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I, Nicholas Darragh Birck, hereby submit this original work as part of the requirements for the degree of:

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Reclaiming Existing, Underutilized Infrastructure: Aquatic Options For Transit-Oriented Infill Development

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Reclaiming Existing, Underutilized Infrastructure: Aquatic Options For Transit-Oriented Infill Development

A thesis submitted to the Graduate School of the University of Cincinnati in partial fulfillment of the requirement of the degree of Master of Community Planning in the School of Planning in the College of Design, Architecture, Art, and Planning

by

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In cities across America, there are various existing assets that were produced to complement the overall system making up total infrastructure. Often, however, rather than utilizing existing forms of transportation infrastructure (e.g. unused rail lines, navigable water), new highways and roads are built to serve areas that can already access existing non-road assets. Better use could be made of existing, viable infrastructure for a lower cost than new highway construction, while leaving far greater areas of land open for development. This would result in significant economic, social, and ecological spillover benefits. The use of such infrastructure for mass transit would provide declining communities with decreased travel times to other places, such as central business districts, since they would provide dedicated rights-of-way. Often, waterside communities are filled with properties that are not economically feasible to develop due to high costs in elevating them above floodplains. A relatively small investment in aquatic-based transit, such as vessels and dock improvements but little property acquisition or right-of-way construction and maintenance, would immediately make these properties worth reclaiming, promoting the infill redevelopment of existing communities rather than furthering detrimental urban sprawl.
# Table of Contents

TABLE OF FIGURES.......................................................................................................................................VI

INTRODUCTION.............................................................................................................................................. 1

CONCEPTUAL LITERATURE REVIEW ......................................................................................................... 7

I.  BRIEF HISTORICAL DISCUSSION OF URBAN WATERFRONT DEVELOPMENT ........................................ 8
   A. Overview..................................................................................................................................... 8
   B. Boston & Hingham, Massachusetts ......................................................................................... 9
   C. Cincinnati Metropolitan Region ............................................................................................. 11
      1. New Richmond, Ohio ................................................................................................................ 13
      2. California, A River Village of Cincinnati ............................................................................. 15
      3. Downtown/Central Riverfront .............................................................................................. 17

TRANSIT-ORIENTED DEVELOPMENT ........................................................................................................ 19

II. INFRASTRUCTURE PLANNING AND CAPITAL INVESTMENTS ................................................................ 19
    A. What is a need? ............................................................................................................................. 20
    B. Evaluation Criteria and Priority Rankings .................................................................................. 21
       1. Fiscal Impacts ............................................................................................................................... 21
       2. Community Economic Effects .............................................................................................. 23
       3. Environmental, Aesthetic, and Social Effects ............................................................................ 23
       4. Effects on Interjurisdictional Relationships .............................................................................. 24
       5. Advantages Accruing from Relationship to Other Capital Projects .......................................... 24

III. LAND USE DYNAMICS IN PROXIMATE COMMUNITIES ........................................................................ 25
    A. Traditional Land Use Characteristics of Riverside Communities ............................................ 25
    B. Impact of Transit on Proximate Land Use ..................................................................................... 26

IV. INFILL DEVELOPMENT THEORIES AND STRATEGIES ....................................................................... 29

METHODOLOGICAL LITERATURE REVIEW ............................................................................................. 32

V.  CINCINNATI PLANNING & DEVELOPMENT .......................................................................................... 32

VI. BOSTON PLANNING AND DEVELOPMENT ............................................................................................ 38

DATA & ANALYSIS.................................................................................................................................. 39

VII. POTENTIAL FISCAL AND ECONOMIC EFFECTS OF AQUATIC TRANSIT INVESTMENT .................. 40
    A. Vacant Land Inventory .................................................................................................................. 41
    B. Zoning Analysis .............................................................................................................................. 46
    C. Costs Analysis ............................................................................................................................... 50
       1. O&M Costs ................................................................................................................................ 51
       2. Vessel Ownership or Leasing Costs .......................................................................................... 52
       3. Terminal Facility Expenses ....................................................................................................... 54
       4. Administrative Costs .................................................................................................................. 56

VIII. ENVIRONMENTAL, AESTHETIC, AND SOCIAL EFFECTS IN STUDIED COMMUNITIES ................ 57

IX. DISRUPTION AND INCONVENIENCE CAUSED BY OHIO RIVER AQUATIC TRANSIT ........................ 59

X. INTERJURISDICTIONAL RELATIONSHIPS ........................................................................................... 60

STATEMENTS ABOUT DATA........................................................................................................................ 65
TABLE OF FIGURES

Figure 1: Location Map of Boston and Hingham, MA (City-Data.com 2010) .................................................. 9
Figure 2: Regional Location Map of Cincinnati, OH. ..................................................................................... 11
Figure 3: New Richmond, OH location map. ................................................................................................. 13
Figure 4: New Richmond's former riverfront central business district. This street was once U.S. 52............. 14
Figure 5: House in New Richmond showing riverboat heritage. ................................................................. 14
Figure 6: Remaining structures and vacant parcels. Note driveway remnant into vacant lot .................... 14
Figure 7: Typical mobile home residence next to traditional historic architecture. ................................. 15
Figure 8: Location Map of Cincinnati neighborhoods California and Downtown .......................................... 16
Figure 9: California's historic business district on U.S. 52. ......................................................................... 16
Figure 10: California's Dominant Public Land User, Cincinnati Water Works ........................................ 17
Figure 11: The last Island Queen under construction at Cincinnati Public Landing, 1924 (Bailey 2010, 102) ................................................................. 17
Figure 12: Banks Project map (The Banks 2010). .......................................................................................... 18
Figure 13: Map of Cincinnati. Note in particular the City boundary extension to the west, dominating river frontage.............................................................................................................................................. 26
Figure 14: Illustrating development patterns of various transit systems (Rodrigue 2010). ............................ 27
Figure 15: Parking deck construction, to lift The Banks above the 100 year flood plain (The Banks 2010). ................................. 33
Figure 16: Proposed riverfront park (The Banks Public Partnership 2010). ..................................................... 33
Figure 17: Proposed riverfront terminus of the Eastern Corridor commuter rail at the Riverfront Multi-Modal Transit Center (Eastern Corridor 2003). .......................................................................................... 34
Figure 18: New Richmond's ineffectively utilized riverfront. .................................................................... 35
Figure 19: Example of desired elevated housing architecture in New Richmond. ...................................... 35
Figure 20: Example of undesirable elevated architecture in New Richmond. .............................................. 36
Figure 21: Launch at Hingham Shipyard rendering, showing mixed use development capability of aquatic transit (Samuels & Associates 2009). ................................................................. 39
Figure 22: California Land Use Map. ........................................................................................................... 41
Figure 23: Typical land uses in California, parking lot and vacant lots.......................................................... 41
Figure 24: California Quarter Mile Non-Revenue Generating Property Inventory ....................................... 42
Figure 25: California Quarter Mile Vacant Land Inventory ...................................................................... 42
Figure 26: California Half Mile Non-Revenue Generating Property Inventory ......................................... 43
Figure 27: California Half Mile Vacant Land Inventory .............................................................................. 43
Figure 28: New Richmond Quarter Mile Non-Revenue Generating Property Inventory .......................... 44
Figure 29: New Richmond Land Use Map .................................................................................................. 44
Figure 30: New Richmond Quarter Mile Vacant Land Inventory ............................................................ 44
Figure 31: New Richmond Half Mile Vacant Land Inventory .................................................................. 45
Figure 32: New Richmond Half Mile Non-Revenue Generating Property Inventory ............................. 45
Figure 33: California Zoning Map. ................................................................................................................. 46
Figure 34: New Richmond Zoning Map .................................................................................................... 48
Figure 35: Map showing New Richmond's Downtown Residential Overlay district (Village of New Richmond 2008, 105) ................................................................. 49
Figure 36: Cincinnati Region map showing proposed ferry terminal locations .......................................... 52
Figure 37: Google Earth measurement image of ferry route ...................................................................... 53
Figure 38: Riverfront reinvestment project partially accomplished by New Richmond .............................. 55
Figure 39: Regatta on the Ohio 1900-1925 (Bailey 2010, 55) ..................................................................... 57
Figure 40: Regional Map showing studied ferry communities and potential regional expansions to the west.............................................................................................................................................. 58
Figure 41: Section of Metro Moves plan by SORTA (Mecklenborg 2007). .............................................. 62
Figure 42: F1 Ferry Route (Massachusetts Bay Transportation Authority 2009).................................. 63
RECLAIMING EXISTING, UNDERUTILIZED INFRASTRUCTURE: AQUATIC OPTIONS FOR TRANSIT-ORIENTED INFILL DEVELOPMENT

NICHOLAS D. BIRCK, J.D.

INTRODUCTION

Among the many issues facing America’s declining urban areas, particularly in the Northeast and the Midwest, this thesis seeks to propose a solution to disinvestment and infrastructure underutilization that are particularly pervasive and visible in certain communities. In “Rust Belt” cities like Cincinnati, shifting population patterns and natural processes have worked to encourage progressive abandonment of formerly dense, vibrant settlements surrounding once robust transportation options. These communities were founded upon their advantageous locations and have since fallen victim to highway sprawl and fringe growth that have left neighborhood housing and business areas decimated and decaying.

There are various existing assets that were produced to complement the overall system making up total infrastructure. For example, railroad lines, which must be constructed to bear significant loads and traffic, crisscross cities with trestles and graded rights-of-way that were frequently the shortest, most efficient routes between population and manufacturing centers. Often as a result of investment in rail infrastructure, employment centers sprang up to take advantage of low shipping costs, and residential development nearby followed to provide workers. This pattern of settlement is particularly evident in older Northeastern & Midwestern cities, where streetcar suburbs and factory “villages” were integrated into the urban fabric. Current population patterns and highways are shaped by these now often forgotten physical
entities, frequently following their routes without even being aware of their presence (City Planning Commission 1948, at 131).

Often, such assets are now rusting and overgrown, but for the most part maintenance is required. Otherwise, communities and daily commuters would face serious consequences, such as frequent debris, decay, and collapse, particularly in the case of abandoned railroad trestles. However, governments continue to subsidize the maintenance for such assets without reaping a reward from the ongoing investment. American cities accept the costs of automobile infrastructure and ignore the other modal choices available, for which citizens and municipalities have already paid the financial, social, physical, and ecological costs. Meanwhile, the communities that previously prospered due to their advantageous proximity to these infrastructure investments have been allowed to deteriorate and decay. Development has occurred outside of traditional communities, resulting in deleterious sprawl settlement patterns.

Rather than utilizing these existing forms of transportation infrastructure, such as abandoned rail lines or navigable water, new highways and roads are built to serve the same properties. The space requirements of highways, particularly interstate-grade expressways, extend far beyond the actual paved surface of the road, eating into potentially developable acreage while duplicating costs and reducing nearby property values. Better use could be made of existing, viable infrastructure for a lower cost than new highway construction, while leaving far greater areas of land open for development and resulting in significant economic, social, and ecological spillover benefits.

However, when plans propose utilization of alternate transportation modes, they often require newly constructed infrastructure, such as highways, high-occupancy vehicle lanes, light rail, and bus rapid transit. Proposals barely, if at all, take advantage of existing infrastructure
such as waterways and heavy rail options (See e.g. Hamilton County Regional Planning Commission 2002). Often, not even existing rights-of-way are utilized, requiring the acquisition, demolition, and construction of duplicative corridors of transportation. This incrementally increases possible costs even further because it removes even more land from developable acreage and does not take advantage of already sunk, ongoing costs on existing, unutilized infrastructure. The recapture value available could be significant.

“Because of their loss of population over the past decades, most cities have underutilized infrastructure that could become the basis for a new collaborative, market-based approach to housing development” (Bernstein 1999). For example, in the Chicago region, a study indicated that communities could accommodate 700,000 households over the next twenty years within walking or shuttle distance of existing mass transit under current zoned densities (Center for Neighborhood Technology 1999) (Bernstein 1999). “Already assembled rights-of-way could represent joint-stakes opportunities for coalitions of multiple municipalities and communities within regions along such corridors” (Bernstein 1999).

The value of underutilized infrastructure in the nine largest U.S. cities alone was estimated at $1.6 Trillion in the mid 1990s (Gyourko 1995). “Disinvestment and underutilization result in the premature write-off of these valuable assets, while maintenance of over-built systems leads to excess customer charges and taxes” (Bernstein 1999). The value of underutilized infrastructure ought to be reclaimed, made the central focus of a new transit-oriented development approach that would capture significant property value increases and allow for a more responsible traffic growth management system in our cities. One of the key principles driving successful transit-oriented development is its pairing with denser, more intense land use. Often, communities such as are the subject of this study already exhibit (or previously exhibited)
denser land use and are still zoned to allow such density. They are infill sites that already possess access to utilities, have already been part of the built environment, and would offer significant fiscal advantages over continued highway sprawl growth and greenspace development. They are also located in political jurisdictions that are interested in, and motivated to support, extensive redevelopment growth.

This thesis proposes that the use of existing infrastructure would be more efficient and affordable than clearing, grading, and constructing all new automobile or light rail access. It is hypothesized that this efficiency and affordability could be harnessed to revitalize older, declining neighborhoods that are concentrated around such older infrastructures. Investment in alternative mass transit would provide these communities with decreased travel times and costs to metropolitan central business districts, since they would provide dedicated rights-of-way. People would not be forced to drive boulevards, stop at endless red-lights, and risk accidents with the thousands of other cars traveling beside them. Also, local populations would be incentivized to engage in redevelopment to accommodate increased population density, increasing social and economic gains.

The term “infrastructure” can be used to describe various modes of transportation assets and even non-transit related resources. For example, I have proposed the inclusion of wireless internet service as a form of “municipal infrastructure” so that it would be placed on a par of priority with long-accepted infrastructure types, such as electricity, water, sewage, and transportation access (Birck 2008). Thus, framing this thesis in terms of “infrastructure” generally would be inappropriate. Even limiting it to transportation infrastructure as a whole would require far greater development than would be appropriate within the scope of this thesis.
Rather than looking at all transportation infrastructure options, such as railroads, road-based modes of transit, or other land-based travel strategies, this thesis will focus on the reclamation and more intelligent utilization of water assets, such as the Ohio River in the Cincinnati metropolitan area or the Mississippi River in the St. Louis area. These urban areas continue to see vitality and value as a result of their positions on major river shipping channels. According to the Executive Director of the Ohio-Kentucky-Indiana Regional Council of Governments (OKI), a “tsunami of freight” is expected to hit the region’s infrastructure. Preparation for this wave of shipping will necessarily require improved freight planning that relies heavily on the much lower costs of the Ohio River (OKI 2009). As will be discussed further infra, plans involve encouraging investment in container barge shipping and intermodal freight facilities on the river to manage the expected increase in container traffic (Id.). It is uncommon, however, among the majority of municipalities in the U.S. to consider water assets as viable passenger transit infrastructure, despite the fact that many of the largest cities actively develop and expand their transit capabilities through the smart use of water.

In order to fully explore this thesis, I have thoroughly reviewed the literature available concerning transit-oriented development, infill development, and water-based transportation strategies. I will briefly discuss historical development patterns and usages that typify the study area communities, such as Boston as an Eastern port and Cincinnati as one of the country’s major interior river cities. Since I plan to concentrate on the Ohio River as a model, I focused data collection and analysis to specific riverfront communities in the Cincinnati metropolitan region.

Many major U.S. cities are on Mississippi and Ohio Valley waterways, because transportation access from productive farmlands to external markets was so much cheaper by
way of the rivers. These centers acted as break-bulk facilities of imported goods and collection points of raw materials that were distributed through their ports. During the twentieth century, many of the largest inland river cities, such as Cincinnati and St. Louis, turned away from their waterfronts, as rivers were frequently polluted and developable parcels were in flood-prone, industrial, and low-value areas. In the cases of these two cities, highway construction during the 1950’s and 60’s increased the physical separation of population and waterfronts, but recent planning initiatives have sought riverfront revitalization.

Along with center city riverfront revitalization, Cincinnati and other cities could utilize water-based transit to restore the prominence of the river and could help reclaim connections lost after the early years of the region’s development. This could encourage regional connections that have occurred by car and interstate for the last fifty years and could shift attention back to the river and its historic downtowns. It could also infuse a transit component into central business district riverfront revitalization plans that would improve commuter access, reduce parking needs, and manifest truly multimodal commitment to transit.

A review of the history concerning urban waterfront development and the literature on transit-oriented and infill development concepts is followed by a review of the methodological literature concerning transportation planning in the selected study areas. Inquiry has been limited geographically first to the Boston metropolitan area, since it has an active transit planning program complete with aquatic mass transit. It has also seen extensive waterfront redevelopment since the removal of the elevated interstate during the infamous Big Dig (MuniNet Guide 2006). The second study area will be the Cincinnati metropolitan area, because it has relatively little land or aquatic transit despite its advantageous natural infrastructure, the Ohio River. Specifically within the Cincinnati area, the city neighborhoods of Downtown and
California, and the neighboring Clermont County municipality of New Richmond, provide the methodological sources for this study.

Once I have looked at current planning activities, particularly published plans and implementation of development in each of the two study areas, I will compile data related to the key areas identified in the literature reviews. For example, I will demonstrate the feasibility of an aquatic transit system in Cincinnati based on current travel demands and commute patterns between the studied riverside suburban communities and the center city’s downtown. I will analyze the possible development potential that could be spurred by such transit investment based on current land uses in the infill communities and build-out capabilities. I then explain the value of the system based on capital improvement evaluation criteria and priority rankings.

**Conceptual Literature Review**

In order to fully understand the concepts and issues that are important to a transit planning proposal of this sort, a substantial theoretical basis must be developed. For this investigation, I have drawn upon urban waterfront history, transit-oriented development theories, and infill development sources to provide guidance for data investigation and analysis. Following a brief discussion of Boston and Cincinnati history and their connections to aquatic infrastructure, I will explore transit-oriented development literature. This literature will establish the analytical framework for this study by defining the necessary criteria for investment into capital infrastructure and clarifying the impact to land use dimensions. I will then discuss the benefits of employing an infill strategy in conjunction with transit investment before moving to the data collection and analysis supporting this proposed aquatic infrastructure investment.
I. **BRIEF HISTORICAL DISCUSSION OF URBAN WATERFRONT DEVELOPMENT**

A. **Overview**

“The specific impact of water-borne transport on land use is difficult to calculate” (Gessaman 1969, 18). According to a 1980 report by the Committee on Urban Waterfront Lands, “[m]ost urban waterfront areas in the United States reflect a lack of planning in their adaptations to successive demands for new functions” (Committee on Urban Waterfront Lands 1980, 16). Political fragmentation, as well as changes in consumer demands, transportation technology, and environmental policies, has led to urban waterfront lands being some of the least catalogued in terms of land use, resource inventory, and hinterland connectivity (Id.). Despite this lack of understanding and research, “[m]ost major cities of the world and of the U.S. owe their being to the fact that at one time or another their use was principally one of a terminal point for water transport” (Id.).

“At one time, the commercial life of coastal cities depended almost exclusively on the activities of their ports” (Committee on Urban Waterfront Lands at 3). Early ports required hotels, taverns, and warehousing, all located near or along the dockside” (Gessaman at 18). “Since the ship is designed only for water use, the location of dock facilities . . . follow[ed] the linear pattern of the shore-line. The impact of this on land use has been the development of warehousing and heavy industry along the shore-line” (Id.).

Later, “as land and air transport of goods and people developed, the attention of city planners and the private sector turned increasingly inland” (Committee on Urban Waterfront Lands at 3). “River transport has been superseded by highway, rail, and air transport . . . so that its importance to city life has become insignificant except as a recreational benefit” (Gessaman at

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1 According to a list compiled by City-Data.com, 7 of the 10 largest cities in the United States are coastal port cities. (City-Data.com).
The resulting abandonment or underuse of urban waterfront lands has created a “cycle of development, deterioration, neglect, and reuse of urban waterfront lands” that has far-reaching economic, social, and environmental impacts (Committee on Urban Waterfront Lands at 3).

Often, planning and development decisions concentrating on urban waterfront lands evoke divisive political debate as they have an impact on the identity and the environmental quality of cities. (Id.). Vacated land has been reclaimed from the shipping industry in various American cities, such as Baltimore, New York, and Boston (Gessaman at 19). “Just as often, though, the city has decided to turn its back to the water, as in Cincinnati” (Id.).

B. Boston & Hingham, Massachusetts

According to City-Data.com, Boston had a population of 609,023 in 2008 (City-Data.com 2010). “Since its founding in 1636, the City of Boston’s fortune has been tied to its port and harbor” (Donaher, et al. 1980, 21). Once the city’s main access point, changes in port technology and policy caused the waterfront to
become “drab, private, proprietary, dark, dirty, [and] noisy” (Id.). The previously open port began to operate more as a public utility, heavily regulated and requiring extensive public capital investment (Id.).

Efforts in Boston since the 1960s have sought redevelopment “to restore openness to the waterfront and to reclaim the waterfront for diverse use” (Id. at 22). Boston has a long history of investing in transit infrastructure which has given it some notable historical significance. For example, it is the first American city to have a subway (Massachusetts Bay Transportation Authority 2010). Due to the strong connection to waterfront and desire to reopen harbor facilities, it is also one of a small number of American cities to offer daily commuter ferry service to nearby communities (Id.).

The first Hingham-to-Boston service began in 1978, placing aquatic transit facilities in the center of the downtown waterfront from the residential community (Town of Hingham, MA 2008). Another visible step in this reclamation of the urban waterfront lands of Boston was the redevelopment of the Mass Pike under the massive “Big Dig” project (MuniNet Guide 2006). Despite its multibillion price tag, the city’s waterfront has been rejuvenated due to the increased connectivity with the urban core.

Hingham, with a population estimate of 22,561, also has a history with waterfront development (U.S. Census Bureau 2008, Town of Hingham, MA 2008). Its main reason for growth came as a result of its selection for the location of U.S. Naval installations, such as a “magazine” and shipyards (Town of Hingham, MA 2008). “At the height of production, 24,000 people were employed working around the clock, seven days a week” (Id.). Post-war suburban expansion saw the development of Hingham into a residential community connected to Boston by highway, bus, commuter boat, and commuter rail line (Id.). Recent developments have re-
centered on the advantageous location of Hingham on the ferry line, with the development of Hingham Ship Yard into “The Launch” (Samuels & Associates 2009).

C. Cincinnati Metropolitan Region

Cincinnati, with a population of 333,336 in 2008, was one of America’s first boom-towns and major inland cities (City-Data.com 2010, City Planning Commission 1948, at 13). Its location at the confluence of the Ohio, Licking, and two Miami Rivers has provided it with a long history tied to the water (City Planning Commission 1925). As early as 1793, weekly keelboat passenger service brought travelers from Pittsburgh and points east to Cincinnati in search of land and opportunities (Cincinnati.com 1999). By 1834, Cincinnati and Covington, KY manufacturers had constructed over 220 steamboats (Id.).

While expanding along—and because—of the river, hydrologic fluctuations frequently occurred which made the Ohio River unreliable as shipping infrastructure. Not only were the city and its environs subject to extensive, excessive flooding frequently, but the river even came close to running dry from time to time. In 1881, river traffic was halted when the Ohio River reached its lowest level on record, 1 foot, 9 inches (Id.). It has thus required significant

Figure 2: Regional Location Map of Cincinnati, OH.
investment to make it a more stable and reliable form of transportation investment, which already exceeded $100,000,000 by 1922 (Jones 1920, City Planning Commission 1925 at 142, Congressional Budget Office 2007).

Despite this heavy investment into the stability of the river for freight shipping, Cincinnati has consciously divorced itself from its urban waterfront lands (Gessaman at 19). This was most visibly accomplished by the decision in the 1950s to site the Fort Washington Way highway corridor directly between the central Downtown business district and the traditional riverfront (Id.). Prior to this time, riverfront uses, which were devoted to river shipping activities, were inadequate and in complete decline due to flooding and shifts to trucking and rail freight (City Planning Commission 1925 at 145, City Planning Commission 1948). Many first floor spaces were unoccupied, and the area was targeted as early as 1948 for urban renewal and civic entertainment purposes, such as the stadia which are currently in place (Id.).

In addition to siting expressway complexes between its central business district and the river, Cincinnati has suffered extensive political opposition to river redevelopment (Varady 1995). As mentioned earlier, planning and development decisions concentrating on urban waterfront lands evoke divisive political debate as they have an impact on the identity and the environmental quality of cities (Committee on Urban Waterfront Lands at 3). Cincinnati is not an exception to these debates, but typically here river development has been blocked in order to protect river views for affluent hilltop residents (Varady 1995). Concern for views has stymied redevelopment of Cincinnati’s East End for decades, and has resulted in onerous height restrictions which make investment less attractive to developers (Id.). Even residents of
Kentucky insert themselves into Cincinnati riverfront development issues, arguing for the protection of their downtown skyline views.

Another characteristic of Cincinnati region river settlement patterns has been the development of numerous towns and villages along the Ohio River. These neighborhoods developed due to their advantageous locations on the river and the ease of access to Cincinnati thereby. The studied communities of New Richmond, Ohio and California, a Cincinnati neighborhood, reveal the decline that has occurred but also the potential for renewed growth with refocused attention on river transit. River transit had declined so precipitously that by 1925, the City Planning Commission stated: “There are no commuters and virtually no local transportation of passengers on the Ohio River, except to Coney Island. Therefore, local transportation by water can also be left out of the account [of transit inventory] except to the latter resort” (City Planning Commission 1925, at 111).

1. New Richmond, Ohio

The Village of New Richmond was founded as two separate settlements in 1814 and 1816 (Dellinger Architects 2000). The villages of New Richmond and adjacent Susanna merged in 1828, when the area saw its most extensive period of growth. From the 1820s to the 1880s, New Richmond flourished with the birth of the steamboats, and the village
saw impressive construction and business growth during this period (Id.). During its height, New Richmond residents believed that the settlement might be “becoming a future rival to the nearby Cincinnati. Much of the charm and character of the Village is found in the remaining structures that were built in this time period” (Id.). This period of prosperity ended abruptly in the 1880s with the advent of the railroad and the subsequent shift of freight shipping to road and rail, away from river (Id.).

The asset that led to the village’s greatest growth later created the conditions for its deterioration. Due to the village’s situation on the Ohio River, it suffered consistent, devastating flooding, being dealt a “final blow” by the infamous 1937 Flood (Id.). Since then, modest downtown growth was seen with the construction of the Beckjord Plant and U.S. 52. The need for

Figure 4: New Richmond’s former riverfront central business district. This street was once U.S. 52.

Figure 5: House in New Richmond showing riverboat heritage.

Figure 6: Remaining structures and vacant parcels. Note driveway remnant into vacant lot.
workforce housing spurred the development of mobile home housing in the village’s low-lying areas of the village where older structures had been destroyed by previous flooding. The recent flooding in 1997 proved the vulnerability of this settlement pattern and most recent metropolitan growth has been concentrated in the highlands above the original downtown (Id.). The 1997 flood resulted in an estimated $300,000 in infrastructure damages alone, and “as of April 1, 1999, sixty-three (63) structures were permanently removed” due to direct flood damage or through mitigation efforts (Id.). Assuming “per household average of 2.96 this represents a population decrease of 186 residents” which does not include the many vacant residences not yet addressed or awaiting acquisition through mitigation programs (Id.).

2. California, A River Village of Cincinnati

The river village community of California has been a neighborhood of Cincinnati since it was annexed thereto in 1909 (Hill 1986). Together with Mt. Washington, it makes up Cincinnati’s extreme southeast border with Anderson Township and is the first section of the city to be reached from New Richmond via U.S. 52. While it had been founded in 1849 and had been successful as a small community, California’s major source of prosperity came by its location near the Coney Island Amusement Park, which began operations in the 1880s.
By 1896, the popularity of Coney Island resulted in continuous steamboat passenger service between California and the Downtown Riverfront (Cincinnati.com 1999). Coney Island and California suffered from consistent flooding, particularly the 1937 flood, and thus were neglected over the twentieth century. The last Island Queen steamboat to service Coney Island exploded in Pittsburgh in 1947, and the next 60 years of progress have “not been kind to California” (Cincinnati.com 1999) (Hill 1986). Cincinnati’s beltline Interstate 275 and the Cincinnati Waterworks have consumed much of the land that was part of the originally platted town, removing potential parcels from tax rolls (Hill 1986). Many remaining parcels have been devastated by flooding and have thus been difficult to develop. As will be discussed further infra, the community has
ample acreage for redevelopment along with the requisite regulatory framework in place to allow for aquatic based transit development.

3. Downtown/Central Riverfront

As early as 1925, and still at issue in 1948 with the publication of that year’s Cincinnati Metropolitan master plan, the city’s central riverfront neighborhood was viewed as a derelict, underutilized wasteland of old warehouses and irrelevant shipping facilities (City Planning Commission 1925, City Planning Commission 1948). In the 1948 plan, the area was simply known as “Riverfront Redevelopment Area” (City Planning Commission, 1948). Only 2,000 feet of riverfrontage in the city were utilized in water transportation by 1925 (City Planning Commission 1925, at 13). The existence of such conditions led to the construction of the city’s major east-west interstate arterial, Fort Washington Way (Interstate 71 and U.S. 50), between Third and Second Street. This placement severed the central business district and modern office core from the original riverfront downtown, and created further neglect and deterioration for the remaining structures.
Even in the 1948 Metropolitan Master Plan, the area was recognized the potential for riverfront redevelopment as a luxury housing/entertainment district (City Planning Commission 1948, 144). Cincinnati previously had an active river recreation culture which continues to this day. However, plans were only ever partially completed, leading to the construction of the original Riverfront Stadium (since replaced by Great American Ballpark) and a coliseum. The remaining land became expansive “interim” surface parking lots servicing the nearest downtown office towers (Id. at 158). During the 1990s, the last of the riverfront warehousing was taken by Hamilton County and cleared. The city and the county developed two new stadia, a national museum dedicated to the Underground Railroad, and plans for a new live-work-play neighborhood called “The Banks” were approved (The Banks 2010).

With The Banks project, the city has committed itself back to its central riverfront. The development is seen as a new centerpiece for the city, and has occurred following a realignment of the interstate that physically cut the central business district off from the river. Once the area is elevated from the floodplain by city financed parking garages, it is intended to be a new neighborhood, with offices, retail, restaurants, and housing needing intermodal connectivity to its regional neighbors (Id., The Banks Public Partnership 2010).
TRANSIT-ORIENTED DEVELOPMENT

Analyzing the potential of a water-based transit system to spur waterfront development in existing population centers depends upon transit-oriented development (TOD) planning theories and strategies. There is a diverse and extensive body of literature devoted to TOD, and this scholarship particularly emphasizes the impact such development can have on land use decisions, property values, and commuter patterns. While most American scholarship concentrates on the development abilities of rail and land-based transit systems to catalyze development, certain metropolitan areas have capitalized similarly on water-based transit systems as well. One can use the same general principles and terminology in exploring these similar development scenarios.

The literature concerning transit-oriented development can be reduced to several salient topic areas. Critical in any initial transportation planning effort is the study of capital requirements and assets that are already in place. Another important consideration is the potential impact that will accrue to communities in proximity to transit assets, in terms of land use changes that will optimize the investment in the transit infrastructure and the value that can be captured by increased private investment and development. Finally, an analysis of current traffic patterns and problems with existing assets should be compared against projected changes in order to define a measure for success.²

II. INFRASTRUCTURE PLANNING AND CAPITAL INVESTMENTS

One of the obvious initial concerns with any transit development is the availability of and projected impact on local government capital investment funds. A project must first address an identified need. Once it is determined that the infrastructure investment is a need, it must then be given priority for capital investment. Some municipalities employ complex rankings systems to

² Discussion of this point will primarily be limited to the Data & Analysis section, infra.
determine the projects in which they will invest. Typically, when a capital outlay is significant enough, as in the construction of a commuter rail line or interstate highway spur, adjacent communities will see vast changes in land use needs and development patterns. This will, in turn, have a major impact on travel times, commute patterns, and regional trip generation that can reduce burdens on existing capital assets. Since this thesis proposes a major capital outlay project, needs analysis and rankings criteria that are used by municipalities to assess project appropriateness provides a solid analytical framework for data collection and analysis.

A. What is a need?

According to Douglass B. Lee, “[a]n infrastructure need is any capital project for which the benefits exceed the costs” (Lee 1988, 46). This is an admittedly broad definition, and the terms benefits and costs are also construed broadly to include all impacts to economic, social, and opportunistic values, both positive and negative (Id.). It is instructive, however, in providing a “framework within which the need for greater or lesser levels of investment can be evaluated” (Id., at 47).

This basic needs assessment provides the foundation upon which the majority of high-level infrastructure projects are judged. Lee indicates that this benefit-cost analysis has been built into assessments at the federal level, and “[a]s the capacity and quality of the system improved, the marginal benefits of further new construction declined while costs rose” (Id.). Thus, while neither the explicit nor exclusive guiding principle in the needs assessment for the Interstate Highway System, this factor had a major impact on the priority and completion schedule for many of the routes in the system during its most prolific and expansive years.

In order to optimize the capital stock, decision makers must be able to “select the right total amount to invest, and choose the best projects within that total” (Id., at 49). This achieves
the most efficient level of investment which essentially indicates maximized benefits and minimized costs. In highway terms, optimized capital investment yields the highest capacity, premium surface condition, and maximum safety and minimizes time, running costs (wear & tear), and accidents (Id., at 49-52).

B. Evaluation Criteria and Priority Rankings

In order to determine which infrastructure projects merit implementation, “[p]roject proposals need to be rated and ranked in some manner” (Hatry, Millar and Evans 1990, 6). Hatry, et. al., conducted a survey of 25 municipal respondents designed to assess technical review procedures employed by central offices when determining capital improvement project implementation (Id.). From the results of this survey, they condensed the responses into eleven evaluation criteria which they felt were most important for local governments (Id., at 7-9). While all eleven criteria are instructive and relevant to the development of this thesis, for the purposes of brief review, I will limit discussion to the most essential. They include fiscal impacts; community economic effects; environmental, aesthetic, and social effects; amount of disruption and inconvenience caused by the project; effects on interjurisdictional relationships; and advantages accruing from relationship to other capital projects (Id., at 9). Another key component that is necessary to any public expenditure on capital improvements is the political situation, which will be explored for the specific study areas in the methodological review.

1. Fiscal Impacts

While providing data on the projected costs of a capital project might seem obvious, there are different direct project costs that are valuable to decision makers beyond initial development or implementation costs. Consideration should also be given to operations, maintenance, energy, and liability issues in determining the outlay of capital funds.

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Hatry, et. al., recommend that decision makers consider capital costs in the traditional sense (Id., at 7). “Departments should provide both the annual total cost for the project and the annual net local government cost3. . . Departments should show future-year capital costs to complete the project as well as those for the budget year under consideration.” They also recommend indication of future potential savings, such as the aversion of a full replacement by a strategically timed rehabilitation capital outlay (Id.).

Operating and maintenance (O&M) costs enumerate “the expected change in O&M costs” to the budget (Id.). Operating and maintenance costs are:

[1] hose costs that have been incurred for the administration, supervision, operation, maintenance, preservation, and protection of the [investment]’s physical plant. They include expenses normally incurred for such items as janitorial and utility services; repairs and ordinary or normal alterations of buildings, furniture and equipment, care of grounds; maintenance and operation of buildings and other plant facilities; security; earthquake and disaster preparedness; environmental safety; hazardous waste disposal; property, liability and all other insurance relating to property; space and capital leasing; facility planning and management; and, central receiving (University of Florida Office of Cost Analysis, 2009).

Hatry, et. al., recommend annual projections showing the future years affected by the investment, including any potential savings that might accrue to the investment itself or other infrastructure as a result of the implementation (Hatry, Millar and Evans, at 8).

Potential changes in revenue streams can have a significant impact on the decision of whether to fund a capital project (Id., at 8). Certain capital outlays, such as highway realignments, can result in the loss of adjacent private properties, and thus property tax revenues (Id.). Conversely, certain projects can improve access to properties previously inaccessible and not developable, thus providing a new source for business and residential development and the

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3 The annual net local government cost takes account of expected extrajurisdictional funding sources, such as federal and state contributions. (Hatry at 7).
increase in taxes. Also, while many transit projects rely on public subsidy to operate, some are successful enough to pay for themselves and other capital projects (Pederson 1980, 37).

Other important cost considerations include the potential impact on energy requirements and the risk of legal liabilities. Energy requirements “can be an important consideration especially in times of rising energy costs and national shortages,” particularly in budgets that have large motor vehicle pools and high petroleum consumption (Hatry, Millar and Evans, at 9). Legal liabilities can be ongoing and excessive, particularly when a municipality elects not to fund a capital outlay that could limit liability, “such as for flood damage incurred as a result of water-main breaks” (Id.).

2. Community Economic Effects

While it is not one of the typical functions of transportation planning departments to quantify the economic impact of their capital outlays, this factor is one of the most important when implementing a transit-oriented development. The success of a TOD depends upon the positive economic impact it creates in its proximate communities.

Hatry, et. al., recommend engaging the municipality’s economic development agency in order to ascertain “information on the economic effects of proposals, which would also ensure uniform analysis across proposals” (Id., at 13). Particularly with transit developments, communities can expect beneficial impact in each of the following: property values; future tax base; added jobs; citizen income increases; business development; and “stabilization or revitalization of declining neighborhoods” (Id.). Projects like TODs are intended to spur growth and development, and they are supposed to have significant influence on community economic development.

3. Environmental, Aesthetic, and Social Effects
Today, environmental considerations are some of the paramount concerns with transportation projects.\(^4\) For example, one of the main goals of the Revive I-75 Corridor Study is to “incorporate\([e]\) green infrastructure principles to reduce and filter storm water naturally and minimize negative climate impacts” (City of Cincinnati, 2009). Environmental buzzwords abound on transit plans, and especially concerning are “[n]oise and air and water pollution, even if they do not cause significant health problems” (Hatry, Millar, & Evans, at 13). Social effects are easier to convey in the negative sense, such as when a highway project levels, displaces, and disconnects communities within the planned route. This criterion would also take account of changes in travel time and recreational opportunities (Id.).

4. Effects on Interjurisdictional Relationships

This criterion, while given little treatment by Hatry, et. al., is important to a regionally expansive transit-oriented development strategy (Id., at 15). Capital investment into heavy transit, such as rail lines, has historically created “‘String of pearls’ suburbs,” each of which may be a separate jurisdiction (Pederson, at 10). In the Chicago area, this development pattern along Metra lines is visible reaching into adjacent counties and states (Commuter Rail Division of the Regional Transportation Authority, 2010). In Boston, the ferry system connects outlying suburban communities with the central business district and creates a strong connection between jurisdictions (Massachusetts Bay Transportation Authority, 2010).

5. Advantages Accruing from Relationship to Other Capital Projects

This criterion is an important one to transportation planners interested in developing multi-modal, multi-nodal systems in their regions. Hatry, et. al., illustrate this with the example of coordinating a street rehabilitation project with water main replacement so that interruptions

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\(^4\) This source, published in 1990, illustrates an anachronism here by discounting the environmental and grouping it together with aesthetic and social effects.
can be minimized and costs can be shared across implementing agencies (Hatry, Millar, & Evans, 16). Comprehensive transit plans rely on the advantages available via interconnectedness. In the Boston region, riders make efficient, advantageous use of capital investments, when they ride a boat to a station which services subway, regional rail, and airport transit. For example, a rider from Hingham can ride a ferry to Rowes Wharf, and then with a short walk to South Station can ride different transit options to Cambridge, Logan Airport, Old Orchard Beach, Maine, Providence, Rhode Island, or even Washington, D.C. (Massachusetts Bay Transportation Authority, 2010 National Railroad Passenger Corporation, 2010).

III. Land Use Dynamics in Proximate Communities

There are obvious qualitative and quantitative connections between land use and infrastructure that impact the settlement patterns of communities. “Cities have long utilized their control over access to infrastructural needs in order to influence the direction and pattern of urban growth, promote diversity of land use, encourage urban compactness, foster intensity of development within the central business district, and promote accessibility” (Birck 2008, 631). As a distinct form of infrastructure, cities can impact settlement patterns and land uses by manipulating land rents and transit costs through transportation facility investment.

A. Traditional Land Use Characteristics of Riverside Communities

Research into current riverfront land use development indicates several interesting tendencies that follow from the discussion supra at §I.a. First, development has tended to spread in a linear fashion along the river, since this is the most valuable land for initial commercial development and commerce. A quick look at a map of Cincinnati’s municipal boundaries belies the former value and importance placed on river frontage, as the borders extend along the river in a distinct, linear fashion.
The second characteristic of land use along urban riverfront spaces is the tendency toward industrial/low value commercial uses once a settlement has reached maturity. Since growth in most American river cities shifted away from the flooding river banks, the riverfront parcels were typically left to uses engaged in river shipping, warehousing of bulk commodities, and low rent commercial uses, such as motels and bars (Gessaman 1969, Committee on Urban Waterfront Lands 1980, City Planning Commission 1948). The risk of catastrophic loss to floods forced higher value commercial and residential uses away from the riverfront. The later shift in the U.S. economy from a manufacturing- to a service-base, contemporaneously with the decline in non-truck shipping, then reduced the occupancy of even these low rent uses. The resulting state of abandonment and neglect is prevalent in the communities of the Cincinnati region, which included even the downtown riverfront of the CBD until the 1990s (Federal Writers’ Project 1943, Gessaman 1969, Committee on Urban Waterfront Lands 1980).

### B. Impact of Transit on Proximate Land Use

There is a paucity of research into the use of aquatic transit as a form of transit-oriented development that can drive land use changes. While there are developments beginning to occur, it is a relatively recent phenomenon to be discovered by developers, and thus academic research has not yet caught up with the state of the practice. Since there are similarities in carrying capacity, trip time, station location, and other factors between aquatic mass transit and well-understood rail mass transit, review of traditional land-based TOD literature is appropriate.
“The theoretical link between land use and transportation is found in location theory” (Lee and Yujnovsky 1971, 8).

Location theory incorporates space as a cost variable in location decision making by users of land, such as firms and consumers (Id.). While there are many complex models that seek to predict travel demands, such as disaggregate choice models and entropy models, it will suffice for this study to work from the simple, traditional rent theory (Id., Jansen, et al. 1979).

Rent theory explains the function of transportation costs where all other costs are assumed to be equal (Lee and Yujnovsky at 10). If costs are equal, then profits would be equal, with variable costs resulting from transportation to a central market location (Id. at 11). “Since sites closer to the market are more profitable, owners of these sites will charge more for their use” (Id.). Thus, increasing the efficiency of transportation, which results in lower transportation costs, can make an otherwise undesirable or inaccessible location viable (Id.). In this case, “[a]ccess is the effective nearness to . . . activities . . . of interest” (Id. at 15). Changes to a transportation system can improve access without location change, and where transportation investment can achieve economies of scale (e.g., by investing in fixed asset infrastructure) efficiencies can be maximized even further (Id. at 12).\(^5\)

\(^5\) Essentially, then, the investment in the transportation system constructively adds value to a location by functionally lowering its transportation costs to a point of interest.
Accordingly, strategic investment into transportation network efficiency can increase access for—thus desirability of—a particular spatial location. This is the basis upon which transit-oriented development operates (Id.). TOD is almost universally lauded for its ability to generate and sustain “smart growth” that pays not only for the transit, but also the rest of the development, in terms of fiscal impact to a municipality. TOD locations are desirable due to the increased transportation efficiency and thus decreased costs to firms and potential residents. As such, it is a tool that can be successfully utilized to attain several important city planning goals. First, TOD influences positive patterns of growth. Proximity to low cost, convenient transportation encourages intensity and diversity of uses, promoting a denser, more active twenty-four hour neighborhood district of residential, retail, and services activity (Id., Lee 1971, Pederson 1980, Stein 1988, Hudnutt 1998, Paumier 2004, Guy 2001, Birck 2008, Rodrigue 2010).

TOD encourages compact development that is more pedestrian friendly than traditional suburban detached single-family development with separated commercial use. “A minimum catchment area of 400 dwelling units or 1000 residents, beyond a 450 meter walk distance [just over a quarter mile] to a transit stop is often required for an extension of service” (Rodrique 2010.) In Cincinnati’s 1925 plan, the walkability standard for transit service was noted quite aptly: “It is generally felt by traction experts that a trolley or bus line should be near enough to the people whom it serves, so that no one will be required to walk more than a quarter of a mile, or at the outside half a mile” (City Planning Commission 1925, 110). A more important transit system, such as rail or ferry, provides the critical capacity to such a large population and simultaneously acts as a point of high convergence, drawing multi-modal users, such as bicycles, park-and-rides, and subsidiary transit connection, and higher intensity commercial and retail activity (Id., Pederson 1980, Stein 1988, Hudnutt 1998, Guy 2001, Paumier 2004, Birck 2008).
A second important goal that is attainable through TOD is new economic development. “Infrastructure facilities not only serve many public functions but also play an important role in private-sector economic activities. . . The quality of the public infrastructure is therefore an important ingredient in the location decisions of private enterprises.” (Birck 2008, quoting Stein 1988). Combined with the infill concepts discussed infra, it can be inferred that placing high-quality infrastructure investments in declining neighborhoods could catalyze private-sector development, entrepreneurial activities, and increased tax receipts to the provider.

One major justification for TOD over the use of traditional bus transit service is its perceived permanence (Thomas 2009). It is argued that developers will make long term investment decisions based on more permanent transit improvements such as a streetcar line or other rail that they wouldn't make on a bus line, which can be changed with “a can of orange paint” and new signs (Id.). With rail systems, steel on the ground and other fixed assets are physical evidence of public investment into a place and its accessibility. This gives consumers and investors more certainty when making housing and shopping choices (Id.).

IV. INFILL DEVELOPMENT THEORIES AND STRATEGIES

Infill development is becoming an ever more important tool in the arsenal of planners seeking to combat sprawl and its related excessive costs (Real Estate Research Corporation 1982). Many cities contain parcels that have been left undeveloped by “leapfrog” settlement patterns. Infill development strategies seek to target these parcels with development incentives, saving utilities and services from costly extensions. This more compact development pattern also reduces the costs that are incurred by the addition of users to the system (Id.). In cities that have experienced extensive outmigration, a surplus of utility capacity could occur, and encouraging infill development helps to distribute cost burdens more equitably (Id. at 3).
There are many excellent reasons for a municipality to pursue a policy of encouraging infill development, or “smart growth.” Preservation of greenspace and agricultural lands, reduction of land costs, compact development, energy conservation, and neighborhood economic support all accrue when vacant parcels are developed (Id.). In terms of neighborhood revitalization, sensitive infilling can provide “[n]ew housing [that] will appeal to the middle-income taxpayers whom cities want to attract and retain, while . . . increasing the population base that supports neighborhood retailing and cultural institutions (Id. at 4). This increased activity can lead to sustained investment in rehabilitating existing residential and commercial structures (Id.).

According to a study conducted by the Real Estate Research Corporation of selected infill parcels, the bulk of the inventoried properties were found to be “free of severe physical limitations to development” (Id. at 7). While the vast majority of their studied parcels were a quarter acre or less (“the equivalent of the average single-family detached homesite”), more than half were found to be adjacent to other vacant land which could allow assembly into a larger project (Id. at 5). It was discovered that communities “‘overzone’ for industrial or commercial uses in the hope of attracting tax ratables” while ignoring efficient multi-family housing (Id. at 7). Also, it was discovered that most infill parcels were owned by local individuals or businesses, with only one-fourth being owned by people in the real estate speculation business (Id. at 8).

“Effective infill policies and programs must be based on a sound understanding of the quantity of infill land, its key characteristics . . ., and the development economics (Id. at 17). In order to assess these criteria in their studied communities, the researchers compiled vacant land

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6 Such as “location, size, ownership, availability, market attractiveness, zoning, and physical limitations” (Real Estate Research Corporation 1982, 17).
inventories which identified the infill opportunities available (Id.). For the purposes of this thesis, such an inventory will be discussed *infra*, and was conducted by use of Geographic Information System (GIS) with data available from county GIS agencies. Once the vacant parcels were inventoried, the researchers analyzed them based on availability of municipal services, physical limitations, current zoning, and by surveying landowners to assess sale interest/potential.

For a community to truly experience productive infill development, government must be active in supporting the changes necessary to accommodate it. “Local government actually can assist infill efforts” which “will require better targeting of existing resources as part of a city’s development strategy” (Id. at 43). Government can help with incentive programs and regulatory improvements to stimulate developer interest in—and remove development obstacles from—infill parcels. Other strategies could include working with neighborhood residents to generate support for growth and addressing market weaknesses by offering advantageous financing, lowering risk, or doing pilot demonstration projects (Id. at 44). Governments can also assist by addressing site problems such as improving infrastructure and can increase land availability through eminent domain and land banking (Id.). Through tools such as tax abatements, density bonuses, downzoning, and infrastructure investment, municipalities can lower the cost of investment in center city parcels, promote denser, more compact development, and correct for accessibility issues and zoning failures.

**CONCLUSION**

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7 “The most commonly noted sites with environmental problems are those located ‘in the floodplain.’ . . . if planners choose not to count vacant infill land in the 100-year floodplain, they will underestimate infill development potential as long as local ordinances permit at least some urban uses on flood-prone land” (Id. at 23, emphasis added).
In reviewing the literature concerning urban waterfront development, capital investments, TOD, and infill development, it becomes apparent that a solution to river neighborhood decline could be investment in aquatic mass transit infrastructure. I hypothesize that the capital outlay involved with such an approach to transit-oriented infill development would score high marks and receive priority ranking using the scoring criteria for capital investments. The improved interjurisdictional relationships and linkages, together with the positive fiscal impacts and spurred community economic development and environmental benefits of an infill TOD should justify the expense. Considering the substantially lower transportation costs, the improved land use, and the better returns on utilities, regions could successfully promote smart growth strategies and vibrant, sustainable neighborhood centers in existing, outlying communities.

**Methodological Literature Review**

In order to ascertain the feasibility of an aquatic TOD infill proposal in the study area, it is useful to examine current plans and transit trends. These information sources will speak to the political will and expectations of the studied communities and will provide insight into future growth prospects. It will also allow prediction and planning for potential sources of problems to the current transportation system in place that could be alleviated by this proposal.

V. **Cincinnati Planning & Development**

Initial research into Cincinnati’s planning activities as they relate to this thesis revealed several competing agencies, plans, and partnerships that could be leveraged to create a more comprehensive transportation network connecting important revitalized areas. Key opportunities and problem areas include The Banks project and the Streetcar plan in the center city, the Eastern Corridor, rail initiatives, highway projects, and coordination among the various transit operators in the region.
Cincinnati’s riverfront redevelopment project, known as The Banks, is envisioned as a live-work-play neighborhood on the city’s prime real estate (The Banks 2010). Two stadia and a national museum center have been placed as keystone tenants to anchor the development, and the local government has leveraged extensive inter-governmental transfers of funds to raise the land above the 100 year flood plain (Id., The Banks Public Partnership 2010). This has been accomplished by constructing a massive parking garage, atop of which is planned millions of square feet of mixed use development, including hotels, retail, offices, parkland, and residential development (Id.). Plans even include boat landings for recreational and cultural vessels as a visible symbol reconnecting the city to its river heritage (Cincinnati Park Board 2009). As part of early redevelopment efforts involved with the lowering of the Fort
Washington Way expressway, a “multi-modal” transit center was constructed underground (The Banks 2010).

Since it was built, this transit center has remained essentially inactive. It was intended to receive light rail trains from the Eastern Corridor and exurbs, but the exurban light rail plan was resoundingly rejected by voters in 2002 (Pilcher 2002). The Eastern Corridor plan has been slow to move as well, as a result of its involvement with a state and national scenic river (Klepal 2005). The planned Cincinnati Streetcar would operate near the transit center, making it a possible multi-modal connection if it is ever implemented (Thomas 2009). Thus, plans for the center city manifest a clear political and economic will to redevelop and reconnect to the river.

While no transit has yet been implemented, and the current project provides necessary numbers of parking spaces, there is clear evidence that interest in transit exists. As a regional project, connections to other jurisdictions via existing and future transit can be assumed.

One of the key neighborhoods to this study, California, was included as one of the communities in the Eastern Corridor Land Use Vision plan. In the City’s 1980 Coordinated City Plan, the neighborhood was identified as a desirable location for additional development of medium density housing and commercial uses (City Planning Commission, 1980, Map 3, Map

Figure 17: Proposed riverfront terminus of the Eastern Corridor commuter rail at the Riverfront Multi-Modal Transit Center (Eastern Corridor 2003).
6). As a result of the Eastern Corridor Land Use Vision plan, much of the community was rezoned to Riverfront Residential, one of the city’s least restrictive zones. This plan provides compelling evidence of the political will of the neighborhood to take a growth-supportive orientation. Since it was determined through extensive public involvement and interjurisdictional cooperation, its recommendations and actions by the city in reliance on it can stand as policy support for the zoning selected and the uses allowed thereunder. As will be described infra, TOD infill development in such a zone can create significant, compact, sustainable mixed use development that would infuse the neighborhood with a population high enough to support such a convergent, highly used and accessible transit.

New Richmond has also been active in comprehensive planning and seeking transit connections for its residents. In its most recently adopted comprehensive plan, the village outlines its vision for the redevelopment of its “Olde Village” section, which is the historic downtown that has been devastated by flooding, traffic pattern shifts, and disinvestment. One of the stated development goals of the comprehensive plan is to
“[e]ncourage the construction of new buildings in the Olde Village, which contribute stylistically to the historic structures, when they are done as elevated or flood proofed structures” (Dellinger Architects 2000). The plan also describes that:

[the Olde Village presents many sites with development potential for a variety of housing types, ranging from luxury town homes with river views, to more affordable single family attached or detached homes . . . Many desirable sites are available for new residential development of elevated houses. As more sites are developed, and the mitigated properties are cleared, it can be expected that higher income level people will be attracted to developing housing with river views and access in the village (Id.).

The plan essentially outlines development strategies and potentials that are attainable by means of transit-oriented infill development, as proposed by this thesis. The plan admits that “[t]he Village simply does not utilize its location on the Ohio River effectively” (Id.). By restoring the historic connection to river transit, the village could spark the growth its comprehensive plan seeks to encourage.

One of the key priority rankings criteria discussed supra involved the ability of a capital outlay to accrue advantages from other capital projects. Recently, municipalities and metropolitan planning organization have recognized the importance for local and regional freight planning, particularly as it relates to the river. This is a recognition in a truly etymological meaning of the word, since the issue was well aired in the city’s first official plan of 1925, and solutions for mechanized, intermodal port facility designs were already proposed (City Planning
Commission 1925, at 144). In response to this recent revival of the issue, Cincinnati’s OKI formed a Freight Working Group in 2005 to once again “begin to understand the impact freight will have on the Tri-State region. The focus from the beginning has been to take action on freight improvements through relationship-building among the private sector, public sector, regional and super-regional interests” (OKI 2010). This freight planning initiative by OKI has the capacity to leverage extensive federal funding that has been made available through the Marine Highways program (Department of Transportation Maritime Administration 2010, OKI 2010). The Marine Highways program, which aims to improve the freight capacity and port infrastructure of America’s sea and inland commerce centers, could be leveraged to complete improvements necessary to return passenger travel to the Ohio River.

Further related to capital project coordination, the recent development of transit services in the Cincinnati region’s outlying communities could be modified to seamlessly integrate with an aquatic mass transit of higher capacity. The recently developed Clermont Transportation Connection provides bus transit access from Downtown New Richmond to Downtown Cincinnati. It also operates busses from other parts of Clermont County to each other and to Downtown Cincinnati. These busses could be used to expand the ridership capacity of transit investments in New Richmond, rather than spending 45 minutes driving high cost, high traffic routes between Eastgate, New Richmond, and downtown Cincinnati. Instead, they could bring people into New Richmond to shop and transfer to a ferry. This could reduce travel times and costs significantly, both for riders and the operator.

Another major project that will have an impact on commuters from New Richmond and California, as well as the many others using U.S. 52, I-275, and I-471 to access downtown Cincinnati is the Brent Spence Bridge replacement project (Parsons Brinckerhoff 2010). “The
National Bridge Inventory lists the Brent Spence Bridge as functionally obsolete due to the capacity, sight distance, and safety concerns associated with its current configuration” (Id.). The planning process is still early in terms of environmental impacts, alternatives considerations, and approval for implementation, but qualitative observation indicates that authorities will choose replacement of the bridge as the main I-75/I-71 span (Id.). When the time comes for the bridge’s operations to be impacted by plans, traffic will necessarily be diverted to other regional spans, pushing the current highway’s congestions of commuters and interstate travelers onto I-471. This will have a significant impact on commutes from the East and from the studied communities, which have no other interstate access connection and will be forced to seek alternate routes on local roads.

This situation illustrates the tenuous access connection via highway that is available to the studied communities. Another recent situation that did so as well was the discovery of structural deficiencies in the Combs-Hehl Bridge connecting Ohio with Kentucky on I-275. Inspections in 2008 discovered cracked plates on the bridges that required closing the spans for three weekends overnight (WLWT.com 2010). The maintenance project cost the Kentucky Transportation Cabinet over $500,000 dollars and demonstrated the vulnerability of the highway commute connection (Id.). The the dependence on bridge connections for access on both I-275 and the I-471 Daniel Carter Beard Bridge risks obvious chokepoints that would impact the regional economy significantly.

VI. BOSTON PLANNING AND DEVELOPMENT

Research into Boston’s waterfront planning and development activities indicate that the city and its region are very successful in capitalizing on such infrastructure assets. Since Boston reunited its urban core with its waterfront, it has seen billions of dollars of redevelopment
(Committee on Urban Waterfront Lands 1980, Muni-Net Guide 2006). Additionally, the region already has an active aquatic transit system linking its South Shore communities with its central business district, within walking distance of the multi-modal South Station. This connection has resulted in exactly the type of transit-oriented infill development being advocated in this thesis. As will be discussed further *infra*, the Launch at Hingham Shipyard has capitalized on its location at the Hingham Ferry terminal, which has half-hourly cruises to South Station in Boston, to create a mixed-use, transit-oriented lifestyle community. It has converted the greyfield that was the Hingham Ship Yards into a successful infill development with 1.2 million square feet of mixed use development on 130 acres (Samuels & Associates 2009, *see infra* Figure 42).

**DATA & ANALYSIS**

Data collection and analysis has been concentrated in the two specific study areas of California and New Richmond, and will follow the needs analysis discussed *supra* in Section II. In order to determine whether the benefits that might accrue by utilizing the Ohio River as mass transit infrastructure would outweigh the costs—thus making it a need—guidance will be provided by the priority criteria discovered in the literature review on capital infrastructure investments, which included fiscal impacts; community economic effects; environmental, aesthetic, and social effects; amount of disruption and inconvenience caused by the project;
effects on interjurisdictional relationships; and advantages accruing from relationship to other capital projects.

VII. POTENTIAL FISCAL AND ECONOMIC EFFECTS OF AQUATIC TRANSIT INVESTMENT

Investigation into the traditional fiscal impacts elucidated in §II critical, such as capital, O&M, and energy is necessary for a full evaluation of this proposal. Also, direct effects on municipal revenue streams caused by changes to current land uses and zoning-permitted development in the studied communities provide insight into the potential fiscal impact of the investment. As mentioned in §III, transit location can have a significant impact on adjacent land uses since it will artificially lower accessibility costs, thereby creating development opportunities. As discovered in §IV above, infill development can effect fiscal resources positively by reducing service costs, increasing population, and promoting more compact development patterns. In tandem, the effects of these two theories can provide a powerful solution for the problem of decline in the Ohio River’s old communities.

In order to discover the potential fiscal and economic impact of this proposal, I will discuss the fiscal situation of the ferry route from Hingham to Boston, in terms of traditional costs. Further, a review of existing land uses in these areas allows an inventory of available development land. A zoning analysis provides allowable, as of right build out capabilities, which can help predict costs and revenues that could be generated.
A. Vacant Land Inventory

As discussed previously, waterfront development has historically tended to spread in a linear fashion along the shoreline or riverbank, and has tended to support industrial and shipping uses, along with other low rent uses catering to mariners and transient shipping crews (Gessaman 1969, 18-19). Due to pollution, shifts in shipping technology and modes, and continued flooding, many cities, notably among them being Cincinnati, abandoned their waterfronts and allowed them to deteriorate (Id.).

As a result of disinvestment due to flooding and population shifts, lots in New Richmond and California largely stand vacant and undeveloped. While there is a distinct orthogonal street grid still remaining in California, many of the parcels have little evidence of previous habitation, washed away by a century of flooding that is now largely controlled by capital investment into the river (Hill 1986, Congressional Budget Office 2007). In order to ascertain infill development potential, I performed an analysis of current land uses in the study areas to determine vacant and

Figure 22: California Land Use Map.

Figure 23: Typical land uses in California, parking lot and vacant lots.
non-revenue generating parcel data. Where parcel size was available only in square feet, I converted the square feet to American acres with simple arithmetic. If acreage was provided by the data source by found to be 0, the same square footage conversion was performed to generate an acreage value. Data were collected concerning parcels within a quarter-mile and a half-mile of potential TOD access sites since these are recognized standards of walkability within the state of the practice.

My analysis of California land use trends revealed a neighborhood dominated by vacancy and public land ownership. Specifically, the downtown district revealed over 19 acres of vacant land within a quarter-mile of a potential ferry terminal site (Cincinnati Area GIS 2010). Within the same buffer area, non-revenue generating public land comprised an additional 10.9 acres, for a total of over 30 acres of vacant or non-revenue generating land within a quarter-mile distance of a potential TOD investment site. Land use classifications for all vacant land in California fell under residential for the most part, with some abandoned commercial sites, indicating a likelihood of freedom from brownfield contamination, which tends to accompany former industrial use sites (Id.).
Almost the entire California downtown district falls within a half-mile walkshed of the proposed TOD site. This distance is still considered walkable for the purposes of neighborhood planning and design, and the data indicates significant infill development potential. The half mile land analysis of vacant parcels broke down as follows (in acres):

<table>
<thead>
<tr>
<th>Commercial</th>
<th>Residential</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.55117197</td>
<td>28.0334492</td>
<td>30.58462</td>
</tr>
</tbody>
</table>

A look at all non-revenue generating properties by land use illustrates the perceivable dominance of publicly owned lands in the neighborhood, eliminating over 100 acres, many of formerly occupied parcels, from the city’s and the neighborhood’s revenue base.

<table>
<thead>
<tr>
<th>Commercial</th>
<th>Residential</th>
<th>Public/Utilities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.55117197</td>
<td>28.03344917</td>
<td>73.70415</td>
<td>104.2888</td>
</tr>
</tbody>
</table>

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8. See Figure 22: Downtown California Land Use Map, which still illustrates the former parcels platted within publicly owned land.
My analysis of New Richmond land use trends revealed a neighborhood dominated by abandonment as well, mostly of former residential uses. Specifically, the downtown district revealed almost 16 acres of vacant land within a quarter-mile of a potential ferry terminal site (Clermont County GIS 2010). Within the same buffer area, non-revenue generating public land comprised an additional 8.9 acres, for a total of almost 25 acres of vacant or non-revenue generating land within a quarter-mile.
distance of a potential TOD investment site. Land use classifications for all vacant land in New Richmond fell under residential for the most part, with some abandoned commercial sites, indicating a likelihood of freedom from brownfield contamination, which tends to accompany former industrial use sites (Id.).

Almost the entire New Richmond downtown district falls within a half-mile walkshed of the proposed TOD site. This distance is still considered walkable for the purposes of neighborhood planning and design, and the data indicates significant infill development potential. The half mile land analysis of vacant parcels broke down as follows (in acres):

<table>
<thead>
<tr>
<th>Commercial</th>
<th>Residential</th>
<th>Industrial</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.9910258</td>
<td>60.00150854</td>
<td>2.678</td>
<td>82.67053</td>
</tr>
</tbody>
</table>

A look at all non-revenue generating properties by land use illustrates the perceivable dominance of vacant residential lands in the neighborhood, eliminating over 100 acres, many of formerly occupied parcels, from the village’s revenue base.
Assuming arguendo that the industrial sites are brownfields with severe physical limitations to development, this still leaves well over 100 acres of otherwise underdeveloped, underutilized, non-revenue generating land uses within a reasonable walking distance from potential TOD investment.

### B. Zoning Analysis

The City of Cincinnati has placed much of the prime vacant residential parcels of the California district, which are within a quarter mile of the proposed TOD site, under RF-R Riverfront Residential zoning. This is one of the city’s least restrictive zonings in terms of allowable uses and density of development. Nearly any type of commercial, residential, or public use is permitted, including transportation facilities such as passenger terminals and shipyards. According to §1415-03 of the Cincinnati Municipal Code, the specific purpose of this designation is stated as follows: “RF-R Riverfront Residential/Recreational District. To optimize the scenic beauty of the riverfront while mixing residential uses into
current public and semi-public land uses and to enhance the stability and revitalization of adjoining neighborhoods” (City of Cincinnati 2010, §1415-03). The applicable building code provisions for properties within the 100 year floodplain also applies, which merely requires buildings to be elevated between 1 and 3 feet (Id. at §1109-01). While heights are capped at 35 feet, this is measured above the base flood elevation, allowing for buildings almost four stories tall, or three stories with under-house parking (Id. at Schedule 1415-05).

Maximum building coverage of a lot in this district is 60%, and multi-family housing developments with a minimum 2,000 square foot dwelling area can be constructed. This regulatory framework permits as-of right development within a walkable distance to transit that, if maximized, could infuse the neighborhood’s vacant riverfront parcels with 425,383.65 square feet of new residential (or mixed-use)\(^9\) development (Id., Cincinnati Area GIS 2010). If purely residential construction were developed, over 200 new dwelling units could be constructed (Id.).\(^10\)

When this RF-R zoning analysis is applied to the non-revenue generating public properties within a reasonable walking distance, it reveals nearly 3 million square feet that can be developed as of right into 1,767,297.26 square feet of residential, over 880 units (Id.). Thus, if purely residential development were pursued on the RF-R zone vacant and public parcels in California, the neighborhood could see the addition of over 1,000 new dwelling units (Id.). As of right under this zoning, a development could include a substantial mix of uses bringing extensive population growth and spur economic activities to support a large scale transit investment.

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\(^9\) The RF-R zoning allows commercial uses such as restaurants and eating establishments, hotels, and retail.

\(^10\) While beyond my analytical capabilities, a thorough fiscal impact analysis of the potential developments in the study areas would be extremely useful in determining the truest benefit-cost ratio of this proposal. The newly developed OKI Fiscal Impact Analysis Model would probably be able to provide the necessary calculations.
It would be prudent to utilize the RF-R zoning for its flexibility of other use types since much of the remaining vacant or publicly owned parcels within the half mile walkshed of the proposed TOD investment site are zoned for SF-4 Single Family Residential development. The zoning code defines this districting as follows: “SF-4 Single-family. This subdistrict allows moderately high density single-family housing. The minimum lot size is 4,000 square feet” (City of Cincinnati 2010, §1403-03). Vacant parcels under this zoning comprise 521,941.6 square feet, or 130 lots at a minimum 4,000 square feet (Id., Cincinnati Area GIS 2010). Were the parcels under public ownership included, an additional 205,485.3 square feet of space could provide another 51 residential lots (Id.). Fully developed to capacity, the neighborhood would be infused with a further 727,426.9 square feet of residential development within a half mile of the transit stop (Id.).

New Richmond’s zoning in the downtown area indicates extensive residential and commercial development opportunities (Village of New Richmond 2008). Within a quarter mile of the potential TOD site, there are nearly 10 acres of vacant residential parcels, all of which are zoned under one of New Richmond’s multiple residents zoning districts (Id., Clermont County GIS 2010). Within a half mile walk of the proposed transit site, there are nearly 1 million

Figure 34: New Richmond Zoning Map.
square feet of vacant land with this zoning (Id.). According to the district zoning in place there, this square footage could result in the maximum density of 416 residential lots as of right.

These lots are only those that could be created out of vacant parcels in the half mile walkshed. Even greater potential for growth and development is available when considering the publicly owned parcels that are zoned multiple residence. Non-revenue generating parcels comprise almost 700,000 additional square feet of property in the half mile study area, which would provide another 290 residential lots (Id.). Thus, as of right development in the half mile walkshed could produce 706 new multiple residence lots on infill sites (Id.).

The rest of the vacant and publicly owned parcels within the half mile study area are zoned for commercial uses (Clermont County GIS 2010). In total, these parcels comprise almost 2 million square feet of land that could revitalize New Richmond as a commercial center in its own subregion of the Cincinnati area. In combination with increased residential development, this could spur unprecedented renewal in the downtown district.

The area immediately surrounding the proposed transit investment site is subject to a special zoning overlay called the “DRO” Downtown Residential Overlay District.” According to New Richmond’s zoning text, this overlay district’s purpose is to:

promote the development of multiple family construction within the Front Street Business district on vacant parcels while preserving existing structures to be utilized for commercial activities in conformance with the B-1 regulations. It is the further intent of the “DRO” Downtown Residential Overlay District to encourage residential uses in

![Figure 35: Map showing New Richmond's Downtown Residential Overlay district (Village of New Richmond 2008, 105).](image)
conjunction with commercial activities in order to create an active street life, enhance the vitality of businesses, and reduce vehicular traffic (Village of New Richmond 2008, 105).

This overlay, in addition to a Neighborhood Business Overlay District and a Mixed Use Overlay District, seeks to restore the vibrancy of the downtown by promoting mixed uses, density, and business variety on a scale that is visible at the Boston study area discussed next (Village of New Richmond 2008, 102-108).

Hingham’s shipyard area was no different than California and New Richmond in terms of deterioration and underutilization. As discussed previously, it was built out of a need to supply war ships during the 20th Century, and the loss of this manufacturing sector left the yard an abandoned greyfield. (Samuels & Associates 2009). Capitalizing on this asset, a developer has transformed the area immediately surrounding the ferry wharf into The Launch at Hingham Shipyard. This development “is delivering a mixed-use, transit-oriented development that’s located on the water—giving this destination enormous appeal.” (Id.). Intended as an anchor for the larger Hingham Shipyard community, The Launch is a mixed use development of “shopping, dining, entertainment, recreation, luxury living and a celebration of history.” (Id.).

C. Costs Analysis

Data concerning the “traditional” cost elements of aquatic mass transit such as capital, O&M, and energy consumption information were made available for this project by the Central Transportation Planning Staff (CTPS) at the Boston Region Metropolitan Planning Organization. According to a CTPS memorandum, water transportation service costs can be divided as follows: “vessel operating and maintenance costs, vessel ownership or leasing costs, terminal costs, and administrative costs” (Humphrey 2001, 1). Similar data were not available from the Cincinnati
region’s primary transit service provider, Metro, but since the majority of the service provided by this organization is standard bus operations, general assumptions can safely be made.

1. O&M Costs

According to the CTPS memorandum, many initial cost requirements that relate to safety, such as crew size and vessel load limits, are under the jurisdiction of the U.S. Coast Guard, and are determined on a case-by-case basis thereby. The Coast Guard issues “Certificates of Inspection valid for three years” which consider the waterway used, the number of passengers, the distance from land traveled, and the duration of voyages (Id. at 2). “Commuter boat routes such as those to Hingham and Quincy using vessels with capacities of up to 149 passengers typically run with one captain and two deckhands” (Id.). While the wages and fringe benefits costs for the MBTA commuter boats were not available, the report cites commuter boat feasibility studies that estimated captain wages at year 2000 levels to be $15 per hour and deckhand wages were estimated at $11 per hour, with 30% additional for benefits (Id.).

Fuel costs are highly dependent upon the vessel selected for passenger service. Hingham ferries, operated by Boston Harbor Cruises, are 350-passenger, 35-knot catamarans, which have “a reported fuel consumption rate of 275 gallons per hour” (Id. at 4, Boston Harbor Cruises, 2010). More likely appropriate to the proposed ferry system in the Cincinnati area would be the far less consumptive 149-passenger, 30-knot catamaran with fuel consumption rate of 99 gallons per hour (Humphrey 2001 at 4). With rising fuel costs in recent years, it’s difficult to pinpoint what exactly fuel would cost in the proposed ferry system, but “fuel was the single largest

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11 According to a Metro official’s recent lecture, Metro bus drivers earn $20 per hour plus benefits. Employee wages and benefits are by far the highest cost element of Metro’s budget, $61.4 million of the $94.5 million budget (Southwest Ohio Regional Transit Authority, 2009).
operating cost component for all high-speed boat alternatives” in several Massachusetts feasibility studies (Id.).

2. Vessel Ownership or Leasing Costs

“On land-based transit vehicles, the maximum number of passengers that can be carried at one time is limited mostly by the number that can fit on board,” whereas boat carriage limits are set by the Coast Guard (Id. at 11). Vessel choice depends heavily upon anticipated peak demand under typical conditions in order to target capacity low enough to keep cost per passenger down yet high enough to prevent turning passengers away (Id. at 12). The most heavily patronized ferry service in the Boston region is the Hingham route, which showed boardings in 2000 between 134 and 346 per trip, with ridership over 149 on four out of nine trips (Id.). The author of the memorandum recommended leasing vessels at first in order to facilitate capacity adjustments.

Maximum operating speed is another important consideration in vessel selection as outlined by the memorandum (Id. at 13.). Hingham commuter ferries make the trip to Rowes Wharf in 35 minutes with 30-knot catamarans, but parts of the trip are strictly speed limited to 10

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12 Additional maintenance costs involve engine overhauls, oil changes, and the like. “The cost estimates . . . for the MBTA Hingham commuter boat allow $203,000 for vessel repair and maintenance in Fiscal Year 1998, increasing to $212,000 in fiscal 2002.” Another major cost included in this section of the memorandum which I will not discuss is insurance.

13 N.B.: Many boat operators elect to have larger vessels certified only for 149 riders because different safety and crewing requirements apply when over 150 passengers are carried.
knots or less due to harbor traffic, channel navigation, and erosion caused by wakes. As mentioned supra, a Cincinnati ferry would likely be a 149-passenger, 30-knot catamaran. Commercial boats such as those proposed in this study should be able to operate for the most part at maximum speed on river stretches between stops, aside from wake limitations between the Daniel Carter Beard Bridge and the Brent Spence Bridge. According to measurements taken on Google Earth, a complete trip from New Richmond to The Banks via California is 17.54 nautical miles. The trip from New Richmond to California is 10.75 nautical miles, with 6.02 nautical miles to the Beard Bridge and another .77 nautical miles to The Banks. Thus, assuming a 30-knot speed between New Richmond and the Bridge with a 2 minute stop at California, and 5-knot (idle) speed from the Bridge to the Banks, a commuter trip should take slightly less than 45 minutes, and only 20 minutes if boarding at California. Google Maps driving directions, assuming no traffic from point to point, indicate a 30 minute commute from New Richmond to the Central Riverfront, and a 15 minute commute from California to the Central Riverfront. With a typical rush hour slow down on I-471 North, these trips can easily take an extra 15 or more minutes by car, plus incidental costs incurred, such as parking, insurance, gas, and maintenance, to name a few.

According to the CTPS memorandum, a feasibility study in the year 2000 estimated the purchase cost of a 149-passenger, 30-knot catamaran at $2 million. A contemporaneous study

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14 Since this is also the location of the proposed Downtown/Central Riverfront station, boats would need to operate at idle speeds regardless of regulations.
estimated the costs of a similar vessel to be between $2.5 and $3 million. Assuming the higher range, the amortized cost per month ranged from $31,675 to $38,010. Hingham-sized catamaran had an estimated capital cost ranging between $4.45 million and $5.5 million depending on speed. In order to offer half hourly departures from New Richmond, I would estimate that a Cincinnati regional system would need 3 vessels, costing just over $9 million.

3. Terminal Facility Expenses

Terminal facility costs “would include expenses related to the docking of vessels and expenses related to land-side passenger facilities including waiting areas, shelters, and parking if provided” (Id. at 15). According to the CTPS memorandum, a feasibility study was conducted wherein land-side and water-side improvements would be needed in order for the studied municipality to utilize the site of an existing town-owned pier that had been exclusively used for private boating. Including design and engineering costs, the improvements were expected to cost $847,000 and $1,890,000 respectively. Additional sources of terminal costs arise where private dock facilities need to be leased, or docking fees are charged by a public dock owner (Id.).

While the costs estimated in the cited study are from about 10 years ago and are site-specific, they provide a base from which startup terminal costs in the Cincinnati regional system could be estimated. In Cincinnati, a port that has only been used for private boating will necessarily provide the startup facilities upon which public investment will improve in order to implement this system, much like the cited study. The site proposed for a ferry facility in California, at the end of Rohde Avenue, is currently a private dock facility which could be retrofitted and upgraded to suit increased river activity. This will possibly reduce initial upfront capital investment costs, but will not alleviate the need for improvements in parking and maintenance facilities, passenger shelter and retail capacities, and dock upgrading. In this
situation, the current owner of the dock facility might willingly participate and lease dock space to the transit operation, adding an incremental docking fee cost.

Particularly in the case of New Richmond, which could act as a park-and-ride terminal facility that would open transit to an even broader suburban population from Clermont County, extensive investment into parking facilities would need to be addressed. The site proposed there is currently unutilized riverfront space, as current private boating dock facilities are located too far away from the center of town to provide a walkable connection. The Village has been active in obtaining intergovernmental fund transfers for the improvement of its waterfront and it has stated in its plan to better utilize its location thereon, and thus would likely act as a partner in the transit investment. This could mean free of charge docking facilities provided by the local government, saving capital costs upfront.

For a Downtown Cincinnati ferry facility, the proposed site is already undergoing massive public investment and redevelopment. It has been singled out as a multi-modal transit site, and has already had a transit center constructed. It also has a recreational dock facility planned. With minimal modification to the plans, this proposed transit investment could be easily incorporated and connected to the Central Business District and the new Banks neighborhood, as well as the current regional bus systems and the planned rail investments (the

Figure 38: Riverfront reinvestment project partially accomplished by New Richmond.
Streetcar and the Eastern Corridor, which terminate at the site). Currently, on Cincinnati’s Public Landing, which is administered by the Cincinnati Park Board as harbormaster, docking fees are waived and thus free of charge to all public users. As a partner to the transit investment, this fee arrangement could be continued for a ferry implementation and reduce the capital costs upfront.

Terminal operating costs are another component that should be considered. Terminal staffing depends on the range of amenities and services provided, and could require a staff member or could be automated in terms of ticketing and parking charges (Id. at 17). At Hingham and Boston, ticket offices are staffed for 7.5 hours each day, so one person can staff the office, and some services in the area handle ticketing on the boat. Automatic fare cards further reduce the need for ticketing where commuting is popular, and such a culture is the goal of this proposal.

4. Administrative Costs

Administrative costs depend on the organizational arrangement selected for the implementation of this project. It could be effectuated as a private transit provider with a subsidy from the local governments, as in Hingham, or it could be created as a sub-unit of SORTA and be under Metro’s supervision. “Supervisory costs would be more closely related to the number of vessels than to the number of employees on each vessel” (Id. at 21). Thus, depending on the size of the investment and the organizational structure, this project could be placed under transit supervisory management already in place or be covered by private-public contracts. Other costs here would include advertising and marketing, accounting and legal, and other general overhead costs, such as utilities expenses and office supplies.
VIII. ENVIRONMENTAL, AESTHETIC, AND SOCIAL EFFECTS IN STUDIED COMMUNITIES

While this project is not generally concerned with the environmental impacts of development or transit, the importance of this factor generally to the practice right now warrants some limited discussion. According to the U.S. Department of Transportation’s Maritime Administration, water transportation was the second most energy efficient mode of transportation in 2007 (Department of Transportation 2007 at 22). It was more efficient than truck and even transit, and was second only to rail, which has high capital costs that offset efficiency.

An obvious concern that many planners might have with this project is its emphasis on dense, intense floodplain development. As mentioned supra in §IV, fn. 7, though, “if planners choose not to count vacant infill land in the 100-year floodplain, they will underestimate infill development potential as long as local ordinances permit at least some urban uses on flood-prone land” (Real Estate Research Corporation 1982, 23). The vast acreages of non-revenue generating properties discussed in the Land Inventory and Zoning Analysis sections would fail to ever create positive fiscal impact and would contribute to the continued decline of the studied communities.

One of the interesting social aspects that make this TOD investment attractive is the potential to renew river connections that have been lost since the destruction of the Island Queen. Cincinnati once had an extremely active river culture that has diminished along with the commercial connections to the river, and current plans for grand riverfront parks are in part intended to rekindle these lost

Figure 39: Regatta on the Ohio 1900-1925 (Bailey 2010, 55).
connections. By investing into transit on the river, citizens would have a physical, visible symbol retying them to the river as a daily part of Cincinnati life again.

Another possible correction that can be achieved by this proposal is investment to improve east-west connections that have been troubled for decades in the Cincinnati area. This project can be expanded to western communities of the Cincinnati region which were not studied, but which should be investigated in order to further utilize the TOD infill potential of this plan. The purpose of the Eastern Corridor plan is to investigate and correct this lack of connectivity between the eastern suburbs and the central business district. This proposal can take that connectivity further and reach all the way to OKI communities in Indiana if desired.

Social impacts can be even more personal than the described regional connectivity. The romance of water travel is not insignificant, and it has even found its way into fiction writing. “Blue skies as far as he could see and the city skyline stretching out before him like a surreal postcard. He liked the ferry, liked the way it made the commute seem less frantic” (Kingsbury, 2003, 84-85). Not only are there the aesthetic-social aspects of the ferry commute as described, but on Hingham vessels, most are equipped with wireless internet, allowing commuters to complete work on their way or network socially on handheld devices, rather than suffering through rush-hour traffic.
IX. **Disruption and Inconvenience Caused by Ohio River Aquatic Transit**

A key issue that is typically involved with transit project implementation is the severity of disruption to current traffic and commute patterns. The effectuation of the 3C rail plan in Ohio is being complicated by the debate over station location within the Cincinnati region. While the obvious favorite choice is Union Terminal, disruption to freight shipping that relies upon the railyard behind Union Terminal would inhibit performance of both passenger travel and freight shipping.

The Ohio River’s current major transportation function is also freight shipping. In 2008, over 13,445,000 short tons of commodities were shipped through the Port of Cincinnati (U.S. Army Corps of Engineers 2009). Cincinnati remains one of the nation’s largest inland ports by volume, and as mentioned, plans are occurring to invest further into freight shipping. Barge containerization and facility improvements should facilitate increases in shipping, as well as improved coordination of increased traffic.

I surmise that investing into passenger transit on the river would lead to improved coordination of increased traffic. Traffic control could lead to increased efficiency and even further shipping and commuting increases. While there is a high volume of shipping by volume, these commodities are moved by relatively few actual vessels per hour. Barge capacity is very high per unit shipped, as implied by the energy efficiency data stated *supra*. Also, safety regulations would have to be researched to ensure collisions between barge and ferry traffic remain minimal, and coordinate with continued recreation boating.

Also, this project should improve traffic conditions on regional interstate routes. While increases in population resulting from TOD infill development would increase vehicular traffic
regardless of ridership, much would hopefully be diverted onto the river. This could reduce accident rates, traffic congestion, and automobile needs in the population.

X. INTERJURISDICTIONAL RELATIONSHIPS

Travel times and commute patterns within and between metropolitan communities are critical in informing transit investment decision making. From traffic counts on interconnecting major roads, commute trip origin/destination information, and peak & off-peak travel times, planners can develop a clear picture of a population’s transportation needs, particularly in identifying failures in the system. Models are also utilized by metropolitan planning organizations to determine rates of increase before system saturation results in gridlock and to calculate actual costs incurred by travelers in the system.

In the Cincinnati area, regional transportation planning is in the hands of OKI, the region’s metropolitan planning organization (MPO). As such, the Council’s staff, as well as the Ohio Department of Transportation (ODOT), collects and compiles the necessary traffic and commute data for the region’s roadway and transit projects from various sources, such as the U.S. Census and third party consultants. These data indicate the necessary commute patterns, as well as the current and future asset situation that makes an aquatic transit system on the Ohio River feasible. The Cincinnati region’s mass transit options are provided by the Southwest Ohio Regional Transportation Authority, known locally as Metro, by the Transit Authority of Northern Kentucky (TANK), and by the Clermont Transportation Connection (CTC) (Southwest Ohio Regional Transportation Authority 2009, Transit Authority of Northern Kentucky 2010, Clermont Transportation Connection 2010).

According to data compiled by ODOT, traffic between New Richmond, Ohio, and downtown Cincinnati, Ohio, has steadily and predictably increased since 2003 (Ohio Department
of Transportation 2010). The 2000 Census reported that 74,655 Clermont County, Ohio residents commuted alone to work, with an average commute time of 28.2 minutes (Ohio-Kentucky-Indiana Regional Council of Governments 2002). US 52, the principal limited access arterial highway connecting downtown and suburban New Richmond commuters to the Downtown Cincinnati commercial district via Interstates 275 and 471 saw an increase in average annual daily traffic (AADT) increase from 14,570 in 2003 to 16,120 in 2006, over a 10% increase in three years (Ohio Department of Transportation 2010).

In a region notorious for its lack of mass transit responses to congestion and traffic, increases on US 52 have been enough to spur the implementation of a bus route from New Richmond to Downtown Cincinnati, operated by Clermont Transportation Connection. This express route transit connection between Cincinnati and New Richmond, which was implemented in 2007, typically takes 30-40 minutes, depending on traffic, and departs twice in each commuting direction per weekday (Clermont Transportation Connection 2010). While this is a relatively small investment into mass transit, it does evidence potential political and economic interest in further connection. Traffic count data on US 52 confirms that New Richmond alone adds over 7,000 daily travelers to the commute into Cincinnati (OKI 2006).15

California is located on an access ramp to the beltline freeway, I-275, which provides direct access to downtown via I-471. The neighborhood is well connected to other regional destinations via I-275 and U.S. 52, but traffic counts in all directions are very high. Between California and Downtown Cincinnati on the I-275 bridge, there was over 61,960 in AADT in 2002, which increased to 79,070 by 2005, a nearly 30% increase in three years (Ohio Department

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15 This was determined as follows: 8,297 vehicles were counted at the intersection of U.S. 52 and Frank Willis Memorial Rd. This counts vehicles traveling on the southeast side of New Richmond, which would include travelers from outside heading into or through New Richmond. At the intersection of U.S. 52 and Ten Mile Road (SR 749), on the northwest side of New Richmond heading to downtown Cincinnati, there were 15,351 counted in the same year (Ohio-Kentucky-Indiana Regional Council of Governments 2006).
of Transportation 2010). I-471, the interstate spur which connects both New Richmond and California to downtown Cincinnati via I-275, saw traffic count increase from 82,900 in 1995 to 94,000 in 2005, an increase of nearly 12% in ten years, which has impacted both New Richmond and California commuters (Id.).

As stated supra, the Cincinnati region’s mass transit options are provided by Metro, TANK, and CTC. All of these providers utilize buses exclusively, with Metro transporting more than 22 million riders per year (Southwest Ohio Regional Transportation Authority 2009). Metro brings approximately 20% of downtown Cincinnati’s workforce into the city (Id.). None of Metro’s plans has proposed to utilize the river as a transit option. Its most ambitious proposal for mass transit in the region included light and commuter rail, streetcars, and buses, but ignored the possibility for river transit (Mecklenborg 2007).

None of the proposed rail or mass transit options proposed by this plan provided service to Southeastern suburbs such as California or New Richmond (Id.). The only potential impact the plan would have had on these communities’ commute patterns might have been minimal reduction in congestion on I-471, which was planned to see bus/rail investment (Id.). Despite the attempted comprehensiveness of the plan, it failed to gain popular approval, and thus never materialized as a regional initiative (Id.).

Figure 41: Section of Metro Moves plan by SORTA (Mecklenborg 2007).
Riverfront locations in the Cincinnati area do not have access to aquatic transportation systems. The only ferry service in the region, the historic Anderson Ferry, has been in continuous operation since 1817 (Anderson Ferry Boat Company, 2008). The ferry is the only north-south automobile connection between the Brent Spence and I-275 Bridges, and thus saves Cincinnati western commuters miles of driving to catch flights or travel to work at the airport (Id.). It has an informal operation schedule, running at most two ferries an hour, and takes fifteen minutes just to cross the Ohio River (Id.). It provides a critical interstate connection that impacts many jurisdictions on both sides of the river, and illustrates the capability of ferry operations to do so. As illustrated in Figure 40, the proposed ferry system would have an impact on two Ohio counties, two Ohio municipalities, multiple city neighborhoods, and even Indiana communities if fully expanded as proposed.

In the Boston region, data is available from the Massachusetts Bay Transit Authority (the T) as well as the Boston Region Metropolitan Planning Organization, the Metropolitan Area Planning Commission (MAPC), and the Massachusetts Department of Transportation (MassDOT). For this study’s comparison, I have decided to look at Hingham, MA for comparative data, the primary beneficiary of the T’s commuter ferry service.

service in the Boston region serves nearly 5,000 passengers annually (Boston Metropolitan Planning Organization 2005). While this is a relatively low percentage of the region’s mass transit ridership (less than 1%), which has access to heavy commuter rail, subway, and extensive bus service, it is nonetheless significant in the region. Massachusetts, along with New York, California, New Jersey, Michigan, and Washington accounted for two-thirds of all U.S. ferry passenger capacity in 2005 (Bureau of Transportation Statistics, 2006).

The major ferry route operated in the Boston area is the MBTA’s F1 line, which operates daily between Hingham Shipyard and Boston’s South Station (Massachusetts Bay Transportation Authority, 2009). MBTA ferries also connect other South Shore communities with Boston’s downtown as well as Logan International Airport, one of the world’s busiest airports. As a regional transit provider, MBTA is able to incentivize ferry ridership: “MBTA monthly boat passes can be used on MBTA bus, subway, inner harbor ferry and commuter rail zones 1A through 4 services, as well as the Route 714 bus in Hull” (Massachusetts Bay Transportation Authority, 2009). Riding the ferry from Hingham takes thirty minutes to Boston, with service every thirty minutes or less during peak commuter hours and year-round weekday service, including most holidays. (Id.).

Research revealed that transit costs greatly undercut driving costs between the Hingham Yard to Rowes Wharf. The drive time between the two, absent highway traffic, takes roughly the same amount of time as the ferry ride, 26 minutes. It covers a distance of about 13.4 miles (Google 2010). Monthly parking costs in the area costs over $400 per month, plus vehicle mileage costs. Meanwhile, MBTA’s monthly ferry pass costs $198 per month and includes unlimited travel on local bus, subway, express bus, inner harbor ferry, and Zones 1-4 on commuter rail. In the South Shore area, ferry locations have free or low cost daily parking and
are tied into local transit options, such as bus routes (Massachusetts Bay Transportation Authority, 2009). Prior to 2007, the area did not have commuter rail services, thus ferry ridership was the only feasible alternative to car commuting (Boston Region Metropolitan Planning Organization, 2009).

**STATEMENTS ABOUT DATA**

The data collected by GIS analysis, public information requests, and research indicate a favorable benefit-cost ratio for the proposed ferry system on the Ohio River. Based on the development potential in the studied communities alone, let alone the potential for regional expansion and further TOD infill development, the municipalities involved should expect to see positive fiscal impact and reduced sprawl development patterns. Based on Massachusetts studies into ferry feasibility, Cincinnati neighborhoods could see major impact with relatively low upfront capital costs. All development could occur as of right and politically, plans in the region indicate the will exists to implement such a project.

Interjurisdictional connections that previously occurred by river could be restored in a relatively seamless manner by this proposal. It would have a multi-state impact and would be capable of relieving the future congestion that has been projected by local transportation planning agencies. East-west connections could create new social patterns that have not existed previously in the Cincinnati region. The ability of this project to take advantage of other capital investments already planned, such as the Marine Highways program, indicates an availability of funding and the existence of organizations to coordinate implementation.

**FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS**

I find that my hypothesis is supported by the literature reviewed and by the available data that I collected. For a city like Cincinnati, that owes its existence to its advantageous location on
the Ohio River, this physical reconnection to the river could prove energizing for the region. Often, historical approaches to transit problems were reasoned, calculated, and efficient, but became forgotten and ignored due to the incredible ease of automobile travel. With automobile commute costs on the rise due to gas, insurance, congestion, and parking shortages, the inefficiency of this commute practice is showing its weakness. It is time to reinvest in practical transit that can be started with low capital outlay but can achieve powerful economic and social advantages.

By following the basic needs analysis discovered in the literature on infrastructure investment, and by locating appropriate data in the study areas to illuminate the criteria involved, this thesis has shown the effectiveness of the proposed solution to benefit the region far more than it burdens it. Municipal fiscal impacts would generally be positive, rather than the typical negative impact of highway construction, since infill development should be effectuated. Other costs, such as asset, O&M, and energy factors, are all more productive than, or at least comparable with, other more mainstream transit investments, such as bus or rail.

By infusing a transit component into active developments already occurring, this project can act as a demonstration of the region’s ability to benefit from transit. This would hopefully lead to continued investment into other modes of transit, such as commuter rail, subway, and intercity passenger rail, which could all culminate in various hubs creating intermodal and internodal connectivity. Each of these modes could be incorporated into The Banks’ multi-modal transit center and prove to Cincinnatians that a car-free lifestyle is possible here.

Theoretically then, a citizen of New Richmond would be enabled to live there without an automobile, saving on maintenance, gas, licensing, tax, parking, and insurance costs. They could work in the developed commercial activity in New Richmond, or they could commute to
California, downtown Cincinnati, Indiana, or any other location serviced by Metro and connecting from ferry terminals. This would open up new areas for employment and housing to many populations in the region that would prefer car-free lifestyles or who cannot afford cars.

Based on the research involved in this thesis, I would recommend implementation of this proposal as soon as possible. All signs indicate the political support necessary from the jurisdictions studied to see this project through. Also, since it is a community-, transit-, economic-based proposal, there should be many avenues of funding available via intergovernmental transfers. For example, the sources that have already funded New Richmond’s riverfront improvements, the National Scenic Byways and CDBG funds, could be used to invest in the assets necessary to make this project possible. These funds would be available to all the municipalities involved by their share, as well as ODOT and USDOT funding sources for new starts in surface transit.

All that I have proposed is in line with existing plans in the studied communities. The plans for New Richmond, California, and downtown Cincinnati’s riverfront all call for increased residential and commercial development at a large scale and density. They also all seek to encourage infilling, walkability, transportation access, and economic development. These entities have provided an advantageous regulatory framework to allow such development as of right, they just have not hit upon the right mix of support and transit access to see development occur.

As such, implementation of this project should be considered a need under the benefit-cost analysis, and should thus be studied further. More sophisticated fiscal impact analyses could be performed by OKI to determine the exact benefit-cost analysis, based on current values, tax rates, market demand, and capital costs. Cincinnatians should have the option to utilize the
river as our predecessor citizens did, and we should commit to our historic communities by investing in their survival.


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