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I, David Burgei, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture.

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Autonomous Edge Cities:
Revitalizing Suburban Commercial Centers with Autonomous Vehicle Technology and New (sub)Urbanist Principles

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Autonomous Edge Cities:
Revitalizing Suburban Commercial Centers with Autonomous Vehicle Technology and New (sub)Urbanist Principles

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Abstract

Edge cities, suburban commercial districts on the outskirts of larger metropolitan areas, have always been centered on the convenience of accessibility. Due to the personal automobile often being the only means of transit in these suburban zones, edge cites today are dominated by wide-multilane streets, and expansive parking. This convenience for the driver comes at the expanse of pedestrian traffic, public space, and urban connection.

The rapidly emerging technology of driverless vehicles will prove to change the focus of edge cities. Driverless vehicles will be safer, and travel more efficiently than cars driven today. Without the need for convenient parking, and clear delineation of vehicle and pedestrian zones, edge cities can become richer, more pedestrian friendly environments, while retaining and improving upon current benefits of easy accessibility.

This thesis explores the recent advancements of autonomous vehicles, and the opportunities they create for people and urban design. These opportunities are integrated with principals of New Urbanism to develop a revitalization of Tri-County, an edge city of Cincinnati, OH.
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Introduction

Humans have always adapted and constructed our built environments to reflect our preferred method of transportation; towns sprouted up along railroads, and public transit hubs have become important landmarks in major urban centers. Edge cities, the suburban commercial districts on the periphery of metropolitan areas, are the latest reflection of the American automobile. The proliferation of personal mobility encouraged a sprawl of single family homes, away from their city centers and cores. Amongst this sea of housing, new areas of commerce began to form, providing easy access to shopping and commerce, closer than the city core and with easy access for the automobiles required to get there. These developments are sometimes referred to as edge cities, preforming many of the roles of the central city, but on the periphery of the metropolitan limits. The ample vehicular access edge cities provides requires vast parking lots, and wide road lanes. This often comes at the expense of the civic roles traditional urban centers provide, including public gathering spaces, pedestrian friendly streets, and a natural connection of spaces.

The advent of autonomous vehicles (AVs), vehicles that can safely operate in any situation, without the need of a human driver, may prove to be the most transformative event in transit and urban design since the introduction of the automobile and the national highway system. Cutting edge companies, such as Google, Audi, Apple, and Tesla are researching and investing in technology to make these self-driving vehicles safe and convenient. As these vehicles realize their full potential, and replace the traditional personal automobile, a unique opportunity to transform and retrofit our existing car-centric edge cities arises. Without the need to cater to the human driver’s potential for error, need for convenient parking, and clear
separation of space, edge cities now have the room, and ability, to introduce new functions that can allow them to become thriving communities for living and working.

**The Car**

The dream of autonomous vehicles has been on the mind of consumers ever since the technology was depicted in General Motors’ *Futurama* exhibit at the 1939 World’s Fair. In the years since, there have been many experiments and advancements to make this dream a reality. Initially, deficiencies in communication and sensor technology limited the pace of breakthroughs. Momentum began to accelerate in 2004, when DARPA hosted their first “Grand Challenge’, a rigorous 150-mile course through the Mojave Desert for completely unmanned vehicles. In the first year, none of the fifteen vehicles completed the course.\(^1\) By the next year, five of twenty-three teams completed the challenge, signaling a shift in understanding in the burgeoning technology. Google began their experiments in AVs in 2010, by combining existing AV technology with their mapping technology. What many consider to be the first consumer-grade self-driving technology became available in 2016, when Tesla released their “Autopilot Mode” via software update to existing cars. This move has caused renewed mainstream discussion into the premise and details of a future with autonomous vehicles.

In 2014, to help establish an understanding regarding the advancement of autonomous driving, the National Highway Traffic Safety Administration established levels of automation along the technology’s progression\(^2\). Levels 0 – 2 are already standard technology in vehicles on sale today. The first is level 0, which has no level of automation whatsoever. At this level

\(^1\) (Lipson and Kurman)  
\(^2\) (National Highway Traffic Safety Administration)
the human driver has full control over all car functions. Level 1 automation introduces function-specific automation, which are single automated functions that work independently from one another. Examples of level 1 automation include cruise control and parking assist, nearly standard features today, that the driver can turn on and off. Level 2 automation combines two or more automated functions to work together. This can be seen in functions like adaptive cruise control, which can sense traffic flow and automatically adjust cruising speed.

Level 3 automation brings us to a point that begins to feel “driverless.” At level three, drivers can give up full control of the vehicle under particular traffic and environmental conditions. While the driver is hands off, the driver/passenger must remain ready to take control in a matter of seconds. Tesla’s “Autopilot”, and Uber’s experimental AVs currently operate at level 3. While these examples have proven relatively successful, concerns have been raised that level 3 vehicles will give drivers a lessened sense of responsibility for the care, regardless of the need to remain alert at all times.

Level 4 automation begins when the vehicle is able to handle most driving situations, during which the driver is relieved of his need to remain alert. Only in unique conditions is the driver required to keep alert or take-over.

At level 5 automation, the vehicle is completely capable of driving itself in practically any situation. The “driver” of the vehicle no longer has any expectation of actually controlling it. It is at this level that we can fully call a vehicle autonomous, and any of the benefits of AVs become available. However, while we may be very close to having automation that works in 90% of circumstances, reaching full automation may still take time.
(Figure 2) Sensor and Cameras on Autonomous Vehicles- New York Times
Modern AVs use a combination of Radar and Lidar imaging to provide the onboard computer with a detailed view of the surrounding terrain and hazards. This view is compared with the view from satellite maps and pre-recorded street view to ensure the vehicle remains on course. To achieve level 5 automation, the artificial intelligence needs to be more robust to work out the logic of complex edge cases, and unpredictable situations such as determining a grocery bag moving in the wind, from a small mammal crossing the road. Tesla CEO, Elon Musk described “the true problem of autonomy getting a machine to be 99% correct is relatively easy, but getting it to be 99.9999% correct, which is where is ultimately needs to be, is vastly more difficult. ... Making such mistakes at 70 mph would be highly problematic.”3 However, given the exponential historical growth rate of artificial intelligence, achieving this level of intelligence would seem to be a mere inevitability. AVs will need to be able to automatically communicate with each-other and with the road itself. This may require significant roadway infrastructure investments, and may be the largest hurdle to leap, in order to attain a seamless, driverless transit network.

Once level 5 AVs are ready for the mass market, they will quickly become the standard, and the transition from human driving to an exclusively automated driving system will be in full motion. According to a report by the National League of Cities, only six percent of major US cities are currently considering self-driving vehicles in their long term transportation plan.4 As the major transition from driven to autonomous vehicles takes place, over the course of about ten years, cities will have to plan for how self-driving vehicles will interact with personal driving

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3 (Lipson and Kurman)
4 (National League of Cities)
vehicles. Although AVs will be able to interact safely with driven vehicles, and operate in existing street networks, major benefits of efficiency and traffic reduction may not be felt until AVs are able to interact on a network with each other, not having to make concessions for the human driver. In order to capitalize on AV efficiencies during this transition, highways may have to be divided into driving and AV lanes to accommodate different speeds and inter-car spacing. Parking will have to be reduced carefully, to make cities as accessible and walkable places, but still allow for reasonable parking for remaining driving vehicles. The auto industry expects AVs to be fully proliferated, and the population of traditional vehicles to be negligible, around the year 2035.\(^5\) Thus, cities should be considering the effects of AV in infrastructure and master planning now.

**Initial Impacts of AV Technology**

AV technology will prove to be a massive disrupter to many industries centered around transportation. Already, AV is being implemented on commercial scales in simple predictable environments. In the remote and desolate Australian outback, mining companies use large automated dump trucks to transport materials from mines to processing locations.\(^6\) Semi-truck driving will become almost entirely automated, allowing for flexible and efficient delivery. In August 2016, Uber purchased the truck driving startup Otto, to develop and integrate AV technology into existing trucks, and apply them to the logistical challenges of the industry.\(^7\) Without concerns for driver scheduling, commercial transportation will be able to make ground deliveries quicker, and on a more dependable schedule.

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\(^5\) (Bhuiyan)  
\(^6\) (Clark)  
\(^7\) (Woodall)
A large impact AVs will bring to the daily life of typical citizens, particularly those residing in the suburb will be in a shift from vehicular ownership, to a shared vehicle subscription service. Ride-hailing services, such as taxis or Uber, will see a significant reduction in costs with the integration of AV technology. Today, the majority of the fare for a yellow taxi or Uber goes to paying the driver. Without the driver, fare will only need to cover the cost of fuel, and the depreciation of the vehicle to turn a profit. Because the industry is extremely competitive, prices for consumers are expected to plummet. A 2013 report by the Earth Institute at Columbia University suggests that autonomous taxi cabs in New York City could charge as little as $0.50 per mile, one eighth of the current price of a driven taxi cab\(^8\). Some predict this price getting even lower. Tasha Keeney, an industrial innovation analyst with ARK Investment Management, expects fares to go as low as $0.35 a mile for a typical autonomous midsized vehicle.\(^9\)

With AV technology making ride hailing rates so low, it is reasonable that many citizens will question the concept of vehicle ownership in the future. In 2016, the American Automobile Association estimates the cost of vehicle ownership on a traditional medium sedan driven 15,000 miles annually to be around $8,600.\(^10\) This figure accounts for operating costs such as fuel, maintenance, and tires, as well as the ownership costs of insurance, finance, depreciation, and registration. If we assume the hailing rate of $0.35, a passenger can take a self-driving taxi for over 24,000 miles for the same price as owning a car driven 15,000.

\(^8\) (The Earth Institute) \\
\(^9\) (Huston) \\
\(^10\) (American Automobile Association)
Due to low utilization of personal vehicles, unmanned vehicle sharing services will prove to be more cost efficient than ownership for a wide swath of current vehicle owners. While expected costs for driverless ride hailing services varies, this diagram predicts the effective range of these services for a daily commute at various process per mile.
Apart from this argument, ideas of driving and vehicle ownership have already begun to change in US drivers, even without the proliferation of AV technology. In 1980, 66 percent of all seventeen year-olds had their driver’s license; that number had dropped to 47 percent by the year 2010. In 1985, people between the ages of twenty-one and thirty-four purchased 38 percent of new cars that year; in 2010, the same demographic accounted for only 27 percent.11 Studies like this suggest that younger generations are not as heavily invested in their vehicles, financially or emotionally, as their previous generations were, and are more likely to consider ride sharing or ride hailing as their primary transit method. Major automobile manufacturers, including Ford, GM, Audi, and Tesla, are anticipating this shift in automotive culture and are beginning to explore ways to pivot from their traditional role as car manufacturing companies, to mobility companies.

As more and more citizens opt for ride hailing, benefits of the service will begin to increase. Increased ridership will increase fleet size of the services, this will dramatically reduce wait time for the passenger, and empty driving costs (driving with no passengers, earning no fare) for the vehicle. A larger fleet will allow for a greater diversity of specific-purpose vehicle designs.12 Someone commuting into work with their neighbor can opt for a small two seated vehicle, while a family about to leave on a trip can call in a minivan with car seats pre-attached.

A considerable, but declining, segment of the population considers their vehicle choice as a status symbol, or reflection of their character. To satisfy these consumers, many vehicle

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11 (Gallagher)
12 (Litman)
service subscriptions will be brand based, giving users willing to pay a premium, access to luxury vehicles with a Lexus, or Mercedes Benz subscription.

Automated Vehicle technology will allow newfound mobility to segments of the population that were isolated by their inability to drive, because of our increasingly sprawled world. This population includes the economically disadvantaged, who cannot afford the high initial investment of purchasing a car; young people who cannot get a driver’s license, and rely on parents to chauffeur them from place to place; as well as the elderly and disabled who have lost their ability to drive. In a November, 2015 report by the National Council on Disability, Chairmen Jeff Rosen remarked the following:

“The potential benefits of autonomous vehicles can hardly be more significant. Indeed, autonomous vehicles will change the world for everyone, but the most dramatic impact could be for people with disabilities and people who are aging, provided that their needs are understood and technology solutions are paired to meet such needs. Inaccessible transportation remains one of the biggest deterrents to employment and community involvement in the United States. Accordingly, autonomous vehicles have the potential to become an essential component of their independence, economic development, and well-being. Autonomous vehicles hold great promise to advance all places that Americans go each day. They offer the possibility of ending the isolation that many people who are aging experience by keeping them connected to others and to activities that are often lost when we lose the ability to drive.”

13 (National Council on Disability)
Autonomous vehicles will change the way we think about transportation. The simplicity and convenience of the technology will make many reconsider traditional methods of driving, and even models of vehicle ownership. This, paired with the new found mobility of populations unable to drive, will allow us to be more flexible in how we move about.

The Street

Currently, the urban plan of most American cities is dominated by the accessibility of the automobile. While adapting to the population’s apparent preferred transportation methods is logical, cities have become less walkable as they have expanded and spread out to a scale that fits the automobile. In many environments, this vehicle-centric method of movement becomes the only practical method. Vehicular traffic cuts into our most bustling gathering spaces, and parking takes up a very large amount of prime real-estate. In the United States, parking infrastructure covers approximately 5,000 square miles, an area larger than Puerto Rico. According to Eran Ben-Joseph, in his book, ReThinking a Lot, in many cities, surface parking lots can occupy over a third of the metropolitan foot print. This massive amount of parking is often required by the city, in codes that require a certain number of parking spaces per tenant/customer, regardless of the availability of public transit. The result is a large portion of the city not meant for human occupation, other than to get to your car. 14

One of the clearest benefits of level 5 AVs is the potential reduction in congestion in cities, as self-driving cars will be able to negotiate intersections and crowded streets more efficiently. Autonomous cars would have the ability to communicate with each other, meaning they would be aware of each other’s movements, and could move around each other without

14 (Ben-Joseph)
stopping. Even without any improvements to infrastructure to handle increased speeds, experts estimate a 300% increase in efficiency on our roads\textsuperscript{15}. The SENSEable City Lab at MIT predicts traffic lights will become a thing of the past as cars will communicate with each other at intersections, in an automatic method similar to air traffic control. This benefit could also extend to highways, which could then become both safer and faster.\textsuperscript{16} While benefit are present with minimal improvement to the existing road system, a reimagining of the road system can not only increase safety and efficiency, it also allow for new life and activity along the street, as will be discussed in a later chapter.

**The Suburbs**

Perhaps nowhere else will AVs alter the form on a large scale, then in the suburb, a neighborhood typology that was born from the mobility of the automobile. While discussing her book, *The End of the Suburbs*, Leigh Gallagher posits: “Our housing pattern has always been arranged around our transportation, because you have to be able to get around.” This simple thesis helps us understand how the sequence from the horse, to the streetcar, to the personal automobile, has allowed cities to expand, thus spilling into the suburbs. It is in the suburbs that we can see how the automobile has most clearly effected how we live. Convenience of parking and driving has made our houses, and commercial centers spread out. In many places simply walking to a building next door is not even considered due to the far distances between buildings, and the speed of vehicle traffic.

\textsuperscript{15} (Baumgardner)
\textsuperscript{16} (Alter)
In *The End of the Suburb*, Gallagher suggests people are beginning to leave the suburbs to escape the long and costly commute, and seek places with a better sense of human scale, “a place where you can walk to get a cup of coffee.” Gallagher began her research after discovering that the growth in cities began to outpace the growth in suburbs, in 2011, for the first time in one-hundred years.¹⁷ Gallagher makes the point that people’s attitude to the American Suburb is changing, and this is without considering AV technology. How will the suburb and the attitudes about it continue to change as we are introduced to a new paradigm shift in transportation?

The suburb was envisioned as a refuge from the industrial nature of the city, but this vision has been transformed by the desire for personal space, and a convenient driving experience, to a land completely dominated by the automobile. For this reason, suburbs above all urban typologies are likely to see the largest transformation from self-driving technology. Suburban road networks, as well as building and parking typologies are going to see potential transformations.

Many buildings in the suburbs are designed as objects, set back from the street, to be viewed on all sides. These buildings, as objects, serve only a single purpose, an office, a grocery store, etc. Part of this form is the intent of the architect and property owner to express the buildings use and make it instantly identifiable to drivers who can only afford a quick glance as they drive past. This kind of design is encouraged by large parking lots and winding streets. Design moves such as these favor the individual building, but cause the surrounding community to suffer, as connections and reactions are lost.

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¹⁷ (Gallagher)
Tri-County currently emphasizes vehicle traffic and parking as the almost exclusive means of travel on the site.
Even though people may be willing to commute further, creating more suburbs, AV technology has an even greater potential to transform suburbs, particularly at a time when a change in focus is needed, as Gallagher has shown. The modern suburb was born from, and continues to evolve around, a convenient driving experience. Today, this results in business areas whose chief concern is easy flow of traffic and ample, stress-free parking. The resulting strip-malls and drive-thrus feature parking lots are three times the size of the locations they serve, and little to zero expectation of pedestrian traffic. In the future, we can densify these areas to give them an urban-like appeal, bringing stores closer to the road, and moving any needed parking away from the front door.

The Future of the Suburb and New Urbanism

To suggest that suburban commercial districts are designed for the car is somewhat disingenuous. Cars do need paved roads, and considerable turning radius to properly maneuver, but the parking, wide lanes, access roads, and general sprawl are more directly designed for humans driving cars to be able to do so safely. Typical suburbs existing today feature primarily single use buildings, requiring single purpose trips with the car. Even during a single shopping trip, a visitor is likely to get in the car and move several times in order to avoid venturing across vast parking lots or streets void of sidewalks to arrive at a new destination. Once the intended purpose of the trip in complete, the visitor has little reason to linger, wander into new shops, or interact with others in the area.

The clearest benefit of this type of commercial zone is hassle-free, convenient vehicle access and parking, and much has been sacrificed to maximize this benefit. However, once
humans are removed from the stresses driving, and close-proximity parking no longer needs to be considered, these benefits will become largely irrelevant, leaving little desirable on the site as-is. However, the opportunity for infill redevelopment provides a strong opportunity to reintroduce civic elements missing in the American suburb.

The practices of New Urbanism are quite applicable to areas centered around the driverless car. New Urbanism is an urban design movement that values environmentally friendly, walkable neighborhoods, with buildings that share a close relationship to each other and the street. New Urbanism seeks to create stronger communities, through the creation of public space, management of sprawl, and the connectedness of the environment. A building should not be considered separate from its street, nor the street separate from the block. New Urbanism has always understood the challenges automobiles can have on pedestrian life, and have made efforts to limit its dominance where possible. Soon, autonomous vehicles allow us to fully separate the needs of a car from its driver as well as plan mobility by foot and vehicle in whole new ways.

A goal of New Urbanism is to allow travelers to be able to do more per trip, without needing the retreat to the car, by planning a diverse mixture of building types in a walkable area. In *Retrofitting Suburbia*, Ellen Dunham-Jones estimates that it is realistic to assume such development can allow for a 30% cut in vehicle miles traveled compared to communities for a similar size. In Atlanta, GA, where the average employed resident drives 66 miles per day, employees who work at the compact, mixed-use development of Atlantic Station average only 10.7 miles per day, residents average a mere 8 miles per day.18

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18 (Dunham-Jones and Williamson)
A cornerstone in the development of many New Urbanist communities is easy access to public transit, such as a streetcar or subway system, as it allows users cheap mobility without the need for vast swaths of parking. While ideal in communities that have the population to support such transit systems, the initial public investment of land, time, and money make such projects a challenge to see to completion. In lieu of such public infrastructure, AVs will prove to be a flexible and beneficial alternative, with a fraction of the initial investment. The benefits of a rail-line can be substituted with existing interstates and highways, which will run faster and more efficiently than they currently do.\(^{19}\)

In ways mentioned, the challenges of decline of the modern suburb, and the opportunities in the rise of AVs meet at a point that makes the implementation of New Urbanism easier and more beneficial than ever before. Suburban grey fields in edge cities will become an ideal, and flexible, locations to serve suburban neighborhoods with services and spaces needed to make a stronger community to live and work.

\(^{19}\) (Zakharenko)
The Site

Cincinnati’s Tri-County area is an ideal area to target for redevelopment and densification centered around AV technology. Located just inside the northern tip of Cincinnati’s outerbelt (I-275) along Princeton Pike, the 380 acre area features nearly all building uses and types found in a typical suburban edge city, including strip-malls, car dealerships, and big box stores. The area’s most commanding feature is an enclosed shopping mall. Originally built in 1960, the Tri-County Mall has seen multiple additions and today has a leasable area of 1.3 million square feet. On the southern end of the site sits an office park of seventeen office buildings, three to four stories each, surrounded by ample parking. The commercial area is surrounded by the community of Glendale to the south, Springdale to the west, industrial areas of West Chester to the north, and I-75 to the east. Adjacent to the south-east of the site lies a 150 acre park that includes the Oak Hill Cemetery, and Tri-County Golf Ranch.

An increase in vacant retail buildings at Tri-County suggest an edge city in need of transition. A steady stream of vehicular traffic flows along Kemper Road and Princeton Pike, yet big box stores and strip-mall tenants remain empty. The Tri-County mall was bought out of foreclosure in 2013 and is currently in the process of a 35-million-dollar improvement process. Even though the mall has continued interest from tenants and a somewhat steady stream of shoppers, owners of the building admit the mall likely has more rentable retail space than it needs.²⁰
(Figure 5) Tri-County, Cincinnati
In the next twenty years, as we transition toward a future time when AV technology fully integrates into our daily driving, it is important to note additional societal changes that will impact the use of our suburban site. Online shopping and automated delivery will continue to disrupt brick and mortar retail establishments such as those found on in Tri-County. The previously discussed notion of reduced car ownership will have major negative effect on the large auto dealerships, who may no longer have interested parties to sell new vehicles to. Office space will still be needed, but an increase in flexible hours, and telecommuting may change how these office buildings are used. If Tri-County continues as is, the area risks becoming irrelevant with, or without, advancements in transportation.

The rise of autonomous vehicle intersects with the decline of the suburban commercial zone at an interesting point. AVs make the key benefits of these areas irrelevant while at the same time providing a catalyst for urbanization. According to Arthur C. Nelson, coordinator of the Metropolitan Institute at Virginia Tech, an estimated 2.8 million acres of suburban grey fields (underused, failing, or outdated real estate) will become available for development by the year 2024. If only one fourth of this area is redeveloped into mixed-use centers, they have the potential to supply half of the required housing needed by 2030. Tri-County is one of Cincinnati’s strongest sites for this type of grey field redevelopment.

Methodology

So what can be done in Tri-County to encourage healthy growth? Currently, buildings of similar, singular uses are informally separated into districts: office buildings to the south of the site, car dealerships along Kemper Road, and big-box retail to the east of Princeton Pike. As

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21 (Dunham-Jones and Williamson)
space becomes available, due to reduced parking requirements or closure of business, new structures should be infilled that feature a multi-use program, focusing on uses not currently implemented in the area, such as single and multifamily housing, while also providing retail, office, and recreation spaces. A diversity of building functions can provide an area with a greater sense of visual interest to attract new visitors and residents. The new diversity of users that such a site provides, can keep a healthy amount of people interacting at different times of the day.

The commercial district needs to embrace its local residents and help build a stronger sense of community by facilitating the growth of “third spaces”. Sociologist Ray Oldenburg uses the term “third spaces” to describe places where local people routinely hang out and socialize. Examples of these spaces include coffee shops, corner pubs, and plazas, where people can interact with each other free from the hierarchical roles that dictate work and home life.22 Suburban areas typically have limited amounts of third spaces, sometimes only a chain café/restaurant. Rather, suburbs tend to provide communal spaces that are more segregated, providing each age/interest group their own separate space. The separation of these spaces is intensified by the busy roads, street offsets, and parking lots required for people to reach them. Successful third spaces usually occur in areas with regular foot traffic and narrower streets where pedestrians feel a link to both sides of the street.

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22 (Dunham-Jones and Williamson)
The New (sub)Urbanist Form

Perhaps the greatest challenge for the Tri-County commercial district in becoming a New Urbanist neighborhood is the current road system. The major arterials of Princeton Pike and Kemper Road are inhospitable to users on foot or bike because smaller, winding lanes, that connect the major streets to parking lots, have little to no relation to the buildings they ultimately serve. In order to facilitate healthy growth with autonomous vehicles, a new road system needs to be designed for the neighborhood that emphasizes walkability and connectivity, while at the same time keeping a safe and steady flow of AVs.

An interesting method of developing this new streetscape from a birds eye view can be seen in OMA’s 1991 masterplan for the La Défense region of Paris, Mission Grande Axe. The strategy was centered around creating urban renewal and order, by examining expected life of the short-lived buildings and blocks, and planning a new system to take their place. As part of the project, the architects removed buildings by increments of 5 years to reveal a rigid city grid that would help carefully tie the region to Paris’s historic center while retaining its own identity. Key spaces and buildings capable, or worthy, of withstanding the test of time remain, breaking up the grid at their locations.

Similarly, a first step in planning this kind of intervention in Tri-County is to examine which buildings are likely to remain, and which buildings have limited viability left. Buildings that are isolated, or disregard their surrounds may be planned for removal if they are deemed architecturally insignificant. Purpose-built structures, such as car dealerships, should be considered for adaptive reuse or demolished.
Once a decent understanding of likely remaining buildings is made, a new system of streets can begin to be established. A grid system, similar to one used in OMA’s masterplan allows for flexible and unpredictable growth, as well as an easy system to evenly disperse traffic. Without the fear of getting lost, AVs will be able to break away from the main arterial roads, which can form a series of calmer streets.

An alternative to this type of grid might be found in a variation of the Smooth Growth urban design system by Marshall Brown Projects. Smooth Growth is typically implemented to restructure urban areas in periods of depopulation. Smooth Growth overlays new streets and pathways on existing urban grids to react to the form and density of remaining buildings, and creates new zones out of collections of vacant lots. The new layer of roads and paths would allow existing buildings to interact with the street in exciting ways. New building projects could be planned on these newly defined vacant lots, but the irregular shape the blocks take could prove a difficult design challenge.

The New Streetscape

The street connects buildings in a neighborhood, and therefore the people that use and occupy them. In this redevelopment of Tri-County, the new streetscape is crucial in providing interaction, and building community. As mentioned previously, AVs are expected to operate much more efficiently, and faster where needed. Freeways and interstates, such as I-75 and I-275, which border Tri-County, are spaces that will be free of other types of traffic, allowing for considerable increases and speed, and reduction in congestion. However, this same quick reaction, sensing and communication of AVs will allow for safer interaction with pedestrians at lower speeds as well. The overall reduction in traffic congestion will make slower speed
(Figure 6) Mission Grande Axe, La Defense – OMA

(Figure 7) Smooth Growth – Marshall Brown Projects
districts easier to implement. This ability to interact safely will encourage pedestrians to seize a larger presence and priority on the street.

The life of the street in an urban community often dictates the whole life of the neighborhood. It is the public area between (generally) private buildings that is shared by all, and acts as a point of connection between all of their unique purposes and programs. It is in this area that the community bonds and shares its character. Yet, streets can often be seen just as much as a barrier as a connection. Streets often present danger and confusion, as distracted or confused drivers move through with top priority, leaving pedestrians weary to cross. AV technology will allow many streets to shed the identity of boundary, creating a flexible urban space that reaches across the street from building to building, as areas of distinction between cars and pedestrian are erased. Pedestrians can feel free to take ownership of the street creating space where they deem most exciting. Vehicles, equipped with advanced sensor technology will be able to carefully, yet nimbly move through the space along with the pedestrians. To bring these streets to life, landscape furniture is needed to create spaces of gathering and engagement. A well-furnished street encourages the community to spend more time interacting outdoors because it will feel more like a relaxing walk in the park, rather than a frightening walk along a four lane highway.

Rather than restricting access to vehicles in key streets, making pedestrian-only boulevards, vehicle access will be allowed throughout the site in a de-emphasized manner. These suburban sites were born out of convenience of access, and with AVs, that convenience can still remain while providing a pedestrian friendly environment.
(Figure 8) New Streets of Tri-County empower pedestrians on the street, while still allowing access to AV vehicles.
Tri-County’s new streetscape will be a blended environment, with no clear delineation of vehicle and pedestrian spaces. Along the street, the furnishings ensure a human scale to the environment, and provide areas of rest and collection for pedestrians walking along. Ample vegetation provide shade, and visual interest along the walk. Small areas of repose are dispersed every 200-300 feet along streets providing gathering areas and quieter places to linger. Tri-County’s new streetscape will be a blended environment, with no clear delineation of vehicle and pedestrian spaces. Along the street, the furnishings ensure a human scale to the environment, and provide areas of rest and collection for pedestrians walking along. Ample vegetation provide shade, and visual interest along the walk. Small areas of repose are dispersed every 200-300 feet along streets providing gathering areas and quieter places to linger. These site furnishings, and green spaces break up the linear paths of the street. Vehicle access down this path weaves through these elements in an unbroken, but under-emphasized clearance, allowing two vehicles to safely pass each other. Vehicles on this path will operate slowly, able to stop for a pedestrian that may cut in front of it. By making vehicle zones less clear, pedestrians will be encouraged to utilize a greater portion of the street, feeling free and safe to cross over when something peaks their interest.

Key boulevards in Tri-County, particularly those branching off the central plaza, connecting the parks and the school area, place an even greater priority on pedestrian travel than other streets, in order to facilitate more convenient pedestrian travel across larger
(Figure 9) New Street Section
(Figure 9) Site Plan of pedestrian boulevard connecting parks with central plaza.
distances of the site. These streets restrict vehicle access to only immediate pick-up and drop-off at designated locations. Although the option of hopping in a vehicle still exists for those who need it, multiple areas of interest and the ability to easily walk between them will encourage visitors to the site to walk for short trips within Tri-County. The goal of this blended approach is to provide a more convenient travel experience by both foot and vehicle.

**The New Communities**

Tri-County, in its current state, is a place people visit as quickly as possible, driving to their predetermined location, completing their purchase/meeting, and departing. For the area to flourish, these visitors need to be encouraged to stay longer, visiting multiple locations in a single trip. New and improved streetscapes will help in this regard, but for Tri-County to truly flourish, new groups of people should be encouraged to not only visit, but live there as well.

As mentioned previously, autonomous vehicles have the potential to grant newfound mobility to those who were previously limited by their inability to drive. A site that integrates programs utilized by these demographics will empower these groups and create a more dynamic and rich society for all. Of particular interest are older children aged ten to fifteen. A variety of supervisions would have to be put in place, such as parents ordering the ride, or monitoring cameras in vehicles, but being able to jump in a car could give older children and younger teenagers the ability to explore and interact without the need to get a ride from their parents, or schedule a playdate with a friend who lives too far away to walk to. New third spaces in Tri-County would have the potential to attract a mixture of young and old. One move to help achieve this would be to build new education facilities that integrates with the rest of
(Figure 11) Site Plan of pedestrian boulevard connecting parks with central plaza.
the new community. New school facilities located at Tri-County could serve students from nearby school districts or provide unique programs that could attract students from the entire northern Cincinnati area. A tradition often seen in smaller rural towns, where the community becomes galvanized around the local school and its activities (such as sports or choir concerts) could be better introduced into the area, by intrinsically linking the schools and communities together. Public plazas near athletic complexes could become the site for rallies, and afterschool clubs could hold meetings at local businesses.

In a similar way, AVs will empower elderly populations in a newly urbanized district. Many individuals in this age group are losing their ability to drive, and/or have trouble walking long distances. The barriers that tend to isolate the elderly into nursing homes or their private residences will begin to break down, with AVs able to move the elderly about on slow moving streets. By focusing development of third spaces around these newly accessible groups, and encouraging interaction through pedestrian movement, the community will see a richer diversity than before.

**The New Tri-County**

After understanding the new streetscape of Tri-County and the new communities to be cultivated there, it is possible to examine the placement of key programing and general use of zones on the site. For the sake of discussing programming in the revitalization of Tri-County into an Autonomous Edge City, the site can be broken down into a series of large blocks, bound by the major roads of Princeton Pike, Kemper Road, and Tri-County Parkway (*figure 9*). Each block will be broken down into smaller, more complex pieces, or repurposed entirely.
(Figure 12) Revitalization blocks of Tri-County
Without the need for expansive parking lots and wide roads, and the desire for public spaces and pedestrian accessibility, it becomes possible (and imperative) to densify the foot print of Tri-County’s commercial center, while increasing its scope. Shrinking the footprint will open up greyfields to different functions that might be missing from the surrounding communities.

Oftentimes, shopping centers were built in low-lying areas, because they were on the edge of already developed neighborhoods. In order to limit the risks of flooding, the centers were heavily regraded, and drained. Block 1 in Tri-County, aligns to such a description. The block is populated with aging strip-shopping, and struggling big box stores. Part of the restoration of Tri-County will include demolishing buildings on this location, and relocating remaining program to the south of Kemper Road. With the land free of large structures, efforts will be made to reconstruct a lake and wetlands on the low lying area. This effort will enrich Tri-County, and surrounding communities with renewed access to nature, a component currently missing in the edge city.

Tri-County Mall dominates block 2. Because the building’s existence as a mall is already being brought into question, this revitalization plan suggests repurposing the structure. Empty anchor stores in the mall would be perfect candidates for automated delivery warehouses, able to quickly deliver local residents necessary items, such as groceries, quicker than a typical shopping trip. Other places in the mall can be used for a variety of purposes as athletic complexes, maker-spaces, or data warehousing.

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23 (Dunham-Jones and Williamson)
(Figure 13) Master plan of Tri-County

- Blue Roads – Vehicle Arterials
- Green Roads – Pedestrian Boulevards
- Purple Roads – Secondary Roads
- Light Grey – Existing Buildings
- Dark Grey – New Buildings
Blocks 3 and 4 are the focus of revitalization in Tri-County, bringing in a swath of new mixed use buildings, creating a connected, enjoyable walkable neighborhood. The new development is anchored by a public plaza in block 3, and the new school in block 4. A boulevard links the two, and another crosses the plaza to connect blocks 1 and 5. These streets will be similar to those described in the previous section, *The New Streetscapes*, and will be primarily for use of pedestrians, with vehicles allowing limited access for the immediate drop off / pick up of passengers. The secondary streets that feed into these thoroughfares will also seek to be pedestrian friendly, although restrictions on automobile are eased, creating more of a shared street.

Many of the new buildings on the site will be multi-story mixed use, with the first floor ideally to provide dining, entertainment, or retail opportunities (including retail potentially relocated from blocks 1 and 2). Upper floors on these buildings are flexible, but apartments and office space is encouraged. For those seeking a larger residence, townhouses will be located in small, but accessible groups. Amongst the new structures, a few existing office buildings remain, woven into the new urban fabric. While the practice of purchasing a car may become entirely a thing of the past, a large car dealership will remain as a place to service rental vehicles, which will be driven almost constantly, and may need maintenance more often. Keeping blocks 1 and 2 rich in function will help the area remain active at all times of the day, instead of shutting down after business hours, or becoming 1 a bedroom community.
(Figure 14) Before and After of Tri-County Office Park
Similar to Block 1, a large part of the office park on Block 5 will be given to nature, emphasizing the role of “park” in office park. The offices in this site will remain, but nearly all parking can be removed, creating a public park ideal for exercise and recreation. New construction in the park will be restricted, but building owners can expect to see a rise in demand and value as their office become “park-side property”.24 Because the roads in the existing block are significantly offset from the building, new roads will replace the old, running on the periphery, and depositing passengers near the front of existing buildings, whether the buildings remain offices, or are repurposed for another use.

Conclusion

The advent of autonomous vehicles finally seems in site. While plenty of progress still needs to be made, the acceleration of the breakthroughs shows promise for the burgeoning technology. AVs will make travel cheaper, and more accessible for all segments of the population.

Our built environments need to take advantage of this shift in mobility. Previous advancements in transportation resulted in infrastructure that diminished the role of the human scale. However, the redevelopment of Tri-County is an exploration in how this improvement in transit will not just improve our ride to a location, but also in what our experience can be once we get out of the vehicle. New program for new residents occurs where parking once dominated, and vehicles can safely coexist in areas emphasizing the pedestrian experience. The result allows us to recreate connected neighborhoods and streetscapes, with little compromise, accessible to both pedestrians and passengers.

24 (Dunham-Jones and Williamson)
Bibliography


