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Public Consultations on Undergrounding Power Lines for Downtown Revitalization: The Cases of Pleasant Street in Northampton, MA and Main Street in Medfield, MA

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PUBLIC CONSULTATIONS ON UNDERGROUNDING POWER LINES FOR DOWNTOWN REVITALIZATION: THE CASES OF PLEASANT STREET IN NORTHAMPTON, MA AND MAIN STREET IN MEDFIELD, MA

FINAL PROJECT FOR THE MASTER OF REGIONAL PLANNING

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CONTENTS

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 power lines 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 (although it can also be a delicate issue for areas that are flood prone).

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, followed by a direct consultation made with residents from Medfield, 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 next part of the research with Medfield, MA residents was made through a web-based survey distributed by the local Planning Department. Such an arrangement was reached after discussing the issue with several town and city planners from Massachusetts via the Massplanners listserv, and the town of Medfield showed interest in taking part of this research.

The proceedings from Northampton to promote public participation in the decision-making process of determining the grant's destination, as well as the process of designing a willingness to pay survey to address the issue of undergrounding with the population 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

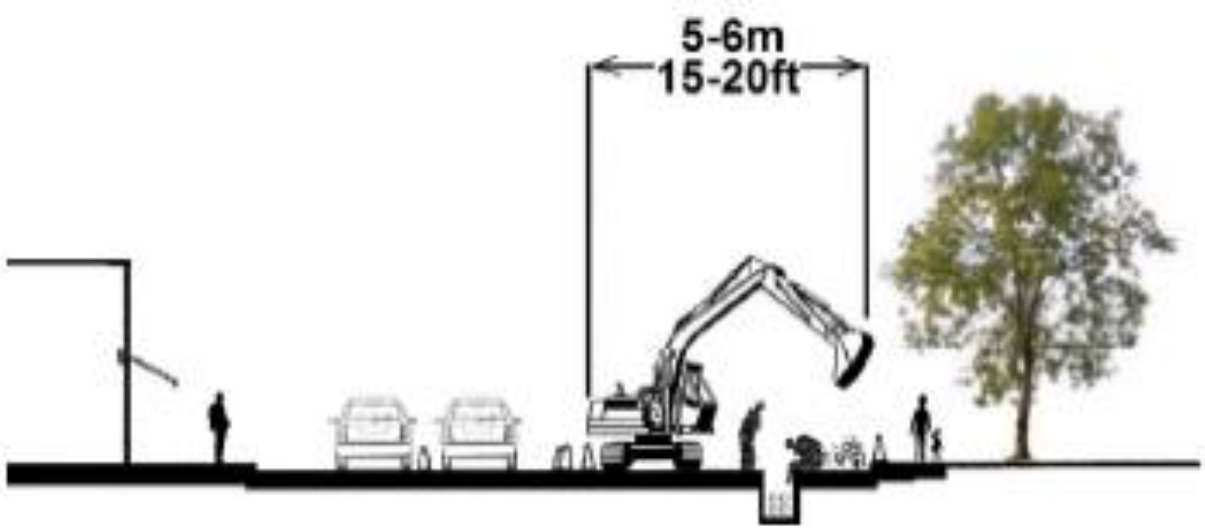
Overhead Systems	Underground System
▪ Cost: Overhead conductors' number one advantage. Significantly less cost especially during initial construction. ▪ Longer life: 30 to 50 years vs. 20 to 40 for underground lines. ▪ Reliability: Shorter outage duration because of faster fault-finding and faster repair. ▪ Loading: Overhead circuits can more readily stand overload conditions.	▪ Aesthetics: Underground conductors' number one advantage. Much less clutter. ▪ Safety: Fewer opportunities for public contact with system components. ▪ Reliability: Significantly fewer short and long outage durations. ▪ O&M: Overall lower maintenance because of less vegetation management expense, but other issues must be considered. ▪ Longer Reach: 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 Antoniello 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 line 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)

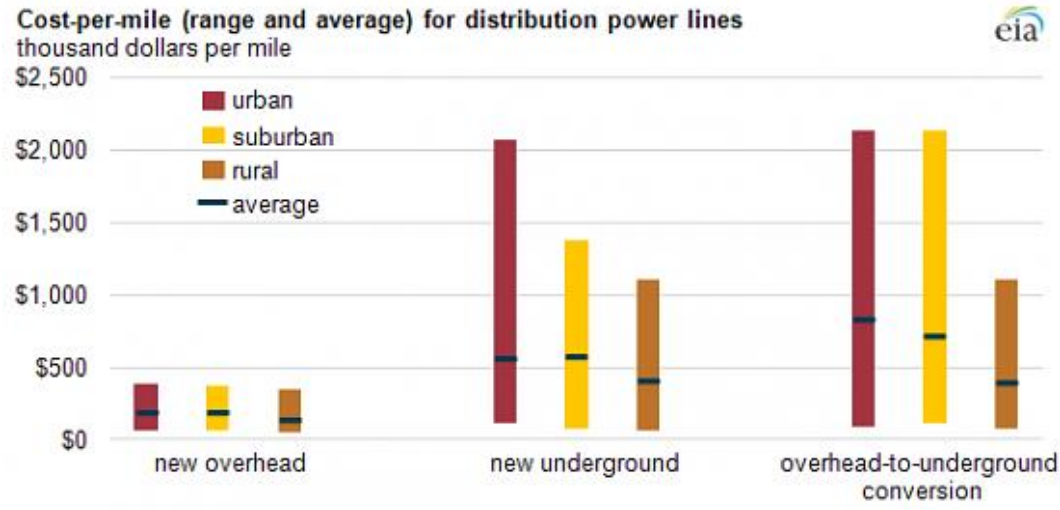
The picture above shows the workers from an electric company in Arkansas, during an ice storm from 2009 that caused several outages. If the wires were underground, the wires wouldn't be in contact with the ice, and there would be no need for pruning the trees.

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 demonstrate 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



Source: MacMillan, T. (2014)

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.

Analysis and Discussion

The issue of undergrounding the power lines has proven to be a hot topic among planners and city administrators. In the February issue of Planning – the magazine from the American Planning Association, there was an entire session dedicated to this topic, called 'How Low Should you Go', by William Atkinson. In this work, the author showcases the examples of Palo Alto, CA, San Marcos, TX, Colorado Springs, CO and Washington, DC, highlighting the importance undergrounding for these cases due to both aesthetics and storm resilience. And more importantly, the connections made between the local administrations, the population representatives and the electric companies, creating a Public Private Partnership-like relationship.

The State of Massachusetts is no exception, as the expressive level of responsiveness from the e-mail listserv Massplanners has shown ever since the theme came to debate earlier in this year. During these conversations, it became clear that in a New England context, the issue of heavy snowfalls typical from the harsh winters from the region present a significative challenge to the local electrical grid. The state can be an important partner, by providing grants called MassWorks Infrastructure Grant, to help financing infrastructural improvements in the streets. Plus, the local electric companies can also play an important role with the maintenance and reformation of the electrical grid. Eversource Residential (former WMECO in some regions) has already done works with undergrounding in Massachusetts – Medfield, MA is part of their coverage area.

In the State of Massachusetts most towns require new housing subdivisions to bury new utilities and there is a statutory mandated guideline for burying existing power lines, as a response to the Chapter 166 section 22B from the General Law. Capitalizing on of this law, the Town of Amherst received a $1.5 million MassWorks grant in 2014 for infrastructure improvements at its Northern Downtown

Gateway area. The improvements include undergrounding the last remaining section of above ground utilities in the downtown.

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. Additionally, the Historic Deerfield downtown undergrounded their utilities along Main Street a long time ago, as a result of external funds they got.

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. The town of Natick recently received a similar grant to place their utilities underground.

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 $45.00 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.

There are also other cases where big utility companies also contribute with the surcharge of utility bills to finance undergrounding. National Grid used to have a program where Towns could vote to request a surcharge of 2 percent of everyone's electric bill over a 20 year timeframe to fund undergrounding in selected areas. The towns of Canton and Holden, MA made use of that option, and undergrounded utilities in their center between 10 to 20 years ago, and there are also precedents where NStar, Verizon and Comcast partnered with the City of Boston in order to coordinate undergrounding.

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 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. Such an approach can signalize for future researches, relying on short, medium and long term comparisons between estate prices in a given location with power lines overhead vs. a similar location with the power lines underground. These comparisons can use time ranges like one, three, five years, and so on after the power lines were undergrounded in that given location, to see how the power lines underground affect the buildings' values. Plus, if there is a positive appreciation in the estate prices resulted from undergrounding, the municipalities can apply for Smart Growth initiatives line T.I.F. (Tax Increment Financing) or D.I.F. (District Improvement Financing) funds. The T.I.F allows for a municipality to anticipate benefits of future development (such as increased property tax revenues) to pay for infrastructure improvements, whereas D.I.F. concentrates the tax dollars for redevelopment districts instead of improvements for specific developments.

Figure 6 – Undergrounding works in progress in Worcester, MA

Source: author's own collection

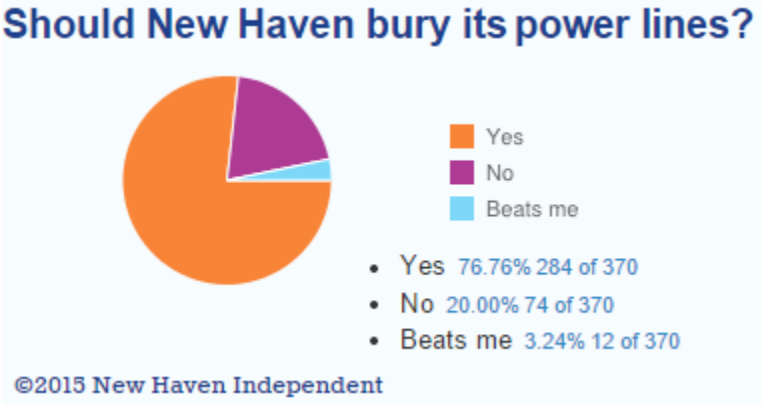
The picture above was taken in 2015 in Worcester, MA, and shows an undergrounding work in progress. Here it is possible to see that the wires are buried inside a conduit (sometimes in a concrete duct, due to high

voltages of tri-phasic cables), 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, and the road is further than the sidewalk from the tree roots.

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.

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. In short, 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 three to ten times more, depending on items like local topography, and preexisting infrastructure.

Figure 7 – A measure of popular support for undergrounding in New Haven, CT



Source: MacMillan, T. (2014)

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 I of this project. The WTA experiment consisted in a choice experiment to determine were 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 I, 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.

Thanks to the circumstances, the second experiment, with Medfield, allowed for a willingness to pay experiment (as opposed to the willingness to allocate made in Northampton). The difference between the WTA and the WTP experiments is that in the former the money subject to discussion is not originated from the participants' pockets, but from an external source [MassWorks grant in that case]. In the appendix II it is possible to see the exact design of the survey built using SurveyMonkey platform and administered by the Town of Medfield Planning Department.

Figure 8– View from Main Street – Medfield, MA

Source: Author's own collection

The picture above was taken in Main Street Medfield, in the corner where the Town Hall building is situated. The picture shows the tri-phasic transmission lines on the top (requiring more caution due to its higher voltages), as well as minor cables for other utilities and domestic electricity along the sidewalk and crossing the street. In terms of future technologies, it is reasonable to assume that the communication lines may disappear by themselves gradually due to obsolesce (giving place to wireless devices). But when it comes to electric transmission, it is hard to foresee going wireless being a solution. Thus the necessity to consider placing them underground in order to get rid of this form of visual pollution.

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, FAICP, to build the WTA experiment in what concerned the proposals for undergrounding power lines within that area.

The research in Medfield allowed for a willingness to pay experiment that was built after hearing from the Town Planner of Medfield Sarah Raposa, AICP, about their intentions to verify how a stretch of half a mile in Main Street could look like if the power lines were underground, as well as a possible alternative for funding through surcharge in the utilities' bills.

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 way 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
Power cuts without warning		
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]
Power cuts with written notice (occurring in normal business hours)		
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 access 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)

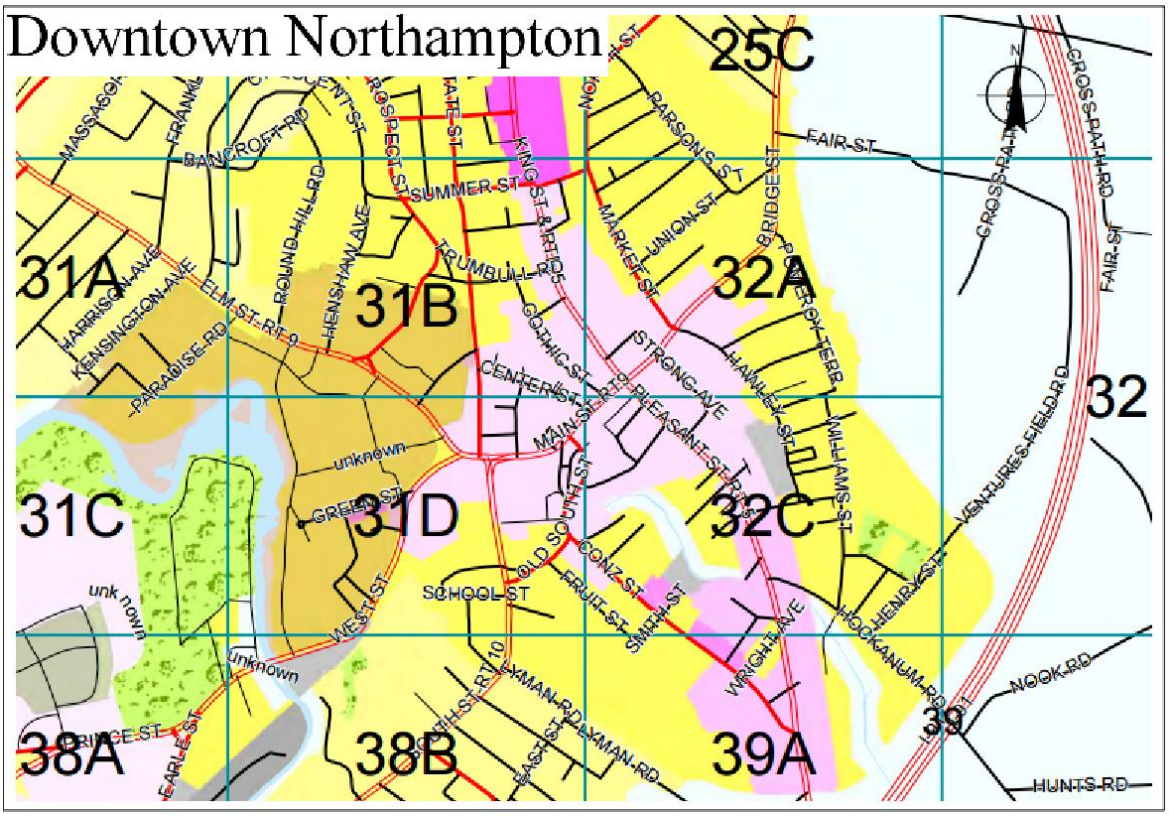
Pleasant Street Futures Plan from Northampton, MA

The first part of this research focused in three areas along Pleasant Street in Northampton, MA, where revitalization plan was prepared by the Office of Planning and Sustainability as part of an application for MassWorks grant. 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. 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.

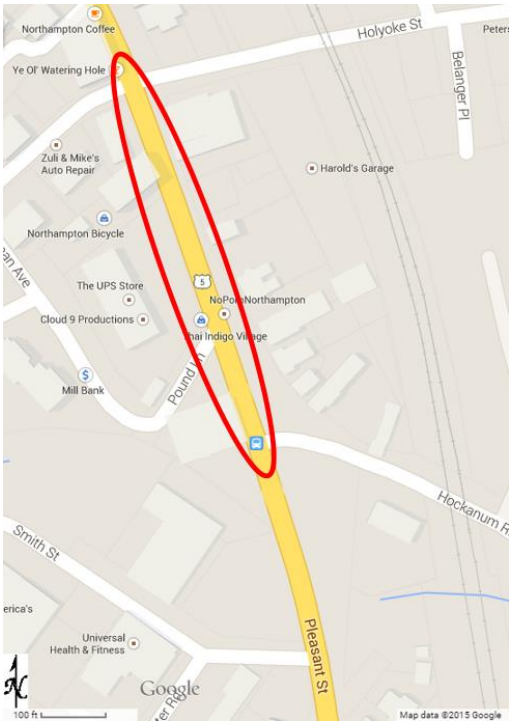
Map 1 – Zoning In Downtown Northampton



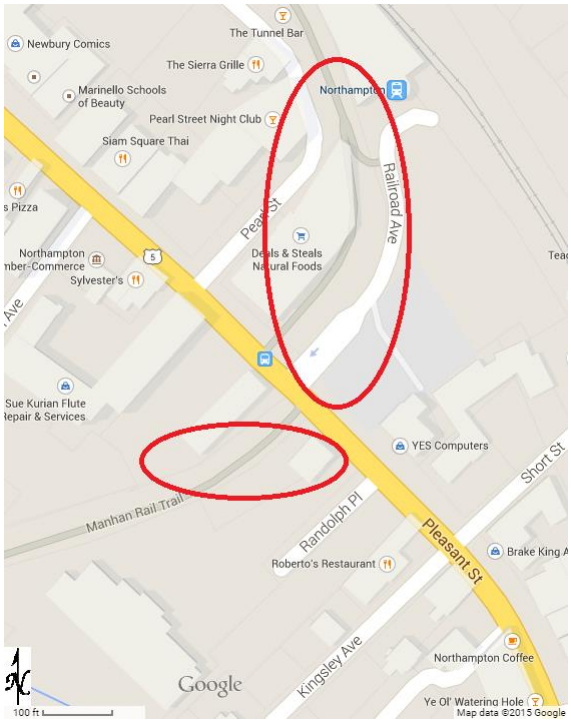
Source: City of Northampton webpage (adapted from)

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.

Maps 2 and 3 – Locations where the photographs were taken at the sites selected for undergrounding in the "Pleasant Street Future" plan



Source: Google Maps (2015)



Source: Google Maps (2015)

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 with 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 I, 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 I of this work. The answers (showing what should be prioritized according to the people) were collected at each of the three tables were the participants were divided into.

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.

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.

Figure 9: one of the three tables with maps and flip charts for discussion

Source: Author's own collection

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 I), with adaptations to highlight the costs related to undergrounding of utility lines in total and per feet.

Table 4 – Budget presented in the workshop (where the undergrounding proposals appeared)

Project	Underground utilities (linear feets)	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.

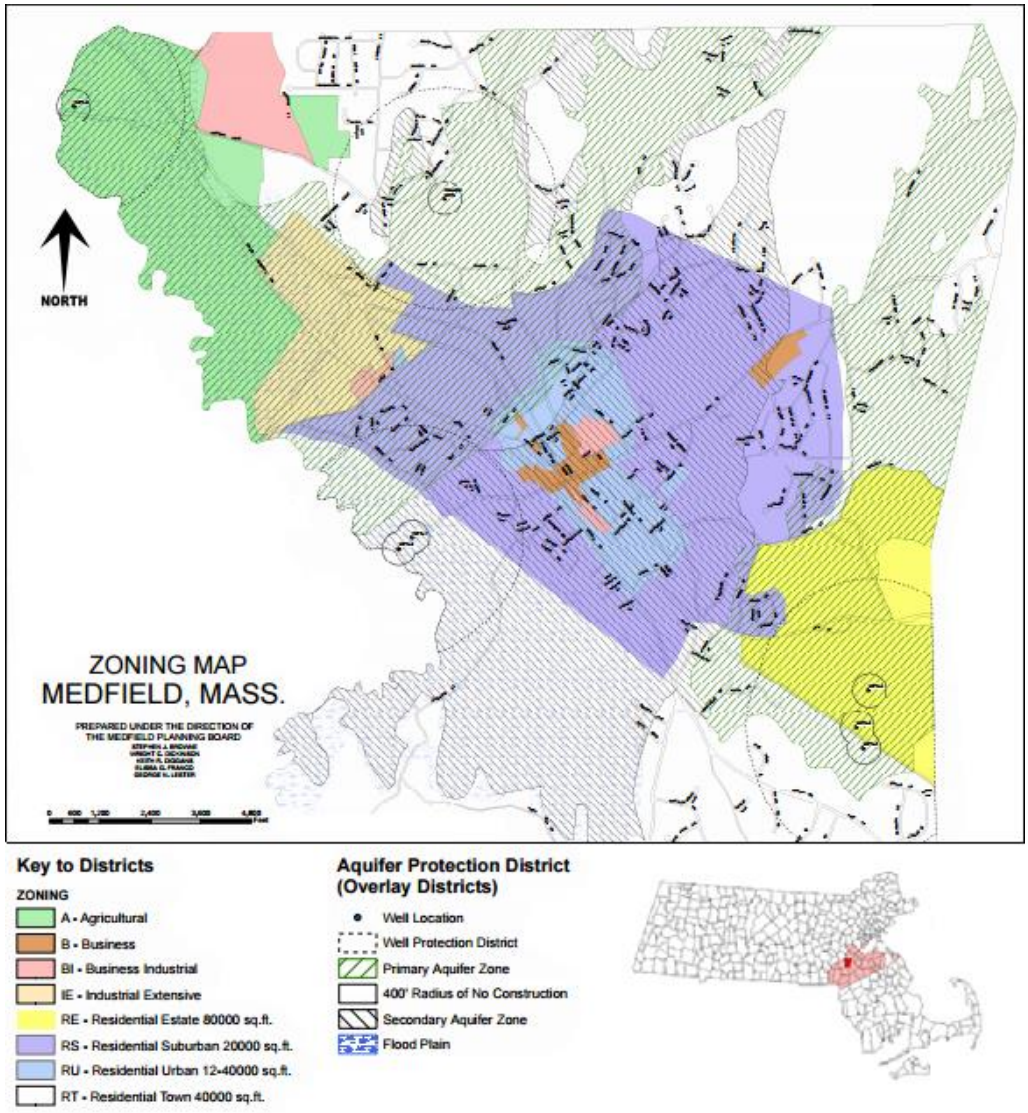
Figure 10 – Word cloud with the most commonly mentioned terms (project proposals)

Source: Northampton Planning and Sustainability Office

Undergrounding in Main Street Medfield, MA

The town of Medfield, MA is the part of the Boston Metropolitan Area, located in Norfolk County in Massachusetts. It has a population of circa twelve thousand people, with a per capita income of $55,786 according to the 2010 census. The inset map within map 4 shows Medfield location (in red) within Norfolk County boundaries (pink) and the State of Massachusetts.

Map 4 – Zoning In Downtown Medfield



Source: Town of Medfield official webpage (adapted from)

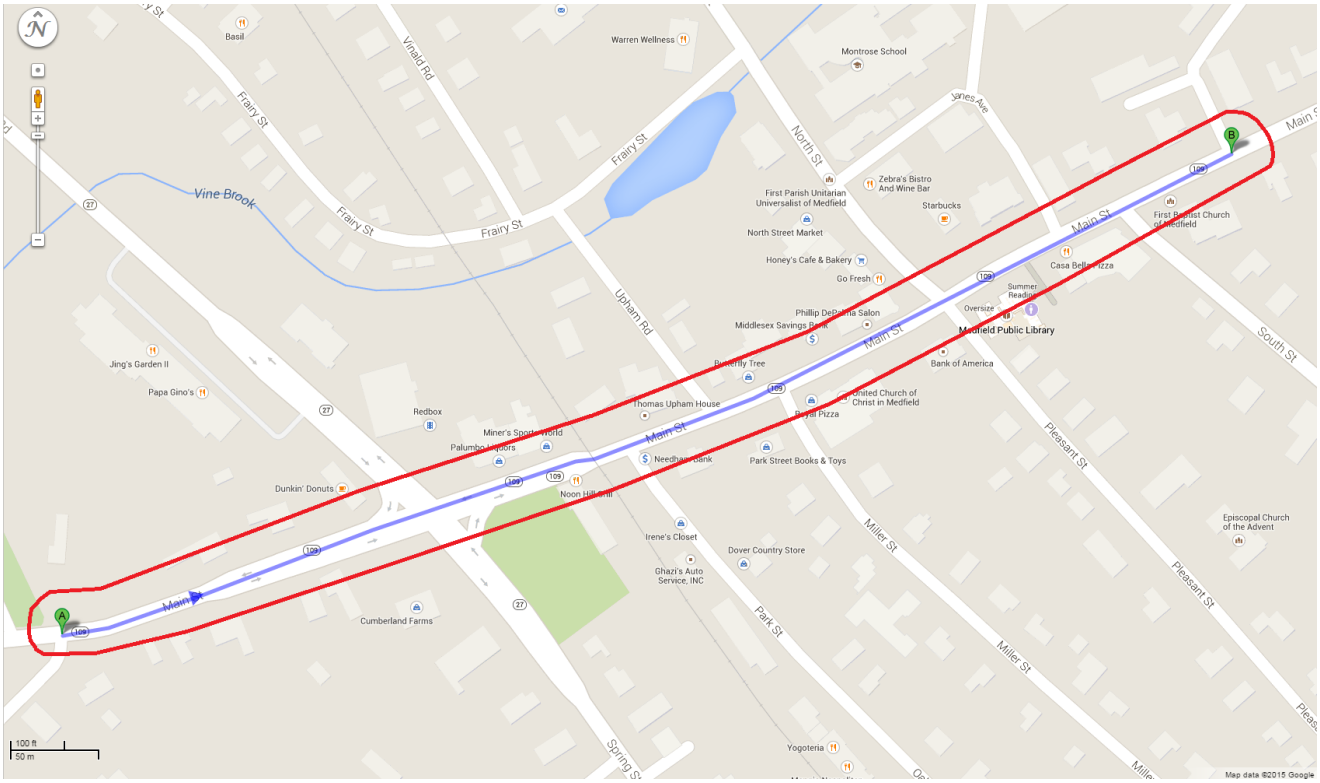
Downtown Medfield has a predominantly Business zoning, surrounded by Residential Urban zoning, making the infrastructural issues to have an impact on businesses, residents and the overall population who use the many services offered in the downtown area.

Despite having a downtown area in relatively good conditions, the Town of Medfield believes it could still offer a better environment to its population regarding the downtown infrastructure and conditions. After driving down to Medfield and verifying its conditions it was possible to assess where there was room for improve the local infrastructure through undergrounding of power lines Undergrounding, and after delimiting the area to a 0.5 mile strip across Main Street, it was possible to prepare a visual-preference based combined with willingness to pay survey for this research with the pictures and modifications (shown in the Appendix II).

The methodology for answering to these questions is achieved by a survey distributed to the population of Medfield by the local Planning Department. The design of this survey was divided to assess people's visual preferences on Undergrounding by showing pictures to a group of people with locations with and without overhead power lines (also getting their opinions on the aesthetic aspect of these places).

The pictures taken were from Google Street View (the location can be seen in Map 5) and manipulated through Photoshop to erase the overhead power lines. Next, a question was made in order to measure their WTP for any potential additional costs that can result from undergrounding. The scale used for the answers had five classes ranging from zero to five, showing a willingness to pay from 0% to 3% extra. In case of answering for the 0% option, it was also requested that the participant shared a few words to justify that choice.

Map 5 – Location where the selected photographs were taken from for the Medfield experiment



Source: Google Maps (2015)

Results

The survey has had a total of twenty five valid answers so far, with some being remarkably similar those found in Navrud et al. (2012) – aforementioned in the background section (see pgs. 17 and 18). These responses took around a month to be collected, as this is the period the survey has been online until closing date of this report. But the Town of Medfield can also keep it online for as long as needed, as well as publicize its link to their public in case more answers are desired.

If on one hand the limitations of having based the survey exclusively on visual preferences to determine the WTP, it is possible to infer that the direction of the research might be on the right track, considering the similarities between these two experiments. Below are some data on the collected answers:

Table 5: Number of respondents and respective answer rates:

Answer Choices	Responses	
i. 0% (in that case, please answer why in the box from next question)	12.00%	3
ii. 1%	24.00%	6
iii. 1.5%	12.00%	3
iv. 2%	28.00%	7
v. 3%	24.00%	6
Total		25

Source: SurveyMonkey

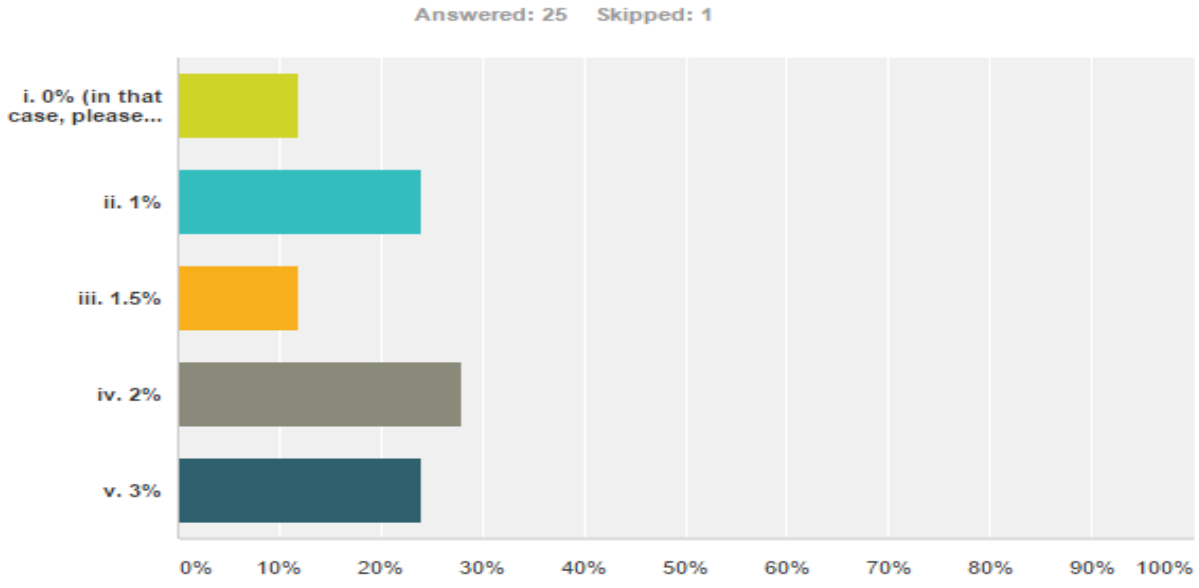
The written answers are the component that allow us to compare and check the similarities from both research results more easily. The written answers are the following:

- "Utility bills are already too high."
- "I am more interested in the actual dollar amount than the percentage increase."
- "How long would the surcharge be in place? While I would agree to pay a surcharge, the utilities have not kept up with service on the poles in Medfield. How many married poles are there and how many pole are in disrepair. Please take note of the pole in slide three in front of the bank of America building. Maybe the town should start to fine the utility companies for lack of service, say $25 dollars per month per pole that is in disrepair."

- “There is no argument that the undergrounding is visually appealing. But from a return on investment perspective I don't see anything compelling. If it were to happen I feel that the cost burden is better absorbed by the downtown businesses and the utility companies. The town's economic development committee should focus on a strategy to grow and support our local businesses and aesthetics could follow later. We don't have a comprehensive strategy for revitalizing our town center. I would love to support our local businesses but the center of town is disjointed between shops and residential and parking is below standard. Overheard wires is a low level priority for me to the creation of a downtown redevelopment strategy. Thanks.”

- “Electric are costs rising enough already due to fossil fuel usage reductions. Increase in alternate energy generation-solar/wind--at 5 times the cost of conventional generation will drive costs even higher. The minimal aesthetic improvement from undergrounding on an already not particularly attractive downtown Medfield is not worth any increase.”

Figure 11: chart with the proportion each response:



Source: SurveyMonkey

The results observed show a clear disposition from the participants to contribute somehow with financing the undergrounding of the power lines along the half mile stretching Main Street Medfield. Only three from the twenty five respondents were not willing to pay a surcharge in the electric bill for that matter.

The other 88 percent of the respondents declared willingness to pay for that in different amounts – with six people (24 percent of the respondents) willing to pay 1 percent in surcharge; three people (12 percent of the respondents) okay with a 1,5 percent in surcharge; seven people (28 percent of the respondents) willing to pay 2 percent extra; and six people (24 percent of the respondents) willing to pay a three percent surcharge in the electric bill.

Even among the respondents that were not willing to pay any surcharge, it is possible to see a desire for improvements in the downtown area, considering their complaints on how the electric company has been treating the poles, as well as the need to attract more businesses – measures that can still go in parallel with undergrounding of power lines.

CONCLUSION

After all these discussions, it is safe to assume that the issue of undergrounding the power lines is indeed relevant to the field of Planning, Public Administration, and Landscape Architecture similarly to what already appears for the Electrical Engineering literature. The highly enriching debate undertaken with planning practitioners from Massachusetts in Massplanners listserv reinforced such an assumption, and the lack of literature about that topic for non-engineers creates a gap that this Master's project hopes to help filling.

We saw the pros and cons of undergrounding power lines, and concluded that the pros in terms of enhance in safety, climate resilience, aesthetics and even transmission are faced by a higher, and sometimes prohibitive, extra cost. However, it also makes sense to infer that the economic benefits resulted from undergrounding power lines, such as downtown revitalization and potential estate appreciation can help to alleviate the initial cost burden. Plus, we investigate alternatives for financing the conversion to from overhead to underground power line systems through external grants (MassWorks in Northampton's example), and/or crowdsourcing (consumers' participation in Medfield's example) – and ways to achieve these mechanisms.

Perhaps the fact that most parts of Downtown Northampton already counts with the power lines underground in most parts 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 the 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, Holden and Canton, MA have been doing since the 80's.

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.

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 capturing 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."*

That conclusion is similar to what motivated the willingness to pay experiment in Medfield, MA. There, the cases of Concord and Canton, MA can serve as direct sources of inspiration, and the grounds for justifying undergrounding of power lines as a tool for revitalizing the downtown area are set. Hopefully, the Town of Medfield will be able to take advantage of the willingness to pay experiment in course with the residents, collect more useful feedbacks, and bring the case to the local electric company as well as to other stakeholders that might participate in the process.

The examples of these municipalities from Massachusetts, as well as from cases where the electrical companies have contributed with undergrounding efforts, show that Medfield is in the right track. Thus, it is important to keep working in that direction so to collect enough evidence of popular support demanding for undergrounding in their Main Street, and make the case for a public-private-partnership with Eversouce in order to implement such alterations.

Implementation

As for the implementation of the conversion from overhead to underground power line systems in downtown areas, it is relevant to highlight that, because these are not new developments being built from start, the electric companies have no obligation to pay for the costs – this is why our alternatives for funding are important. Once the municipality have a budget lined up for undergrounding, it might be interesting to coordinate the conversion efforts with the local electric company in charge of maintaining the overhead lines and poles. Here a public-private-partnership can come to place, with even a combination of division of labor being part of the deal.

The local Department of Public Works can coordinate with the local electric company who stays in charge of the conversion, the eventual maintenance, quality control and guidelines. In Massachusetts there are already the precedents of NStar, Verizon and Comcast partnering up with the City of Boston, Eversource partnering up with Easthampton, and National Grid partnering up with Canton in order to coordinate undergrounding. As always, it is encouraging that the municipalities keep contact and cultivate a constructive channel of relationship with the community representatives from the respective electric companies of their regions.

Lessons Learned

As the differences between public acceptance in Northampton and in Medfield show, it might make a difference to bring undergrounding proposals to public opinion alone as opposed to in a combination with other infrastructural projects. Nevertheless, the opportunities that undergrounding the

power lines can bring in terms of new features from landscape architecture such as more vegetation, parklets, better sidewalks, and so on, in where used to be occupied by the cables and poles overhead, can also serve to convince the public about its importance.

On the other hand, the weight of such public consultations can also vary accordingly to what source of funding is being attempted, as well as the stakeholders that might be influenced by the conversions. If a municipality gets awarded by a grant like MassWorks, and the application for the grant already predicts undergrounding of power lines, there is not much else to discuss once the moneys is aligned. But again, if the public acceptance is a key factor for making ends meet in a project for undergrounding (such as in the crowdsourcing option of bill surcharging), it might help to disclose that project separately.

Future Researches

For future researches that attempt to find economic justification for converting from overhead to underground power line systems, it may be a good road to explore further works that follow the direction of McNair and Abelson (2010) and Haggerty (2012), that explore the appreciation of estate thanks to undergrounding of power lines. With that approach, the authors argue that the appreciation of the estate values that results from having the power lines underground can result in another source of financing for a municipality in 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.

By further exploring that approach, future researches could focus on short, medium and long term comparisons between estate prices in a given location with power lines overhead vs. a similar location with the power lines underground. These comparisons can use time ranges like one, three, five years, and so on, after the power lines were undergrounded in the given location, so to see how the power lines underground affect the buildings' values. In case there is an appreciation in the estates' values due to undergrounding, the municipalities can apply for Smart Growth initiatives line T.I.F. (Tax Increment Financing) or D.I.F. (District Improvement Financing).

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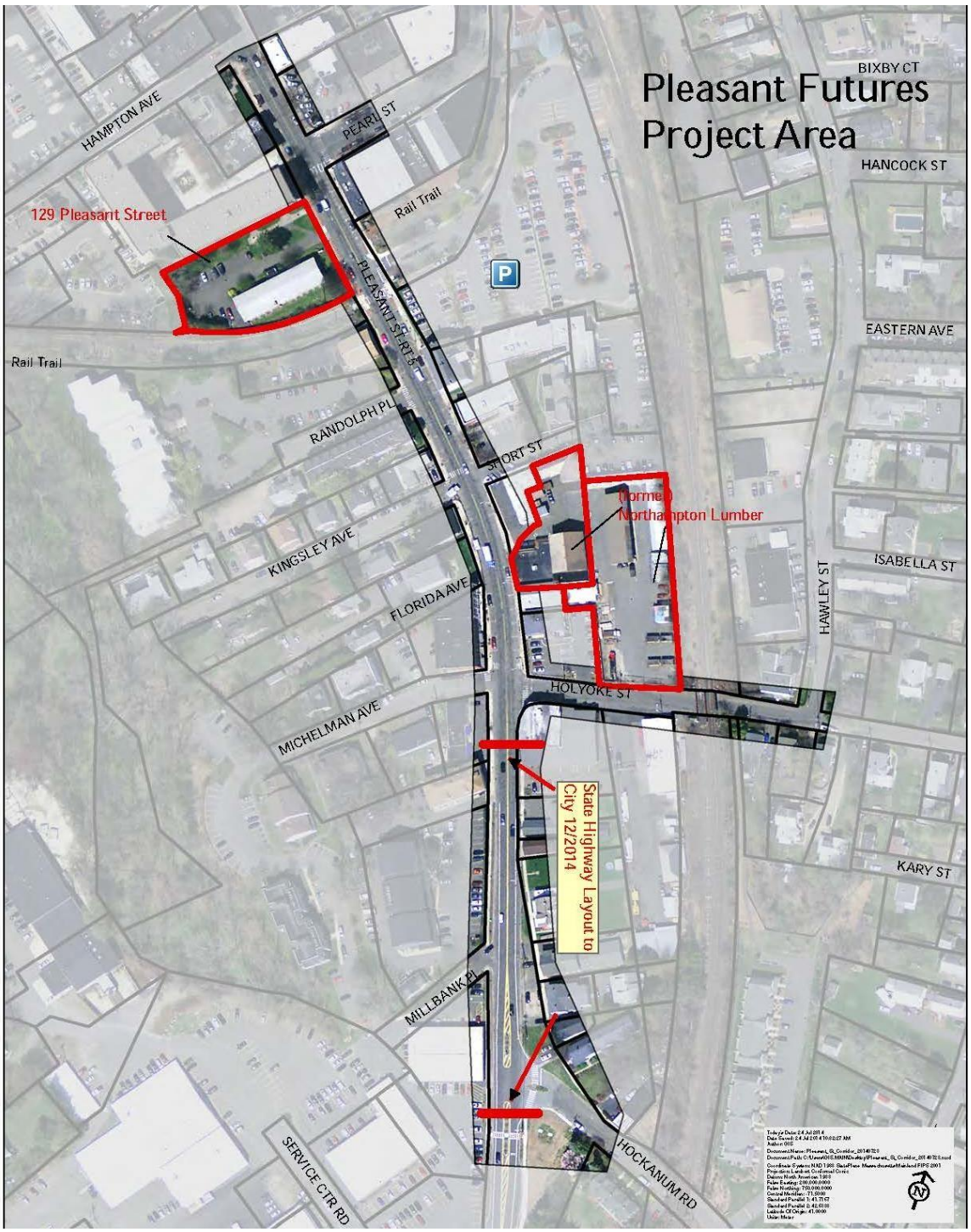
APPENDIX I

In this appendix I it is possible to see excerpts taken from the presentation that the Director of Planning from Northampton, 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

	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 (liner ft)	Bicycle & parking lanes (linear ft)	TOTAL
Near 129 Pleasant Street mixed-use housing and commercial														
Intersection Pleasant St. and Pearl St.	Close excess curb cuts	828	56		1									
Southeast of intersection Pleasant/Pearl	Close curb cuts	72	12											
Pleasant Street rail trail crossing	Reset granite wall blocking sidewalk	135				135	300			50				
Pleasant St. near 129 Pleasant (both sides of street	Repair obsolute infrastructure and create walkable area	200			6							4	200	
Near Northampton Lumber mixed-use housing and commercial														
Pleasant St. northeast of Short St.	Close excess curb cuts	65	13											
Pleasant/Short/Kingley intersection	Transform from highway to walkable street-- two curb extensions	120	110		4	2		300		300	2			
Pleasant St between Holyoke & Short Sts	Close excess curb cuts	1,266	111		4	2				50				
Pleasant/Holyoke/Michelman intersection	Transform from highway to walkable street-- two curb extensions	120	110		4	2		300		300	2			
Holyoke Street	Connect neighborhood	2,705	575		2					100				
Pleasant St south of Holyoke Street	Transform from highway to walkable street-- cycle track	1,200	200											
Pleasant St south of Michelman Ave	Close excess curb cuts	498	65											
Holyoke Street	replace storm drain								1					
Northampton Lumber by Pleasant St (both sides)	Repair obsolute infrastructure and create walkable area	200			2	2						4	200	
Former MassDOT Highway Right-of-Way to allow housing and businesses to thrive														
Pleasant Street between Michelman & Hockanum	Transform from highway to walkable street-- sidewalk, drainage, trees	504			11								400	
Pleasant Street between Holyoke & Hockanum	Transform from highway to walkable street-- sidewalk, drainage, trees	1,628			8					200			500	
Hockanum Road	Connect neighborhood	416			2					200	1		200	
Hockanum Road at Pleasant Street	Transform highway intersection to walkable intersection		120		5					500	1	4		
	Totals (units)	**9,957**	**1,372**		**49**	**8**	**135**	**900**	**1**	**1,700**	**6**	**12**	**600**	**900**	
	Unit Cost	**$10**	**$50**		**$2,000**	**$2,500**	**$250**	**$100**	**$500,000**	**$100**	**$4,000**	**$1,000**	**$300**	**$10**	
costs with demolition and installation	**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

Close excess curbs

Aggressive crosswalks

Replace sidewalk /curb

Define street edge

Repair sidewalks

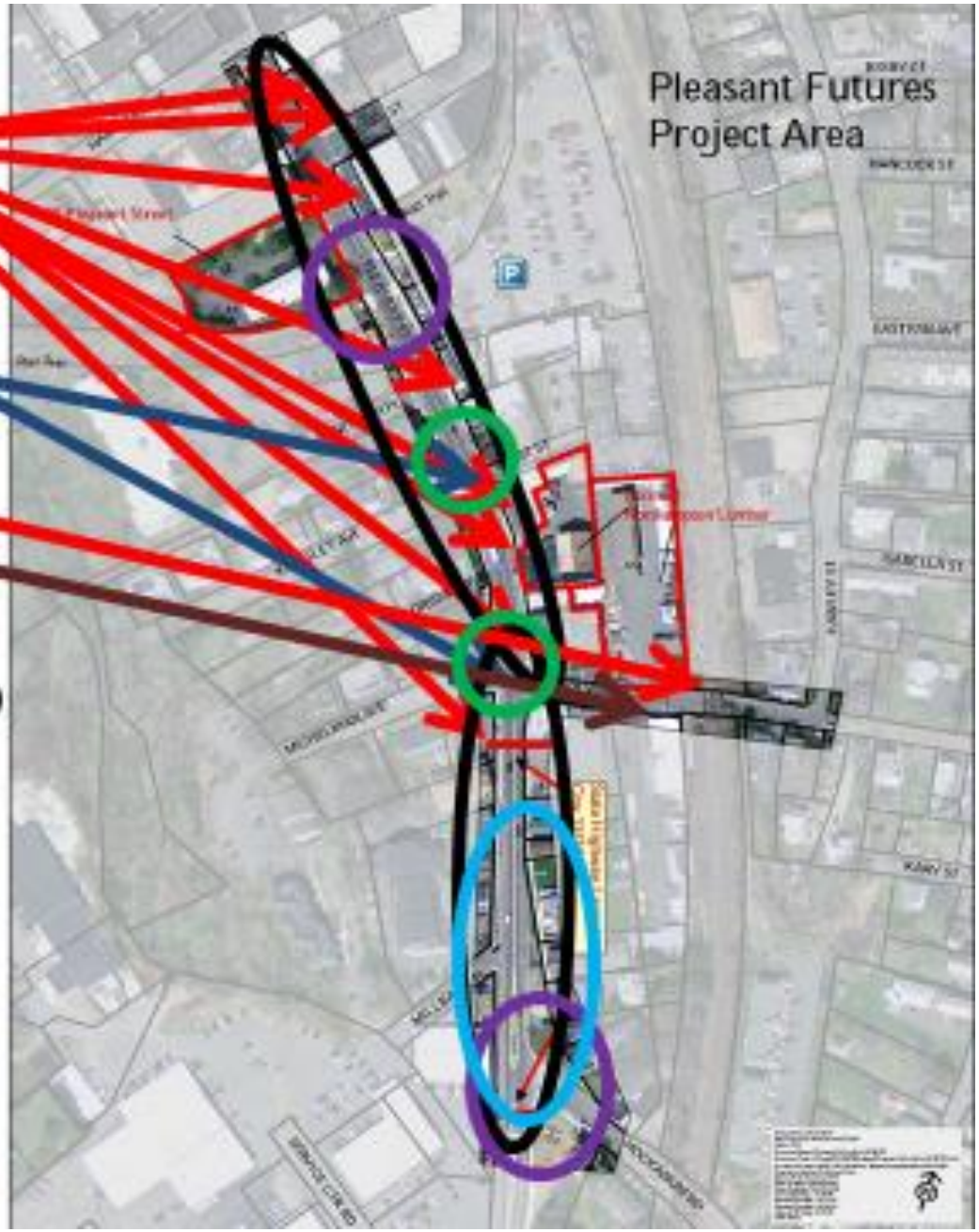
Add street trees w/LID

Curb extensions w/ parklets and LID

Calm Hockanum and improve safety

Create LID Park

Underground utilities



APPENDIX II

In this appendix II it is possible to the Willingness to Pay experiment that was sent to the population in the form of a survey by the Planning Department of the Town of Medfield, MA. It consists in a series of pairs of pictures that were taken from google street view in the approx. half mile stretch of Main Street Medfield, MA – where the proposal for undergrounding takes place, followed by the exact same pictures digitally manipulated to erase the overhead power lines (see Map 5).

With that format, the participants were able to see the two pictures of each pair in a sequence of 'before' and 'after', so that it becomes easier to draw a comparison between the two scenarios. These four pairs of pictures shown in this draft are from an area with mixed zoning where there are businesses, residential buildings and other components of the civic life.

Next, one simple question that will try to determine how strong would be the population's disposition to finance such alterations depicted. The question(s) had the following phrasing:

. "Considering the previous photos from Downtown Medfield, to what extent would you be willing to pay for the undergrounding of the utility lines (surcharge on the utility bill)?

In case of positive answer, please check the maximum amount of increase that would be tolerable.

0%

1%

1.5%

2%

3%

2. If your answer on the previous question was 0% (i.e. "no"), could you tell us why?

Introduction

"Over the next pages, you will be shown four pairs of photos (taken from Google Street View, and altered via Photoshop). Each pair shows part of Main Street as it currently appears, and the same location if there were no overhead power lines. This alteration is achieved by burying the power lines below the asphalt, and is called Undergrounding.

The benefits from undergrounding power lines can be seen in terms of aesthetics, less power outages due to storms, more space in the sidewalks for the pedestrians, more room for trees, etc.

Due to the extra costs of undergrounding, the goal of this brief survey is to get the residents' opinions and willingness to pay for potential undergrounding sites.

We count on your participation to evaluate the four locations and answer one question at the end. This survey was designed to take just a few minutes of your time."

Pair # 1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Google earth


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© 2015 Google
© 2015 Google
Google earth

Pair # 2

Pair # 3

Pair # 4

*** 1. "Considering the previous photos from Downtown Medfield, to what extent would you be willing to pay for the undergrounding of the utility lines (surcharge on the utility bill)?**

In case of positive answer, please check the maximum amount of increase that would be tolerable.

- ☐ 0%
- ☐ 1%
- ☐ 1.5%
- ☐ 2%
- ☐ 3%

2. If your answer on the previous question was 0% (i.e. "no"), could you tell us why?

_____