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Consulting with Public About Undergrounding Power Lines for Downtown Revitalization: The Case of Hockanum Road and Manhan Rail Trail at Pleasant Street in Northampton, MA

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**CONSULTING WITH PUBLIC ABOUT UNDERGROUNDING
POWER LINES FOR DOWNTOWN REVITALIZATION: THE CASE
OF HOCKANUM ROAD AND MANHAN RAIL TRAIL AT
PLEASANT STREET IN NORTHAMPTON, MA**

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DOWNTOWN REVITALIZATION: THE CASE OF HOCKANUM ROAD AND MANHAN
RAIL TRAIL AT PLEASANT STREET IN NORTHAMPTON, MA**

CAPSTONE PROJECT FOR THE MASTER OF PUBLIC POLICY AND ADMINISTRATION

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INTRODUCTION

This research is about a particular form installation of electric cables known as Undergrounding. The term undergrounding is associated to the fact that this type of infrastructural installation consists in burying the electric cables beneath the surface instead of leaving these cables hanging on top of poles that are spread throughout the landscape.

Before moving to the research question, it helps to understand why it may be desirable for public administrators to promote undergrounding of power lines. Although the literature on undergrounding is mostly for engineers' perspectives, the case studies reveal the positive and negative aspects of undergrounding – with the pros being related to aesthetics gains, as well as enhanced safety due to more resistance to inclement weather and clearer rights of way, while the cons are basically related to the costs.

This paper investigates the possibilities for financing the works to change existing overhead electric power lines into undergrounded wires. Considering the higher costs of undergrounding, it becomes necessary to search for alternatives to raise the funds necessary for these works. A potential way to direct the funding options to finance undergrounding, while fostering the public participation onto the budgetary decision-making process, can be reached through willingness to pay experiments. And this option was explored with the participation of a group of residents from Northampton, MA.

Recently, the Planning Department of the City of Northampton promoted a series of studies to determine the best allocations for a grant made available by the State of Massachusetts for infrastructural investments called MassWorks. This process included a workshop to consult with the

local population about their priorities for the proposals from the grant application – with this project assisting with workshop’s preparation where undergrounding was concerned.

The proceedings from Northampton to promote public participation in the decision-making process of determining the grant’s destination will be described in methods session. Hopefully, the results from this workshop will serve to help to guide future public consultations seeking popular support to finance undergrounding.

BACKGROUND

As early as in the 19th century, authors have been conducting studies that investing undergrounding as an alternative for the “cobweb of wires”, in the words of Jacques, W. W. (1885) that resulted from the modernization of telecommunications and spread of electricity in cities like Paris.

In the table below taken from a study from The Oklahoma Corporation Commission, there is a comparison between underground and overhead systems, and here it is possible to see that the pros outnumber the cons. The advantage attributed to O&M (Operations and Maintenance) in Underground Systems can be understood through Mehta, V.K. and Mehta, R. (2005, 305), where the authors explain that undergrounded systems have a lot less reactance than overhead systems due to less spacing between the conductors.

Table 1 – Overhead/Underground Comparison

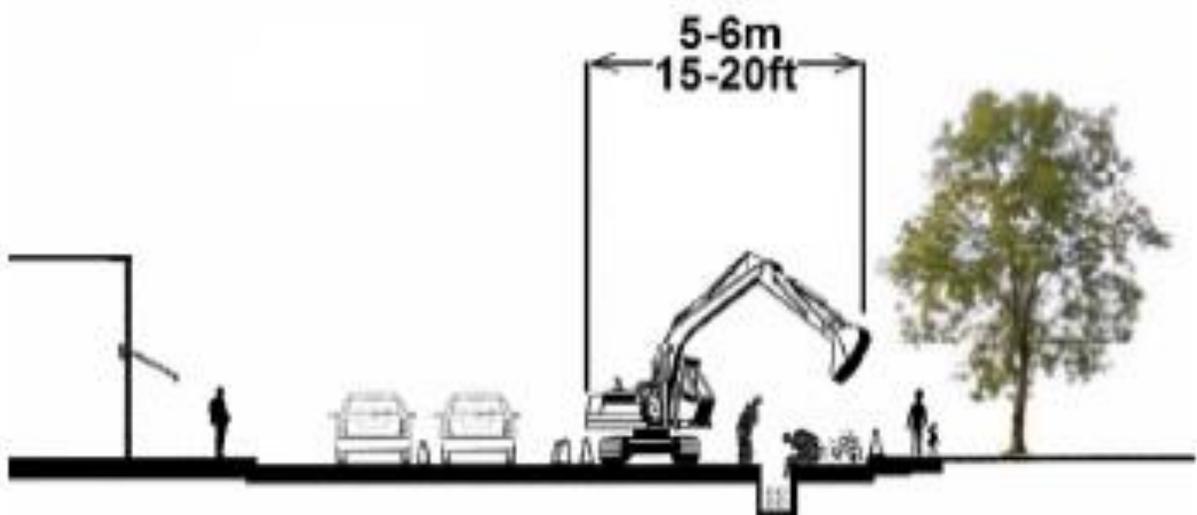
Overhead Systems	Underground System
<ul style="list-style-type: none">▪ <u>Cost</u>: Overhead conductors’ number one advantage. Significantly less cost especially during initial construction.▪ <u>Longer life</u>: 30 to 50 years vs. 20 to 40 for underground lines.▪ <u>Reliability</u>: Shorter outage duration because of faster fault-finding and faster repair.▪ <u>Loading</u>: Overhead circuits can more readily stand overload conditions.	<ul style="list-style-type: none">▪ <u>Aesthetics</u>: Underground conductors’ number one advantage. Much less clutter.▪ <u>Safety</u>: Fewer opportunities for public contact with system components.▪ <u>Reliability</u>: Significantly fewer short and long outage durations.▪ <u>O&M</u>: Overall lower maintenance because of less vegetation management expense, but other issues must be considered.▪ <u>Longer Reach</u>: Less voltage loss because reactance is lower.

Source: Oklahoma Corporate Commission, 2008

Interestingly, this also shows that the more modern technologies can work in favor of undergrounding, considering that in the 1885 work by W.W. Jacques, the author cited two main obstacles for undergrounding of power lines as being *Retardation* and *Induction*. The first being caused the proximity between electric lines in the telephonic lines, resulting limits to speed of transmission, and the second being caused by the proximity of the cables that create interferences between electric lines in the telephonic lines, resulting in buzzing in the call qualities. But since the telecommunications nowadays are mostly wireless, plus the fact that undergrounding of electric lines can help to distance the telephonic and the power lines.

Another study from the State of Minnesota, the engineers Earle Bascom III, Earle C. Rusty and Victor Antonello presented a schematization of how the installation of underground systems should occur in an urban context. Due to the greater complexity of the infrastructural works in an urban context, the costs may escalate to even higher amounts when compared to similar works in rural areas. (Bascom III et al. 2011, 2).

Figure 1 – example of a right of way in a city street



Source: Bascom III et al. (2011)

The advantages of undergrounding are literally clear, as the results are visible in the façades of the buildings in front of places that would otherwise have the power cables overhead on electric poles (with the cables ultimately being invisible). But despite the aesthetical improvements, it is possible to argue that undergrounding enhances the areas' levels of safety, considering that by being buried underground, the cables will be less vulnerable to climatic events and accidents that can be caused by winter storms for example. Another advantage is that it could help to preserve the trees, since it would decrease the demand for wood for electric poles, and decrease the need for cutting or pruning trees to make room for the power lines.

The foremost visible difference between underground and overhead power lines is in the visual aspect, as the figures below can attest. The places depicted are being shown as currently are (with the wires overhead), and how they could look like without the utility lines (wires buried underground). The location of Pleasant Street in Downtown Northampton was selected for being part the area where the MassWorks grant application took place.

Figures 2 and 3 – Views from Pleasant Street – Northampton, MA



Source: author's own collection

The pictures above were taken near the intersection of Pleasant Street and Holyoke Street in Downtown Northampton. The electric poles and wires overhead were erased using Photoshop, so that the viewer can visualize how the area would be with undergrounded power lines, and compare it with the current look.

Another important difference is a greater reliability, durability and resistance of undergrounded power lines as opposed to overhead power lines. This happens because, by keeping the power lines away from tree branches as well as natural elements like gusty winds and ice, the electrical grid becomes significantly less vulnerable to disruptions. In a newspaper article from 2014, the City of New Haven CT was subject to a similar questioning about undergrounding, where the journalist argued that over the last three years, New Haven suffered three severe snowstorms that affected the energy supply in several neighborhoods due to trees breaking the transmission. This author also witnessed how keeping the power lines and the natural elements separated can make a difference between having or not having electricity after a storm, from being in Brooklyn, NY after Hurricane Sandy – where, differently from what happened in New Haven as described in the article, the fallen trees did not cause power outages.

Figure 4 – a street in Flatbush, Brooklyn, NY in the aftermath of Hurricane Sandy (2012)



Source: Author's own collection

The picture above was taken in a street from Flatbush, Brooklyn, NY the day after the hurricane Sandy hit New York in September 2012. By that time, the author of this project was living in that area, and could witness that, while many parts of NYC experienced power outages due to the hurricane even a week after, this neighborhood never had the power interrupted. The fact that the power lines there are undergrounded was probably a factor of help, since the trees that fell down did not touch the electric lines.

A third advantage from undergrounded power lines can be described by the lesser need of maintenance. Although this might seem counterintuitive, given that the electric wires are easier to reach by the maintenance staff when installed overhead instead of buried underground, the fact is that the maintenance becomes rarer a necessity if underground. The same article from the New Haven Independent from 2014 brought a testimony from the head of the municipal electric company from Concord, MA stating that in fact, the Town of Concord has spent even less with maintenance because their staff is already trained for undergrounded lines, and the city also managed to cut costs by the undergrounded wires with the existing water and sewer networks.

Figure 5– Power Company workers performing maintenance



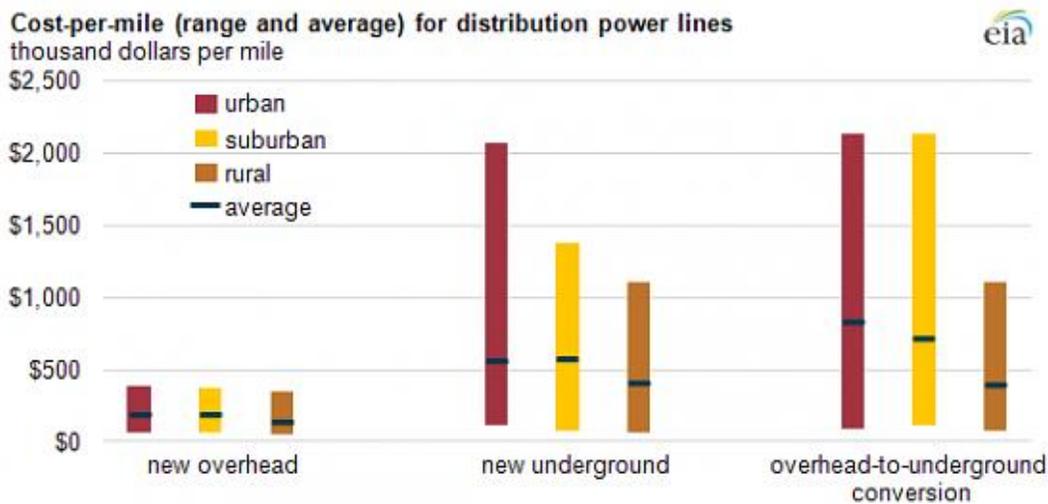
Source: Quillen, K. (2009)

The picture above shows the workers from an electric company in Arkansas, during an ice storm from 2009 that caused several outages. If the wires were underground, the wires wouldn't be in contact with the ice, and there would be no need for pruning the trees.

On the other side of the equation, the main disadvantages from undergrounding the power lines are related to the high costs of such type of installation, considering that it requires digging along all the extension of the wires, as well as providing an insulation to the lines against elements. In the work from Bascom III et al. (2011), from Minnesota, the authors estimate that comparing the costs of overhead utility lines with underground can show a big difference between rural vs. urban sets, as well as currently existing infrastructures vs. new developments.

In rural environments, burying the cables underground can cost around three times the price of overhead cables, whereas in urban contexts undergrounding can cost up to ten times more than overhead. The article from Griffin, J. (2009) from Oklahoma, estimated the costs of Undergrounding as approximately \$580.000 per mile – again leaving room for discrepancies between different infrastructural contexts. The literature appears to use the cost of nearly \$ 1 million per mile as a rule of thumb. But these costs can vary a lot considering different contexts.

Figure 6 - Cost comparison between overhead and underground power lines



The graphic above shows how the costs of undergrounding can vary depending on rural vs. urban and existing infrastructures vs. new developments. The conversion from overhead to underground is pricier than new installations.

In Massachusetts most towns require new housing subdivisions to bury new utilities and Mass. there is a statutory mandated price for burying existing power lines, as a response to the Chapter 166 section 22B from the General Law. However, the tension between the regulatory cost, and the utility's actual costs create a local lack of information on that kind of change. The most direct consequence from the G.L. c. 166, s. 22B can be seen in the new developments being built with undergrounded power lines. Nevertheless, in existing streets, the utility companies pay for overhead wires. But if a community wants to switch from overhead to underground, they will have to pay for the costs, and not the electric companies.

Following that trend, other works with undergrounding in Massachusetts were budgeted as a little under 1 mi for a 800 feet extension in Main Street Great Barrington, as well as 1.6 mi for a half mile extension in Easthampton – although the project in Easthampton also included the redesigning of a parking lot in the area. It is worth to mention that the Great Barrington project for Undergrounding had to be held down due to the costs, while Easthampton was able to find funds for their project through a public-private partnership that included the property owners, the Electric Company Eversource, the Town of Easthampton Planning Department, and the Commonwealth of Massachusetts with the money from MassWorks Infrastructure Program.

As the case from Easthampton shows, the MassWorks Infrastructure Program can be vital for any effort to fund undergrounding of power lines in Massachusetts State. The grant provides funds for municipalities and other eligible public entities seeking to invest public infrastructure improvements to support economic development and job creation that supports a mix of commercial and residential development.

In Northampton, the Department Planning and Sustainability of the City calculated the costs for undergrounding utility lines along 600 feet where Hockanum Road and Manhan Rail trail intersect with Pleasant Street to be of \$ 345,00 per feet, with \$300,00 being from construction costs (demolition and

installation), and the remaining \$45,000 going to design and contingency. Thus, the total cost of the Undergrounding part of the Pleasant Futures plan was calculated to be \$ 207,000, with \$ 198,000 coming from the MassWorks grant, and the remaining \$ 9,000 having to be paid for by the City of Northampton.

Another option for financing the undergrounding of power lines can be directly related to the participation of the public as well as from the electric companies that do service in the respective area. That option – like every investment that seek to promote economic development, is to be envisioned for the long term, and is precisely what the Town of Concord, MA has been doing since the 1980's. With a 1.5 percent surcharge in their utility bills, they managed to install approximately 50 percent of the Town's power lines underground.

In the work from Griffin, J. (2009), the article reports on the authorization given by the Oklahoma Corp. Commission (ACC) to Oklahoma Gas & Electric Co. (OG&E) to recover 68.5 million dollars from the company's customers who subscribe to help making distribution system of the company less susceptible to power failure caused by the weather.

In a different approach, the works from McNair and Abelson (2010) and Haggerty (2012) argue that the appreciation of the estate values that results from having the power lines underground can be another source of financing to such works for the long term, since it brings more revenue to the municipality through property taxes – not to mention the intrinsic value that a revitalized architecture can have to the businesses from the area.

Lastly, another possible disadvantage from undergrounding can be the nuisance created by the public works that include digging into asphalt, temporarily closing streets for traffic, and the noise from jackhammers and other machineries. Although there won't be any tree branch underground, the wires must also be kept apart from tree roots.

Figure 6 – Undergrounding works in progress in Worcester, MA

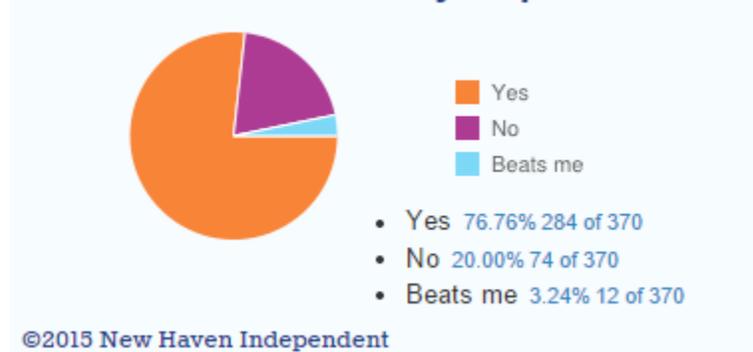


Source: author's own collection

The picture above was taken in 2015 in Worcester, MA, and shows an undergrounding work in progress. Here it is possible to see that the wires are buried inside a wider pipe or duct, which serves to protect the integrity of the cables. Another aspect from the picture is the digging works being made onto the asphalt, and not onto the sidewalk (asphalt is more malleable than concrete).

In terms of popular support, the topic of undergrounding power lines appears to be at a high, considering the responses from the survey made with residents from New Haven, CT in the same article from MacMillan T. (2014), with more than 75 percent of the 370 in favor of undergrounding.

Figure 7 – A measure of popular support for undergrounding in New Haven, CT
Should New Haven bury its power lines?



Source: MacMillan, T. (2014)

In summary, the main obstacle for undergrounding is in most cases the high cost for its implementation. Undergrounding is clearly more expensive than electrical poles, with some estimates showing that the difference can range from thrice to ten times more, depending on items like local topography, and preexisting infrastructure.

With these factors in mind, it is possible to formulate alternatives to financing undergrounding works that take advantage of infrastructural grants such as MassWorks, as well as a combination of methods, with the public sector working together with the private sector and the population once there is a mutual understanding on that matter. For such partnerships, it may be a good start to verify the existence of willingness to pay from the population through experiments that test if there would be a disposition from individuals to share the costs of undergrounding by distribution and mitigation in the utility bills. In the case of Northampton, the money totals are already defined by the budget that is part of the grant application. Therefore, since in that case the money is not coming from people's pocket, but from an external grant, the willingness to pay experiment had to be adapted for a 'willingness to allocate' experiment.

Thus, the willingness to allocate experiment was made in a public forum held by the Department of Planning and Sustainability of Northampton in December 1st, 2014, and shown in the appendix of this project. The WTA experiment consisted in a choice experiment to determine where to allocate the grant money among several infrastructural projects for Pleasant Street – with one of the proposals being undergrounding. The other proposals are in the appendix, and an important detail of the WTA experiment from this research is the mensuration of the demand for undergrounding by ranking it on a scale side by side with the other projects for comparison.

METHODS

In order to address the questions of how the population would prefer to see the money from MassWorks grant spent in, the Planning and Sustainability Office of the City of Northampton conducted public consultations to present the plan “Pleasant Street Futures”, envisioning the Pleasant Street area – a vision that is part of the city’s application to the grant. At the workshop held in December 1st, 2014, this research assisted the Planning Director Wayne Feiden, AICP, to build the WTA experiment in what concerned the proposals for undergrounding power lines within that area.

Measuring willingness to pay/allocate from public

The literature from Economics about willingness to pay experiments is mostly used for measuring contingent valuation of environmental resources. This method basically consists basically measuring the population’s willingness to pay regarding any given issue that will represent extra costs to the public. In their work *Estimating the Value of Undergrounding Electricity*, the economists Ben McNair and Peter Abelson proceeded with a series of econometric calculations to come up with a pricing to the service of electric generation and transmission to households in Australia (McNair and Abelson 2010, 377). In another work from McNair et al., called *Households’ willingness to pay for overhead-to-underground conversion of electricity distribution networks*, the authors seemed to have chosen to proceed with a different methodology for the CV evaluation. This time the willingness to pay was measured by surveying a cohort of consumers with a questionnaire known as Choice Task, filled with Attributes and Levels that ought to be ranked by the public according to their preferences (McNair et al. 2011, 2562).

Table 2 – Attributes and levels (sets of)

Attribute	Levels	
	Current service (overhead) alternative	Undergrounding alternatives
Your one-off undergrounding contribution (A\$ 2009)	0	1,000, 1100, 2000, 2100, 2800, 3000, 3900, 4000, 6000, 6200, 8000, 8200, 11,800, 12,000, 15,900, 16,000
<i>Power cuts without warning</i>		
Number of power cuts each five years	Set by respondent	Proportions of status quo level: 0.25, 0.5, 0.75, 1 ^{a,b}
Average duration of power cuts	Set by respondent	Proportions of status quo level: 0.33, 0.66, 1.33, 1.66 ^a
<i>Power cuts with written notice (occurring in normal business hours)</i>		
Number of power cuts each five years	Set by respondent	Proportions of status quo level: 0.2, 0.4, 0.6, 0.8 ^{a,b}
Average duration of power cuts	Set by respondent	Proportions of status quo level: 0.33, 0.66, 1.33, 1.66 ^a

^a Rounded to the nearest integer.
^b Absolute levels (0, 1 and 2) were assigned where respondents chose very low status quo levels (1 or less).

Source: McNair et al., 2011

The State of Virginia sponsored a 116 pages report from 2005 that had, among its goals to provide a well detailed study about undergrounding power lines in Virginia. And for that study, cases from California and Boulder, CO were analyzed to serve as examples (Morrison et al. 2005, 101). The aforementioned report also proceeded with an experiment with the same methodology of Choice Experiments (Morrison et al. 2005, 83). The next table will show how the sets of attributes and levels that can differ and taken into consideration different approaches when making a Choice Task experiment, with different levels of complexity as well. The table above was built with numbers from a meeting where participants were asked to provide willingness to pay figures on an annual basis, which were then converted to a monthly basis. The average one-time fee would be for replacing the customer’s overhead system for an underground system

Table 3 – Consumers’ Willingness to Pay

Residential Consumers WTP for Undergrounding Utilities	Average Monthly WTP (Statewide Conversion) (\$ per month)	Average Monthly WTP (Partial Conversion) (\$ per month)	Average Initial one-time fee^(b) (\$)
Interested Members of the Public w/ Overhead Service	24	17	392
Kickoff Meeting Participants w/ Overhead Service	9 ^(a)	not asked	400
Kickoff Meeting Participants w/ Underground Service	6 ^(a)	not asked	not applicable

Source: Morrison et al., 2005

The study from Navrud et al. (2012) also proceeded with a similar methodology to assess the public’s willingness to pay, this time working with populations from Oslo, Norway. It is interesting to notice too that that study took place in the country with the wealthiest population in the world in terms of per capita income. Such particularity may have influences in the people’s willingness to pay concerning undergrounding. But it is still an interesting case also due to the straightforward way of putting the questions of the attribute set to the participants, as exemplified here:

- “I want the underground cable, but others should pay”
- “I don’t want to place a money value on environmental quality”
- “I protest the way in which the question is asked”
- “I pay enough in taxes and fees already”
- “Too many power lines in the city”
- “Electricity is expensive enough already”
- “I pay through my electricity for similar projects already” (Navrud et al. 2012, 287)

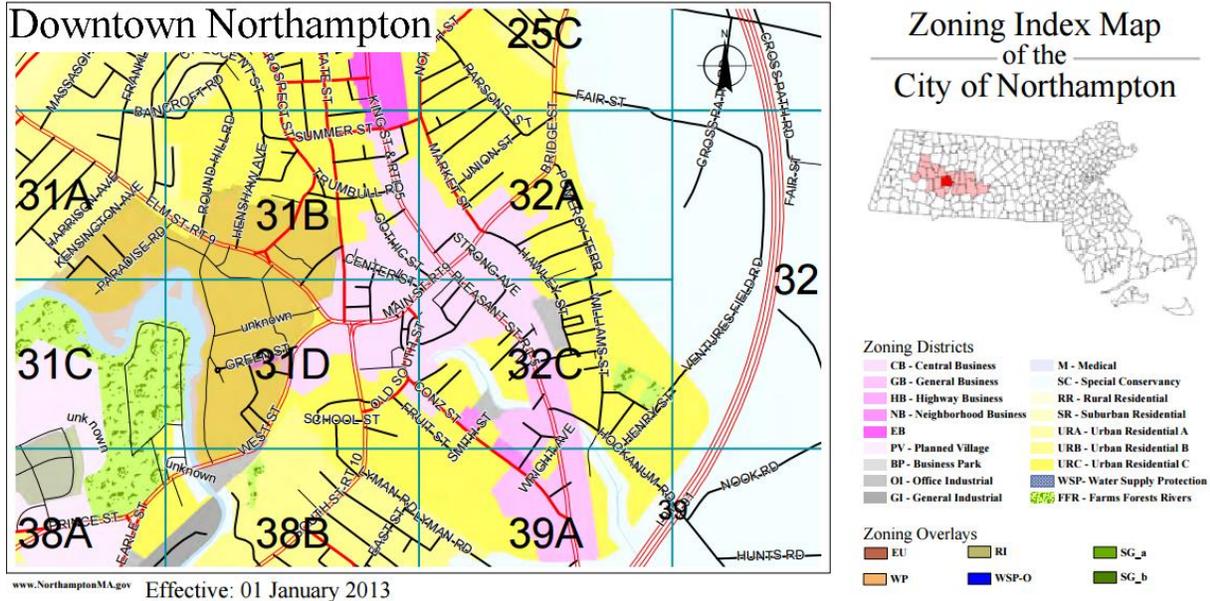
Pleasant Street Futures plan from Northampton, MA

Another important aspect of this research is the location itself that was chosen to serve for a case study. The City of Northampton, MA is located in Hampshire County, and is part of the Pioneer Valley area, in Western Massachusetts. It has a population of circa twenty eight thousand people, with a per capita income of \$33,440 according to the 2012 American Community Survey, and despite having an already vibrant downtown area, the Planning and Sustainability Office is seeking to apply for the MassWorks grant to invest in infrastructural improvements.

The plan to revitalize parts of Pleasant Street called “Pleasant Futures”, calculated the use for approx. \$ 1.5 million from the grant so to invest in improving the infrastructure. Once the plan and the budget were aligned, the Planning Department of the City of Northampton conducted public consultations in order to determine how to use the money, and the part of the plan presentation that included undergrounding of utility lines in selected areas was prepared as part of this research in collaboration with Northampton’s Planning Director Wayne Feiden, FAICP .

It is important to mention that the areas from Downtown Northampton where the plan has focused have Central Business, General Business and Urban Residential C zoning (as the Map 1 shows in the squares 32A and 32C), making the infrastructural issues to have an impact on businesses, residents and the overall population who uses many of the services offered in the downtown area – which are key factors to make an application to a MassWorks grant competitive.

Map 1 – Zoning In Downtown Northampton



Source: City of Northampton webpage

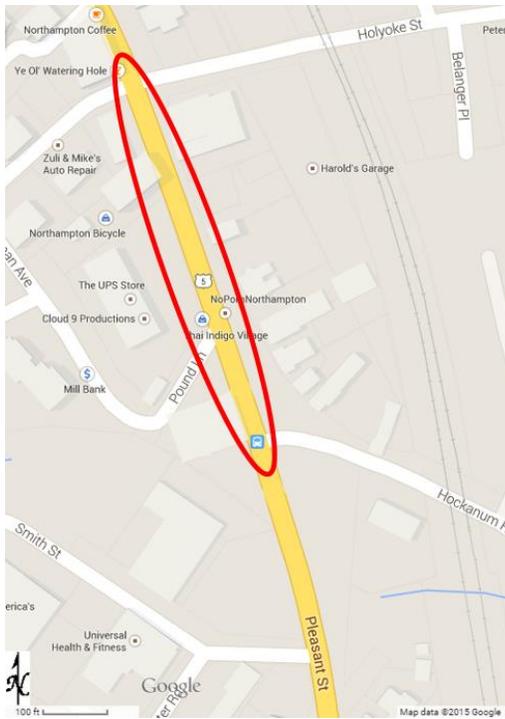
The methodology for answering to these questions was put to practice in the public workshop held for the residents of Northampton by the Planning and Sustainability Office in December 1st, 2014. The design of this the part of the presentation that dealt with undergrounding of power lines was created to assess people’s visual preferences on overhead vs. underground systems by showing pictures to a group of people with locations with and without overhead power lines, and getting their opinions on the aesthetic aspect of these places, to then ask them to rank what should be made a priority in order to receive the funds from the MassWorks grant.

These pictures were taken by the author at the sites where the projects had proposals to underground the lines (the locations can be seen in Maps 2 and 3) and manipulated through Photoshop to erase the overhead power lines. The areas with projects to underground power lines are part of the squares 32A and 32C in the map 1. The entirety of the area comprised by the Pleasant Street Futures plan can be

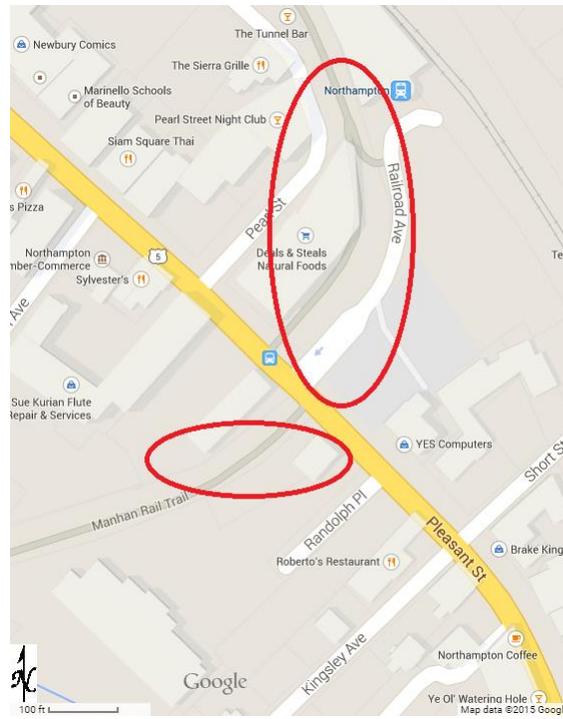
better visualized in the two maps from the appendix, that were part of the presentation given to the participants of the public workshop.

The presentation with the entire cost structure and the fixtures of each intervention can also be seen in the appendix of this work. The answers (showing what should be prioritized according to the people) were collected at each of the three tables where the participants were divided into.

Maps 2 and 3 – Locations where the photographs were taken at the sites selected for Undergrounding



Source: Google Maps (2015)



Source: Google Maps (2015)

Public participation workshop

The Planning and Sustainability Office of the City of Northampton, MA, has conducted a study called “Pleasant Futures Strategic”, which included several urbanization projects for areas in Pleasant Street and other parts of Downtown Northampton. The project’s re-designing intentions were to enhance the existing character of historic centers and promote walkability, a mix of uses, transit connections and active community life. And the workshop’s intentions were to look at existing conditions, as well as engaging the public through a community-based interaction. This included an in depth meeting where residents, public officials and stakeholders participated in the workshop process. This activity allowed participants to identify areas of concern and priority, and offer their feelings of positive, negative and transitional areas along the corridor. The city’s planning department created flyers that were distributed through the city departments, as well as along downtown Northampton to make business owners and residents aware of the event.

The workshops occurred on May, 12th and December 1st, 2014 – and the later had the aid of this research on its preparation. The December event took place the Union Station, near the Manhan Rail Trail and Pleasant Street itself, and a total of 30 people attended the public workshop, which started with a presentation from the director of Planning and Sustainability of Northampton, Wayne Feiden, FAICP, where he explained the project and showed the graphic representations for each idea, as well as the budget from the MassWorks grant for the revitalization works.

Next, the workshop proceeded with three tables serving as map stations, with one member of the Northampton Planning Department as table captain and note taker to record the responses on a flip chart. With approx. ten participants at each table the participants spoke about general feelings relating the Pleasant Street and its surroundings. The participants were given a pens to mark their points at the

maps, and the table captains had markers to list the priorities that the participants elected based on the ideas presented for Pleasant Street Future in the initial talk.

Figure 8: table with maps and flip charts for discussion



Source: Author's own collection

The projects brought to discussion in the workshop consisted in building aggressive crosswalks, replacing and repairing sidewalks/curb extensions, defining street edges, adding trees and parklets with LID (low impact development) and undergrounding utility lines – and that is where this project work together with the Planning Dept. of Northampton.

The recommendations received during the workshop became a willingness-to-pay experiment, since the participants could prioritize their favorite policies based on what share of the budget from the MassWorks grant was to be allocated to each work. A complete cost structure with each idea receiving a certain amount of the money from MassWorks was prepared by the Planning and Sustainability Office, to be shown at the December presentation, and in that budget it was possible to see that the City of Northampton is counting with a grant of \$1,446,365 for financing the infrastructural works.

From this total, the amount being allocated to Undergrounding is of \$198,000. In addition to the MassWorks money, The City of Northampton is also supposed to add a five percent fee for designing works that total \$ 9,000 for the undergrounding works and \$65,246 for the overall plan. The table below reproduces what was shown to the participants in the workshop (the original table is in the appendix), with adaptations to highlight the costs related to undergrounding of utility lines in total and per feet.

Table 4 – the budget presented in the workshop

Project	Underground utilities (linear feet)	TOTAL (including the other projects)
Near 129 Pleasant Street mixed-use housing and commercial (Manhan Rail Trail)	200	
Near Northampton Lumber mixed-use housing and commercial (Manhan Rail Trail)	200	
Former MassDOT Highway Right-of-Way to allow housing and businesses to thrive (Hockanum Rd.)	200	
Totals (units)	600	
Unit Cost	\$300	
Total Construction (costs with demolition and installation)	\$180,000	\$1,304,920
Total Design (10% MassWorks)	\$18,000	\$130,492
Contingency (10%)	\$19,800	\$143,541
TOTAL MassWorks	\$198,000	\$1,446,365
Additional design (+5% City)	\$9,000	\$65,246
GRANT TOTAL MassWorks + City	\$207,000	\$1,511,611

Source: City of Northampton Planning Department

Results

The workshop concluded with the participants presenting their priorities, and with some actions being considered more urgent than undergrounding the utility lines. The word cloud below was made by the Planning and Sustainability Office of Northampton, and demonstrates how each intervention is perceived in terms of being prioritized. The larger the words in the cloud, more often they were mentioned by the participants.

In that cloud it is possible to notice the term “Bury-Electric”, circled in red – which is an evidence of a popular demand for undergrounding. Nevertheless, it also becomes clear that undergrounding is not the most urgent intervention that should be implemented in the first time. Terms like “Improved-crosswalks”, “Trees”, “Parks”, and “Multi-modal” did appear in front of “Bury-Electric” (which is a synonym of undergrounding). And that trend shows that there is a demand for more green spaces and better mobility options that can translate to more friendly outdoor spaces for people on transit be it by foot or by other sources of transportation.

That niche, however, is also not so distant of undergrounding, considering how burying the power lines can create room for more trees and other vegetation, as well as more space for pedestrians in the crosswalks. Looking at the big picture, the option for undergrounding is still relevant, for being part of the interventions that, when put together, can make an investment in infrastructural improvements sounder.

DISCUSSION AND CONCLUSION

The fact that most parts of Downtown Northampton already count with the power lines underground may have contributed for this issue not to be on top of people's minds. Plus, the small scale of the undergrounding proposals in Hockanum Road and the Manhan Rail Trail compared to the totality of "Pleasant Futures Strategic" plan may have reduced its impact, which could also explain the lesser attention that undergrounding received in this experiment.

The costs of the undergrounding proposals for these two sites in Northampton are competitive and match with what the literature has shown for similar works across the nation (in urban environments) and even cheaper than what was found in Easthampton, MA. However, this was not enough to justify prioritizing undergrounding of utility lines before other infrastructural improvements.

If the goal is to verify the acceptance of undergrounding only, perhaps it would help if the public consultations about undergrounding are brought alone instead of combined with other projects. It may also be the case that in sites where the majority of the surrounding infrastructure isn't already undergrounded, the public opinion could be more favorable to that type of intervention, since there would be a greater vulnerability to inclement weather in terms of power outages.

In the numbers shown in the literature, when the question was presented to the public it passed the test of popular demand, as the survey from New Haven, CT made evident. Following that track, a next step could be asking the population about the possibility to incorporate a small surcharge on the utility bills in order to finance undergrounding, similarly to what the town of Concord, MA has been doing since the 80's.

The research in Northampton with the "Pleasant Street Futures" plan had to adapt a willingness to pay experiment into a willingness to allocate one, since there were other projects being proposed

together with the project for undergrounding, and the source for the funds was the grant from MassWorks (and not the participant's own funds). In future researches that aim to try to capture the population's support for undergrounding and transform that into an alternative for funding, it might help to ask the residents more directly and with a more direct focus on undergrounding – returning to a willingness to pay experiment instead of a willingness to allocate. In Wayne Feiden's, FAICP, own words: *“Had we asked the question as Concord did, do you want to pay 1.5% of your electric bill to underground power lines, we might have received the same answer or a different one, but because we didn't ask that question we don't know the answer.”*

The undergrounding project being proposed by Northampton was neat, competitive and clearly exposed. However, due to the source of funding that was chosen to be implemented, these works' continuation (as well as with the other projects from Pleasant Street Futures) will depend on the City of Northampton being awarded or not the MassWorks grant. Considering the scale of priorities that the public has chosen, the undergrounding part of the plan will also depend on the amount of money collected, according to the totality of the MassWorks grant. In other words: if the entire sum of \$1,446,365 is received, then the undergrounding of 600 feet along Manhan Rail Trail and Hockanum Road will be able to receive the \$198,000 as budgeted. In case Northampton does not get the grant, the Concord, MA example can serve as an inspiration for alternative sources of funding for undergrounding that counts with the public participation.

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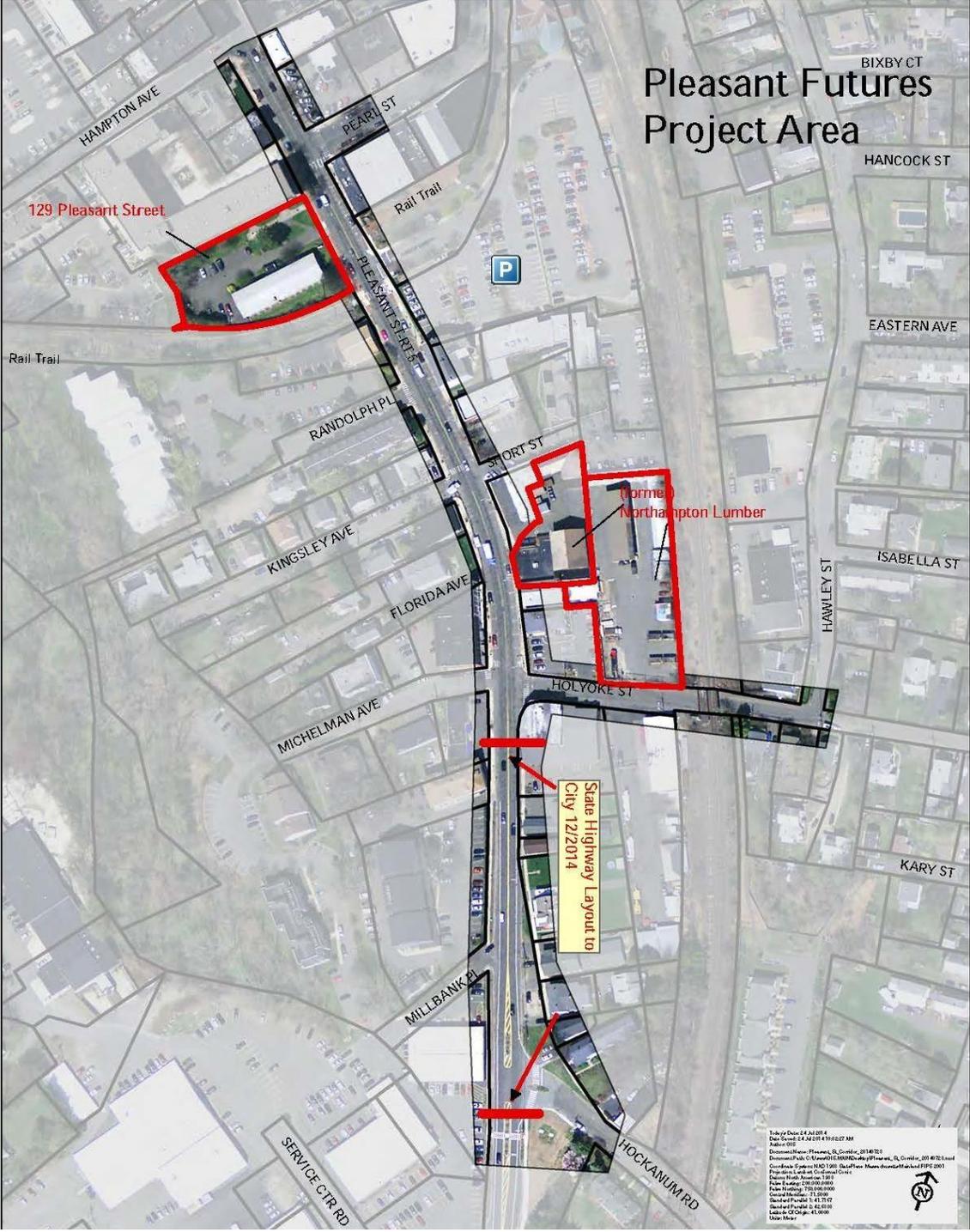
APPENDIX

In this appendix it is possible to see excerpts taken from the presentation that the Director of Planning from Northampton, Mr. Wayne Feiden, FAICP, gave to the public that attended the workshop in December 1st, 2014. For contextualization, the presentation itself was adapted to the format of this report, and only the slides that have relation to the undergrounding part of the project were kept, as well as those that help to understand the totality of the “Pleasant Futures Strategic” plan.

The second, third and fourth slides show pictures taken on collaboration of this project with the Planning Department of Northampton for the December workshop about the “Pleasant Street Futures” plan. The pictures were taken at locations of Hockanum Road and the Manhan Rail Trail, where such works could be done, and were then manipulated through Photoshop to erase the power lines overhead. Thus, during the presentation at the December forum, the participants had the chance to compare what the areas look like now and how they could appear once the power lines were undergrounded.

The next two slides show the full cost structure of each project with totals with where each share of the MassWorks grant would be allocated, and a map of the “Pleasant Futures Strategic (2015)” plan, with all the different proposals and the respective locations of each project. Besides undergrounding of power lines, the other projects being proposed for the revitalization of Pleasant Street were: i) close excess curbs; ii) aggressive crosswalks; iii) replacing of sidewalks/curbs; iv) defining street’s edge; v) repair sidewalks; vi) add LID (low impact development) in streets; vi) curb extensions with parklets and LID; vii) calm Hockanum and improve safety; and viii) creating a LID park in that area.

Pleasant Futures



Undergrounding Rail Trail



Undergrounding: Union Station



Undergrounding: Pleasant/Hockanum



Money Money

Project	Concrete sidewalk (sq. ft.), demo, excavation	Granite Curb (linear ft)	Trees, grates, filters, system (each)	Bench (each)	Reset granite blocks (sq ft)	Signature Crosswalks (sq ft)	Drainage pipes (each)	LID drainage (sq ft)	Catchbasins and drainage (each)	Wayfinding signs (each)	Underground utilities (linear ft)	Bicycle & parking lanes (linear ft)	TOTAL
Near 129 Pleasant Street mixed-use housing and commercial													
Intersection Pleasant St. and Pearl St.		828	56	1									
Southeast of intersection Pleasant/Pearl		72	12										
Pleasant Street rail trail crossing		135							135				
Pleasant St. near 129 Pleasant (both sides of street)		200		6									200
Near Northampton Lumber mixed-use housing and commercial													
Pleasant St. northeast of Short St.		65	13										
Pleasant/Short/Kingley intersection		120	110	4	2								
Pleasant St between Holyoke & Short Sts		1,266	111	4	2								
Pleasant/Holyoke/Michelman intersection		120	110	4	2								
Holyoke Street		2,705	575	2									
Pleasant St south of Holyoke Street		1,200	200										
Pleasant St south of Michelman Ave		498	65										
Holyoke Street							1						
Northampton Lumber by Pleasant St (both sides)		200		2	2								200
Former MassDOT Highway Right-of-Way to allow housing and businesses to thrive													
Pleasant Street between Michelman & Hockanum		504		11									400
Pleasant Street between Holyoke & Hockanum		1,628		8									500
Hockanum Road		416		2									200
Hockanum Road at Pleasant Street			120	5									
Totals (units)	9,957	1,372	49	8	135	900	1	1,700	6	12	4	600	900
Unit Cost	\$10	\$50	\$2,000	\$2,500	\$250	\$100	\$500,000	\$100	\$4,000	\$1,000	\$300	\$10	\$10
Total Construction	\$99,570	\$68,600	\$98,000	\$20,000	\$33,750	\$90,000	\$500,000	\$170,000	\$24,000	\$12,000	\$180,000	\$9,000	\$1,304,920
Total Design (10% MassWorks)	\$9,957	\$6,860	\$9,800	\$2,000	\$3,375	\$9,000	\$50,000	\$17,000	\$2,400	\$1,200	\$18,000	\$900	\$130,492
Contingency (10%)	\$10,953	\$7,546	\$10,780	\$2,200	\$3,713	\$9,900	\$55,000	\$18,700	\$2,640	\$1,320	\$19,800	\$990	\$143,541
TOTAL MassWorks	\$120,480	\$75,460	\$107,800	\$22,000	\$37,125	\$99,000	\$550,000	\$187,000	\$26,400	\$13,200	\$198,000	\$9,900	\$1,446,365
Additional design (+5% City)	\$4,979	\$3,430	\$4,900	\$1,000	\$1,688	\$4,500	\$25,000	\$8,500	\$1,200	\$600	\$9,000	\$450	\$65,246
GRANT TOTAL MassWorks + City	\$125,458	\$78,890	\$112,700	\$23,000	\$38,813	\$103,500	\$575,000	\$195,500	\$27,600	\$13,800	\$207,000	\$10,350	\$1,511,611

