over time, low rises can increase in size to high rises. This creates flexibility, aggregation, and organic development from a central anchor space: the highway infrastructure.

This project accepts infrastructure not as a divider of the city but as a seam – an anchor that the city develops around. Building up the density of Syracuse can help mend a broken city fabric while accepting new driverless technology and its accompanying infrastructure can propel the city and its economy forward. By being in unison with new autonomous vehicle infrastructure, the urban environment can develop naturally while restoring what needs to be repaired.

Endnotes

1. Weiss/Manfredi, *Public Natures: Evolutionary Infrastructures (*New York: Princeton Architectural Press, 2015), 162.
2. Ben Walsh, "Urban design and public policy perspectives on the choices for renovating or rerouting the I-81 elevated highway in Syracuse, NY," (symposium, Presentation at Future Infrastructures: The Over and Under of I-81, Syracuse, NY, March 22, 2018).
3. Eric Jaffee, "How Driverless Cars Could Make Traffic Dramatically Worse," CityLab, January 25, 2015, Web.
4. Preservation Association of Central New York, "Sprawl," *Syracuse Then and Now,"* Web.
5. Alana Semeuls, "How to Decimate a City," *The Atlantic*, November 20, 2015, Web.
6. Ibid.
7. Federal Highway Administration & Syracuse Metropolitan Highway Council, *The I-81 Corridor Study.* (Albany: New York State Department of Transportation, July 2013), 11.

Bibliography

Articles

Cuff, Dana. "Architecture as Public Work." In *Infrastructure as Architecture: Designing Composite Networks.* Berlin: Jovis, 2011.

D'Hooghe, Alexander. "The Objectification of Infrastructure: Elements of a Different Space and Aesthetic for Suburban America." In *Projections 10: Designing for Growth and Change.* Cambridge: MIT, 2011.

Gutfreund, Owen. "Rebuilding New York in the Auto Age: Robert Moses and His Highways." In Robert Moses and the Modern City: The Transformation of New York, ed. Hillary Ballon & Kenneth T. Jackson. New York: W. W. Norton & Company, 2007.

Kamell, Elizabeth and Roberts, Jacob. "Downtown 'Transformation' Must be Guided by Urban Vision." *The Post-Standard* (Syracuse, NY) Sept. 14, 2003.

Jaschke, Karin. "City is House and House is City: Aldo van Eyck, Piet Blom, and the Architecture of Homecoming." In *Intimate Metropolis: Urban Subjects in the Modern City.* Ed. Vittoria Di Palma, Diana Periton, & Marina Lathouri. New York: Routledge, 2008.

Thun, Geoffrey & Velikov, Kathy. "Conduit Urbanism: Retooling Regional Ecologies of Energy and Mobility." In *Infrastructure as Architecture: Designing Composite Networks.* Berlin: Jovis, 2011.

Books

Chakrabarti, Vishaan. *A Country of Cities: A Manifesto for An Urban America.* New York: Metropolis Books, 2013.

Koolhaas, Rem. *Delirious New York: A Retroactive Manifesto for Manhattan.* New York, NY: The Monacelli Press, 1978.

Jacobs, Jane. *The Death and Life of Great American Cities.* New York: Random House, 1961.

Lloyd, Scott & Stoll, Katrina. *Infrastructure as Architecture: Designing Composite Networks.* Berlin: Jovis, 2011.

Lynch, Kevin. *The View From the Road.* Cambridge: The MIT Press, 1965

Le Corbusier. *Le Ville Radieuse.* Boulogne: Seine, 1935.

Schorske, Carl. *Fin-de-Siecle Vienna.* New York: Alfred A. Knopf, Inc., 1979.

Weiss/Manfredi. *Public Natures: Evolutionary Infrastructures.* New York: Princeton Architectural Press, 2015.

Maps and Documents

Advisory Design Panel Report. "Redevelopment Proposals for Sites No. 2, 2a and 3: Near East Side Urban Renewal Project NYR-30." Department of Urban Improvement, Syracuse, 1963.

Atlas of the City of Syracuse, NY. JW Vose, Syracuse, 1892.

Atlas of the City of Syracuse, NY. GM Hopkins, Syracuse, 1924.

Atlas of the City of Syracuse, NY. GM Hopkins, Syracuse, 1938.

Central New York Regional Planning & Development Board. "Syracuse Metropolital Area Land Use Analysis." Syracuse-Onondaga County Planning Agency, Syracuse, November 1970.

Clarke, H. Wadsworth. "Map of the City of Syracuse." Andrew Boyd for the Syracuse City Directory, Syracuse, 1873.

"General Plan Area Characteristics." In *Existing Land Use Syracuse*. City of Syracuse Department of Planning, Syracuse, February 1967.

"Syracuse Hill Neighborhood Development Plan." Syracuse Urban Renewal Agency, Syracuse, 1961.

Walsh, William and Central Syracuse GNRP Executive Board. "Central Syracuse: A General Neighborhood Renewal Plan - Part 1 Development Policies and Objectives." Syracuse Urban Renewal Agency, Syracuse, October 1964.

Reports

Federal Highway Administration & New York State Department of Transportation. *I-81 Viaduct Scoping Report.* U.S. Department of Transportation. April 2015.

Federal Highway Administration & Syracuse Metropolitan Highway Council. *The I-81 Corridor Study.* New York State Department of Transportation. July 2013.

National Association of City Transportation Officials. *Blueprint for Autonomous Urbanism.* NACTO. Fall 2017.

New York State Department of Transportation. *Draft Final Technical Memorandum #1: Physical Conditions Analysis.* NYS Department of Transportation. January 2011.

New York State Department of Transportation. *Draft Final Technical Memorandum #2: Strategic Development and Evaluation.* NYS Department of Transportation. July 26, 2013.

Syracuse Metropolitan Transportation Council. *Case Studies of Urban Freeways for the I-81 Challenge*. SMTC. February 2010.
United States Census Bureau. *United States Census 2010.* U.S. Department of Commerce. 2010

Symposiums

Walsh, Ben. "Urban design and public policy perspectives on the choices for renovating or rerouting the I-81 elevated highway in Syracuse, NY." Presentation at Future Infrastructures: The Over and Under of I-81, Syracuse, NY, March 22, 2018.

Web

Adams, Eric. "A Sorta-Self-Driving Mercedes Tackles America's Greatest Fear: The Roundabout." *Wired*. July 18, 2017. Web.
Deshaies, Jaosn. "Case Studies: New video highlights projects in other cities." *Syracuse Metropolitan Transportation Council*. April 15, 2011. Web.
Deshaies, Jason. "Case Study Review: What workshop participants thought about Cincinnati's Fort Washington Way." *Syracuse Metropolitan Transportation Council*. December 16, 2011. Web.
Ferguson, Isis. "9 Principles of Ethical Redevelopment to Consider in Order to Improve Communities, Not Gentrify Them." *ArchDaily*. January 30, 2018. Web.
Flint, Anthony. "Infrastructure's Big Moment is Coming." *CityLab*. May 8, 2017. Web.
Marshall, Aarian. "Trump's $1 Trillion Can't Fix US Roads - These Ideas Could." *Wired.* May 18, 2017. Web.
Metz, Cade. "How Driverless Cars See the World Around Them." *The New York Times.* March 19, 2018. Web.
New York State Department of Transportation. "I-81 Viaduct Alternatives." *Official New York State Portal.* Web.
Preservation Association of Central New York. "Downtown Syracuse." *Syracuse Then and Now."* Web.
Preservation Association of Central New York. "Forman Park." *Syracuse Then and Now."* Web.
Quintal, Becky. "Smart Moves for Cities: The Urban Mobility Revolution Will Start With These 3 Projects." *ArchDaily.* November 25, 2015. Web.
Semuels, Alana. "How to Decimate a City." *The Atlantic.* November 20, 2015. Web.
Shepardson, David. "House Unanimously Approves Sweeping Self-Driving Car Measure." *Reuters*. September 6, 2017. Web.
Stewart, Jack. "Tesla's Model 3 is Here, and It's Much More Than an Electric Car." *Wired.* July 29, 2017. Web.
"The Plan for a Strong and Just City." *#OneNYC*. 2017. onenyc.cityofnewyork.us/.
Washington, Robin. "Autonomous Vehicles Will Mean the End of Traffic Stops." *Wired.* September 30, 2016. Web.