



# Town of Middlefield Communications Committee

## Last Mile Broadband Report

### Middlefield's Last Mile Broadband Alternatives

#### Introduction

This report concludes the Communications Committee's "due diligence" in examining Middlefield's last mile broadband alternatives. We have conducted countless hours of research, posted extensive analysis on the town website, engaged a leading consultant, and held dozens of meetings – including joint meetings with potential vendors, the Massachusetts Broadband Institute (MBI), and other towns.

After examining several approaches, we have identified five broadband choices:

- **Do nothing**, and give up our town's share of the state broadband grants.
- An **all-wireless solution** owned by the town and fully funded by state grants.
- A **hybrid solution** owned by the town that employs fiber in more densely settled portions of town, and wireless in the scattered outlying areas.
- A **fiber-to-the-home (FTTH) solution** owned by the town and implemented by the MBI, partially funded by a state grant.
- The same **FTTH solution** implemented by the MBI, with the town *signing over ownership* to a new WiredWest Corporation.

Our fiber & wireless findings are summarized in the table below.

Solution	Est Cost	State Grant	Owner	Mbps	Estimated Cost per Customer <sup>1</sup>			
					Operating	Finance	ISP	Total
Wireless	\$ 562K	\$??	Town	8-20	\$45	\$0 <sup>2</sup>	\$24	\$69 <sup>3</sup>
Town fiber	\$1,590K	\$580K	Town	25+	\$101 <sup>4</sup>	\$46	\$25	\$172 <sup>5</sup>
WiredWest	\$1,590K	\$580K	WW	25+	\$?	\$46	\$?	\$49 <sup>6</sup>

<sup>1</sup> Monthly, based on 60% take rate (131 subscribers).

<sup>2</sup> If fully funded by state grant, see p. 3 below.

<sup>3</sup> Phone additional \$20; phone only = \$35.

<sup>4</sup> Crocker Communications estimate based on Leverett fiber experience.

<sup>5</sup> Phone additional \$20.

<sup>6</sup> Stated in WiredWest business plan for 25 Mbps broadband, see pp. 7-8 below.

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## Do Nothing

We were told by MBI Director Eric Nakajima when he met with our town on September 14 that some towns, like Florida, may pass up their share of state grant monies, as it would entail substantial borrowing to fund a fiber implementation.

Such a course may not be as absurd as it sounds when it comes to fiber. It would not encumber the town, and given the torrid pace of technological advances and the rapid switch from fixed to mobile communications, especially among the young, any 20-year investment in rural fiber might appear speculative, at best.

## All-wireless Solution

An all-wireless solution could be entirely constructed with state grant funds, *if* the town's share of state grant funds is \$580,000, as discussed on p. 5, and *if* the entire grant is available for such a project. The latter "if" looms especially large, as according to the MBI's *Last Mile Broadband Policy*, the \$40M in state funding will be split 45/55 for professional services and construction.<sup>1</sup> Should this split also apply to a wireless installation, our town would not receive its fair share of state funding, since professional services would likely be a much smaller proportion of total costs. We are seeking a policy clarification from the MBI on this.<sup>2</sup>

We recently visited the town of Royalston, where they have implemented a wireless broadband pilot, underwritten by an MBI grant. They are charging \$78 per month for 10/5 broadband. Phone service is an additional \$25. At the time of our visit, we found that the free WiFi at the General Store came in at 16/5 Mbps.

In following up with Fred Goldstein of Interisle, Royalston's technical consultant, we were astonished to discover that the MBI had already contracted Interisle to conduct a study of fiber, wireless, and hybrid broadband options for Middlefield!<sup>3</sup>

The MBI provided us with a Broadband Planning Assistance Grant to extend Interisle's work to incorporate the latest technologies and town-supplied data & requirements. The result shown in the accompanying presentation on "Affordable Last Mile Wireless Broadband for Middlefield MA," lays out a plan to deliver wireless broadband to the entire town, and near term deployment of enhanced technologies, such as LTE.

Services offered would be:

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<sup>1</sup> MBI *Last Mile Broadband Policy*, July 30, 2015 (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/2015-07-30-MBI-last-mile-program-policy.pdf>), p. 2.

<sup>2</sup> Letter to the MBI re the financing of alternate broadband solutions, op. cit.

<sup>3</sup> *Fiber, wireless, and hybrid broadband options for Middlefield*, <http://middlefieldma.net/wp-content/uploads/comcom/lastmile/mbi-middlefield-fiber-hybrid-wireless-study.pdf>.

- **Affordable Internet**, with initial download speeds of 10-20 Mbps, that meets or exceeds the FCC “Connect America” standard (see Appendix B)<sup>4</sup>,
- **Up to 1 Gbps** service in the business district and other locations with point-to-point access to antenna towers.<sup>5</sup>
- **Phone** service for those wishing to replace their Verizon land lines.
- **No Cable TV**. Those who wish can keep their dish, get over-the-air HDTV, or subscribe to Netflix, Sling, YouTube, etc.

Total estimated construction costs for the initial rollout in 2016 come to \$502K, with estimated upgrade costs of \$60K in 2017. The total of \$562K is under the \$580K in broadband grant funds earmarked for Middlefield, provided, again, that the MBI gives us our full funding allotment for a wireless network.

Estimated Middlefield charges would be:

- 10-20 Mbps broadband, \$69
- Broadband + phone, \$89
- Phone only, \$35.

Prices could vary based on actual operational costs and service provider charges.

Three companies have expressed an interest in providing wireless services, but they do not currently have personnel in the immediate area, and would prefer to hire local staff only if they can serve multiple towns in the region.

### Conducting a Wireless Pilot

Middlefield's hilly, tree covered terrain presents challenges for wireless communications. If the town is interested in pursuing a wireless solution, we would recommend that we first apply to the MBI for a grant to pilot the wireless network to 30 customers in the spring of 2016.<sup>6</sup> The purpose would be to gather and review user experience data, prior to deciding on a rollout to the entire town during the remainder of

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<sup>4</sup> MBI's *Last Mile Broadband Policy* states and any system they support must provide “ubiquitous” 25/3 Mbps service. They do not appear to be holding Royalston to this standard, most wireless ISPs do not provide consumer-level service at speeds above 10 Mbps, and TV White Space is incapable of 25 Mbps service in Middlefield. The FCC's “Connect America Fund” defines broadband as 10/1 Mbps (see Appendix B). Op. cit., p. 3.

<sup>5</sup> Customer charges will apply for additional hardware and/or bandwidth.

<sup>6</sup> To do so would delay our final deployment decision beyond the MBI's July 1, 2016 financing deadline, requiring an extension from the MBI. *Last Mile Broadband Expansion in Massachusetts Information for Municipalities, March 31, 2015*, p. 4 (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/2015-03-31-last-mile-project-guide.pdf>).

the calendar year. Included would be tests of the latest TV white space (TVWS) technologies for the most obstructed paths.<sup>7</sup>

## Hybrid Fiber/Wireless Solution

Another option is a hybrid solution that employs fiber in more densely settled portions of town, and wireless in the scattered outlying areas.

A hybrid system will add about \$40-50K per mile to the cost of an all-wireless system – e.g. adding 10 miles of fiber would bring total construction costs to the neighborhood of \$1M. That might require a property tax increase and/or a 5 year note to finance. There would also be additional maintenance costs for a mixed system, as we would be dealing with two sets of technical specifications.

As with a wireless system, the current MBI broadband policy indicates that they may not be willing to release all of Middlefield's funds for a mixed system.

## Town Fiber Solution

According to an email from MBI Director Eric Nakajima to the Middlefield Selectboard, the total cost to build a fiber-to-the-home network in Middlefield is \$1.59M.<sup>8</sup> He goes on to suggest that we appropriate \$1.01M “for the amount of debt to be authorized by your town,” leading one to infer that the town's share of the state's last mile broadband grant is \$580,000. We have asked the MBI to confirm the latter amount.<sup>9</sup>

The town was also told to consider “administrative fees” to issue the bonds of approximately 3% for up to \$1M, or \$30,000 in Middlefield's case.

## FTTH operational costs

When it comes to estimating FTTH operational costs, we are fortunate to have the actual operational costs for the recently implemented network in Leverett MA, which come to \$321,888 per year, or \$44.68 per subscriber per month.<sup>10</sup>

Middlefield's operational costs per subscriber would be higher, since its population is only 28 percent of Leverett's (521 vs 1876 in 2010), spread out along more road miles (38 vs 35). Thus, Crocker (Leverett's service provider) estimates that Middlefield's FTTH operational costs would be \$158,874 per year, or \$66.20 per subscriber per

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<sup>7</sup> Pilot results would also apply to other towns implementing wireless or hybrid solutions. The MBI must agree not to charge our town for the pilot in the event of failure to meet specified requirements.

<sup>8</sup> Eric Nakajima to Middlefield Selectboard, March 4, 2015 (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/2015-03-04-nakajima-to-selectboard.png>).

<sup>9</sup> Letter to the MBI re the financing of alternate broadband solutions, October 26, 2015 (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/2015-10-26-letter-to-MBI.pdf>).

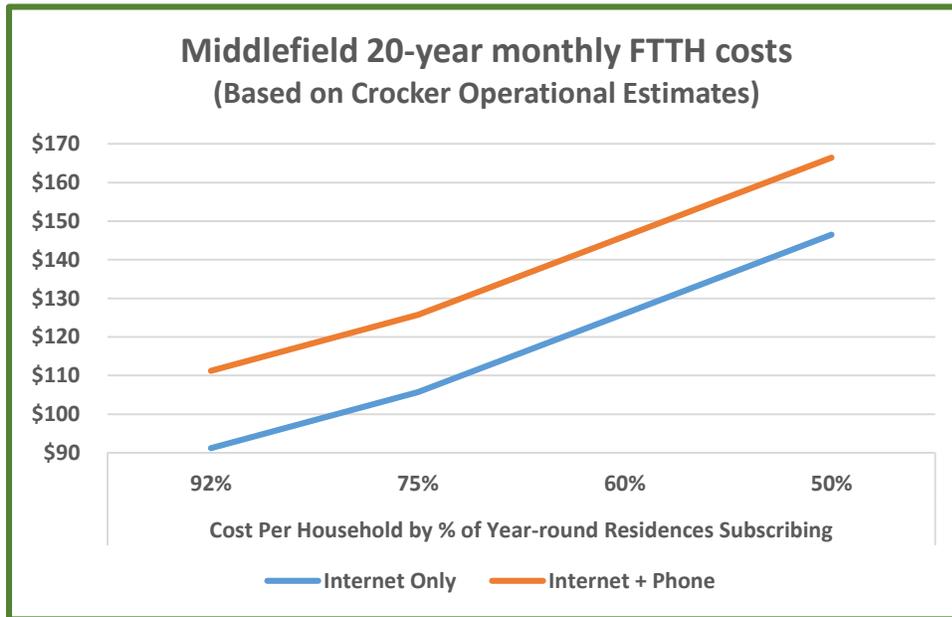
<sup>10</sup> *Operational + Service Costs for Middlefield's Fiber*, <http://middlefieldma.net/wp-content/uploads/comcom/lastmile/fiber-costs.pdf>, p. 5.

month based on a very high take rate of 92% of Middlefield's 218 year-round residences.<sup>11</sup> Per subscriber costs escalate as the take rate goes down.

### Total operational + service costs

Now that we've calculated operational costs, what about the cost of the broadband service itself? Crocker charges \$25 per month for 100 Mbps broadband – a reasonable fee for an internet service provider (ISP).

When we add ISP charges to the operating costs, we get a total of \$126.06 per user per month if 60% of potential users sign up. Crocker charges another \$20 per month if you want fiber phone service. Total operational + service costs by take rate are shown in the following chart:



### FTTH financing costs

We have an idea of what the operating costs would be, but what will it cost to finance a \$1.01M infrastructure? According to slide 22 of the December 2014 Financial Forum conducted by the MBI, the Franklin Regional Council of Governments and WiredWest, the town would issue notes for a portion of the total cost in years 1 & 2, on which it would pay interest at the nominal rate of 0.5 percent.<sup>12</sup> At the end of year 2:

- Town has the option of renewing notes into Years 3-4-5; pays interest plus minimal principal (approximately 3.8% of principal in Year 3)
- On project completion, town issues long-term bonds (assume interest rate 4%)<sup>13</sup>

<sup>11</sup> *Ibid.*, p. 1.

<sup>12</sup> *Last Mile Broadband Financial Forum, December 11, 2014* (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/december-financial-presentation.pdf>), p. 22.

<sup>13</sup> *Ibid.*

Applying the above parameters to Middlefield's financing, the town would have estimated up-front costs of \$261,233 in the first five years (when there would be no prospect of revenues from WiredWest or another ISP, and total payments over the 20-year period would amount to \$1,448,142, or \$72,407 per year.<sup>14</sup>

We can consult with UniBank re Middlefield's financing options. Several towns are also exploring the possibility of obtaining authorization to bond using one-year rollover notes.

Whatever the bonding method employed, it will probably require annual audits at an estimated cost of \$10K per year.

### Designating a service provider

Should the town retain ownership of its fiber infrastructure, it would have to engage, either on its own or in cooperation with other towns, firms to maintain the physical infrastructure and an ISP to deliver broadband services to customers. For example, Holyoke Gas & Electric maintains Leverett's infrastructure, and Crocker Communications is their ISP.

Crocker has offered to be the town's ISP, and Holyoke Gas & Electric has expressed an interest in providing comprehensive services. We have held discussions with Axia Networks, the operator of the MBI's middle mile, but they appear to have dropped out of the picture.

### WiredWest FTTH

The town could sign over ownership of its fiber network to the proposed WiredWest Fiber Cooperative Corporation, in exchange for a stake in proportion to its share of the aggregate contributions of participating towns.<sup>15</sup>

Their draft business plan projects a year five 47% "take-rate", at which "WiredWest can not only meet its operating expenses and reserve requirements, but can fully reimburse towns for the principal and interest payments on the debts they incur."<sup>16</sup>

Since WiredWest advertises "fast internet service of \$49 a month" (25 Mbps) and "100 Mbps superfast internet service" of \$79 a month,<sup>17</sup> it is hard to see how they could pay off the town's debt through user fees when, even at a 60% take rate, financing costs alone would be \$46 per user per month. On top of that, you would have operational costs of \$101, excluding ISP charges.<sup>18</sup> While Middlefield may not be typical of the proposed last mile towns – for example, Crocker estimates that Worthington's

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<sup>14</sup> *Middlefield's Fiber Financing Costs*, <http://middlefieldma.net/wp-content/uploads/comcom/lastmile/2015-07-17-MBI-fiber-financing.pdf>.

<sup>15</sup> *Business Plan for WiredWest Fiber Cooperative Corporation, Working DRAFT*, June 25, 2015 (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/ww-business-plan-06-25-15-draft.pdf>), p. 3.

<sup>16</sup> *Ibid.*, p. ii.

<sup>17</sup> *Ibid.*, p. 55.

<sup>18</sup> *Crocker-Based Cost Estimates*, op. cit., p. 5.

operational costs would be \$15 less; Hawley's \$21 more – it is unlikely that it would deviate by such an order of magnitude from the WiredWest average.

Should Middlefield join WiredWest Fiber, it would be committed to building a FTTH infrastructure as discussed above. In addition:

- It would have to transfer its assets to the cooperative.<sup>19</sup>
- It would lose the ability to switch service providers should WiredWest be unable to fulfill its promises, such as 25 Mbps internet for \$49 a month.<sup>20</sup>
- Should the project fail to generate sufficient TV, phone, and data revenues, taxpayers in member towns, including Middlefield, would be held legally liable for millions of dollars in up to 30-year bonds, plus interest, operating expenses, and any cost overruns “regardless of WiredWest operating results.”<sup>21</sup>

Moreover, a town may not withdraw from WiredWest for 10 years, and then, only “provided that the Cooperative has not entered into financial obligations (bonds, loans or other financial vehicles) based on or requiring the participation of said Member.”<sup>22</sup> In the event of withdrawal, “ownership of the network and its components must remain with WiredWest to assure its ongoing operability, and customers will continue to be served by WiredWest”.<sup>23</sup>

Eric Nakajima said that the MBI would be releasing its review of the WiredWest Business Plan in October. We have yet to receive a copy of this review, but when it arrives we will post it on our website and see if it is consistent with the above analysis.

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<sup>19</sup> According to the draft WiredWest Operating Agreement:

"Broadband Assets" means (i) all of the funds allocated or granted by the Massachusetts Broadband Institute to a Member for the purpose of financing the design and construction of the WiredWest Regional Network, (ii) all of the proceeds of borrowings of a Member under M.G.L. Chapter 44, Section 8(8) for the purpose of financing and establishing the WiredWest Regional Network and (iii) all documentation, including without limitation all engineering drawings and designs, and all equipment and facilities acquired or constructed by a Member using the funds or proceeds set forth in the foregoing clauses (i) and (ii) or otherwise acquired under M.G.L. Chapter 44, Section 8(8)

*Operating Agreement of WiredWest Municipal Lighting Cooperative LLC, 10/21/15 Draft* (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/2015-10-21-draft-wiredwest-operating-agreement.pdf>), p. 2.

<sup>20</sup> While some economies may be achieved in working cooperatively with other towns, there are ways to achieve this without ceding ownership or the freedom to choose providers, cf. <http://middlefieldma.net/wp-content/uploads/comcom-minutes/2015-06-23-minutes.pdf>.

<sup>21</sup> *Last Mile Broadband Financial Forum*, *op. cit.*, slides 13 & 17.

<sup>22</sup> *WiredWest Operating Agreement*, p. 8.

<sup>23</sup> WiredWest email to delegates regarding the Operating Agreement, October 21, 2015 (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/2015-10-21-wiredwest-email-to-delegates.pdf>.)

### Leverett's FTTH Solution

It should be noted that Leverett MA – where they have already have a fully operational FTTH network with drops to all premises – adopted the view that the fiber network is a public utility, built via property taxes, not with borrowing paid off through surcharges on subscriber fees.<sup>24</sup> The Leverett Broadband Committee warned us multiple times not to join the WiredWest regional network as:

- We would be exposed to open-ended construction and operational liabilities.
- The WiredWest business model appeared to make no sense and there was no way that they could generate adequate revenues via their advertised rates.
- They have no experience in maintaining a network and providing services, and have no idea how complex and costly the task can be.
- It is vital not to be tied to a particular network operator or ISP, but to have the ability to choose whoever can best serve the interests of the town.

The town of Otis appears to be following Leverett's lead by dropping out of WiredWest, stating that "the Town should own and control a \$5.5 million dollar asset funded solely by taxpayer dollars; this way Otis can choose its own network operators and internet service providers on a short term competitive basis." They doubt that WiredWest would generate sufficient revenues to repay towns' debt service, and balked at a business plan that "includes a substantial sales and marketing staff as well as four officers earning six figure salaries."<sup>25</sup>

The towns of Alford and Mt. Washington are also pursuing fiber broadband projects on their own.

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<sup>24</sup> Town of Middlefield Communications Committee, Report on Visit to Leverett June 11, 2016 (<http://middlefieldma.net/wp-content/uploads/comcom-minutes/2015-06-11-leverett-visit.pdf>).

<sup>25</sup> "Select Board Opts Out of Wired West," <http://middlefieldma.net/wp-content/uploads/comcom/lastmile/otis-selectboard-opts-out-of-wiredwest.pdf>.

## Appendix A: Potential Rural Alternatives

There is talk of beaming rural broadband to earth from the likes of Google, Facebook, SpaceX and OneWeb.<sup>26</sup> OneWeb, for example, expects to have a constellation of 684 low earth orbit satellites that will deliver affordable internet and cellular service to rural areas throughout the globe starting in 2019, thanks to lower cost techniques for assembly and launch.<sup>27</sup> Should such an alternative take hold in the near future, it might draw customers away and jeopardize our ability to service debts incurred by the town or WiredWest to underwrite a fiber network. However, similar ventures, such as Teledesic, have failed in the past.

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<sup>26</sup> "Google, Facebook, SpaceX, OneWeb plan to beam Internet everywhere," (<http://www.cnn.com/2015/10/30/tech/pioneers-google-facebook-spacex-oneweb-satellite-drone-balloon-internet/>).

<sup>27</sup> <http://www.oneweb.world/#solution>.

## Appendix B: FCC Connect America Fund Reverse Auction

The Federal Communications Commission has implemented Phase II of its Connect America Fund,<sup>28</sup> which uses the fees collected on interstate telecommunication services (currently about 17%) to subsidize broadband service. Its goal is to provide 95% of customers in rural areas (that do not currently have 4/1 Mbps broadband service) with 10/1 Mbps broadband within six years. (Note: that these are less than the MBI requirements of 100% of customers and 25/3 Mbps service.)

Members of the incumbent class of large “price cap” carriers, including Verizon, were given the option of accepting a fixed fee to provide at least 10/1 Mbps broadband, plus telephone service to all of their service areas.

Verizon passed on the offer for Massachusetts. Thus, Middlefield is among the unclaimed blocks in the FCC’s “reverse auction” to be held in late 2016 or 2017, in which service providers will bid for subsidies to provide 10/1 Mbps broadband plus telephone service.<sup>29</sup> The *low bidder* will then have six years to build out service.

Since individual towns within the Connect America “final eligible areas” are generally not established service providers qualified to bid, we will have to look to the MBI to go after these last mile subsidies on our behalves:

- If the MBI, as the established middle mile provider, enters the low bid, then it would receive that subsidy to the exclusion of competitors, including Verizon or Verizon Wireless.
- If the MBI fails to bid, then a competitor entering the low bid could apply the incentive to take business away from whatever network Middlefield builds – whether fiber or wireless.<sup>30</sup>

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<sup>28</sup> <https://www.fcc.gov/encyclopedia/connecting-america>.

<sup>29</sup> Oddly enough, the FCC’s “Final Eligible Areas Map”, excludes a small triangle below the intersection of Skyline & Chester roads (<https://www.fcc.gov/maps/connect-america-phase-ii-final-eligible-areas-map>).

<sup>30</sup> This is perhaps less of a risk for wireless, since no town funds will have been expended, the bidder might still rent tower space from the town, and the town’s radio equipment will probably be depreciated before the subsidized competitor rolls out service to 95% of eligible locations.

## Appendix C: Outstanding Issues

The following is a list of outstanding issues identified in the text:

- Will the MBI grant Middlefield its full share of broadband funding for a wireless network (p. 3)?
- Will the MBI require any wireless network funded by state grants to provide “ubiquitous” 25/3 Mbps service, or will it suffice to meet the FCC’s “Connect America” standard of 10/1 Mbps (p. 4; Appendix B)?
- Can we attract wireless providers to the area with the possibility of providing service to multiple towns (p. 4)?
- Will the MBI grant us an extension beyond its July 1, 2016 financing deadline, to give us time to conduct a wireless pilot in the spring of 2016 (p. 4)?
- Will the MBI provide a grant to finance a wireless pilot in the spring of 2016 (p. 4)?
- Will the MBI agree not to charge our town for the pilot in the event of failure to meet specified requirements (p. 4)?
- Is the town’s share of the state’s last mile broadband grant \$580,000 (p. 5)?
- How would the town finance a fiber project (pp. 6-7)?
- When will the MBI issue its review of the WiredWest business plan (p. 9)?
- Will the MBI bid for Connect America funds on behalf of towns within the FCC’s “final eligible areas” (p. 11)?
- Above all, will the MBI provide the town with a *timely review of this report*, as part of its “fiduciary obligation to ensure that State funds are expended in ways that best advance the public objectives of the broadband initiative.”<sup>31</sup>

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<sup>31</sup> *Solving the Last Mile, Fall 2014 Municipal Leaders Meeting* (<http://middlefieldma.net/wp-content/uploads/comcom/lastmile/mbi-wiredwest-municipal-outreach-presentation-11062014.pdf>), p. 6.