Lowell Canal Bridges

TIGER VII Application
June 2015

Contact: Craig Thomas, Chief Design Planner
City of Lowell, Massachusetts
50 Arcand Drive
Lowell, MA 01852
978-674-4252
cthomas@lowellma.gov

www.lowellbridges.com

Project Changes from Pre-Application

This project is largely consistent with what was described in the Pre-Application submitted on May 1, 2015, which receive the Project ID: cthomas1234404. The project applicant, scope, type, objectives, and intent are unchanged.

However, upon completion of preliminary engineering studies for the Lowell Canal Bridges in mid-May, it appears that the total project costs will be lower than previously anticipated. As a result, this application includes a smaller project cost and consequently a smaller request for TIGER grant funding. This information is detailed below:

	Pre-Application	Final Application
TIGER Request	$19,440,000	**$13,389,750**
Total Project Cost	$24,300,000	**$16,737,188**
Total Federal Funds	$19,440,000	**$13,389,750**
Total Non-Federal Funds	$4,860,000	**$3,347,438**

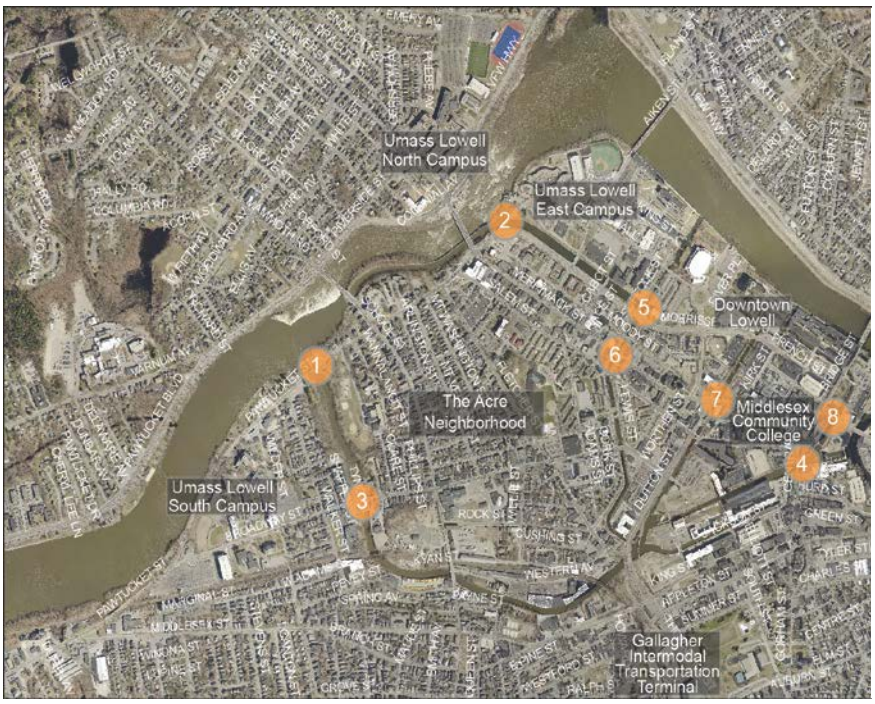
The difference is largely driven by the estimated costs of repairs to the Central Street (4) and Merrimack Street over the Western Canal (6) bridges, which appear to have more cost effective solutions than originally anticipated.

This significant reduction in the total project cost reduces the TIGER funding request to below the average urban grant award over the past six program rounds, reducing the relative importance of considering segmentation of the project. This has reinforced the City of Lowell's position that the fundamental challenge of private ownership with little incentive for maintenance of bridges carrying essential public infrastructure can only be fully resolved if the entire project is implemented.

Lowell Canal Bridges TIGER VII Application

Project Description

Lowell, Massachusetts is known as the "Birthplace of the American Industrial Revolution," resulting in its designation in the late 1970s as the first urban National Park celebrating the country's industrial heritage. Chief among Lowell's significant historic resources is an unparalleled, intact 5.6 mile network of power canals. An unusual legacy of this otherwise celebrated heritage is that eight canal bridges serving Downtown Lowell, the adjacent Acre neighborhood, and the campuses of the University of Massachusetts Lowell remain in private ownership. Seven of the bridges are currently in various states of disrepair or deterioration, necessitating weight restrictions and closures that adversely impact public safety, commerce, economic development, traffic congestion, National Park tourism, and transportation efficiency in the City to a significant degree. Buses, school buses, fire trucks, and commercial vehicles are prohibited from crossing some or all of these spans and therefore must use cumbersome and circuitous alternate routes.



The City is seeking a $13,389,750 grant from the TIGER VII program for the rehabilitation of Lowell's canal bridges to eliminate the weight restrictions that are crippling transportation circulation and impeding public safety, economic opportunity, and access to education in the Downtown area.

1. Pawtucket Street over the Pawtucket Canal (L-15-050)
2. Pawtucket Street over the Northern Canal (L-15-049)
3. Broadway over the Pawtucket Canal (L-15-030)
4. Central Street over the Lower Pawtucket Canal (L-15-035)
5. Suffolk Street over the Northern Canal (L-15-052)
6. Merrimack Street over the Western Canal (L-15-047)
7. Merrimack Street over the Merrimack Canal (L-15-046)
8. Kearney Square over the Eastern Canal (L-15-038)

The responsible ownership party, Enel Green Power North America, a multi-national power company ("Enel"), has not prioritized the necessary expenditure of funds to maintain or repair/replace these structures. Enel has taken the position that it is not obligated to maintain the bridges to standards that would avoid weight restrictions, provided that the weight limits resulting from the conditions of the bridges are adequately posted. The City of Lowell has

negotiated an agreement to acquire the bridges from Enel as part of a partnership effort to rehabilitate them and restore the transportation network serving Downtown Lowell, ending the private ownership of key public infrastructure. As part of the agreement, Enel will make design and construction contributions to the project.

Key Project Benefits

- Access to education will improve after eliminating weight restrictions and bridge closures which force lengthy detours for public school buses transporting school children under a voluntary school desegregation program, UMass Lowell intercampus transit, and public transportation access. The same detours stifle economic opportunity by delaying deliveries and other commercial trucking.
- Public safety will be enhanced by allowing fire apparatus to cross all of the bridges and more efficiently respond to calls in the Acre neighborhood, UMass Lowell campuses, and Downtown Lowell. Eliminating sidewalk closures and installing proper crash barriers between sidewalks and travel ways will restore pedestrian safety and convenience; one span currently forces its 6,700 daily pedestrian trips into the travel way because both sidewalks have been closed for safety reasons due to structural deterioration.
- Public health will benefit when detour routes for trucks and buses that now run through the Acre and an adjacent low-income Southeast Asian neighborhood, introducing significant additional traffic and associated emissions to these areas end, potentially reducing the disproportionately high rates of asthma and other respiratory conditions that have been documented among Lowell residents.
- As a defining feature of the Lowell National Historical Park, the Canal system is an essential component of the visitor experience. Addressing the bridges will help reopen a key segment of the National Park's canal walkway system and preserve the safety of their canal boat tours, in addition to restoring the aesthetics of the urban national park environment.
- Central Street is part of Lowell's principal north-south arterial, Pawtucket Street is part of the City's principal east-west arterial, and Merrimack Street is a minor arterial that acts as Downtown Lowell's main street. Rehabilitating the bridges will prevent the potentially catastrophic traffic congestion, economic, safety, environmental, and health impacts of a full closure of one of the spans along these routes.

Project Scope

The project will include the complete replacement of three bridges (1-Pawtucket Street over the Pawtucket Canal, 2-Pawtucket Street over the Northern Canal, and 5-Suffolk Street over the Northern Canal) and repairs to three bridges (4-Central Street over the Lower Pawtucket Canal, 6-Merrimack Street over the Western Canal, and 7-Merrimack Street over the Merrimack

Canal). In conjunction with the TIGER project, Enel has agreed to replace the Broadway Bridge over the Pawtucket Canal (3) at their own expense. The Kearney Square Bridge over the Eastern Canal (8) was recently replaced in response to an emergency structural failure that was more cost effective to address with a replacement than a repair project.

In all cases, the new bridges will provide enhanced pedestrian and bicycle accommodations and will remove posted weight restrictions to allow transit buses, emergency vehicles, and commercial trucks to utilize the crossings. All of the replacement bridges will be designed in partnership with the Lowell National Historic Park and Lowell Historic Board to complement the historic canal system.

Adverse Impacts of the Canal Bridge Restrictions

Six of the eight bridges are currently restricted in some manner that limits vehicle or pedestrian use and access (in some cases both). All but one of the bridges are likely to see further restrictions in the next year or two if nothing is done to address their deterioration. This circumstance generates significant risks and adverse impacts for the community, the region, and interstate travel, as illustrated below:

Public Safety – weight restrictions on the bridges limit the ability of fire vehicles to cross them. Given the high density of housing, institutional, and commercial buildings in the area served by these bridges, as well as the fact that there are dozens of buildings that require ladder truck access to respond to fire emergencies, failure to improve the bridges would pose significant risks to public safety and emergency response.

Public Transportation – the posted weight limits on several bridges prevent Lowell Regional Transit Authority (LRTA) buses from crossing them, resulting in circuitous detours that complicate public transit service in the community, create unnecessary delays and inconvenience for riders who depend on the LRTA bus system, and make it difficult to service entire sections of the core of the City.

Economic Development – the bridge capacity restrictions prevent many commercial vehicles, including tractor trailers and larger straight trucks from crossing the bridges. As a result delivery and shipping services cannot efficiently reach destinations in several industrial and commercial districts in Lowell's core, artificially limiting opportunities for economic reinvestment in a mid-sized post-industrial city as businesses choose other locations, including sites in New Hampshire that are more difficult for inner city residents to access, to avoid these challenges.

UMass Lowell Transportation – UMass Lowell consists of three geographically separate campuses as well as a handful of

Downtown Lowell properties, including a 500-bed residence hall at the Inn and Conference Center. The University operates a regular schedule of shuttle buses to provide an average of over 7,000 unlinked daily trips among these campuses, in order to reduce parking demand and traffic congestion. Existing and pending weight restrictions on several of the canal bridges prevent the University buses from travelling the shortest distances between campuses, decreasing convenience and efficiency, which in turn suppresses ridership and increases traffic and parking demand. In addition, the University's transportation demand management (TDM) program encourages sustainable transportation options for intra-campus movement along with commuting. The success of these programs is completely dependent on the canal bridges.

Pedestrian Safety – in several cases, one or both sidewalks along these bridges have been closed due to advanced deterioration of the underlying structure. As a result, pedestrians are forced to cross streets at dangerous locations near bridges. In one case 6700 pedestrians per day are forced to walk in the street, separated from vehicle traffic by only a low guardrail temporarily mounted directly to the bridge deck.

Utilities – all of these bridges carry utilities across the canal system. In some cases, these are major utility service lines serving large numbers of commercial and residential properties. If bridge deterioration continues unabated, water, sewer, gas, and electric services may be compromised in large areas of Lowell.

Environmental Justice – Five of the bridges are located in Lowell's Acre neighborhood, which has been home to successive generations of low-income immigrant communities dating to the mid-1800s. The neighborhood remains among the poorest in Massachusetts. The condition of these bridges hampers access to economic opportunity for these residents, having contributed to the limited economic development in the neighborhood.

In order to provide a more equitable education system, the City of Lowell entered into a voluntary busing program to desegregate its schools in the 1980s. That program remains in place today, but the buses which transport students from the Acre neighborhood are diverted to lengthy detour routes to avoid these bridges.

The detour routes for trucks and buses around the bridges also run through the Acre, and the adjacent Lower Highlands neighborhood – a low-income area with a high concentration of immigrant and second-generation Southeast Asian populations. This introduces significant additional traffic and associated emissions to these areas, contributing to the disproportionately

high rates of asthma and other respiratory conditions that have been documented among Lowell residents[1].

National Park Visitor Experience – As the defining feature of the Lowell National Historical Park, the Canal system is an essential component of the visitor experience. The Park Service operates canal boat tours, which pass under several of these bridges and has constructed canal walkways under and alongside several others. The conditions of the bridges have forced the closure of a key segment of canal walkway and impact the safety of the canal boat tours.

Impacts on the Regional Transportation Network – Because nearly all of the opportunities to cross the Merrimack River between Route 3 and Interstate 93 are located in areas of Lowell served by one or more of these canal bridges, a significant proportion of interstate and intrastate transportation activity in the Merrimack Valley and Southern New Hampshire passes through this area and is impacted by the increasing restrictions limiting utility of these bridges.

Users and Beneficiaries

With the exception of the Suffolk Street bridge (5), the eight canal bridges are located on urban arterial streets. The table below illustrates the number of daily vehicle trips on each span based on counts conducted in April 2015 and historical traffic counts maintained by the Northern Middlesex Council of Governments. All counts are Average Annual Daily Traffic (AADT) seasonally adjusted per MassDOT standards. Counts are rounded to the nearest 50.

	Street	Canal	AADT
1	Pawtucket Street	Pawtucket	7,800
2	Pawtucket Street	Northern	2,800
3	Broadway Street*	Pawtucket	7,600
4	Central Street	Pawtucket	12,200
5	Suffolk Street*	Northern	1,200
6	Merrimack Street	Western	7,650
7	Merrimack Street	Merrimack	7,300
8	Kearney Square	Eastern	9,200

*counts are based on historical information prior to the current lane or bridge closures.

In addition, pedestrian and bicycle counts for the 8:00AM to 4:00PM period were collected in April 2015 for the two bridges closest to the University of Massachusetts Lowell campuses.

	Street	Canal	Pedestrians	Bicyclists
1	Pawtucket Street	Pawtucket	450	50
2	Pawtucket Street	Northern	6,700	500

[1] Asthma prevalence in Lowell is 13.01% among children, 15.9% among adults, and 13.6% among the elderly, which compares to 10.5%, 9%, and 8.59% statewide (Pediatric Asthma Surveillance 2008-09 and MA BRFSS 2011)

These counts reflect a variety of users including neighborhood residents, regional commuters, patrons of local businesses, and others. In several cases, a major source of the current activity on the bridges as well as potential future benefit from this project is the University of Massachusetts Lowell. UMass Lowell has increased its enrollment by nearly 50% since 2007 and has grown employment by a similar proportion to more than 1400. According to a recent study by the Donahue Institute, the campus generated $812 million in economic impact in 2013. The University has plans for continued growth, further increasing its role as the primary economic engine for the Greater Lowell region. Unfortunately, the capacity of the local road network and availability of parking will artificially constrict its growth unless more campus trips can be shifted to travel modes other than single occupancy vehicles.

The most direct trips between the University's campuses, which are generally between ¼ and ¾ miles, require the use of the canal bridges, particularly the two Pawtucket Street bridges (1 & 2). However, current detours caused by bridge weight restrictions double or triple the length of these trips for shuttle buses, discouraging ridership. Sidewalk closures and narrowed travel ways due to structural deterioration of the bridges limits the safety and comfort of using these bridges for pedestrian or bicycle trips.

Several of Middlesex Community College's Lowell campus properties are located within a block of one or more canals and the canal bridges form key transportation links for their students as well. Community College education is a significant opportunity for ambitious individuals from disadvantaged populations to advance their economic standing. However, that path to opportunity is heavily dependent on transit and vehicle access because many of these students are balancing work and family obligations with their education. The recent structural issues and consequent emergency replacement of the Kearney Square Bridge (8) adversely impacted access to Middlesex Community College by closing it to buses and removing sidewalk access on one side. If the Central Street bridge (4) were allowed to continue to deteriorate, the impacts would be as or more substantial.

Ladders of Opportunity

As the table below indicates, the City of Lowell is one of the least affluent communities in Massachusetts (a state with one of the highest costs of living in the nation), with higher concentrations of low-income, under-educated, and unemployed residents than the state.

	City of Lowell	Commonwealth of Massachusetts
Median Household Income (2006-2010 ACS)	$50,192	$64,509
Percentage of Residents with at least some college education (2008-2010 ACS)	46.1%	62.9%
Unemployment Rate (Feb. 2015, MA Dept. of Labor & Workforce Development)	6.9%	5.4%

Access to employment and education are two of the most important factors in creating ladders of opportunity for these residents. Improved public transportation access is a key factor in both cases, given that residents of these neighborhoods have lower rates of car ownership. This

project will reduce delays and eliminate detours for public transit buses serving these communities.

More significantly, this project will facilitate continued enrollment growth at both Middlesex Community College and UMass Lowell, despite the capacity limitations of surrounding roadways, by creating the infrastructure to support greater multi-modal access to and opportunities for transportation demand management at both institutions. Both of these schools have typically been gateways to higher education for immigrants, low-income, and minority households, with significant proportions of each class being among the first members of their families to attend or graduate with a 2-year or 4-year degree.

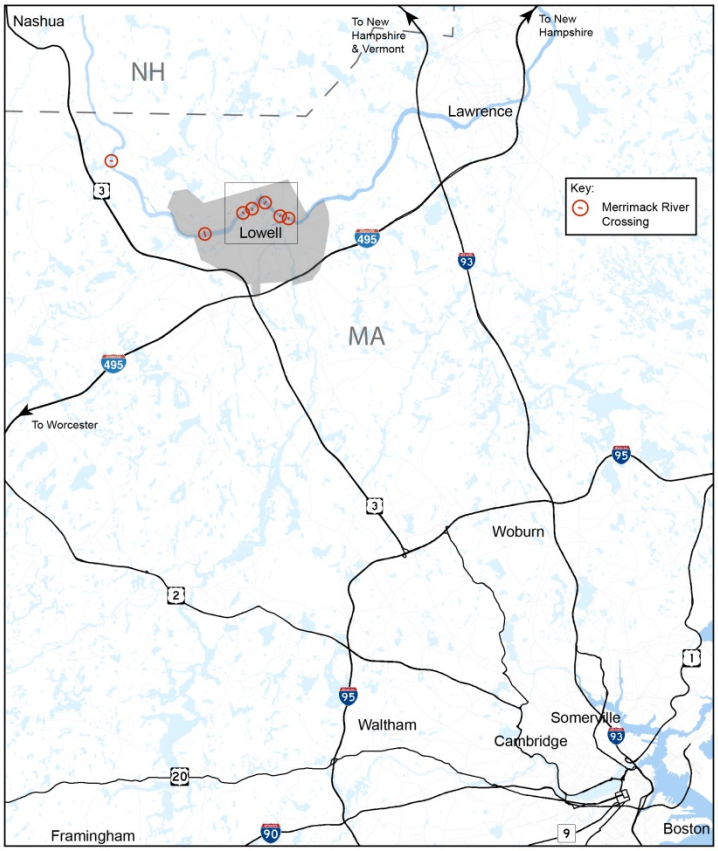
Access to quality elementary and secondary education will also be improved as a result of this project. The voluntary school busing program that the Lowell Public Schools have employed since the late 1980s as a desegregation plan is complicated by the conditions of the canal bridges, which lengthen bus routes to avoid bridge weight restrictions and closures. These impacts disproportionately fall on low-income and minority residents of the Acre Neighborhood, where most of the impacted canal bridges are located.

Why the Private Owner Cannot be Compelled to Address the Bridges

Citizens and public officials alike have complained for years to Enel regarding both the failing condition of the subject bridges and Enel's disappointing progress in repairing the bridges. By resolving outstanding issues with Enel, the City will help to effectuate critical bridge repair that the City cannot presently compel by law. Enel has taken a legal position that they have no obligation to maintain the bridges they own or have easement rights over to any specific capacity or travel mode. Instead, they are only obligated to periodically inspect and post the capacity of the bridges. Similarly, Enel has acknowledged no responsibility to maintain travel lanes or sidewalks, other than to ensure that minimally adequate protective barriers and signage is installed to prevent travel over portions of bridges which are closed due to their deterioration.

Enel has presented a five-year plan for bridge inspections, maintenance, and repair/replacement which would not adequately address any of these needs beyond the Broadway Bridge. Continued inspections and periodic ratings will almost certainly document further deterioration and result in further restrictions and closures during that period.

Project Location

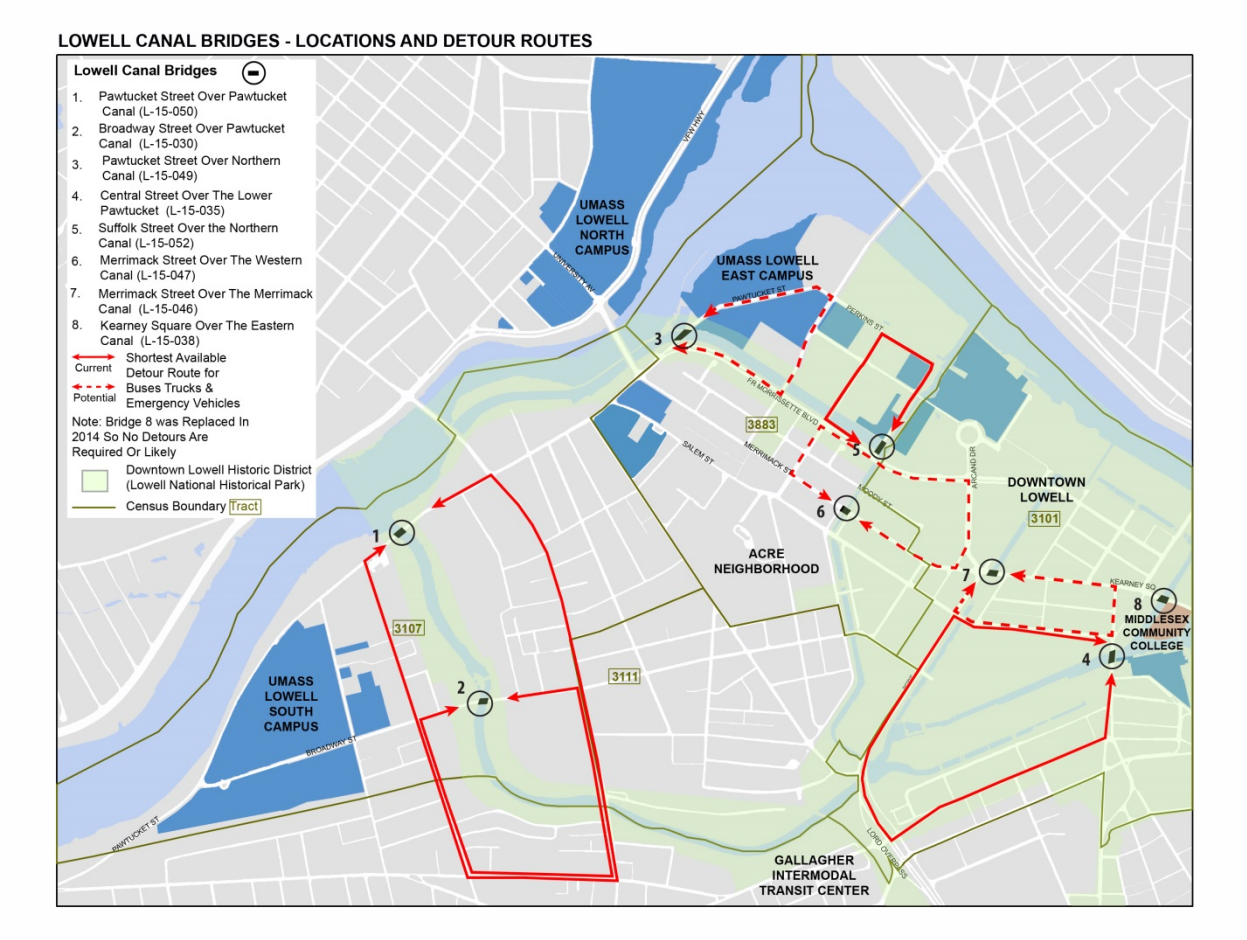


The eight privately-owned Lowell Canal Bridges span various historic manmade power canals in the heart of the City of Lowell, Massachusetts. Located 25 miles northwest of Boston, Lowell is a city of 106,519 residents. These bridges carry several urban arterials through Downtown Lowell and the adjacent Acre neighborhood. In addition to their critical function providing multi-modal transportation access to their immediate surroundings, including the campuses of the University of Massachusetts Lowell, Middlesex Community College, and the Lowell National Historical Park, these bridges are key links to the regional transportation network of Eastern Massachusetts and Southern New Hampshire. Six of the only seven bridges across the Merrimack River between U.S. Route 3 and Interstate 93 (approximately fifteen miles apart along the river) are found in Lowell.

The canal bridges themselves are located within the boundaries of census tracts 3101, 3107, 3111, and 3883. These areas are home to an extremely diverse population, a vast majority of whom are minority and low-income households. Unemployment rates in these tracts are also considerably higher than national averages. All of these census tracts qualify as Environmental Justice Populations under the Environmental Justice Policy of the Massachusetts Executive Office of Energy and Environmental Affairs.

Census Tract	Neighborhood	Unemployment Rate	Minority Population Percentage (2010)	Proportion of Low- and Moderate-Income Households
3101	Downtown Lowell	16.1%	59.7%	69.3%
3107	Acre	10.9%	66.4%	61.3%
3111	Acre	10.8%	97.0%	84.2%
3883	Acre	10.2%	71.6%	86.4%

Sources: U.S. Census 2010, ACS 2006-2010



Project Partners

The Lowell Canal Bridges project is inherently a public-private partnership that reflects the cross-sector collaboration that has been at the root of Lowell's renaissance over the past several decades.

The **City of Lowell**, a municipality with a population of 106,519, is the lead applicant. Lowell's Department of Planning & Development (DPD) will serve as the grant recipient and oversee the project, from permitting and design through construction. With a staff of over 30 economic development, community development, housing, urban planning, and project management professionals, DPD will utilize its strong community leadership, involvement, and project management expertise to successfully complete this project. DPD handles approximately $7 million in federal and state grants each year and is well positioned to oversee and manage a TIGER VII grant.

The City has a strong history of coordinating cross-sector partnerships to manage complicated initiatives involving federal funding. Selected recent examples include:

- A $5 million BetterBuildings grant from the U.S. Department of Energy which created innovative public-private financial tools to support the retrofitting of dozens of historic buildings in the Lowell National Historical Park for energy efficiency.
- Utilizing over $9 million in funding from the U.S. Department of Transportation to support the construction and development of the Lowell Riverwalk and Canalway system.
- Combining funds from the U.S. Department of Housing and Urban Development with capital from private lending institutions to create a loan pool that helped launch over three dozen start-up retail and restaurant businesses.
- Securing over $4 million in funding from various state and federal agencies, including a $2 million Infrastructure Improvement Grant from the Economic Development Administration to permit, design, and construct a new bridge over the Hamilton Canal to access the City's primary economic development district.

The **University of Massachusetts Lowell**, a nationally-ranked research university with over 17,000 students, will support the City through direct financial contributions as well as in-kind services of its professional staff and faculty and consultants. UMass Lowell's Facility Management team has completed over 2 million square feet of new buildings and over $700 million in renovation and capital construction projects since 2007 and has a robust infrastructure of staff and consultant expertise that will assist the City with all aspects of project management from planning and permitting through construction.

Enel Green Power North America, a subsidiary of an Italian multi-national power company, currently owns or controls the Lowell Canal Bridges to be improved. Enel has agreed to convey ownership of the eight bridges to the City of Lowell, contribute financially to this initiative, and in parallel with the TIGER project, complete the replacement of the Broadway Bridge at its own expense. Enel also completed the full replacement of the Kearney Square Bridge in 2014 and will convey the full benefits of that investment to the City at no cost.

The **Proprietors of Locks and Canals**, the descendent entity to the corporation that created Lowell's textile industry and power canal system in the 19th century, remains the technical owner of three of the canal bridges. They have pledged to convey title to these three bridges to the City of Lowell at no cost as part of the comprehensive agreement between the City and Enel, which is responsible for maintenance of these three bridges as well as their own.

The **Lowell Historic Board**, a state-legislated local review and permitting agency, and the **Lowell National Historical Park**, the first urban national park to celebrate America's industrial heritage, will provide technical assistance and leadership to ensure that the designs of the bridge replacements and repairs are consistent with applicable historic permitting requirements and complementary to the historic character of Lowell's canal system.

The **Northern Middlesex Council of Governments**, in its capacity as the Metropolitan Planning Organization for the Greater Lowell region, and the **Massachusetts Department of Transportation** have indicated their willingness to advise and assist the City with technical requirements of implementing this transportation grant.

In addition to the partners listed above, the **Lowell Regional Transit Authority, Lowell School Department, Lowell Fire Department**, and various commercial entities in and near downtown Lowell and the Acre neighborhood will benefit from the elimination of detours of larger vehicles due to weight restrictions and bridge closures.

Finally, numerous other partners representing community, business, transportation, environmental, and education interests in Lowell and the surrounding region have expressed their support for this project and its benefits, as evidenced by the attached support letters.

Project Budget

The following table summarizes the anticipated sources of funding for design and construction for the bridges and associated matching funding commitments, which reflect the cross-sector collaboration behind this project, including private, local, and institutional partners. Matching funds have been committed by the University of Massachusetts Lowell, Enel Green Power, and the City of Lowell. None of the matching funds listed are from federal sources; nor have any federal funds been previously applied to this project. All matching funds are committed as evidenced by the attached support documentation. In addition, Enel is investing approximately $5.5 million more as part of complementary efforts to address the two canal bridges not included in the TIGER project, resulting in a comprehensive solution to the Lowell Canal Bridge challenges.

Enel's contributions will be made directly to the City as part of the comprehensive settlement agreement that also conveys title to the bridges. The City of Lowell intends to issue bonds for the remaining required matching funds, inclusive of the University's matching funds. The two parties will share the debt service costs to repay the borrowed funds on pro rata basis, with the University reimbursing the City for the principal and interest on the first $2 million and the City paying the balance. All funding will be available when needed, consistent with the project schedule.

The Uses of Funding table outlines the estimated project costs for each component of each bridge. The construction cost estimates summarized here are supported by detailed cost estimates for each bridge that are included as appendices. Estimated design costs include survey and geotechnical borings, permitting, and engineering studies. Construction costs include general conditions, contractor mobilization, traffic management, and a construction contingency. All costs assume compliance with federal and state public procurement requirements and payment of prevailing wages.

Lowell Canal Bridges - Sources of Funding

TIGER Project									
Bridge Location	**Estimated Total Cost**	**TIGER Request**	**TIGER %**	**Enel Match**	**Enel %**	**UMass Lowell Match**	**UMass Lowell %**	**City of Lowell Match**	**City %**
1. Pawtucket Street over the Pawtucket Canal	$4,954,125	$3,963,300	80.0%	$340,000	6.9%	$650,825	13.1%	$0	0.0%
2. Pawtucket Street over the Northern Canal	$6,138,000	$4,910,400	80.0%	$420,000	6.8%	$807,600	13.2%	$0	0.0%
4. Central Street over the Lower Pawtucket Canal	$1,823,250	$1,458,600	80.0%	$0	0.0%	$0	0.0%	$364,650	20.0%
5. Suffolk Street over the Northern Canal	$2,945,250	$2,356,200	80.0%	$0	0.0%	$541,575	18.4%	$47,475	1.6%
6. Merrimack Street over the Western Canal	$701,250	$561,000	80.0%	$0	0.0%	$0	0.0%	$140,250	20.0%
7. Merrimack Street over the Merrimack Canal	$175,313	$140,250	80.0%	$0	0.0%	$0	0.0%	$35,063	20.0%
Total TIGER Project	**$16,737,188**	**$13,389,750**	**80.0%**	**$760,000**	4.5%	**$2,000,000**	11.9%	**$587,438**	3.5%
Related Investments NOT Included in TIGER Project									
3. Broadway over the Pawtucket Canal	$3,740,000	$0	0%	$3,740,000	100%	$0	0%	$0	0%
8. Kearney Square over the Eastern Canal	$1,750,000	$0	0%	$1,750,000	100%	$0	0%	$0	0%
Total Related Investments (not included as match)	**$5,490,000**	**$0**	0%	**$5,490,000**	100%	**$0**	0%	**$0**	0%

Lowell Canal Bridges - Uses of Funding

Bridge Location	**Estimated Total Cost**	**Construction**	**Allowance for Environmental, Historic, and Utility Mitigation**	**Escalation to Mid-point of Construction**	**Design (incl. Construction Phase Services)**	**OPM, Field Representation, and other Soft Costs**	**Project Contingency (10%)**
1. Pawtucket Street over the Pawtucket Canal	**$4,954,125**	$3,400,000	$150,000	$443,750	$340,000	$170,000	$450,375
2. Pawtucket Street over the Northern Canal	**$6,138,000**	$4,200,000	$200,000	$550,000	$420,000	$210,000	$558,000
4. Central Street over the Lower Pawtucket Canal	**$1,823,250**	$1,300,000	$0	$162,500	$130,000	$65,000	$165,750
5. Suffolk Street over the Northern Canal	**$2,945,250**	$2,100,000	$0	$262,500	$210,000	$105,000	$267,750
6. Merrimack Street over the Western Canal	**$701,250**	$500,000	$0	$62,500	$50,000	$25,000	$63,750
7. Merrimack Street over the Merrimack Canal	**$175,313**	$125,000	$0	$15,625	$12,500	$6,250	$15,938
Total TIGER Project	**$16,737,188**	**$11,625,000**	**$350,000**	**$1,496,875**	**$1,162,500**	**$581,250**	**$1,521,563**
	100%	**69.5%**	**2.1%**	**8.9%**	**6.9%**	**3.5%**	**9.1%**
Related Investments Not Included in TIGER Project							
3. Broadway over the Pawtucket Canal	**$3,740,000**	$3,250,000	n/a	n/a	$150,000	n/a	$340,000
8. Kearney Square over the Eastern Canal	**$1,750,000**	$1,600,000	n/a	n/a	$150,000	n/a	$0
Related Investments (not included as match)	**$5,490,000**	**$4,850,000**	**n/a**	**n/a**	**$300,000**	**n/a**	**$340,000**

The Broadway Bridge over the Pawtucket Canal is outside the TIGER project because Enel has committed to replacing this structure in 2015 as part of the settlement. The Kearney Square Bridge is similarly outside the project because it was replaced by Enel in 2014 after the bridge had deteriorated to a point where replacement was more cost effective than repair solutions to remedy structural concerns that required immediate attention.

Pre-Construction Costs

The project budget anticipates $1,278,750 in design and related soft costs, inclusive of a contingency and construction phase services. Enel has agreed to pay for the pre-construction design costs related to the two Pawtucket Street bridges (1&2). The City will use its matching funds to pay for the pre-construction costs for the other bridges. As a result, no TIGER funding is required to be allocated to pre-construction costs.

Potential Segmentation

All of these bridges are integral components of the roadway and bridge infrastructure that serves the multi-modal transportation system of Downtown Lowell, the Acre Neighborhood, and forms a significant component of the regional transportation network, in conjunction with the Merrimack River crossings. As a result, the beneficial impacts of a comprehensive solution are greater than the sum of the parts.

Despite the fact that incremental improvements of addressing some but not all of the bridges would have immediate benefits, the fundamental issue of essential public infrastructure being owned by a private company with no incentive and little motivation to maintain it remains as long as even one of the eight bridges is not addressed. For this reason, the project is not likely to achieve a sustainable resolution with only a partial solution.

State of Good Repair

Keeping transportation infrastructure in a state of good repair is essential to sustaining existing transportation services, providing mobility, and supporting livable communities. As can be seen in the engineering reports for each of the Canal Bridges, Enel has not prioritized the necessary funding to maintain the bridges in a state of good repair. Addressing bridge maintenance only by response to crises has yielded ineffective results that are having a devastating impact on the City of Lowell and its residents. Constant deferral and foregoing of warranted preservation treatments has resulted in worsening conditions each year.

Downtown Lowell, the Acre Neighborhood, and UMass Lowell are serviced by two Principal Arterials and a network of Minor Arterials. These corridors accommodate the majority of trips entering and leaving downtown as well as the major commuter flows through the urban area.

The network of Minor Arterials serves the demand for travel between the central business district (CBD) and outlying residential areas.

Lowell's principal north-south arterial is the Central Street/Bridge Street corridor which bisects downtown.[2] The Central Street Bridge over the Lower Pawtucket Canal is the only southern entrance to the CBD and it is a vital component of this North-South Principal Arterial. On average 12,200 vehicles per day cross the Central Street Bridge to access and traverse downtown.[3] Currently the Central Street Bridge has steel girder corrosion and section loss as well as exposed rebar in the concrete deck. The bridge is posted with a weight limit of 25 tons for tractor trailers, and therefore limits the freight shipments into the CBD. Continued neglect of the Central Street Bridge would result in continued deterioration and lower weight restrictions. There are no convenient parallel detour routes into the CBD due to the Concord River and canal network. Any detour would place over 12,000 vehicles a day on the minor arterial network which already has capacity and safety issues.

Pawtucket Street, which runs along the southern bank of the Merrimack River is the City's principal east-west arterial. This corridor connects three major river crossings into downtown and carries an average of 7,800 vehicles per day.[4] In addition, this route is identified in UMass Lowell's campus transportation plan as the 'Primary Inter-Campus Connector Boulevard'. Pawtucket Street is severely hampered by the condition of bridges #1 and #2 which are in need of complete reconstruction.

If the Pawtucket Street canal brides were to be closed or suffer further weight restrictions, the impact on the City and UMass Lowell would be catastrophic. Transit access to and from high density transit oriented student housing on both the east and south campuses of UMass Lowell would be eliminated. In addition, there are no alternative detours which could compensate for the existing amount of traffic. The city's internal road network does not have adequate east-west connectivity, and the bulk of the 7,800 detoured vehicles would be forced onto neighborhood residential streets which have on-street parking and un-signalized intersections.

The Merrimack Street corridor serves as Downtown's main east-west Minor Arterial.[5] The Merrimack Street Corridor connects the two Principal Arterials previously discussed and is the only arterial crossing the Concord River and linking the city's eastern neighborhoods to Downtown. Merrimack Street is known as Kearney Square as it enters downtown from the east.

[2] Bridge St. and Central St. were classified as Urban Principal Arterials by MassDOT in accordance with Section 1006(c) of the Intermodal Surface Transportation Efficiency Act (ISTEA)
[3] Traffic count conducted for TIGER Grant in April 2015 - 12,200 is AADT.
[4] Traffic count conducted for TIGER Grant in April 2015 – 7,800 is AADT.
[5] Merrimack St. (aka Kearney Sq. and E. Merrimack St.) were classified as Urban Minor Arterials by MassDOT in accordance with Section 1006(c) of the Intermodal Surface Transportation Efficiency Act (ISTEA)

The Merrimack Street corridor crosses over three of the Enel-owned canal bridges: #4, #7, & #8. On average, 7,600 vehicles use Merrimack St as it heads west and 9,200 as it heads east. Per definition, these urban arterials are characterized as: [6]

- Serving major activity centers, highest traffic volume corridors and longest trip demands;
- Carrying high proportion of total urban travel on minimum of mileage;
- Interconnecting and providing continuity for major rural corridors to accommodate trips entering and leaving the urban area and movements through the urban area; and
- Serving demand for intra-area travel between the central business district and outlying residential areas.

If funded through the TIGER program, the City of Lowell will take ownership of and rehabilitate these bridges. Following best practice from FHWA, and working in partnership with the Massachusetts Department of Transportation, the City will employ a systematic and cost effective process for bridge preservation to maximize the life of these bridges.

Economic Competitiveness

Cities have been demonstrated to add economic value and stimulate innovation through the aggregation of people and ideas in close proximity to one another by fostering plenty of opportunity for efficient interactions among them. City streets form the core of this connectivity. Lowell and other smaller post-industrial cities in Massachusetts have been designated as "Gateway Cities" by the Commonwealth because of their unique role in serving as hosts to economic opportunity for immigrants and others seeking "ladders of opportunity" through education, entrepreneurship, and employment, consistent with the historic role of cities.

The primary purpose of the surface transportation network is to move people and goods in support of large economic and community development objectives. The ability of places like Lowell to maximize their potential as Gateway Cities is tied directly to the safety, convenience, and comfort of their surface transportation infrastructure, particularly their streets and sidewalks, as well as the bridges that carry them over waterways.

Lowell's core strength and primary area for economic opportunity is as a dynamic center for education at all levels from pre-school through post-doctoral research. The recent growth and expansion of UMass Lowell has been virtually unparalleled in the United States, with a 47% increase in enrollment since 2007, commensurate expansion of campus employment, and dramatic improvement in national stature and measures of academic success. Middlesex Community College has seen similar enrollment growth over the last decade.

[6] Highway Functional Classification Concepts, Criteria, and Procedures (2013 Edition), pg. 15. USDOT-FHWA, Publication Number: FHWA-PL-13-026

Unfortunately if the conditions of the canal bridges are not addressed or are allowed to deteriorate, the increased travel delays, and costs of detours will stifle and potentially reverse this academic expansion. However, if the bridges are repaired and replaced by this project they will serve as key components to a more sustainable multi-modal approach to transportation that will allow the higher education institutions to continue to thrive and expand while minimizing their impacts on traffic. Fully functional canal crossings will also increase access to opportunity through elementary and secondary education by reducing school transportation travel times and operating costs associated with cumbersome detours.

They will also complement the comprehensive efforts of the City of Lowell and its partners to revitalize the Acre neighborhood and its core Downtown. These efforts, grounded in thoughtful planning and innovative preservation-centered strategies, have included conversions of nearly 5 million square feet of vacant mill buildings since the late 1970s, construction of hundreds of units of quality affordable housing, and establishment of dozens of new businesses, many of which cater to specific immigrant communities that Lowell is home to. This tremendous period of urban renaissance can only continue if the transportation network that supports a vibrant and diverse city is able to function effectively. Given that Downtown Lowell and the Acre neighborhood are essentially located on an island surrounded by the Merrimack River and the Pawtucket Canal, the current and deteriorating conditions of the canal crossings threaten to isolate the area and suffocate their revival if not addressed.

Quality of Life

Downtown Lowell and the Acre neighborhood, where the Lowell Canal Bridges are located, have been recognized by numerous federal, state, and private agencies as exemplary models for sustainable and progressive urban revitalization grounded in preservation of historic character, community diversity, and reinvestment. The principles at the core of Lowell's comprehensive Master Plan, Sustainable Lowell 2025 and the Northern Middlesex region's Comprehensive Economic Development Strategy, as well as specific plans to support the growth and development of Downtown Lowell and the Acre neighborhood are all consistent with the Livability Principles of the Partnership for Sustainable Communities. The success of these efforts over the past several decades is threatened by the deteriorating conditions of the canal bridges, which severely undermines the transportation network serving these areas.

Provide more transportation choices - As a well-preserved planned 19th Century company town, Lowell's Downtown and Acre neighborhood is inherently a highly walkable environment. Because this 750-acre area is traversed by 5.6 miles of power canals, it is dependent on a network of bridges to maintain transportation access. This project proposes to correct existing structural, functional, and safety deficiencies of the travel ways and sidewalks on the existing bridges, while enhancing their bicycle and pedestrian accommodations. Eliminating posted

weight restrictions will greatly improve the viability of public school, university, and transit authority buses as convenient transportation options for thousands of daily riders.

Promote equitable, affordable housing - According to the records kept by the Massachusetts Department of Housing and Community Development, Lowell has 5,215 subsidized housing units (12.6% of its total housing stock) affordable to households earning 80% of area median income or, in many cases less. A sizable percentage of these units are located in the Acre and Downtown Lowell areas, and Lowell has employed a deliberate strategy of maintaining sustainable housing choice and opportunity by aggressively supporting the production of hundreds of new affordable housing units in these areas over the past fifteen years. Much of this new production has been in mixed-income developments, the majority of whose units are market-rate to avoid the concentration of poverty. This area is dependent on a stable transportation infrastructure to ensure that these households have safe and efficient access to education and employment opportunities.

Enhance economic competitiveness - As discussed above, this project at its core is about improving the direct access to educational and economic opportunities by eliminating cumbersome detours around deficient bridges that carry major roadways serving the heart of Lowell, the regional transportation network that relies on Downtown Lowell's bridges to cross the Merrimack River, and the campuses of the University of Massachusetts Lowell.

Support existing communities - Lowell has been recognized and celebrated internationally as a model for the revitalization of smaller post-industrial cities through the preservation and repurposing of historic buildings, the redevelopment of Brownfield sites, and the repopulation of its urban core. It has seen over 5 million square feet of formerly vacant mills redeveloped since the late 1970s (with more than half of that total since 2000). Lowell has remediated and redeveloped formerly contaminated industrial sites into a minor league baseball stadium, multi-purpose hockey and entertainment arena, a middle school, artist housing developments, structured parking facilities, and commercial office buildings, among others. In conjunction with these and other investments, the population of Lowell's Downtown and Acre neighborhoods increased by 48% between 1980 and 2010. The canal bridges are critical to continuing rather than reversing these positive trends of reinvestment in an existing urban core.

Coordinate and leverage federal policies and investment - Collaboration with federal partners has been a hallmark of Lowell's renaissance since the Department of the Interior established the Lowell National Historical Park in 1978. The Department of Housing and Urban Development (HUD) has provided millions of dollars of housing and community development funding through block grants and competitive financing for projects. The Environmental Protection Agency designated Lowell as one of its original Showcase Communities and has supported the assessment and remediation of dozens of Brownfield sites to support their redevelopment. The

Department of Energy designated Lowell as one of only a handful of original BetterBuildings communities to demonstrate how energy efficiency and historic preservation can support and complement one another. The Department of Transportation has supported the development of Lowell's Riverwalk and Canalway system through the Public Lands Highway and Sarbanes Transit in the Parks programs. In all of these and other cases, the City of Lowell has proven itself to be a capable and efficient steward, translating federal seed financing into significant public and private investment. Investment in the rehabilitation of Lowell's Canal Bridges can serve as a key next step in supporting and preserving this legacy of federal support for Lowell's public-private partnership.

Value communities and neighborhoods - The Lowell Canal Bridges project is an essential next step in reinforcing decades of federal and local policies that have revitalized Downtown Lowell and the Acre neighborhood as economically, socially, and demographically diverse walkable urban communities that have celebrated their heritage through historic preservation and sensitive infill development. This project is necessary to both preserve and advance this vision.

Environmental Sustainability

The City of Lowell and the University of Massachusetts Lowell, have embraced USDOT and President Obama's challenge to transform the way transportation serves the American people by encouraging transportation that is less carbon-intensive, such as transit, as well as biking and walking which produce zero emissions. This project partners are committed to improving energy efficiency, reducing dependence on oil, reducing greenhouse gas emissions and benefitting the environment and will inform the project design with these values. The City of Lowell and UMass Lowell have both been recognized by the Massachusetts Executive Office of Energy and Environmental Affairs with "Leading by Example" awards for their commitments to environmental sustainability and energy conservation.

Lowell encourages compact, dense, mixed-use development patterns that complement the historic fabric of Lowell and encourage walking, cycling, and transit use. Promoting more sustainable development and travel patterns yields environmental and public health benefits. These include reduced traffic crashes and pollution emissions, increased physical fitness, improved mental health, improved basic access to medical care and healthy food and increased affordability which reduces stress to lower-income households.[7]

The current and future conditions of the Canal Bridges, if left unaddressed, are a major roadblock to sustainably meeting the transportation needs of Lowell's diverse residential population; the expanding student and staff populations at UMass Lowell; the wide-array of

[7] Victoria Transport Policy Institute – Evaluating Public Transportation Health Benefits: http://www.apta.com/resources/reportsandpublications/Documents/APTA_Health_Benefits_Litman.pdf

commuters coming to the city for employment and educational opportunities; and visitors, including 580,000 who annually visit the Lowell National Historic Park, in part to experience the canal system.[8]

The Benefit-Cost Analysis (BCA) highlights the emissions savings resulting from a reduction in vehicle-miles travelled for transit service in the City. To avoid inflating the BCA, no attempt was made to quantify the broader benefits of a more sustainable transportation program that is facilitated by but not solely tied to the rehabilitation of the Canal Bridges as an essential component in the city's transportation infrastructure. However, if the Canal Bridges remain in their current condition or are allowed to deteriorate further by their private owners, the City and the University will be unable to implement the most meaningful steps necessary to continue to increase sustainable transportation mode shares.

An ongoing Comprehensive Service Analysis by the LRTA shows there are over eighty-five hundred households that do not have access to a vehicle in the Regional Transit Authority's service area. Nearly 70% (6,034) of these households are located within the City of Lowell (*Source: ACS 2008 - 2012)*, with particularly high concentrations in Downtown and the Acre Neighborhood. At least 2700 of the 4000 students who live in UMass Lowell dormitories located near the canal bridges on Pawtucket and Central Street also do not have a vehicle on campus. The impediments to transit, walking, and biking posed by the current conditions of the canal bridges disproportionately impact these populations who lack access to vehicles.

As a signatory to the American College & University Presidents' Climate Commitment (ACUPCC), UMass Lowell has committed to accelerate progress towards climate neutrality and sustainability by educating students, creating real world solutions in relation to campus operations, and providing leadership-by-example for the rest of society. The Canal Bridges project will help the University to greatly reduce its transportation related Greenhouse Gas (GHG) emissions as documented in its Climate Action Plan. Replacing the bridges along the Pawtucket Street 'Primary Inter-Campus Connector Boulevard' will enable the city and the University to provide enhanced Transportation Demand Management programs by providing improved infrastructure to support biking and walking, and highly efficient and frequent transit service.

[8] National Parks Service Visitor Spending Effects – Lowell National Historic Park
http://www.nature.nps.gov/socialscience/nps-park.cfm?park=470

Safety

The Lowell Canal Bridges project has a direct and significant impact on safety in two key areas. First, the current conditions of the bridges, including weight restrictions and closures, as well as the likelihood of more closures in the absence of this project, force emergency vehicles on circuitous detours that delay response times, in some cases by considerable amounts. Second, the project proposes to greatly enhance safety for pedestrians and cyclists using the bridges by reopening or constructing sidewalks and bike lanes on all spans.

The city, university, region and state have completed comprehensive Hazard Mitigation Plans in consistent with the policies and guidance of the Federal Emergency Management Agency (FEMA) and the Massachusetts Emergency Management Agency (MEMA). Hazard mitigation is defined by FEMA as "*any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards*".

In each of these plans, infrastructure failure is identified as a pressing concern in Lowell. Reflective of the collaborative nature of this approach for TIGER funding, the project team engaged with the primary providers of public safety in Lowell in order to gain a better understanding of the critical nature of these bridges to public safety. The Lowell Fire Department, Lowell Police Department, UMass Lowell Police Department, UMass Lowell Emergency Medical Services and Trinity Emergency Medical Services agreed upon a joint response to the Canal Bridges in relation to public safety (please also see their support letters attached as appendices to this application):

> *It is impossible to put a monetary value on the importance of the bridges to public safety in Lowell. However, seconds count in an emergency and any kind of delay could be the difference between life and death. If these bridges are allowed to continue to deteriorate the result will be further weight restrictions and certain bridge closures. This will have a catastrophic effect on public safety in the City of Lowell and will severely hinder the ability of our agencies to carry out our mission.*

Current weight restrictions on the Pawtucket Street and Broadway Bridges over the Pawtucket Canal (1&3) force fire apparatus and other emergency vehicles on a 2 mile-long detour route through congested urban streets. Due to a one-way travel restriction on a narrow street, the Pawtucket Street Bridge over the Northern Canal (#2) is presently the only legal vehicle egress from the UMass Lowell East Campus, with its 2000 student dormitory beds, and to the 5000-seat LeLacheur Park baseball stadium. Both sidewalks on this bridge have already been closed to even pedestrians. Given the seriously deteriorated condition of the existing bridge structure and its supporting pier, this vital link on the one-way section of Pawtucket Street will almost certainly be closed in the very near future unless funding for replacement work is secured. Assuming two-way traffic patterns were restored to Pawtucket Street, the circuitous route that this would create to get to and from east campus would result in increased emergency response

times of three minutes on average (estimate data from UMass Lowell EMS Manager). This is especially critical given that the UMass Lowell EMS operation is based on East Campus. EMS vehicles and staff are housed at this location, and the majority of emergency responses originate from this location. The Pawtucket Street over Northern Canal bridge is also the most direct route for EMS access to the North and South Campuses as well as Lowell General Hospital.

The Lowell Fire Department has thirteen companies strategically located in every neighborhood in Lowell, including several near the canal bridges. In addition to fire-related incidents, the Lowell Fire Department responds to calls for emergency medical services, hazardous materials incidents, ice and water rescues/recoveries, automobile accidents/extrications, and technical and high-angle rescues.

Each of these bridges serves a vital role in the ability of the Lowell Fire Department to provide adequate first alarm response throughout the City. Further weight restrictions and bridge closures will not only remove the bridges themselves from the transportation network, but will also increase traffic congestion on the detour routes, including many local streets that already exceed their design capacity, further hindering response times.

The proposed bridge replacements and rehabilitations will improve safety conditions along the roadway by incorporating modern transportation engineering for the cross-section, alignment, design speed, and transition segment designs. The poor lane design, lack of proper crash barriers separating sidewalks from travel ways, and configuration of the existing features on each bridge do not conform to current standards and create a potential safety hazard to all bridge users.

The proposed project, if funded through TIGER, will increase vehicular, pedestrian and bicycle safety and reduce the potential for accidents. Replacing and rehabilitating the existing outdated bridges with those designed and built to modern standards will reduce injury and accidents, improve emergency vehicle access, and promote healthy, attractive alternatives to driving across the bridge through the addition of new bicycle and pedestrian amenities.

For example, despite both sidewalks being completely closed, nearly 7,000 pedestrians a day use the Pawtucket Street bridge to cross the Northern Canal (2). These pedestrians are forced to walk within the travel way, separated from vehicles only by a temporary highway guardrail, bolted to the deteriorating bridge deck. Nearly all of the bridges lack proper crash barriers separating one or both sidewalks from the travel way.

Sight distances on all bridges have been limited by the positioning of “temporary” safety equipment, including jersey barriers, fencing and emergency crash barrels, as well as signage, necessitated by the poor condition of the bridges. These measures create particularly dangerous

obstructions for drivers entering from smaller cross-streets and driveways located near the bridge approaches.

Accident data was reviewed as part of the analysis for this TIGER application. As is typical of short-span bridges of this nature, very few accidents took place on the bridge spans themselves. However, existing and potential weight restrictions and closures on the Canal Bridges divert traffic, particularly heavy vehicle traffic to already congested and dangerous intersections. Of the top 100 High-Crash Intersections in the Northern Middlesex MPO Region, 27 are located in Downtown Lowell and the Acre, and 24 more are within one-half mile of the neighborhoods that are home to the Canal Bridges.

Partnership and Innovation

The current canal bridge predicament is part of Lowell's unique legacy as one of the first "company towns" in the United States. The City was established in the early 19th century after a group of Boston-based investors purchased the water rights in the Merrimack River and began transforming an existing transportation canal into the network of water power canals that remains in place today. Although nearly all of the mills and other property that was once owned by the corporate entities created by these investors have been sold and redeveloped, the canal system and eight bridges that carry public ways across it remain in private ownership.

In addition to being the source of the challenge, this unusual ownership circumstance necessitates a public private partnership solution. Fortunately, over the past several decades, Lowell has developed and institutionalized a culture of partnership that is a model for smaller cities across the country, with cross-sector collaborative initiatives in communication, development finance, regulatory practices, sustainability, affordable housing, neighborhood revitalization, environmental remediation, and transportation projects. The City's revitalization successes since the late 1970s have reinforced a collective recognition in the value of cooperation rather than competition, yielding shared benefits.

This culture has also bred a strong town/gown partnership between the University of Massachusetts Lowell and the City of Lowell, which is manifested in a collaboration to prepare for and submit this grant application as well as in the funding and implementation of the project. Further, this culture has enabled the City and Enel to negotiate a creative settlement of outstanding tax litigation and the bridge challenge. In addition to the matching contributions that Enel is making to this project, Enel has also agreed to complete the replacement of one bridge using its own resources, an investment they value at approximately $3.5 million, and convey bridge ownership to the City at no cost, a contribution which cannot easily be valued.

Further Lowell's culture of partnership has fostered an ethic of inclusion and participatory engagement in planning initiatives. The results of numerous recent examples strongly support the proposed Lowell Canal Bridges Project, including.

- The 2011 *UMass Lowell Campus Transportation Plan*
- The City of Lowell's 2013 Master Plan, *Sustainable Lowell 2025*
- The 2009 Northern Middlesex Council of Governments' *Comprehensive Economic Development Strategy*
- The 2012 Northern Middlesex Metropolitan Planning Organization's *Regional Transportation Plan*
- The ongoing *Pawtucket Street Corridor Plan*, a foundation-funded joint project of the City and University

Benefit Cost Analysis

The Benefit Cost Analysis (BCA) takes an extremely conservative approach to estimating the benefits of the project. Where the known benefits were not readily quantifiable, a qualitative description is offered. With specific reference to the BCA Resource Guide, the valuation of benefits uses a number of assumptions that are required to produce monetized values for non-pecuniary benefits. The different components of time, for instance, are monetized by using a "value of time" that is assumed to be equivalent to the user's willingness to pay for "time savings" in transit. The BCA expresses benefits and costs monetarily in "present value" (PV) capturing the flows of benefits and costs over the project horizon. Project costs and benefits are forecast over 25 years, discounted at both 3% and 7% in line with federal practice.

The BCA calculates a Benefit Cost Ratio (BCR) for the project. The BCR is expressed as the ratio of benefits of a project relative to its costs, both expressed in present-value terms. A BCR above 1.0 suggests that benefits exceed costs, in which case the project creates a positive return on investment.

	Total Project Benefits & Costs	3% Discount Rate	7% Discount Rate
Benefits	$ 53,651,349.44	$ 34,566,339.40	$ 20,549,911.92
Costs	$ 19,345,188.00	$ 16,911,364.25	$ 14,527,101.86
BCR	**2.8**	**2.0**	**1.4**

Current Infrastructure Baseline

Multiple alternative solutions to address the conditions of each of the canal bridges were considered as part of the engineering assessments completed for each bridge in Spring 2015. The BCA values the project costs based on the most cost-effective approach informed by sound engineering judgement.

Project costs are outlined below including final design, permitting, and construction. No right-of-way acquisition costs are involved in this project. The baseline project assumption is that once the project is approved, a phased construction effort would occur from 2017 through 2019.

Project Costs

The total estimated project cost is $19,345,188 including $16,737,188 for final design, permitting, and construction; as well as $2,608,000 for future preventive maintenance based on recommended best practice from FHWA.

Project Benefits

The requested TIGER VII funding will enable the City and its local and regional partners to complete a transformative project that will facilitate a safer and more accessible transportation system that will provide economic, educational and social opportunities and connections within the City and beyond. In conjunction with ongoing transportation and economic development initiatives in the project area, this project will facilitate the continued development of the University of Massachusetts Lowell and support the revitalization of Downtown Lowell and the Acre Neighborhood. The quantitative benefits have been valued at more than $34.5 million (at a 3% discount rate). Additional comments regarding these benefits as well as the qualitative impacts of the project are outlined below.

If left unimproved, the poor condition of these bridges will continue to threaten current and future transportation network efficiency, mobility of goods or accessibility and mobility of people, or economic growth. If funded through the TIGER program, the City of Lowell will take ownership of the bridges and systematically address their deficiencies through replacement and repair projects. Following best practice from FHWA, and working in partnership with MassDOT, the City will employ cost effective strategies and actions to maximize the life of these bridges.

Detailed analyses have quantified benefits in terms of travel time savings and savings in operating cost. Specific attention was paid to ensure that no transfer benefits were included (e.g. fuel savings and vehicle maintenance costs that are incorporated into transit providers cost per mile). As a result of this project, more direct routes for the Lowell Regional Transit Authority (LRTA) and UMass Lowell transit service will be possible. There will also be associated improvements to streets and intersection operations that will reduce delay, congestion and optimize traffic operations. The net present value (2015) of the project's travel time savings over a 25-year period is **$40,808,143.31.**

Operational costs for the Lowell School Department as well as the University and LRTA transit systems will also be greatly impacted by this project. The combined net present value for operational savings is **$12,825,523.29** over 25 years. The BCA workbook also highlights emissions savings of almost **$18,000** in relation to a reduction in vehicle-miles travelled for transit service in the City.

The impact of the Canal Bridges on the economic competitiveness of the Lowell National Historical Park should not be underestimated. In 2014, 568,675 people visited the park, spending

$28,856,100 in Lowell and surrounding communities. The cumulative benefit to the economy, which also takes into account the 433 area jobs this spending supported, was listed at **$40,654,500**. Canal tours are a major attraction for visitors to the park who come to see how "Lowell's water-powered textile mills catapulted the nation – including immigrant families and early female factory workers – into an uncertain new industrial era". The condition of the Canal Bridges has impacted canal tours in the past and is certain to do so in the future if left unaddressed. Along with the demonstrated impact on public safety, the canal bridges, which are such a vital component of our nation's industrial heritage, are an eyesore and have a detrimental effect on the visitor experience to the nation's first urban national park of its kind.

As not to inflate the BCA, no attempt was made to quantify the additional benefits associated with the social costs of carbon, travel time savings for emergency response vehicles, or reductions in the possibility of accidents involving cyclists or pedestrians because these impacts are extremely difficult to value precisely.

Project Readiness

Technical Feasibility

Working in close partnership with officials from the City of Lowell and UMass Lowell, Enel engaged two engineering firms to study the existing conditions of six of the canal bridges[9]. These studies, conducted in Spring 2015 have identified specific concerns with each bridge, proposed repair solutions, and estimated costs, inclusive of design, soft costs, and appropriate contingencies. They form the basis of the proposed scopes of work defined in this application.

1. **Pawtucket Street over the Pawtucket Canal** – This bridge will be completely replaced with a new bridge consisting of welded steel plate girders with a composite reinforced concrete deck. The central masonry pier will not be reused and will be removed. The new bridge abutments will be constructed behind the existing canal walls. All work will be completed within the existing right-of-way, but the new bridge will include sidewalks, protected by historically sympathetic ornamental railings and BR-2 guardrails, and bicycle accommodations within the travel way on both sides. The new bridge will not have any weight restrictions. A 20-inch water main located under the bridge, as well as overhead utility lines and lighting will be addressed as part of the project.
2. **Pawtucket Street over the Northern Canal –** This bridge will be completely replaced with a new bridge consisting of welded steel plate girders with a composite reinforced concrete deck. The central masonry pier will be reconstructed. The new bridge abutments will be constructed behind the existing canal walls. All work will be completed within the existing right-of-way, but the new bridge will include sidewalks,

[9]Enel has agreed to design and construct a replacement for the Broadway Bridge over the Pawtucket Canal and recently completed the replacement of the Kearney Square Bridge over the Eastern Canal in response to an emergency condition.

protected by historically sympathetic ornamental railings and BR-2 guardrails, on both sides and bicycle accommodations within the travel way. The new bridge will not have any weight restrictions but is expected to remain a one-way bridge due to the nature and geometry of the surrounding roadway network. A 16-inch gas line located under the bridge deck, an electrical duct bank attached to the outside of the east side of the bridge, as well as overhead utility lines and lighting will be addressed as part of the project.

3. **Broadway over the Pawtucket Canal** – Although not technically part of the TIGER project, this bridge, which has been reduced to a single travel lane and one-way traffic, will be completely replaced by Enel as part of the overall public-private partnership to comprehensively address the canal bridges. The new span will be a single-span steel stringer bridge on pile supported abutments, spanning the existing canal walls. The new bridge will have sidewalks, protected by historically sympathetic ornamental railings and BR-2 guardrails, and bicycle accommodations in the travel way on both sides, but will not have any weight restrictions. Existing water, gas, and telephone lines will be addressed as part of the project.
4. **Central Street over the Pawtucket Canal** – The proposed work includes a new concrete deck, welding shear studs to the beams for composite action, cleaning and re-painting the existing steel beams, and installation of a BR2 guardrail to the west side of the bridge. Deck construction would occur in phases, allowing two-way traffic to be maintained throughout construction subject to a traffic management plan. Installation of the BR-2 guardrail and the new composite deck will address the two deficient beams that are currently controlling the weight restrictions on this bridge and enhance pedestrian safety. Bicycle accommodations will be added in the travel way.
5. **Suffolk Street over the Northern Canal** – This bridge was closed to all traffic during Spring 2015 as a result of engineering inspections conducted in support of this project. Although short-term repairs are currently being implemented to reopen the bridge to some vehicles, the project anticipates a complete superstructure and deck replacement, as well as repairs to existing masonry piers. The project will also include the installation of historically sensitive ornamental railings and BR-2 guardrails along both sidewalks to protect pedestrians and prevent vehicles from mounting the sidewalks. In addition, bicycle accommodations will be added to the travel way. The completed bridge will have no weight restrictions.
6. **Merrimack Street over the Western Canal** – The proposed scope includes a partial deck and complete sidewalk replacement with replacement beams at these locations, crack repairs, and localized patching for remaining beams. The project will also install BR-2 guardrails at each sidewalk to protect pedestrians and restriping of bike lanes in the travel way. This bridge is not currently posted, but was last rated in 1987. This scope of work will ensure that no future posting is required. All work will be phased to maintain multi-modal access in both directions throughout the construction period.

7. **Merrimack Street over the Merrimack Canal** – This bridge is in generally good condition. Therefore, the only recommendation for construction is the installation of BR-2 guardrail at the north sidewalk to provide pedestrian protection, and to provide an approved crash tested barrier along the entire bridge span. This would allow for historic preservation of the existing pedestrian rail, which is a featured aspect of the bridges throughout the City. Parallel parking protects the south sidewalk.
8. **Kearney Square over the Eastern Canal** – This bridge was completely replaced in 2013 and 2014 in order to avoid complete closure of one of the primary roadways serving Downtown Lowell. No further work is proposed as part of this project.

Financial Feasibility

As discussed in the Project Budget section of this application, the total project is estimated to cost approximately $16.75 million. The City of Lowell is seeking $13,389,750 from the TIGER VII program, which will be matched by contributions of $2,000,000 from the University of Massachusetts Lowell and $750,000 from Enel Green Power North America, and $600,000 from the City of Lowell. The City of Lowell will also take responsibility for maintenance of the bridges following completion of the project. None of the matching funds listed are from federal sources. All matching funds are committed as evidenced by the attached support documentation.

All of the funders are financially stable entities, whose capacity to honor their commitments is not in question. UMass Lowell is one of the fastest-growing major public research universities in the nation. Enel is a profitable multi-national power company. The City of Lowell is a credit-worthy municipality with healthy reserves and conservative fiscal policies.

The City also has extensive experience managing federal grant programs, ranging from multi-million dollar formula block grants to numerous competitive grants financed under the American Recovery and Reinvestment Act. In recent years, the City has been recognized by HUD, the EPA, and the Department of Energy for its grant management and administrative practices.

The cost estimates included in this application incorporate a 20% construction contingency and 10% project contingency to allow for potential cost increases as designs are developed and construction begins. Both firms that have prepared the cost estimates have extensive experience engineering similar bridges over canals in Northeastern mill cities, heightening the City's confidence in their estimates. Allowances are also being carried for utility, historic, and environmental coordination and mitigation as part of the two full replacement bridges on Pawtucket Street which may involve unanticipated costs in these areas. Construction costs are also escalated to the mid-point of construction based on the current trend of 4% annual escalation that has been observed in Eastern Massachusetts.

Project Schedule

The following table outlines the proposed project schedule, which will enable the project to easily complete all pre-construction activity prior to June 30, 2017 and all construction prior to September 30, 2022. A more detailed project schedule is included as an appendix to this application.

	Start	Complete
Grant Agreement Negotiation	July 2015	October 2015
Permitting & Approvals	April 2015*	August 2016
Design	April 2015*	September 2016
Right-of-Way Assembly	March 2016	June 2016
Construction Procurement	October 2016	January 2017
Construction	Winter 2017	Fall 2019

*Note: preliminary activity begun prior to the execution of the grant agreement is not part of the project funded by TIGER grant or matching funds

Required Approvals

This project involves six elements, each of which is the replacement and/or repair of an existing bridge within the constraints of existing right-of-way with independent utility. Although the project elements are expected to provide or restore pedestrian and bicycle accommodations to the bridges and remove current lane closures and weight restrictions, there will be no increase in the number or width of vehicle travel lanes across the spans. With the exception of removal of one existing pier and replacement of one other, there will also be no work within the canals. None of the design plans involve reduction in clearances under the bridges, and no new structural impacts on the canal walls are expected from this project. Five of the six elements are estimated to have a total cost of less than $5 million and each will involve less than $5 million in federal funds. As a result, environmental permitting is expected to be less complex than was required when the City of Lowell coordinated federal, state, and local permitting for a new bridge over a canal in 2009-2010 using a combination of federal, state, and local funding as part of an economic development partnership. That experience was instructive in preparing City officials for the necessary processes that will apply to this project.

- Transportation Improvement Program (TIP) – As evidenced by the attached letter, the Northern Middlesex Metropolitan Planning Organization expressed their support for these project elements at their May 5, 2015 meeting and is prepared to promptly amend the TIP as required upon request subject to the required 30-day public notice period.
- National Environmental Policy Act (NEPA) – Based on consultations to date, the project elements are likely to qualify as categorically excluded under CFR 771.117(c)(22), 771.117(c)(23), and possibly 771.117(c)(28) provided that historic impacts are addressed through a Memorandum of Agreement (MOA) as discussed below. Discussion with the

Coast Guard indicates that FHWA may take the role of "lead agency" and the Coast Guard may act as a "cooperating agency" under NEPA.

- Historic (including Section 4(f), Section 106, and the Lowell Historic Board design review) – Some or all of the bridges are identified as contributing structures to the Locks and Canals Historic District, the Lowell Power Canal and Frances Gatehouse Historic District (a National Historic Landmark), the Downtown Lowell Historic District, the Lowell National Historical Park & Preservation District, and the City Hall Historic District. The project elements in the Downtown Lowell Historic District are subject to design review by the Lowell Historic Board under state statute. All project elements enjoy the support of both the Lowell National Historical Park and the Lowell Historic Board, whose professional staff typically consult with and advise the Mass Historical Commission (MHC), which is the State Historic Preservation Office, on Section 106 and Section 4(f) matters within the City of Lowell. As a result, the City anticipates entering into an MOA with the three historic agencies recognizing that the Lowell Historic Board will undertake design review of all bridges under this project, and compliance with the requirements and conditions of that design review shall serve as sufficient mitigation for any potential impacts to historic structures in conjunction with the project.
- U.S. Coast Guard/Army Corps of Engineers – Project proponents are in consultation with officials from the U.S. Coast Guard seeking a determination as to whether the canals are subject to the regulations associated with "navigable waters" or merely viewed as water supply for power. Based on past precedent in Lowell, no impacts are expected to be identified and no mitigation required even if they are deemed navigable and bridge permits are required.
- United States Fish And Wildlife Service – Project proponents will consult with the US Fish and Wildlife Service to confirm that the project will not adversely impact protected species under their jurisdiction and ensure proper mitigation measures are incorporated into the designs in the event that any are required.
- Federal Energy Regulatory Commission (FERC) – Enel operates the canal system under a power generation license issued by FERC. FERC approval will be required for Enel to convey the bridges to the City of Lowell. Enel will obtain this approval as the license holder following determination that the transfer of ownership will not trigger any significant environmental impacts. Because the bridges do not contribute to the power generation function of the canals and the proposed project is not expected to impact the power generating capacity of the canals, this approval is expected to be granted.
- Massachusetts Environmental Policy Act (MEPA) – Assuming that the MOA on historical effects described above is achieved, the project elements are not expected to meet any of the review thresholds for filing with the MEPA office.
- Massachusetts Waterways Chapter 91 Licensure – Based on past precedent, it is anticipated that the project elements will require Chapter 91 Waterways Licenses from the Massachusetts Department of Environmental Protection. Because the project designs

will remain within existing rights-of-way, will require only limited work in the canals themselves for two of the bridges, and will not reduce the clearances under the bridges, it is not expected that any adverse impacts which require mitigation will be identified as part of this licensure.

- Massachusetts Department of Transportation (MassDOT) Chapter 85 Bridge Review – Engineering designs will be submitted to MassDOT for review and approval under the Chapter 85 peer review process prior to bidding. This process is required for municipally-owned bridge construction projects in Massachusetts.
- Lowell Conservation Commission Approval – Project proponents will seek a determination of applicability from the Lowell Conservation Commission under the Massachusetts Wetlands Protection Act and City of Lowell Wetlands Ordinance. A negative determination is likely based on several similar precedent projects and consultation with the Conservation Commission Administrator, but time has been allowed in the schedule for the full Notice of Intent process should that prove to be necessary.

Assessment and Mitigation of Risks

Project proponents have already begun consultation with regulatory and permit authorities who may have jurisdiction over this project. The information derived from these consultations as well as similar recent precedent projects has informed a somewhat aggressive but realistic schedule for permits and approvals. The schedule allows for up to two months of additional time for permitting in the event that one or more approval processes is delayed without impacting the proposed construction start. The project schedule has incorporated sufficient time to comply with both Federal and Massachusetts public construction procurement and contracting requirements. Further delays can be absorbed by delaying the construction start up to three additional months without significant impact on being able to mobilize contractors for a spring 2019 field construction start.

With the exception of the bridges themselves, all right-of-way needed for the project is currently owned by the City of Lowell. Both Enel and the Proprietors of Locks and Canals, the owners of the bridges, have provided written assurances of their willingness to convey the bridges to the City in conjunction with implementing this project. The conveyance of the bridges will require FERC approval, which has been incorporated into the project schedule as discussed above. Even a four month delay in the bridge conveyance beyond the current schedule would not impact the City's ability to bid the project on time.

The construction schedule anticipates project completion nearly three years before the September 2022 deadline for the completion of TIGER VII projects, allowing ample time to absorb potential delays during construction.

Federal Wage Rate Certification

Office of the City Manager
City Hall • 375 Merrimack Street • Lowell, MA 01852
P: 978.970.4400 • F: 978.970.4007
www.LowellMA.gov

Kevin J. Murphy
City Manager

FEDERAL WAGE RATE
CERTIFICATION

I, Kevin J. Murphy, City Manager for the City of Lowell, Massachusetts hereby certify that the City of Lowell will comply with the requirements of subchapter IV of chapter 31 of title 40, United States Code (Federal wage rate requirements), as required by the FY 2015 Appropriations Act for the proposed *Lowell Canal Bridges* project seeking federal funding under the TIGER Discretionary Grants program.

Signature: Kevin J. Murphy

Date: 6/3/2015

Name: Kevin J. Murphy
Title: City Manager

The City of LOWELL *Alive. Unique. Inspiring.*

Supporting Documentation

The following materials can be found on the project website: http://www.lowellbridges.com/

- Letters of Support
    1. Coalition for a Better Acre
    2. Greater Lowell Chamber of Commerce
    3. Lowell Community Health Center
    4. Lowell, MA Congressional Delegation
    5. Lowell, MA State Legislative Delegation
    6. Lowell Fire Department
    7. Lowell National Historical Park
    8. Lowell Plan
    9. Lowell Police Department
    10. Lowell Public Schools
    11. Lowell Regional Transit Authority
    12. MassBike
    13. Northern Middlesex Council of Governments
    14. Northern Middlesex Metropolitan Planning Organization
    15. Trinity EMS
    16. UMass Lowell Campus Police
    17. UMass Lowell Freewheelers
- Project Map
- Detailed Project Schedule
- Engineering Reports
    1. Pawtucket Street over the Pawtucket Canal - Kleinfelder
    2. Pawtucket Street over the Northern Canal - Kleinfelder
    3. Broadway over the Pawtucket Canal - TEC
    4. Central Street over the Lower Pawtucket Canal - TEC
    5. Suffolk Street over the Northern Canal - TEC
    6. Merrimack Street over the Western Canal- TEC
    7. Merrimack Street over the Merrimack Canal - TEC
    8. Kearney Square over the Eastern Canal – n/a
- Benefit/Cost Analysis
    1. Excel Spreadsheets
    2. Documentation
- Right of Way
    1. Purchase & Sale Agreement between Enel and the City of Lowell
    2. Proprietors of Locks and Canals Commitment Letter
- Matching Funds
    1. Lowell City Council Votes and Resolution
    2. City of Lowell Commitment Letter
    3. UMass Lowell Commitment Letter
    4. Enel Commitment Letter
- Permitting
    1. Permitting memo from Rackemann Strategic Consulting, Inc.
    2. Lowell Historic Board Letter
- Federal Wage Rate Certification